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AND ITS PRACTICAL APPLICATIONS

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The Outlook for the Year In this issue the *Electrical World* presents a number of signed statements on vital matters affecting the electrical industry. In so doing it calls attention not only to the matured views of those who express their opinions, but also to the fact that the subjects treated are of such serious importance that they demand earnest consideration. It can be taken for granted that, given any fair chance of development and times that are not unduly hard, central stations will make a good showing in increase of gross earnings. No other public utility industry is so bright with promise in this respect. This fortunate condition, however, should not blind the sight of central-station managers to the other problems on the horizon. Foremost among these problems at present are those that deal with public policy affairs. They touch the industry, not to retard its growth, but to question the lines on which that growth shall take place in the future. It rests largely with the industry to see that the lines of development are wholesome and will pass public scrutiny. With development in promise along these satisfactory lines, it rests with the public to withhold restrictive hands and to uphold gladly all policies that are constructively for the advancement of the company and the community it serves. Public inquiry into electrical matters has been insistent, and it will be more insistent in the future. The work that this imposes upon the industry is not to be regarded lightly. It means that the companies shall subject their own transactions to the same sort of critical analysis that they are likely to receive from commissions representing the public.

Work of the Standards Bureau In his Atlanta paper, extracts from which are published in this issue, Dr. Rosa says that the engineers and experts of the Bureau of Standards are unbiased and absolutely independent. The *Electrical World* takes pleasure in testifying to the high character and earnest effort of those who have guided the bureau to its present position of standing and usefulness. No one should withhold from them the credit that is their due. If work of the kind they have done is well done, there is a natural tendency for it to increase, and this has been the experience of the Bureau of Standards. Certainly the scope of activities of the bureau is much greater now than it was a few years ago. There is an inevitable drift toward a still further enlargement of activities, and Dr. Rosa outlines some of the ways in which services are to be rendered. In the technical investigations which have been conducted so acceptably by the bureau in the past, the personnel of its heads and associates has been a large influence making for success. It is greatly to be desired that the same high character that has influenced them shall always be manifest in the work. If it is, the assistance of the government will be a factor of much helpfulness in the solution of the technical problems of the industry and may be so anticipated.

The Big Creek Electric System All things considered, the Big Creek system, described in this issue, is the most remarkable one yet put into operation in this country or anywhere else. In the first place, the transmission line is the longest straight-away system ever installed. We believe that its 240 miles reach has never been anywhere nearly equaled in regular work, although a similar distance has been spanned incidentally on the huge network of the Pacific Gas & Electric Company. Beyond this, its working voltage, starting off at 135,000, is the highest yet utilized commercially. It is not likely long to remain unsurpassed, however, even if for the moment it holds the record. Quite aside from these superlative features, the Big Creek plant has other extraordinary details which forcibly strike the attention. It is very notable, for instance, from the hydraulic standpoint. The drainage area is singularly small, only about 88 sq. miles, but the annual rainfall averages 80 in. or more, the basin being one of those unusual areas where the precipitation is abnormally high. Such conditions are now and then found in mountainous districts near the sea, as, for instance, in the east of Scotland. The run-off, too, a factor extraordinarily dependent on local conditions, rises to the remarkable figure of about 50 in. Moreover, the topographical conditions are such that the great volume of water can for the most part be successfully impounded without forbidding expense. In keeping with the scheme for water storage, a somewhat unusual wheel arrangement is used. The nozzles are stationary and controlled by needle valves. There are two independent oil-pressure governors, each controlling a single wheel and so arranged that either wheel of the unit can be worked quite independently so that partial loads may be handled with the greatest possible hydraulic efficiency. In addition, each governor operates a relief valve to take care of excessive rise of pressure in the pipe line. The bearings which carry the wheels and rotor are of unusual construction, with hollow forged steel shafts 20 in. in diameter resting in water-cooled babbitted bearings 5 ft. long, being lubricated with auxiliary pressure-oil supply. The exciters are planned for either motor or impulse-wheel drive. These features are sufficient to mark the plant as of exceptional engineering interest quite aside from the voltage used or the length of the transmission. The plant was placed in service on Nov. 8, 1913, at 135,000 volts, and the pressure will be raised when needed to 150,000 volts, for which the line has been planned. It is really gratifying to record the starting of this very notable development, for it is not only altogether remarkable in voltage and range, but its design displays a degree of resourcefulness very pleasing in these days of banal standardization when prescriptions per catalog are too often the order of the day. Now and then a chance like this is given to the engineer to make real progress, and fortunate is he to whom it falls. By such plants does the art advance and the community benefit. Uncle Sam did well when he granted the permit for its construction.

Alternating-Current Rectifier

The experience gained during the past twenty years in the delivery of electric energy at large rates over long range has confirmed the conclusions which were reached at the outset as to the best conditions obtainable. For long-distance transmission between a single main generating station and a single main receiving station it is always a matter for special consideration whether the energy should be transmitted by direct or by alternating current. When, however, a network of high-tension lines may have to connect a plurality of stations, some generating and others consuming, then the alternating-current system is much more flexible. On the other hand, for general moderate-tension energy distribution, and especially for street-railway work, the direct-current system has distinct advantages. In America, at the present time, a very large aggregate amount of power is thus generated and used in transmitting energy to a distance, through the medium of alternating currents, and converted through synchronous apparatus for direct-current delivery and distribution.

The converter substation is a well-known element in energy distribution systems, and the efficiency of these substations is relatively high. Nevertheless, there is always inconvenience and expense in maintaining rotating machinery in substations. A stationary rectifying apparatus would have great advantages over synchronous converters in large systems. Every increase, therefore, in the available size, permissible output and effectiveness of mercury-vapor rectifiers is a distinct gain to the energy transmission engineer. If it were possible to carry on a railroad locomotive a transformer and rectifier of sufficient power to supply its motors with direct current effectively, the electrical system would indeed become very simple.

The *Electrotechnische Zeitschrift* has recently published an article, by Mr. J. Epstein, recording measurements made in a foundry and factory plant receiving rectified single-phase alternating current for motor operation, without the intervention of a storage battery. The energy was taken from single-phase alternating-current mains at 3 kilovolts pressure through a transformer, and delivered to a direct-current motor load of from 40 kw to 50 kw, through a bank of four metallic mercury-arc rectifiers. The efficiency of the rectification was about 90 per cent. Oscillograms accompanying the article indicate that when the load was non-inductive the delivered voltage and current were both pulsatory, and to a similar degree. When the load was highly inductive the current became less pulsatory, or had its pulsations smoothed out, but the pulsations in the delivered emf were increased. It is evident that hot-wire instruments will not give the same readings as Weston instruments in such a pulsatory current circuit. It would be interesting to see what effect the character of the load might have upon the wave-form on the alternating-current side of the rectifier.

Central Stations in Large Cities

An address recently delivered by Prof. G. Klingenberg before the British Institution of Electrical Engineers brings out some startling contrasts between the electricity supply systems in London, Berlin and Chicago. As our readers well know, the last-named city under a singularly progressive arrangement has a wonderfully well-organized system of unified supply. London, on the other hand, is an example of complete disorganization in spite of some remarkably well-managed local undertakings. Berlin has an orderly supply, although its territory is less completely controlled than in the case of Chicago. The enormous railway load in Chicago makes comparisons difficult, but some of the data gathered are decidedly instructive. The first striking fact is the very inefficient way in which the business has been exploited in London, doubtless attributable in part to the fact that most of the undertakings are municipal and as a rule in rather serious competition with cheap gas. With three times the population of Chicago, London uses for lighting and motor service less than 25 per cent more energy and has an insignificant railway load. Its sixty-four stations show 50 per cent greater first cost per kilowatt than the six plants that supply service to the Western metropolis, more than double the operating cost and 10 per cent less efficiency in the distributing system. Moreover, the London wage cost is 60 per cent higher than that in Chicago, and its fuel cost more than double.

Here certainly is evidence enough of the shocking inefficiency of small stations as against large ones, and there is too plain evidence of the difference between large and small ones, especially when the latter are operated at low pressure. Probably the feature most effective in raising the distribution efficiency in Chicago to the remarkably high figure of very nearly 90 per cent is the very large proportion of railway load carried always in a few points and in very large amounts. Berlin, with a traction load of less than one-third the total, also shows an efficiency of distribution hardly better than that of London. Chicago has the phenomenal load-factor of 41 per cent, Berlin 33.1, and London 24.9. In Berlin, in spite of a rather stiff municipal participation in the profits, the net profit on the capital is greater by 2 per cent than that in Chicago, no large traction load having been taken on at very low figures. The fuel cost per kilowatt-hour in Berlin is double that in Chicago and outweighs tenfold the difference in wages cost. In fact, an analysis of the respective costs in these two cities leaves some doubt in one's mind as to how far it really pays as an earning proposition to take on large loads at low rates. It does help the load-factor and the efficiency of distribution, to say nothing of greatly increasing the total receipts, but it seems to pull down the average price per kilowatt-hour to an extent that, temporarily at least, outweighs the other advantages from the standpoint of net earnings per dollar of real money invested.

Professor Klingenberg took up seriously the problem of helping out London by bulk from large stations and showed, of course, the inevitable large gains. Yet, considering the very low costs reached in some of the London plants, it may be an open question whether a group system based on improvements on present practice might not yield better profits by lessening the great cost of the complete revision of so great a number of individual systems. The most efficient of the London plants compare well with anything in the business.

Railroad Electrification

The former and present views of Mr. B. J. Arnold on the electric-railway situation, outlined in this issue, furnish a striking example of the cautious foresight of the skilled engineer. Indeed, things have turned out, or rather have not turned out, much according to his shrewd prophecy of nine years ago. At that time, to glance at the situation in review, it was perfectly clear that from an engineering standpoint electrification of terminals or even main lines was perfectly feasible and that in many cases it would give promise of no inconsiderable economies. To those who, like Mr. Arnold, knew something of the practice of railroading from the inside it was equally evident that most roads would not take up electric service except under compulsion, save in the most unusual circumstances. Electrification means a large investment in real money, which is a hindrance to the wonted dividends, particularly when the borrowing power has already been seriously impaired by various feats of finance. Hence it turned out, even as Mr. Arnold predicted, that while in certain directions there was large activity, progress in general electrification was slow. Terminals and tunnels have been, by force of law or public opinion, re-designed for the newer motive power, but it is only recently that steps have been taken to inaugurate the larger enterprises. As Mr. Arnold truly says, the whole matter to-day is one of economics, and we are sorry to say that in the present state of railway affairs the prospect of improvements which mean increased capital charges is rather remote even when there is good prospect of saving in operating charges.

On the engineering side of the matter there is no fear of failure by any of the methods that have been used here and abroad. If the harmonious co-operation between roads of which Mr. Arnold speaks can be brought about, great benefits in terminal facilities will surely follow, and the way will be open for extensions into trunk-line service. Yet such co-operation implies heavy initial expense with the accompanying difficulties and will have to come slowly.

Perhaps the most striking part of Mr. Arnold's discussion is that devoted to the mutual relation between cities and transportation companies. His suggestions sound somewhat more radical than they really are. With the present trend of public opinion, the public authorities are absolutely certain to take an increasingly strong hand in the administration of public utilities, and perhaps it is wise thus to recognize the situation at the start rather than to wait in a state of nervous tension for it to take what will inevitably be its future form. If one could start *de novo* with a transportation system in a large city, the task of arranging suitable reciprocal relations with the municipality would be comparatively easy. Unhappily such a case is quite beyond possibility, and the actual situation is greatly complicated. The fundamental difficulty is to determine that fair value of the property on which every reasonable man agrees that a fair return should be allowed.

It is perfectly well known that there always has been a strong tendency to capitalize on the probable future earning capacity of the property rather than on the physical valuation, however liberally construed. It is equally well known that in most cases necessary renewals, and indeed successive mistakes, in equipment have usually been met by increase in capitalization rather than by suitable provision from the earnings. In plain terms the dividends have been in no small part taken out of the property, trusting, not without reason, that the increasing value of the traffic would allow the real deficit to be hidden behind a new bond issue. It is perhaps for this reason that Mr. Arnold recommends that the city or state should supervise not only the capital expenditure but also the operation of the property. The remedy seems to us drastic, but perhaps it is necessary. It seems that it might be sufficient to hold such grip on the administration as would prevent the payment of dividends until sinking fund provision had been made sufficient to maintain permanently the then physical value of the investment. If the issue of new securities were limited to the purpose of legitimate extensions at their actual cost, there would be little complaint about compelling the public to pay dividends on watered stock. It is always a question whether control of operation would prove efficient in the present state of political morality, while the limitation of new issues of securities and the enforcement of proper reserves are things comparatively easy to enforce.

Electrical Industrial Growth in 1913

By T. C. Martin

THERE will no doubt be found some hardy and irrepressible spirits ready to sing the glories of 1913, but probably few will be recruited into that optimistic chorus from the ranks of electricity. Other fields of human endeavor in these United States may be more jubilant, but even that is open to question. Perhaps there is nothing better than taking your own medicine, and it is beyond denial that for many years past the electrical arts have been beyond all others those most provocative of and insistent upon change and progress. Let the accent be heavier on change than on progress, because it is still open to argument in socialistic quarters that Kelvin, Faraday, Morse, Edison and a few others are enemies of the human race in bringing to it new gifts, speeding it up, summoning it to higher efficiencies and economies. At least, we electricals have been introducing real change. More than that no "progressive" can claim; political or otherwise. And if we wanted to stop the advance we should not know how to do it.

In a year when practically all that is best in American enterprise, effort, activity and individualistic struggle toward better conditions has been under chill, repression and disaster, the many arts electrical, shaped wholly by human wants and necessities, have lifted themselves to higher levels. If those levels have on them, like milestones, the dollar mark of accreting totals, it may be unfortunate in days when to increase the wealth of the race is a crime. But it cannot be helped. It can only be cured by the abandonment of all that has gone before in uplift.

Commercial Advance

It is here proposed to size up electrical advance by the dollar yardstick. Others can rightly take the scientific or the inventive aspects, but it all gets down to the benefit that can be derived by humanity in the mass; for not even the abstruse metaphysician lives to himself alone, although his affinity may be some star millions of years away. In all electrical developments we have to deal with the impress made on average utilization and consumption with the appliances at command to replace old forms of apparatus or lure people to the use of new comforts and conveniences. Fortunately, in America we have a population which has come here chiefly to escape from the Old World habitude of self-denial and have a good time, so that what is saved on armaments can be "blown in" on armatures and their output. It is at least significant that the average expenditure of the public in this country on electrical service is some five or six times what it is in any European country with a respectable claim to be more civilized than we are. Which raises the fair question as to whether the highest use of electricity is not civilization at its best. Certain it is that electricity has played a vital part in the progress of civilized communities.

For several years the *Electrical World* has tried to sum up the general advance in the field for which as a whole its name is a sufficient warrant, and the present writer has as editor frequently done for it in that respect what he now does as a "looker on in Venice," with a very keen special interest in the traffic on the Grand Canal of electric light and power. Some figures are now submitted which are entitled to the "E. & O. E." inscription of every careful bookkeeper's statement and must be taken for what they are worth. It has been customary to take six or seven grand divisions of industrial electricity and to present estimates of the value of their output or their service to the public, the total thus standing concretely for the extent to which electricity is used in the United States. Conversely such figures give some measure also of the extent to which we fall short of "saturation," and that again affords some indication of the opportunities ahead of everybody in the electrical industry.

Rate of Increase

Obviously, it is essential to base such estimates on established data or fairly well-proved rates of growth, and the figures here presented have at least that merit. For example, the United States Census Bureau has recently issued its report on electrical manufacturing for 1909, giving a total of $221,000,000 of product valued at the factory, and showing as compared with 1904, when the amount was $140,000,000, an average gain of 10 per cent per annum for the five years. The same ratios would give a total for 1913 somewhere around $310,000,000, whereas the estimate presented for 1912 in these columns last year was $350,000,000. But the census figures do not include any of the enormous production of poles and cross-arms, iron and steel towers for transmission lines, glassware and porcelain ware made specially for electrical purposes, bare iron and copper wire drawn to be suspended on all these supports.

Then, too, in the broadening domains of electrochemistry and electro-metallurgy no credit comes to electricity in the government figures, which, in export trade, even put electric locomotives in a class with which it is generally supposed electricity has nothing to do. In like manner the 30,000 tons or 40,000 tons of electric steel—there were 29,105 in 1911—as well as all the electrolytic copper, are counted into the statistics of the steel and copper industries. Even an electric automobile belongs to the vehicle industry. Hence the difficulty of making comparisons year by year. But with a definitely known output of strictly electrical apparatus of about $310,000,000 in 1912, it should be moderate to place the total in 1913, inclusive of some proportion of the factors just named above, at the impressive total of $400,000,000.

In some branches of electrical manufacturing there was serious stagnation, but one leading expert, to whom an output of $100,000,000 is normal, writes: "I should say that a gain of 10 per cent in the electrical apparatus business is fair for this year. Of course, you understand that the latter part of the year does not show this gain, while the early part of the year might show more."

Electric Railways

The greatest department of electrical earnings is that of street railways, and the total in this field was placed last year for 1912 at $625,000,000, or less than 10 per cent over the previous year. Statistics extending over a long term of years would seem to indicate an average gain of 7 per cent or 8 per cent in gross, but this is complicated to some extent by the increasing volume of earnings in electric service on main steam lines in zones of rapid expansion. Assuming that the figure of 1912 was near the mark, it would be conservative to apply a gain of 5 per cent to the total, making at least $650,000,000. One authority who studies such figures as closely as anybody in the world is inclined to put the gain for the year at 6 per cent, which gives us somewhere around $675,000,000.

Central Stations

The central-station field is most difficult to estimate or bring to book. It seems almost impossible that an industry well-nigh fifty years old dating from its first arc lamps, or forty from its first incandescent, could go on increasing for two decades at the rate of 15 per cent or 20 per cent per annum. But one cannot deny hard facts, and it might be argued from them that the modern central station, in getting closer and closer to the human needs of the time, has at last discovered the secret of eternal youth. The available and authentic statistics show that without going back of 1902, when a higher rate of "getting there" may have prevailed, the gross earnings of the industry rose from $85,000,000 in that year to nearly $176,000,000 in 1907. That is somewhat better than 20 per cent gain per year, or more than doubling every five years. The Census Office has recently made public some of its earliest figures for the central-station industry in 1912, marking the five-year period, and it is almost startling to see how the 15 per cent or 20 per cent rate of growth is maintained. The older the State the less likely is a gain because of the pre-established conditions, but it is significant to note that in Vermont in ten years the gain has been 140 per cent and in snug little Rhode Island 124 per cent, and then you get a jolt in learning that Connecticut shows 305 per cent. Wonder if Dunham had anything to do with it? New Mexico and South Dakota cannot show much more, although Idaho looms up with 725 per cent again.

It will be admitted by anyone that there is something not quite normal when the central-station industry can show an average increase at least twice as great as that in the street-railway field, and there is the suggestion of enormous possibilities in both directions. Undoubtedly the American public is under-supplied with transportation, but just so long as the humble investor is told to keep out the congestion in street-car service will remain and our only standing room will be each other's toes. In the central-station field it might be supposed that over-stimulation had done its deadly work, but when one of the foremost authorities in the world, operating in Chicago, says that the system there is barely half-way to its goal of universal service, the inference can only be that increments of 15 per cent and 20 per cent are likely to be maintained these many years to come. The Society for Electrical Development has a plainer mission than even its most sanguine advocates dreamed of.

It will be recognized that a large estimate of growth must be put even in an off year on central-station advance, and that a figure of 15 per cent is within bounds. For the year 1907 no less than $176,000,000 was shown. This would give over $350,000,000 for 1912. A 20 per cent increase would give $420,000,000 for 1913. It has been closely calculated by various authorities that an output valued at $450,000,000 is nearer the mark, but that was the total assigned in this estimate last year. Probably no one will dispute, therefore, the intention of leaving it just there.

Telephony

The largest field of electrical development after electric railway and central-station work is telephony. Here, again, the art suffers from the lack of recent figures, but there are some data at hand. The gross earnings of the Bell system in 1912 reached the amount of just about $200,000,000. During the excitement and agitation of the last month or two, when the government in its efforts to crowd the Bell people to the wall announced through various mouthpieces that it intended to go into the talking business, President Vail, to reassure the panic-stricken stockholders, stated that the system had gained some $14,000,000 in ten months. This would be at the rate of at least $15,000,000 for the year, or about 8 per cent. As a matter of fact, the telephone industry would be falling short if it did not reach 10 per cent. The only question that remains is how far the independent systems have kept pace. At one time it was reasonably safe to credit them with a total not far below that of the Bell system, but to-day such an estimate looks rather exaggerated. If, therefore, the total were left at the figure of last year, $350,000,000, no one could complain that it was much out of the way.

Isolated Plants

There are no signs or evidences that isolated-plant service is increasing in these days, except in marine work, in some large steel plants, or in factories remote from central-station sources of supply. Hence the figure of $125,000,000 cited for 1911 and 1912 cannot be far out of the way for 1913. The same is true of telegraphy, and of miscellaneous electric service with such endless variety that nearly 1000 manufacturers are required to cover it. Much of this product now goes into an export trade of $25,000,000 a year, which could be increased with an intenser effort to market it.

Summary

A table is presented herewith bringing out the above figures. Last year, after the general activity of 1912, an estimate was made that came out slightly in excess of $2,100,000,000. While, on the whole, 1913 was such a blue and disappointing year, it is felt that no great error will be made in submitting the total of $2,160,000,000 as one that probably hits pretty close to the real mark.

As to the near future, all the indications are those of rapid advance. Mr. Frank A. Vanderlip, the great banking authority, has pointed out that the central-station industry alone requires about $180,000,000 of new capital annually, and has estimated that the allied industries call, with it, for about $400,000,000, or, roughly, $8,000,000 per week. Such floods of money are forthcoming, but must be invited by reasonable reward; and thus the total of gross earnings is forever carried forward, the investor receiving a very modest return for his upbuilding of the industry and the benefits it confers on the entire community. Few fields have been more susceptible and sensitive to the restrictions placed upon them of late years by repressive legislation than the electrical; few will respond more quickly to a loosening of the trammels and an invitation to advance and become more useful to the public. In hydroelectric development and energy transmission alone the opportunity and demand exist for work utterly beyond anything heretofore attempted or done, but the man who risks timidly a dollar in it will not hazard it without a better prospect of getting it back with a buffalo nickel added than he has had in the past.

DATA ON GROSS INCOME OF ELECTRICAL INDUSTRIES, 1913

Electrical manufacturing	$375,000,000
Electric railways	650,000,000
Central stations	450,000,000
Telephone service	350,000,000
Telegraph service	85,000,000
Isolated plants	125,000,000
Miscellaneous	125,000,000
	$2,160,000,000

Applied Electrical Science in 1913

By A. E. Kennelly

THERE are so many branches of electrical science and so many ramifications of its applications that no single presentation of opinion concerning the progress of electrical science during a single year can be expected to cover more than a portion of the entire field. If, as is claimed by some electromagneticians, the whole subject of radiation—luminous as well as non-luminous—is nothing but a by-product of electromagnetism, and if, again, as some contend, all matter is composed of electrons—so that inertia and gravitation are merely little incidents of electromagnetic action, while all of chemistry is but another aspect of the same general electric activity—it is evident that there would be hardly anything left to consider in the universe, as yet known, after electricity had been thoroughly discussed, and one would be reminded of Mark Twain's friend in Italy, who begged his guide to sum up the disclosures of the preceding week by announcing that the Almighty had made Italy from designs by Michael Angelo!

There have been, however, noteworthy advances in electrical science during 1913, even under a modest interpretation of the scope of that science from the standpoint of electrical engineering. These advances may be classified, for the purpose of discussion, as relating to theory, to application and to convention.

Roentgen Rays

In regard to theory, the most remarkable step, perhaps, has been the general admission of the conclusions derived from experiment, that Roentgen rays have wave-length and are capable of being reflected, besides being susceptible of interference. The wave-length of visible light appears to be thousands of times as great as the wave-length of Roentgen rays. This inference as to the existence of Roentgen wave-trains opens up a wide field for the investigation of ultra-microscopic structures with the aid of photography. That is to say, light fails to reveal structures that are of small dimensions by comparison with 1 micron, because the waves of light are too long for the purpose. Although we cannot see Roentgen rays directly, yet, their wave-length being so small they can be made to penetrate very minute molecular structures and then to reveal their condition, as affected by such penetration, upon a photographic plate. Already some beautiful photographs have been secured of Roentgen rays, after having been filtered though a thin crystalline plate, revealing an orderly pattern of lights and shadows. The analysis and interpretation of such large-scale patterns in terms of what occurs in transit through the crystal calls, however, for much experimental and mathematical investigation.

Electronic Theory

Good progress has also been made in the investigation of the electronic theory of matter toward elucidating stable kinetic groups of electrons. Electric models of chemical atoms are still matters for the future, but suggestions as to the framework of such models begin to take provisional form. Until recently discussion has been directed as to whether the existence of individual electrons could be taken as proved. Now there appears to be no serious protest raised in any quarter against the existence of the electron as a natural unit of electricity, and discussion has more recently been directed to the properties that can rightly be considered inherent in electron groups.

Oscillations

Good progress has also been made in the experimental and mathematical study of electric oscillations over conducting circuits. This progress has been stimulated by inquiries in the radio-telegraphic field. That is to say, the need for more engineering knowledge in regard to the best expenditure of money in radio-telegraphic systems has distinctly accelerated scientific inquiry into the general subject of wave transmission. It looks as though in future a more sharp division would exist between the provinces of knowledge for high-frequency and low-frequency workers than has ever yet separated high-tension and low-tension workers or strong-current and weak-current workers.

Illuminants

In regard to applications, a distinct advance has been made in incandescent lamps of large luminous output and small electric power consumption by the application of laws but recently experimentally established concerning the convection of heat in gases. The improvement gained with such lamps, containing gas at a very respectable pressure, indicates how much caution is necessary in generalizations to the effect that because a device like the incandescent lamp has for years been manufactured in enormous numbers with evacuated globes no hope could be entertained for the success of a lamp which did not employ an evacuated chamber. One is reminded that in medieval times the ordinary water suction pump was commonly supposed to operate for the reason that Nature abhorred a vacuum, the notion of atmospheric pressure not then having come into recognition. Galileo, however, remarked that such generalizations were dangerous, since Nature seemed to stop abhorring a vacuum when it was attempted to work the suction pump beyond a lift of 32 ft.

Radio Communication

Further improvements have been marked during the year in the application of relatively large dynamo machines to the production of alternating currents of sufficient frequency to excite radio-telegraphic sending mast-wires to full resonant oscillation.

Not only has the range of effective radio-telegraphy been distinctly increased during the year, but radio-telegraphy has also been applied to regular time-signaling as well as to transatlantic longitude determinations. Twelve hours out of the twenty-four are now signalized by the emission of official time signals, in accordance with a definite international schedule. A special experimental radio station, near Brussels, has also been brought into action for the study of attenuation of signals at various distances, times and seasons. It is remarkable that the Atlantic Ocean, which it took Christopher Columbus ten weeks of anxiety and doubt to cross in 1492, should now, in the regular course of business, be constantly crossed by radio-telegraphic signals in about the fiftieth of a second.

In regard to the determination of difference in longitude between distant stations with the aid of radio-telegraphy, the reported degree of precision attained is already so considerable that the possibility is suggested of being able eventually to detect in this manner small longitudinal distortions in the terrestrial globe. That is to say, careful measurements of latitude, continued at several observatories, have indicated in recent years that the pole is peripatetic, or that the axis of the earth shifts over what might be called a hectare-lot, so that a stake driven into the mountains of the south pole, truly designating the position of the earth's axis, would have to be moved slowly and steadily from day to day—or even, for greater precision, from hour to hour—within a certain range of total deviation. So careful measurements of longitude, with the aid of radio-telegraphy, might reveal small disturbances in longitude of the earth's crust.

Distinct progress has also been reported during the year in the development of current amplifiers, especially in connection with radio-telegraphic receivers.

International Co-operation

With regard to conventions in electrical science the cause of international standardization made marked advance during the year 1913. The New York midwinter convention of the American Institute of Electrical Engineers, held for the purpose of discussing changes in that Institute's standardization rules, elicited a large amount of valuable experimental and technical material, indicating in itself how much scientific knowledge is sought and found in the quest of a proper basis for industrial standards. This was followed by certain international sub-committee meetings of the International Electrotechnical Commission in Europe, which, in their turn, were again followed by a meeting of the International Electrotechnical Commission as a whole in Berlin. Distinct advances toward international standardization were made at that meeting along the lines of uniform copper-wire tables, uniform machinery ratings, uniform nomenclature and uniform electrotechnical symbology. It is clear that no ill luck has attended the year 1913 in regard to international electrotechnical convention. International commissions were also successfully convened in relation to illumination at Berlin and to physico-chemical symbology at Brussels. Slowly, with the aid of intelligent good will, in spite of the constant menace of arms and warlike preparations, science, through electric telegraphy, fast ships and rapid communications, tends to undo the harm which many past centuries effected in the separation of the desires and ideals of men by mountains, seas and deviations in language. It is true that international commerce and international communication tend to keep the world's good will, but what may not also be said, in this connection, for the international volt, ohm and ampere?

Another distinct advance toward simplicity and uniformity of international relations has been in the adoption this year in the custom houses of all the leading nations of the world, including Great Britain and the United States, of the metric carat of 200 milligrams for the weighing of jewels and precious stones, thus helping to introduce the metric system which underlies all modern science as well as the ohm, volt and ampere.

Regulation from the Telephone Viewpoint

By Theodore N. Vail

WHILE regulation by commission is now a recognized policy of our government, it is still important to bear in mind that in order to be permanently successful regulation must be effective. The legal machinery for effective regulation has been created. The controllers of the machinery are the men chosen to execute the laws. If wise men are not appointed or elected the laws will not be administered properly. If the commissioners have not sufficient ability or breadth of mind to understand clearly the problems before them, they will fail to satisfy the various elements composing the public. If their work does not attract and hold public respect, it cannot be effective.

Regulation Should Be Effective

Because a wise form of control of operations and rates will protect properties as well as the consuming public, it is the duty of managers of public utility corporations to try to make regulation effective. If, however, regulation is to be effective it must be fair. It should be so fair that the justice of it will be recognized by both the corporation and the consuming public. Men of ability and strength of character will be likely to want to follow this course. In order to do so, they will have to resist public clamor at times and undue demands from corporations at other times.

Commissions can never become effective unless the matters over which they are supposed to have jurisdiction are left to them and not taken out of their hands by self-constituted public committees or even by legislative committees. The object of a commission is to obtain deliberate action and gather facts and conditions that cannot be obtained by a temporary committee, and also to establish a body of permanent record and to establish precedent.

There is still room for education on the part of the public and corporation managers as to the best disposition of the problems arising from their relations. Both, however, realize now that a form of regulation is the most promising method of developing the relations that should govern their transactions. Neither one should expect more than he ought to have. Some of the old bargains were closed after long negotiation in which each side showed plainly its belief that if it wanted to get one foot of advantage it was necessary to ask for a mile. Those times have passed. Regulation is not a synonym for trading. It should be on the highest plane. It should develop standards of equity so well recognized that the country would manifestly progress under them.

Fair Rate of Return Essential

A corporation fairly entitled to a return of 10 per cent on its investment in a certain locality should not have to go into court and ask for 15 per cent in order to accept, apparently as a compromise, the 10 per cent to which it is reasonably entitled. If the public wants a rate of, say, $1 for gas now costing $1.25 and it is fairly entitled to some reduction, it ought not to have to ask a rate of 75 cents and accept the rate which it justly should have as an apparently unsatisfactory compromise. The more equitable the rules are the more contented the litigants will be likely to be. If there is a fair question concerning the adequacy of rates or their excessiveness, it is to the ultimate interest of all parties to settle it, if possible, without rancor. Certainly the issue involved in such a case is plain. The company needs a revenue large enough to meet all of its expenses, including depreciation, its taxes and charges and a fair return on the investment. Unless, however, it has a margin above these necessay outlays sufficient to give evidence to bankers of a reasonable certainty of a continuation of enough revenue to meet all of them without default, it will have difficulty in raising capital for extensions.

The ways in which the public and the companies can promote the effectiveness of public regulation vary in different localities. Every effort should be made on both sides to secure commissioners of ability and fairness who will administer the laws that ought to be enforced.

Every effort that is made to put men of less satisfactory kind on commissions will tend to nullify the spirit of regulation and will harm both the public and the companies. If the commissioners are able and are earnestly trying to do their best to solve fairly the problems before them, the public and the companies should uphold their hands.

While the complexity of the telephone industry makes it a difficult subject of regulation, yet it has advocated and seeks full public control. This is done with a confidence in the ultimate fairness of the public and a belief that regulation will help to perpetuate the co-operative relations that should prevail between the public utilities and their customers.

Risk and Public Service Control

By **Robert H. Whitten**

It is an interesting fact that in the general upward trend of prices since 1896 public utility services and products have grown steadily cheaper. While the prices of labor, materials and products have increased tremendously and the cost of living has been going up and up, the price of gas and electric light and the price also of street railway and telephone service, if measured by absolute amount and quality, have shown an almost continuous decline. The greatest advance in prices has been in the case of crude farm products and products of the forest. In the case of articles the price of which depends most completely upon the costs of manufacture the increase has been comparatively small. But while the price even in the case of manufactured products has increased to a considerable extent the rates of charge for services supplied by municipal monopolies have in general declined.

In Massachusetts the average price of gas decreased 47½ per cent between 1886 and 1910. It is estimated that the average price of electric light per kilowatt-hour in Massachusetts cities decreased 48 per cent between 1890 and 1910. While in the case of street railway transportation there has been a quite uniform 5-cent fare, and while during the past few years there has been a tendency to increase the cost of city transportation by curtailing transfers and establishing fare zones, the general trend has been decidedly downward if we take into consideration the possible length of ride and the great improvement in the quality of the service rendered. In general we know that the small, poorly heated and lighted horse car has been superseded by a more commodious, better lighted and heated electric surface car, and this, to a considerable extent, by the more comfortable and much more rapid elevated and subway car. We know also that at first the surface lines radiated 2 or 3 miles from the city center and that now they may radiate 6, 10 or even 15 miles from the center.

Monopoly Versus Competition

The above comparison furnishes abundant justification for a régime of virtual monopoly as opposed to competition, as applied to the above public utility services. The favorable showing of virtual monopoly is due to reduced capital expenditures, reduced operating costs and, more important still, reduced risk.

Public service regulation is a recognition by the state of the essentially monopolistic character of these enterprises. The power of the state to regulate rests largely upon their character as virtual monopolies. A virtual monopoly of the supply of any commodity or service that is important to the welfare of any considerable portion of the community is a delegation of sovereignty. Any corporation in which monopoly is vested is an agent of the sovereign, the state. This monopoly exercises governmental functions, and such a delegation of governmental power is only conceivable on the theory that it is accompanied by a well-defined and effective responsibility to governmental authority.

Efficient public service regulation will make possible further reductions in the cost of production of public utility services. This will come chiefly through its influence on the element of risk. Risk is one of the most important elements in the present cost of such services. If risk could be abolished and the capital charges reduced to a pure interest basis, it is evident that the cost of production would be very greatly reduced. Risk cannot be abolished, but, by effective safeguards and a well-considered policy of public control, it can be greatly reduced.

Uniform Accounting

A distinctive feature that characterizes recent public service regulation is the requirement of uniform accounting. Uniform accounting constitutes the greatest advance toward a scientific and efficient system of public service control. An even more recent development is the exercise of control of security issues. Such control is essential to correct accounting. A chief purpose is to show how much money actually goes into the property. The control of security issues may be used to supplement the accounting control by requiring in certain cases a rewriting of the books of the company as a condition to an approval of a new issue of securities, in order that the books may more truly represent the condition of the company.

A merely nominal control over accounts and capitalization is worse than useless, as it gives the investor a false confidence in the accounts and securities of the company. If, however, the control is efficient, it will result in great benefit to the companies, the investors and the public. To the extent that such control reduces the risk that the investor runs in purchasing securities it will necessarily reduce the cost of financing, the permanent capital charges, and hence the total cost of producing the service.

Risk and Profit

The possibility of adequate profits is not in itself sufficient to reduce the risk of public utility enterprises. In the street railway industry we know that in the past the assumption of large profits, instead of reducing risk, served largely to increase the investor's risk. The supposed profits furnished the excuse for the payment of exorbitant rentals and the capitalization of supposed earning power, resulting in the bankruptcy of the systems. The resulting loss to investors inevitably increased their conception of the risks of the street railway enterprise and hence increased the rate of return required to sell street railway securities.

Another way to reduce risks and safeguard the investment is to build up a liberal reserve and use it in making necessary improvements and betterments. This will reduce the proportion of property value represented by outstanding securities. The increasing value back of the securities will make them an increasingly safe investment. The rate-paying public can well afford to bear the temporary extra cost of reserve building, provided the reserve which they contribute is not made to earn added dividends for the stockholders but is used, first, to safeguard a fair return on the actual investment of the security holders and, second, to reduce the cost of production and the rate of charge.

Methods of Regulation

But under present laws and methods of rate regulation there is nothing to insure that additional revenues allowed for the purpose of building up a liberal reserve will be so used, or if so used that they will not be made the basis for excessive dividends. The companies claim a fair return on all their property, even though a considerable proportion of it has been constructed out of earnings. It is unreasonable to expect the rate-paying public to furnish the capital for improvements and then pay interest and profits on the capital so furnished. If divisible profits could be strictly and continuously limited to a fair return on the money actually contributed by the security holders, there would be no doubt that a conservative policy of making improvements out of earnings would inure to the permanent good of the consumers, the shareholders and the industry as a whole. Without a direct limitation of profits, however, the making of improvements out of earnings often results in a temporary concealment of exorbitant profits, awaiting the time when they can be prudently distributed to the shareholders.

Control of Profits

A direct control of profits seems the logical method of attacking the problem of rate regulation. What is a fair price as between buyer and seller in the case of a monopolized article is usually a question of what constitutes a fair profit for the service rendered. It is in general easier to decide what is a fair profit than to decide what particular rate schedule will exactly produce such profit. In a rate regulation proceeding there are so many factors that are not susceptible of accurate determination that the result must be largely vitiated. If profits are strictly regulated, rates of charge will ordinarily take care of themselves. Rate regulation may then be confined to a prevention of discrimination, and the necessity for even this degree of interference will be largely obviated.

Rewards Based on Efficiency

A system of public service regulation based on a continuous control over divisible profits would also have the advantage of permitting the reward of different companies according to their comparative efficiency in serving the public. Under our present system of occasional rate regulation the tendency is to allow the same return regardless of efficiency. This tends to kill the incentive for efficiency. Of course, it would be possible for the commission in determining what is a "fair return" to take comparative efficiency into consideration. It could have a certain scale of rates of return that it would apply to the various companies according as they stood high or low in comparative efficiency and in the cost of the service they were rendering the public. This, if carried out systematically, would doubtless have certain advantages over the present method, which appears to aim at limiting the company to what is practically a uniform rate of return. The chief difficulty with this plan, however, is that there is no control over the actual profits distributed between the times when the rate-fixing process is exercised. Between these rate-fixing times the company may, and probably will, pay out profits in excess of those that have been determined as "fair" in view of the comparative efficiency of the company's service. This is a fundamental weakness. If it is proposed to reward efficiency with a rate of profit higher than the ordinary, this rate should not be exceeded until such time as increased comparative efficiency would warrant a higher rate of return. There must be a continuous control over the amount of profits that may be distributed in order that a control based on comparative efficiency may be really effective.

Influence of the Holding Company on Electric Utilities

By A. K. Baylor

IN reviewing the growth of electric public service in the United States during recent years, attention is especially attracted to the increasing extent to which outlying districts and communities with small populations are being served.

Modern improvements in high-tension apparatus and transmission appliances have made possible the construction of long-distance lines that a few years ago would have been impracticable on the score of both reliability and cost. As a result, mere villages that could not support any sort of independent central station, and towns formerly inefficiently served, are enjoying high-class electric service from such transmission lines, energy being conveyed into remote and rural districts for mining, farming, ice production, irrigation or industrial work.

The Countryside Network

It appears reasonable to predict that in a few years all sections having substantial populations will be served by networks of transmission lines and the fullest benefits of the principle of infinite subdivision of electric energy, first developed by Mr. Edison for incandescent lighting and now the foundation of modern electric power supply, will be realized.

It is obvious that central stations of relatively small capacities operating within confined territorial limits cannot give the public these benefits, and that many outlying districts cannot be properly served at all, unless their requirements form parts of a combined load, with the larger centers of population as a basis.

The Holding Company as a Factor

In addition, however, to engineering progress and invention, another factor has been at work in bringing about the present conditions under which a large and rapidly increasing proportion of the general public are being served with reliable and cheap electric energy. This factor, which is one of the most important phases of the electric industry at this time, is the holding company.

The economy of bringing together under one jurisdiction the management of a number of separate properties is generally regarded as the chief advantage of holding companies and the principal justification for their existence. The standard of high-class service that is now so generally established in the United States, the benefits of the best technical and expert advice applied even to the smallest central-station, substation or distributing system, the cumulative effect of active up-to-date new-business campaigns at every point, all resulting in improved and cheaper service to the consumers, are directly attributable to centralized control and operation, and without the facilities of such a system they could exist only in the larger communities.

The economies due to central management, while of very great importance, are by no means the only advantages of the holding company system. Back of all such considerations lies the great problem of financing these undertakings. Before economy in operation, engineering supervision or new-business development comes within the range of practical politics, the central station, transmission lines, distributing system and other machinery of service must be created. In providing financial facilities for these purposes the holding company performs its most important function. In fact, the need for such facilities to meet the growing demands of the public for electric service called the holding companies into existence, their creation being due more to financial necessity than to practical or economic advantage.

New Issues of Capital

It is estimated that new capital at the rate of about $8,000,000 a week—$400,000,000 a year—for several years to come will be required, if present progress is to continue. It must be obvious that such sums can be attracted only by securities having not only a nation-wide but an international market.

For every dollar of new annual revenue a capital expenditure of approximately five dollars must be made by electric utility companies in central-station plants, distribution systems and service connections. The natural growth of existing services plus the demand of fresh fields to be served is so great that even if the total revenue from operation of existing systems were applied to extensions without payment of any interest or dividends whatever, still such extensions would be totally inadequate to meet the public demands for service. New investments of capital on a large scale must, therefore, be made in order properly to supply these demands.

To carry out such a financial program, the issues must be large and backed by a high diversity factor. It is exactly these characteristics that the holding company makes possible.

The difficulties met with in financing a project to serve a new community on account of the small size of the issue, the fact that it is based on prospective and not on established earnings, with the disadvantage of a localized risk, largely disappear when such an undertaking is made part of a large issue based on substantial existing earnings with a diversified risk spread over many properties in different localities.

Difficulties in Financing

In some cases groups of established properties may enjoy the benefits of joint operation without the existence of a holding company by being absorbed into a single stock issue of the parent company, but in general this can only be done when all the subsidiary companies are contained within the boundaries of the same state and when the parent company owns outright all such subsidiaries.

Most of the holding companies, however, control properties in different states, and their subsidiaries must be independently incorporated so that as domestic corporations each may perform its functions in the community served. Furthermore, many properties now enjoying the financial, engineering and commercial advantages of holding company membership are not owned entirely by the central organization.

The holding company system has proved itself to be effective in meeting the requirements of the great problem of financing electric public service, and the facilities provided by such companies are more necessary now than ever before in order to maintain existing services, meet the demands of natural growth and provide for new developments. Subject to proper regulation, the holding company in this field has been and is an unqualified public benefit.

Another product of electric public utility development is the bringing of these industries under the jurisdiction of public service commissions, which are as natural an outcome of modern conditions and public necessity as are the holding companies. There is fortunately good reason to expect that the establishment of the commissions in the various states will generally abate and in many instances entirely remove friction and mutual distrust between public service companies and the political authorities and public of the communities served. Generally these commissions, although often made up of men not previously schooled in matters of public service, have shown a disposition to be fair and equitable in their regulations when they have come face to face with the practical conditions they have to deal with.

Commission Regulation

Numerous applications for authority to compete in districts already well served have called forth from the Oregon Public Utilities Commission the following statement:

"One company properly regulated and administered can generally give better and cheaper service than two. It is a waste of capital and a disadvantage to a city to have two sets of telephone and electric-light wires and poles cumbering the streets when one can be made to serve the same purpose. Most utilities are natural monopolies, and the highest efficiency and lowest rates are possible only when each one has the entire business of a given city or territory. Now that we have the right and duty to regulate all public service corporations, the ill effects of monopoly may be escaped and at the same time the beneficial results of economy and efficiency realized."

A similar attitude has been adopted by other state commissions, notably those of Wisconsin and California. Public utility operators have little to fear from the regulations of a body of officials standing on such a platform.

The stronger elements engaged in the electrical service field should devote themselves to a campaign of education of the public at large, the municipal authorities and public service commissioners. Moreover, they should use every proper means at their command to discourage unsound developments and over-capitalization calculated to discredit the industry as a whole and adopt a policy of the greatest possible liberality in dealing with municipalities in connection with the supply of energy for street lighting and the pumping of water for public uses and for all other purposes that are universally recognized as being within the legitimate scope of municipal control and regulation.

Under these conditions, with a full understanding by the public of the nature of holding companies and the benefits that accrue from their operation under fair and reasonable regulation, such companies and the electrical utilities they control and operate will undoubtedly enjoy popular confidence, appreciation and support.

Relative Stability of Public Utility Financing

By W. W. Freeman

An increasing appreciation on the part of the conservative investing public of the stability and attractiveness of public utility investments has been clearly noticeable in recent years. It is a well-known fact that capital is timid regarding unseasoned investments, or those of speculative rather than stable earning capacity; therefore preference is given to securities which are regarded as standard, even though their earning capacity may be less than others which possess ample security but which are not so well known and therefore not so highly regarded.

For some time past bankers and investment brokers have appreciated the fact that public utility companies possess advantages in growth and stability of business which entitle their securities to be classed among the best, and this fact is becoming better understood from day to day by the individual investor.

Among the considerations which lend stability to the public utility securities, the following are worthy of special recognition:

Management

The continued success of a public utility company in any city of reasonable size is merely a matter of proper management, as the elements which are essential to growth and success are to be found in practically every such city to-day. The public is dependent in large measure upon such utilities for its own convenience and welfare and is, with few extreme exceptions, willing to pay a reasonable price for the service, and even in such extreme cases the company is protected against confiscation by the courts. Entirely aside from the growth of the community, no utility company has as yet reached the saturation point of the present population, and the normal future growth furnishes ample assurance of steadily increasing revenue.

The management of these companies has become reduced practically to a science, and through the activities of the various associations covering the street railway, gas and electric industries the combined knowledge and varied experience of the art are at the individual service of every company manager, if he chooses to avail himself thereof. There is less dependence, therefore, upon the human equation with the average manager than in any other field of industry.

Monopoly

A further protection is afforded in the growing and now generally accepted theory that these public utilities are best operated for the public interest in the form of regulated monopolies, thereby guaranteeing to the public, on the one hand, the reduced expenses made possible by the elimination of duplicate investment and by increased efficiency of operation, and, on the other hand, protection against unreasonable charges or conduct on the part of the utility company. The advantages of regulated monopoly are so apparent that the public service commissions in many of the most prominent states are already committed to the policy of refusing to permit competition where the service furnished by the company already in the field is believed to be adequate and reasonable.

Earnings

A most striking feature of public utility companies is that their earnings do not fluctuate widely between normal years and those of business depression, as is the case with so many other business enterprises. This is due in large measure to the fact that the product of these companies has become a necessity to their consumers which cannot be dispensed with, or even seriously curtailed, when reduction in other expenditures becomes a matter of strict necessity. This fact is graphically illustrated in a chart recently issued by Henry L. Doherty & Company, bankers, in which it is shown that during the past decade the net earnings of gas and electric companies have not dropped below 8 per cent on the securities issued in any year, notwithstanding the fact that outstanding securities covering such properties have been increased during the same period by 110 per cent; whereas in the case of large industrial companies, with their outstanding securities increased only 20 per cent, the average net earnings for the ten years are about 7¾ per cent with violent fluctuations ranging from a minimum of 5 per cent to a maximum of slightly less than 10 per cent; and in the case of steam railroads, with their outstanding capital increased 54 per cent, the net earnings average but 4½ per cent for the ten-year period which has been mentioned.

Reliability of Earning Power

From the evidence submitted it is clear that for reliability of earning power, therefore, the public utility companies stand supreme. This applies as well to the security of the investment, as is shown in the same chart. The comparison of the amount of gas and electric securities in receivers' hands per $100 of outstanding securities, covering a period of thirty years, from 1882 to 1911 inclusive, is 37 cents, compared with $1.93, covering national banks, both insolvent and passing through voluntary liquidation; $1.84 in the case of steam railroads and $2.07 in the case of industrials.

It appears to have been unquestionably established that in respect to permanence of investment and regularity of satisfactory earnings the gas and electric industry stands at the top of the list in the several classes of investment securities.

Regulation

Another feature of these securities which serves as a protection to the investor is the regulation by the public service commissions of the states in which they operate. These now exist in so many states as to be generally regarded as ultimately universal. This regulation covers absolutely the issuance of all new securities and serves as a guarantee to the investor that such securities are regarded as sound and stable by the regularly constituted authorities upon whose sanction they are issued.

As added features of state regulation which are of value to the investor there may be mentioned the standardization of accounts and the enforced publicity as to the earnings and operations of the public-service companies.

Through standardization of accounts investors are assured that charges in general are correctly made and that the various elements of income and expense are so set forth as to permit of fair comparison with other companies. The investor, therefore, has the advantage of publicity of earnings with the assurance that they have been properly established through sound accounting methods and may accordingly be accepted without reservation.

Rate-Making for Central Stations

By William H. Winslow

A VIGOROUS movement is now under way to secure legislative enactments and commission rulings enforcing uniform rates per kilowatt-hour for electric energy sold by central stations. The true reason for the campaign is masked by the statement that the electric-supply companies are selling energy to large users at less than cost and making up their losses by unduly high charges to small users. It is, however, difficult to believe that the people back of the movement are ignorant that the result of their efforts, if successful, would be to deprive the central stations of most of the revenues now derived from large consumers, with the further result that the cost of supplying the remaining customers would be largely increased, instead of diminished.

Uniform Rates

The argument for uniform rates is based largely on that most false and dangerous of statistical deceptions known as "average costs," or the spreading of total costs evenly over total product, the use of which has wrecked many a concern and the discarding of which is an essential feature of modern cost accounting. The only conditions under which a schedule of charges based on a general average cost would not produce disastrous results are those resulting from a complete natural or artificial monopoly. An example of the former is a water-works system having control of the only available supply and thus being able to get from large users a much higher rate than is justified by the cost of supplying them, and also much higher than it would cost such users to pump water for themselves were a supply available. The post office is an example of the artificial monopoly, and its practice of delivering a letter at the same price regardless of whether its destination is across the street or across the continent is a most extreme case of the use of average costs. The only way by which such a practice can be successfully maintained is by making it a penal offense, as it is, to deliver local letters by private agency. Old residents of New York City will recall the "Hussey," "Boyd" and other private letter delivery concerns, which had their own postage stamps and did a thriving business at a fraction of the government rates until they were suppressed.

Low Rates Justifiable

It is plain that central stations have neither a natural nor an artificial monopoly of the supply of electric energy to large users and that if they are to secure such consumers at all it must be by making rates as low as, or lower than, the cost at which they can supply themselves. It is not so clear, particularly to the general public, whose knowledge of cost analysis is naturally very limited, that very much lower rates to large than to small consumers are justified by the lower cost of serving the large consumers. It is the object of what follows to make this point clear.

Take the case of a central station midway between two towns of exactly similar size, to both of which it furnishes electric energy and where both towns use the same number of kilowatt-hours yearly and impose the same maximum demand on the central station, but with the important difference that in one town the central station owns the distribution system, transformers, meters, etc., maintains an office and deals with all the individual consumers, while in the other it sells energy through one transformer and meter placed at the point where its transmission line ends, at the town limits, and has no investment beyond that point and no relations with the individual consumers. In such a case the costs which should be evenly divided between the two towns would be interest, profit, depreciation, maintenance and operating costs on the central station and the transmission lines to the respective towns, while the costs which would be assessable only to the town in which the central station owned the distribution system would in many cases equal 4 or 5 cents per kw-hr., or even more.

Large Versus Small Consumers

Now, in what essential particular does the above case differ from that of a central station having one large consumer, with a maximum demand of, say, 500 kw, supplied at one point, and a large number of small, scattered consumers whose aggregate simultaneous demand is also 500 kw?

If both the single large consumer and the center of distribution for the small consumers were at the same distance from the generating station and the consumption, as well as the maximum demand, were the same, the closest analysis would fail to discover any essential difference between this situation and the one presented by the two towns. When, however, the amount of energy used per kilowatt of demand is greater for the single large consumer than for the many small consumers, and this is very likely to be the case, the difference in cost will be even greater. In a computation recently made by the writer the costs per kilowatt-hour for consumer expenses, transformer and meter losses and fixed charges on lines and poles, transformers, meters and services were figured for a single consumer with a maximum demand of 100 kw and a group of small users with the same demand. It was found that the cost of these items for the small users was twenty-one times as great as for the large consumer, though the assumed conditions were much more favorable to the small users than are usually found in practice.

Cost Analysis

It is, perhaps, not overstating the case to say that in almost every instance a full and correct cost analysis of the business of any large central station would show that the real profits are being made from the large users paying the lowest rates, and that the small consumers are barely paying their way as a class and individually are in many cases being served at a loss. This brings to mind an incident related by an official of a large central station. A large manufacturer came to him and said that there were two things he was unable to understand about the central station's charges: one was how it could afford to sell him the small amount of energy he used at his house at 12 cents per kw-hr., and the other was how it had nerve enough to charge him as much as 4 cents per kw-hr. for the large amount of energy he used at his plant.

This illustrates how the matter appears to a man used to cost analyses in his own business, as contrasted with the way it strikes people who have had no demonstration of the fallacy of the average cost idea.

In most cases rates necessary to secure the business of large users of energy can be successfully defended entirely on the ground of the low cost of serving them, such costs including full return on the investment needed for their supply. It can, however, be shown that, should it be required to go further than this and make rates yielding less than a full profit, such rates are proper in that the resulting business makes possible lower maximum rates than would otherwise be found feasible.

The real limitation on such rates is contained in the statement that in no event should any rate be made that does not operate to reduce the sum that would otherwise have to be collected from the rest of the consumers.

The Water-Power Situation

By William B. Jackson

At the present time the abstract question of water-powers is attracting extraordinary attention, and unfortunately much of the consideration of the subject appears to be along illogical and unsound lines. There is a tendency to lose sight completely of the fact that water-powers as property are much like farm lands, which, so long as they are unproductive, add no annual increment to the assets of the community and thereby to the nation, but just as soon as they are made profitably productive they add their yearly quota to the sum total of these assets. Moreover, in the case of every water-power developed and put into service, a definite saving is made in the apparently exhaustible fuel assets of the nation. This is accomplished by making use of power which is otherwise going irretrievably to waste, and it is thus seen that by the development of water-powers a dual advantage is gained. It is also worthy of note that relatively large capital expenditure is necessary in the development of water-powers.

As in the case of land, coal seams and the like, there are some water-powers which are very valuable, there are others which will barely warrant their improvement, and there are still others which under present conditions cannot be profitably developed. As in the case of land and coal seams, it is difficult to predict what the future will bring forth to change the conditions under which water-powers can be profitably developed.

Profitable and Unprofitable Developments

It has become clearly apparent to those who have given the matter of water-powers thoughtful consideration that many of the powers which have been developed in the past have not proved commercially profitable, and from this point of view such powers are therefore not adding to the assets of the nation, but even such developments make a saving in the nation's fuel supply to the extent that fuel would be required to supply the energy generated by them.

The possibility of commercially successful development of water-powers has, of course, been greatly advanced through the improvement of long-distance transmission of electrical energy, but this is only one of the factors which have played important parts in this matter. It is not unreasonable to say that the efficiencies that may be expected from American waterwheels have been improved in general as much as 10 to 15 per cent during the past ten years, and the improvement in generator and transformer efficiencies has also been very marked. With waterwheels giving installed efficiencies of as high as 85 per cent, with generators giving efficiencies of 97 per cent, and with stationary transformers giving efficiencies of 98 per cent, it will be seen that it is now possible to develop water-powers so as to supply to the transmission circuit a very large proportion of the total energy available from the water.

Even in relatively small low-head hydroelectric plants surprisingly efficient use of the water may now be made. In a recent authoritative test of such a plant having a hydraulic head of only 14 ft. the waterwheels showed an efficiency of about 83 per cent and the electric generators an efficiency of over 95 per cent, all losses being included. It should be added, however, that this plant is probably as efficient as any plant of so low a head to be found in this country. But there is some question whether higher efficiency plants of its character cannot be found in Europe, since most European waterwheels are individually designed and constructed for use under the exact conditions to which they are to be subjected, whereas in this country waterwheels of standard construction most nearly fitted for the service required are usually employed. It is probably safe to say that in 1902 no European waterwheel manufacturer made a line of standard waterwheels such as are common in this country. At that time the engineers of the waterwheel department of the Ganz company in Budapest, Hungary, were considering the development of a standard line of waterwheels in accordance with the designs developed by the same manufacturer who built the wheels employed in the water-power previously referred to, and the men in charge of that work for the Ganz company stated that they believed the company was the first European manufacturer to undertake to develop such a line of waterwheels.

Improvements in Waterwheels

The Holyoke waterwheel-testing flume has been in existence for thirty years. It was in existence for a number of years before the great electrical transmission developments became practicable, but so far as can be seen this testing flume has had relatively little effect upon the wonderful improvement in the efficiency and character of American waterwheels which has occurred during the past number of years. The improvement is undoubtedly due very largely to the increasing efficiency of competing prime movers, to the remarkable adaptability and development of the electrical generator and of electrical transmission possibilities, and to the fact that in hydroelectric power developments the amount of power supplied by the waterwheels is known at every moment and the efficiency or inefficiency of the waterwheels is at all times prominently exhibited. It is not difficult for anyone who has been actively engaged in the consideration of hydroelectric developments to recall incidents demonstrating this statement wherein different hydroelectric plants have shown very great diversity in the efficiency with which the waterwheels translate the energy of the water into useful energy, even to the extent of a difference of a third or more, and such conditions in hydroelectric developments are not difficult of detection.

An important and interesting phase of water-power improvement which is little appreciated is found in the fact that there are many powers which considered by themselves are entirely worthless at the present time so far as commercial development is concerned but which may be valuable as a unit in a property having a developed market for electric lighting and motor service and using in co-operation with its water developments energy generated from fuel. Thus water-power developments may be used in very effective combination with steam generation in such a way as largely to overcome the serious handicap of low-water periods and to mitigate greatly the troubles incident to many low-head developments on account of flood-water periods of steam flow. Under such conditions it is often practicable to improve water-powers which would otherwise be impossible of successful commercial development. For this reason electric-service companies frequently find it possible to make commercially successful developments of water-powers which would otherwise be worthless, and they thereby accomplish a most effective variety of conservation of natural resources.

Considering the present attitude of a large part of our people, it is not surprising that public utility companies established in regions where two or more water-powers are within striking distance of their fields of operation make serious endeavor to control all such powers, whether it is their expectation to develop them immediately or not. It is so easy to make a plausible presentation of the wonderful gains to be derived from a water-power development, even though a thorough and honest consideration of the situation would show it to be totally impracticable for successful commercial development, that it has been possible to improve many unsound hydroelectric projects, with consequent destructive competition in the electric-service fields of established public utility companies and with no net gain to the electric consumers but with certain loss to the principals in the undertaking. This situation has arisen many times during the past few years.

Rates for Service

In the determination of reasonable electric-lighting and motor-service rates for some cities, under commission control, which receive their electric supply from water-powers, commissions have found it necessary to base the rates of charge for service upon the results that might have been obtained from hypothetical steam-driven electric plants planned to supply the electric service for the cities under reasonable steam-generating conditions. This result is attributable to the exorbitant costs of service which arise from the consideration of the established hydroelectric plants serving the communities. We have here a concrete illustration of the uncertainty of the value of water-powers, whether developed or otherwise, which emphasizes the fact that the value of a water-power can be determined only by a full knowledge of the conditions in each particular case. There is a surprising amount of water-power agitation throughout this country, and unquestionably a wrong impression is prevalent regarding the commercial value when considering our developed and undeveloped water-powers taken collectively. There is probably nothing finer than some of our water-powers from whatever viewpoint they may be considered, but it should be emphatically appreciated, especially in connection with low-head powers and in connection with any water-powers where the market for the energy is not already developed or is not in the immediate vicinity, that usually there is great uncertainty as to the commercial value of such powers, and that their value can only be determined by a careful study and examination of all factors entering into the situation. Engineers and all people who have the best interests of this nation at heart ought to assist as far as they can the improvement of water-powers where it is commercially practicable to develop them, since every such development adds in a twofold way to the actual assets of our nation, but in considering this matter they should bear in mind that many of the water-powers now in service have been developed on account of ignorance or dishonesty and are not commercially successful. It may be accepted as almost an axiom that anything which stops or checks the progress of the development of commercially valuable water-powers is a detriment to the country, and unless we decline to accept the well-founded belief that our fuel supplies are becoming gradually exhausted, it is evident that our states and nation may well offer effective inducement for the prompt and efficient development of water-powers under reasonable regulations rather than throw any impediments in the progress of their development.

Public Service Corporations and the Public

By Alten S. Miller

THE increasing rates of interest, coupled with the increasing demands of the public and the decreasing income per unit of service rendered, have created a condition that has made it necessary for many companies to curtail extensions and has also discouraged investments in the interest of economy and good service.

Whether the actions of those controlling the companies are the cause of the unreasoning attitude of the public toward the companies or not, it is axiomatic that the latter cannot be seriously injured without commensurate injury to the public. The time has now come when the people must be made to understand this axiom and to realize fully that their interests are indissolubly bound up with the interests of the public service corporations supplying the transportation, water, electricity, gas, etc., to their communities.

The officers and stockholders of the corporations are of the same clay as other members of the human family, and the public should be made to understand this. For the reason that it is necessary to treat every one alike, general rules must be made which will apply equally to all. Such rules or restrictions are often offensive to thoughtless individuals, but there is seldom any difficulty in satisfying customers as to the necessity and fairness of these rules. Experience shows that when the large majority of the people in a community are reminded that they are dealing with human beings and that they are being fairly treated they will themselves insist that the public utilities be fairly treated.

In a number of places in the country there is a complete understanding between the public utility companies and the people. This is not a result of chance but grew out of the deliberate effort on the part of the companies to educate the people on the subject of their operations, aims and necessities, and to secure public sympathy and co-operation.

It is late, but not too late, to do this same thing everywhere. Few realize how many people in the community are stockholders, officers or employees of the public service corporations or indirectly dependent upon them for their living. It would mean much to have all those so interested working to acquaint the public with the problems of the companies.

Such a general educational movement should be started through the associations representing the principal public service activities—railway, gas, electricity, etc. After the details are worked out a concerted movement should be begun all over the United States to enlighten the public and thereby secure its effectual co-operation. It is safe to say that such efforts intelligently directed will, in two or three years, secure for the companies the personal interest of a very large percentage of the people in the communities—a desideratum that every one who has any interest in the subject will understand.

If it is suggested that such a plan is Utopian, the answer is that it has been followed in many places and has produced the desired results. It is neither luck nor graft that sends the head of a large public service corporation to Congress for two terms, with the possibility of many more, or that places other corporation officials in positions of responsibility in the government of states and cities. If each case is investigated, it will be found that the managers and owners have not only been fair to their customers and the public, but have taken the trouble to see that this fact is generally understood.

In conclusion, it is safe to say, in the majority of cases where the companies do not get just treatment, that the fault is by no means entirely on the side of the public. Though the companies may have been more than fair in the treatment of their customers, their duty does not end here. The public must be informed of all the facts, and thereby convinced that the company is fair.

Hydroelectric Transmission Systems

By Louis Bell

THE past year has been somewhat notable for the upward tendency of voltage in transmission work. The little group of plants operated at 100,000 volts and upward is growing more considerable, as reference to the various projects described in the columns of the *Electrical World* during the year will amply show. The interesting part of the situation is not so much that one plant or another has gone on to the higher range of voltage, but that it has done so without any particular difficulty. The early steps in long-distance transmission were handicapped by fear of the machines. Twenty years ago high voltage either in the generators or transformers meant, at the most, a few thousand. The intelligent use of oil and artificial cooling very rapidly removed the limitations that lay in the apparatus itself, and the difficulties were transferred to the line. After it became possible to place trust in the transformers the voltage shot upward to the vicinity of 40,000 within a very few years. Then came a halt due to improper insulator design more than anything else, as well as the beginning of the coronal effects which introduced new difficulties of unknown magnitude. It took a considerable amount of experience and many improvements to render line insulation reasonably safe at 60,000 volts and to demonstrate the limitations of difficulty from the coronal discharge. Then for some years the voltage of first-class conservative practice held steady, and the final impetus which has resulted in the fine group of plants at 100,000 volts or more was due purely to the suspension insulation, which got rid at once of many difficulties.

Commercial Considerations Paramount

The next forward step will be determined by commercial rather than by engineering considerations, for it must be very clear that the way is now open for any voltage likely to be desirable in the near future from the economic standpoint. In other words, present conditions enable one to take care of any distance now commercially desirable on the face of the facts regarding costs of coal and copper. The 240-mile transmission project just started at 135,000 volts in southern California is the longest straight-away transmission yet undertaken, although similar distances have practically been reached around a network. The other top voltages in actual use range around 110,000, with 120,000 and even up to 150,000 looked for in the near future. The extreme voltages proposed belong to the transmission plants on the Pacific Coast, but it is worth noting that, in addition to the three or four Southern plants in the Appalachian region using 100,000 to 110,000 volts, some recent lines of the Connecticut River Transmission Company are being built for 120,000 volts. Even in the New England climate the suspension insulator has turned the trick so far as high voltage is concerned.

Corona Effects

The once feared difficulties with coronal discharge have proved of little practical moment, not because the discharge has been avoided or is a thing which can safely be neglected, but because of the long transmission systems which demand extreme voltage are by conditions of economy confined to projects in which large amounts of energy are involved and the size of the line wires is such as greatly to reduce the coronal effect. In other words, transmission systems big enough and long enough to demand pressures at which there is serious danger from coronal discharge automatically supply a remedy because of the size of the conductors required.

Notable Hydroelectric Installations

Aside from the questions of voltage, the past year has furnished some notable constructions and some details of very exceptional interest. It has been marked, for instance, by the completion of the first half of the great Keokuk project of 150,000 hp in the wheels, transmitting energy at 110,000 volts as far as St. Louis, nearly 150 miles. This plant, being at a very moderate head, involved unusual hydraulic features, including high-power vertical shaft wheels at the very low rotative speed of 57.7 r.p.m. They are by far the biggest low-speed wheels in use in any existent hydroelectric station. The anthithesis of this plant in head and equipment is to be found in the wonderful Big Creek development, an account of which is printed elsewhere in this issue.

Another conspicuous item of the year in hydraulics was the sensational performance of the 6000-hp turbines for the Appalachian Power Company. These wheels under test reached the highest point of full-load efficiency that has yet been recorded, 93.7 per cent, and at moderate loads still showed efficiencies well above those heretofore recorded for wheels under similar conditions. This remarkable performance resulted in an efficiency of 88 per cent from water to busbars, again a record figure well maintained at more moderate loads. The point of the matter seems to be that with wheels working under sufficient head to give a fairly normal design remarkable efficiencies can be obtained provided the output is sufficiently great. Wheels operating under freak conditions of speed or head cannot be expected to do so well, yet it is very evident that wheel design on the whole has been so far improved within the past few years as to reduce greatly all the losses save those which must be classified as physically unavoidable.

Another plant worthy of special notice on account of the hydraulic situation is that at Hale's Bar, on the Tennessee River. Here the fundamental difficulty is variable head, the *bête noire* of the hydraulic engineer, and in this case the variation between low water and flood is from 40 ft. to as low as 19 ft. This very uncomfortable situation was met by placing three turbines on each vertical generator shaft, two of them being used together at times of fairly high head and moderate flow, and the third added only when the head is reduced by flood conditions. This is, of course, an extreme of variable head, but no better solution of the difficulty has been devised than this of multiple wheels. When the head is sufficiently high placing them separately on the shaft, as at Hale's Bar, is the natural arrangement. The arrangement tried on one of the well-known Swiss plants, a composite runner with three sets of buckets arranged radially to meet the difficulty of extreme low head, has not yet been used in America. Nor has the scheme, tried years ago in one of the plants on the Willamette, of an additional turbine coupled to a separate shaft for low-head work connected to the dynamo shaft by pulleys and a wide belt been repeated elsewhere.

Tendency Toward Simplification

A phase of the transmission work noticeably shown in the current year has been a very laudable tendency toward simplification in some of the details. The outdoor substations of the Tallulah Falls plant and some others in the same region are certainly steps in the right direction, as also are the open-air switching stations used, for example, by the Central Georgia Transmission Company. They are signs of relief from the enormously bulky and costly switch gear which have been in use. A still further step in the same direction is that taken by the Southern Sierras Power Company in the plant already alluded to, in which there is a large bank of pneumatically operated open-air switches of the horn type with double break whereby the machines are synchronized on the high-tension side, to the considerable simplification of the station. Such successful revolt against the great cost and complication of the switchboard work in some of the larger transmission stations is encouraging.

Line Construction

In line construction there has been nothing of great novelty. In most of the large installations use is made of the ordinary tower system, although there has been an increase in the use of A-frames. However, line practice in the Drum transmission of the Pacific Gas & Electric Company is worth commendatory notice. Here part of the 110-mile line is subject to very severe weather conditions, and on this portion an extremely strong construction with stranded copper conductors is employed, while for the sake of economy the rest of the line, where the exposure is more favorable, is of aluminum. Incidentally, it may be noted that this particular system has transformer taps arranged so it can be operated from 110,000 volts up to 125,000 volts as may prove desirable.

In closing these notes on high-voltage transmission special mention ought to be made of the decision reported of the State Corporation Commission of Virginia in relation to high voltage and public safety. A complaint was raised by property owners against the construction of a 110,000-volt line in the main along a railway right-of-way. The arguments displayed the same unreasoning terror which used to rouse protest at 10,000 volts, 20,000 volts and all the way up. The decision backing up the project in the most unqualified manner and intimating plainly that the petitioners were victims of needless, though perhaps excusable, fear will go far toward discouraging future attempts to block high-tension construction by legal action.

Developments in Prime Movers

By W. F. Durand

PROGRESS during the past year in connection with central-station prime movers has been detailed and plodding rather than spectacular and epoch-making. It has concerned itself primarily with attempts at a more perfect solution of the general power-plant problem; with search for a more perfect adjustment of the balance between the economic, commercial and engineering factors which supply the regulating conditions under which electrical energy as an article of commerce must be generated and sold.

In the matter of fuels, coal and oil retain substantially the same relation as in recent years. The choice between the two has become an economic rather than an engineering question, and the chief factors which enter into the problem are therefore the relative costs of production and the relative rates of production and demand as between the two fuels, with any other matters which may exercise a determining influence on the relative market price of the two. The most significant tendency of the times in this connection is the growing use of oil as a marine fuel and the recent large extension of its use in our own navy, coupled with the suggestion from the Secretary of the Navy that the government should lose no time in acquiring and reserving oil fields promising an adequate supply for the demands of the naval service.

Boiler Room Practice

Improvements in details in connection with boiler-room practice are steadily appearing. In the combustion of oil fuel, mechanical atomizers are continuing to attract some attenion among engineers generally. In the marine field they represent the standard equipment, providing as they do for atomization without the loss of fresh water by way of the furnace gases. Up to this time, however, the actual atomization is not as perfectly performed by such means as by the use of steam. In consequence, while the atomization, as a step in the program of oil fuel combustion, is performed more cheaply than by steam or compressed air, the resultant furnace economy is somewhat lower, as a rule, leaving the resultant combined economy only slightly if any in favor of the mechanical atomization. There is often, furthermore, a somewhat greater limitation in the range of capacity with good economy than with steam atomization. What is wanted is some form of mechanical atomizer which will realize the atomization of the fuel with the economy in energy expenditure of the best of such devices, and with the effectiveness and resultant furnace efficiency of the best of steam atomizing burners. With such a burner the over-all boiler economy will profit by some 2 to 2.5 per cent, the difference between the 3 or 3.5 per cent of the steam now used by steam atomizing burners and the 1 per cent or less, in terms of equivalent energy, used by mechanical devices.

Indicating and Analyzing Devices

The experience of the year has justified the growing interest in and dependence upon measuring, indicating and analyzing devices for the intelligent control of the conditions of boiler operation. Flue-gas analyzers and recorders, draft indicators, so-called economy meters, etc., are all taking their part in reducing the margin of loss by way of the fire room. It may be well to remember, however, that the best economy device in a fire room is a good fireman—a man who will use these various aids intelligently and as guides to his program of fuel, feed, air and draft control. No instrument or combination of instruments can take the place of brains in the fire room. On the other hand, it is equally true that no amount of brains will serve to determine unaided the conditions of operation with the readiness and certainty secured by the aid of the various instrumental indications and helps. The fundamental conditions of fire-room economy are simply these—complete combustion of the fuel with the minimum excess air and the maximum transfer of the liberated heat through the heating surface to the water, and the consequent rejection of the stack gases with minimum weight and temperature; but the best combination of trained intelligence with instrumental helps and guides is none too good to determine moment by moment the dispositions suited to realize the best result out of these seemingly simple controlling conditions.

In order more perfectly to realize some of the desirable conditions of operation, there has been a growing tendency in recent years to make the operation of certain factors as nearly automatic as possible; that is, to make them as nearly as possible directly dependent on the boiler conditions without dependence on human intervention. Thus systems of automatic draft and damper control, automatic control of feed water and automatic control of fuel supply, either liquid or solid, are all receiving consideration on the part of progressive engineers.

Status of Steam Turbine

In the matter of generator prime movers themselves, the situation of the past few years is substantially unchanged. The steam turbine remains alone and unchallenged in its acceptance as the typical large-unit central-station prime mover. On the other hand, little progress has been made in extending the application of the turbine downward to small sizes, at least with such improvement in efficiency as will enable it to compete in this part of the field with the reciprocating steam engine, still less with the internal-combustion engine. The small turbine with its direct production of high-speed rotary motion has thereby certain direct advantages for the operation of various auxiliaries such as turbine pumps and blowers; but for the main power unit in small sizes the relatively poor economy of the turbine in such sizes rules it out of present consideration, at least where thermal economy is an item of primary importance. The situation thus presents, in the field of the small unit, two prime movers available and bidding for recognition, the reciprocating steam engine and the internal-combustion engine, and in the field of the large unit the steam turbine alone, with a debatable middle ground within which one form or another may be chosen according to special circumstances.

Competition Between Reciprocating and Internal-Combustion Engines

The present competition between the improved forms of reciprocating steam engine and the internal-combustion engine for recognition in the small-unit field is most interesting and significant of the times. The inroads of the latter into the field long held supreme by the former have brought about still further improvements until at the present time the reciprocating steam engine stands as one of the most highly refined and perfected products of engineering skill. Its inherent limitations, however, still leave it inferior to the internal-combustion engine in point of thermal economy, and the engineer is thus confronted with two forms of prime mover, for one of which (the internal-combustion form) may be claimed the best thermal economy yet attained. But with it there must be admitted certain limitations in character of fuel and a likelihood of somewhat greater repair and maintenance bills, while for the other (the reciprocating steam engine) there may be claimed a high degree of mechanical adaptation to the demands of the situation, relative simplicity and low cost of upkeep, though there exists also some relative disadvantage in thermal efficiency.

In accord with the spirit of the times, the consideration relating to thermal economy receives increasing and even ruling weight, and as mechanical improvements and greater familiarity on the part of operating engineers are tending to reduce the relative disadvantages on the score of reliability and cost of upkeep, there is to be noted a definite advance in the status and use of the internal-combustion form. It is perhaps too early to predict the entire disappearance of the reciprocating engine from this field, but at the present time the extent of its use is subject to a marked and continuous relative shrinkage.

Steam Turbine Improvements

Regarding the steam turbine as the typical power-station prime mover, advance in three directions during the year may be noted—namely, improvements in economy, advances in size and wider adaptation to varying conditions of use.

As to economy, note should be made of the construction due to Dr. Ferranti for the use of highly superheated steam gas with superheating between stages. This turbine was referred to in an address by Dr. Ferranti nearly a year ago on the occasion of a James Watt anniversary lecture at Greenock, and it was stated that the tests made indicated a full-load consumption of 0.55 lb. of oil fuel for one shaft horse-power hour, or a thermal efficiency of 24 per cent and better. These results indicate the immediate thermal possibilities with a highly superheated steam gas. There remains the serious difficulties of a mechanical nature to be overcome in connection with the utilization of such a high-temperature medium, difficulties which are said to be satisfactorily met by Dr. Ferranti's construction. This result places the turbine economically not far removed from the Diesel engine and represents the present extreme advance in the use of highly superheated steam.

There remains also the inviting possibility of mixed-vapor turbines. The mixed-vapor-heat prime mover is old in idea and is simply a device for widening out the thermodynamic range of temperature covered by the working cycle. Thus steam and ether or a like substance might be used to extend the range below that realized by steam alone, assuming that a condensing medium at a suitably low temperature were readily available; or, on the other hand, the vapor of some liquid-like mercury might be used with steam to extend the temperature range above that ordinarily available with steam. If such a construction should be attempted, it would be of interest to learn how the economy to be gained would compare with that given by the direct use of steam gas superheated to the mercury-vapor temperature as in the Ferranti turbine above noted.

In the matter of size there seems to be no present limit. The maximum rating has rapidly risen past the 10,000-kw and 20,000-kw sizes and is now at the 35,000-kw point, with loud whispers already of a 50,000-kw unit. These enormous units mean economy thermally and economy in space occupied per unit of power developed. Obviously, however, they are only applicable in stations of large size where they can find an effective place on the daily load curve.

In the matter of adaptation to varying conditions of use, the mixed-pressure turbine is attracting increased attention. This turbine is intended to operate either singly on high-pressure steam or in combination with reciprocating engines on exhaust steam. The combination of low-pressure or exhaust-steam turbines with reciprocating engines has exercised an important influence on over-all station economy in the case of many stations originally equipped with engines. The use of a turbine in this manner has not, however, always provided a combination with sufficient flexibility to meet all conditions of station demand, and the mixed-pressure turbine has been developed to meet more effectively these varying station demands. Such a turbine may receive steam directly from the boiler, or from the engine exhaust, or from pump exhausts or other auxiliary equipment, and it will thus serve to open out the thermodynamic range of all steam so employed to the lower limit reached by the turbine itself.

Internal-Combustion Engines

Recurring briefly to the internal-combustion engine, the Diesel or heavy-oil type is attracting wider and more favorable attention as the difficulties of mechanical construction are being more effectively met and the conditions for effective use more clearly understood. In the marine field sizes have been carried up far beyond those proposed or used in stationary practice, and with perhaps questionable policy. At least for central-station service, the present limitations of such engines to sizes of 1000 kw to perhaps 2000 kw as a maximum should be accepted until the peculiar difficulties connected with the large size of cylinder are more effectively overcome.

It may be noted as an interesting fact that with the turbine form of construction large units make for simplicity of construction, economy of operation and general availability, while in small sizes the construction becomes more difficult in certain ways and the efficiency is lower in marked degree. On the other hand, with the internal-combustion engine the small size is easily built and is efficient in operation, while serious troubles, chiefly in connection with cooling, are introduced by extension to very large units.

The specific consumption of the heavy-oil engine has now become established at not far from 0.4 lb. oil fuel per hp-hr. under full load and favorable conditions. This fact alone will work powerfully for its continuing introduction and for wider extension of use, as further study may serve to remove difficulties and limitations of a mechanical or operative character.

Gas Turbine

The gas turbine is still attracting some attention from engineers and inventors, and reports have appeared of an apparently successful design and construction by Holzwarth, of Mannheim, Germany. This turbine is rated at 1000 hp and is said to have given very hopeful indications of successful operation with a high thermal efficiency. The gas turbine will have the advantage of direct rotary motion as compared with the reciprocating motion of the ordinary internal-combustion prime mover. It remains to be shown, however, whether it will be able to demonstrate any decided improvement in economy, and also whether there will be the same limitation in the matter of size and output of unit as in the case of the reciprocating internal-combustion engine.

Improvements in Lamps and Lighting

By Preston S. Millar

IN a brief review of developments in electric lighting during 1913 improvements in electric illuminants stand out as a prominent feature. In this respect notable advances have been made. In other respects, while the development has been normal and gratifying, there have been no radical improvements.

Incandescent Lamps

For the first time the number of tungsten-filament lamps sold in this country exceeded the number of plain carbon and graphitized lamps. The tungsten lamp has now been applied to practically all classes of service with satisfactory results. It has been improved in many respects, though the improvements have been inconspicuous and little heeded by users of the lamps. During the year the use of a bulb-blackening preventive has been extended to the middle and smaller sizes of lamps, thereby improving their candle-power maintenance. With this has gone improvement in the ruggedness of the filament and improvement in the manner of supporting the filament which further contributed to ruggedness. Tungsten lamp efficiencies have been increased over those of 1912 by from 5 to 15 per cent without decrease in life of the lamps.

The year witnessed the announcement of the development of the tungsten gas-filled lamp and the beginning of manufacture of such lamps upon a commercial scale. As large-diameter filament and high current values are prerequisites of efficiency in this type of lamp, its application appears, for the present at least, to be limited to lamps of the series type and to large lamps of the multiple type. The early efforts of the manufacturers during the past year are understood to have been directed toward the development of 750-watt and 1000-watt multiple lamps and 20-amp auto-transformer lamps for use on existing alternating-current series circuits, as well as lamps of 60-cp and above for use upon series circuits of 6.6 amp and other standard current values. The specific consumption up to date has ranged from about 0.75 watt per mean horizontal candle-power for the smaller lamps to 0.5 watt per mean horizontal candle-power for the larger lamps.

Little has been accomplished during the year in the way of answering the many practical questions which the development of this lamp has raised. It cannot be said that it has been determined in just what form the gas-filled lamp will find its largest development. It is clear, however, that it joins with the arc lamp in creating a demand for operation at higher current values in order to realize the best obtainable efficiencies, and that its influence, like that of the newer developments in arc lamps, will be to foster the use of high-power illuminants particularly in the lighting of streets and other large areas.

Arc Lamps

The most marked developments in the arc-lamp field during the year have been the further improvement of the inclosed or long-burning flame-arc lamp and the extension of the use of the ornamental 6.6-amp magnetite lamp. In the development of the flame-arc lamp the manufacturers of electrodes have made advances. The manufacturers of the lamps have found much with which to occupy themselves in overcoming many of the details of design, construction and operation with which they have had to contend in inclosing the flame arc. The demand for white-light electrodes appears to have increased, the superior color more than compensating for the reduction in efficiency amounting to from 15 to 20 per cent. The manufacturers of both types of arc lamps have turned their attention toward operation at higher current values in order to secure the added efficiencies of which the arc lamp must avail itself if it is to hold its own against the competition of the tungsten gas-filled lamp.

Vapor-Tube Lamps

No radical improvements have been reported in vapor-tube lamps, though the neon lamp has been drawn to the attention of American engineers rather more prominently on account of its demonstration in this country during the year by the inventor, Mr. Claude.

Central-Station Practice

A notable change in lighting practice of central stations during the year has been the extension of the free renewal practice by the larger central stations to include the largest size of tungsten lamp. It would appear that the managements of most large central stations subscribe to the policy of controlling the supply of lamps, even though tungsten lamps may not be given free of charge. Some central stations, however, have abandoned the handling of lamps entirely, turning the lamp business over to jobbers and contractors in their territory. In some few cities where rates have been reduced through city regulation actuated by political rather than economic considerations the central-station companies have been compelled to avail themselves of the opportunity which the introduction of the tungsten lamp affords and have abandoned the free renewal practice, thereby reducing their costs by, say, 0.5 per cent kw-hr., and in part compensating themselves for the reductions in rate which have been forced upon them by unreasoning regulation.

In spite of the fact that the sale of energy for motor service is becoming an ever-increasing proportion of the total business of central-station companies, there was manifested during the year a tendency on the part of such companies to devote more attention to furnishing a good lighting service. There seems to be a realization that, though the lighting part of the business may not bring the largest income, it is, on the other hand, the part of the business in which the company comes into contact with the larger number of customers, and it is, therefore, the part of the business in which there is the greater opportunity for cultivating good public opinion in regard to the service rendered. This added attention to the lighting service manifests itself in a number of ways, including the employment of lighting salesmen or illuminating engineers.

Street Lighting

During the year there have been few, if any, new installations which have set higher standards than before either in intensity or other features of street illumination. There is a tendency toward increasing intensities through the use of larger and more frequently spaced illuminants which is coming about as a matter of growing appreciation of the importance of street lighting. The more liberal use by municipalities of light in streets has been promoted by the many merchants' street-lighting installations of display character. These indicate the advantages of better lighting and the disadvantage of inadequate lighting in other parts of the same cities.

A noticeable replacement of gas-mantle lamps by tungsten-filament lamps has marked the year's record.

Illuminating Engineering

Tendencies in illuminating engineering have indicated broader conceptions of the opportunities and responsibilities resting upon the lighting practitioner. Illuminating engineering is coming to be recognized as artistic engineering of light. This has entailed a realization of the unique character of this specialty, and few engineers who have examined the subject now fail to see in this a distinct specialty.

In illuminating practice the general use of more decorative and artistic lighting auxiliaries and the more general insistence upon lower orders of brightness for light sources have perhaps been the chief developments of the year.

Society Activity

The Illuminating Engineering Society has quietly developed its activities, broadening its scope and securing a larger measure of support from the lighting industry. At the close of the year its promise of future usefulness appears brighter than ever before.

The International Photometric Commission was reorganized during the year to form the International Commission on Illumination. American participation in this international body is through the United States national committee, which is supported by those of the national technical societies which are more immediately interested in matters of illumination. The first meeting of the commission, held in Berlin during August, was attended by a delegation from the United States national committee, the members of which took prominent part in the organization of the new body. This commission appears likely to serve in the illumination field a purpose similar to that served by the International Electrotechnical Commission in the electrical field.

Photometry

There have been no notable developments in photometry during the past year. The wide range of color now encountered in ordinary commercial illuminants imposes a requirement for the perfection of methods of heterochromatic photometry, and this requirement is further emphasized by the growing tendency to resort to photometry in a broad range of lighting practice in fields in which previously it has not been employed. It is understood that in a number of laboratories independent investigations are under way with a view to developing improved methods of heterochromatic photometry, and it would appear that some means for coordinating these efforts is desirable. This is a problem of such difficulty that the efforts of all laboratories in the country might well be combined in securing the best solution of the problem. The standardization of a wide range of color screens for the simplification of commercial photometry is a step which has become generally desirable during the past year.

In general, photometry may be said to be less important as a generally employed routine process, as in the rating of incandescent lamps, and to be of growing importance in a wide range of work in which it is used as an aid in the design of illuminating installations and in the study of the qualities of illuminants. In the former the measurement of brightness of illuminated objects has become recognized as an essential supplement to the measurement of illumination intensities.

In General

The developments of the past year may be said to have been in most respects wholesome in character, making for improved illumination. A survey of the lighting conditions in this country indicates as the most important requirement to better illumination extensive educational work in order to convince the public of the importance of good illumination. A number of agencies are at work and have accomplished much during the past year in this direction. Their achievements, however, have only served to demonstrate the need for much greater effort along this line. Lighting practice lags greatly behind knowledge of lighting principles. General practice should be brought measurably close to best practice in illumination. The experience of the past year has indicated that this can be accomplished only through arousing public sentiment in favor of good illumination.

Radio-Telegraphy and Telephony

By John L. Hogan, Jr.

THE year just closed has seen marked progress in the unification of radio-telegraphic practice by a tendency toward the use of better methods of transmission and the partial abandonment of obsolete instruments. While by far the greatest number of messages and existing stations are involved simply in the ship-and-shore traffic, there are being installed and developed in competition with wire and cable telegraphs "wireless" spans over great stretches of land and sea. Radio service continues and seems ever to extend its humanitarian work in the protection and saving of lives at sea; and in 1913 the effectual enforcement of legislation requiring that each station constantly maintain an operator on duty has resulted in rescues of several ships whose fate would otherwise have been, at the best, uncertain. In this work, however, all is not yet what it might be, since except in a few notable instances the emergency equipment installed aboard most vessels, and upon which absolute dependence must be placed when accident disables the ship's power supply, is of the ancient and ineffective induction-coil type. The federal radio inspection service of the Department of Commerce has done much toward securing and upholding a moderately high standard of utility among shipboard installations, but cannot immediately insist upon too rigid application of all good service criteria. By law, every ship transmitter, whether the regular or the emergency outfit, is required to be capable of signaling 100 miles under average daylight conditions, but it is a matter of common knowledge that the letter of this ruling is often reached only by most adroitly taking advantage of the favorable times for demonstration transmission. When there is reached a still better co-operation between shipowners, the radio companies and the Department of Commerce it is probable that the spirit underlying the legislation will be met, to the vast benefit of service and the further safeguarding of those at sea. If, at the same time, the restraint and punishment of vicious experimenters and the encouragement of legitimate and useful activities on the part of amateur operators can be increased, it seems likely that there will be caused no more suffering such as that which, only a few weeks past, was brought about by the criminal and unfounded report of accident to the S. S. *Rio Gande*, sent broadcast by some unknown radio degenerate.

Space Signaling

In addition to the normal ship-and-shore communication and to competitive radio-telegraphy which now bridges both the Atlantic and the Pacific, a number of special applications of space signaling have been undertaken. The governments of France and the United States have been experimenting between Paris and Washington, direct by wireless, in securing exact data for comparing the velocity of grounded electromagnetic waves to that of light, and several railroads are attempting to establish reliable communication with moving trains and to adapt the radio service for emergency train dispatching in event of serious wire trouble. The military uses of the art have undergone development, with especial emphasis upon signaling from aeroplanes when under way and on the design of simple and portable apparatus for field telegraphy. In some cases plants primarily intended for a single use are actually utilized in other ways; for example, immediate construction of the long-discussed British imperial chain of stations has been urged on the ground that they are expected to be of the greatest utility in connecting England's scattered possessions when cables may be cut, yet the normal and peaceful occupation of the tremendous installations is to be the transmission of private toll telegraph correspondence.

The courts, in both their criminal and equity branches, have contributed toward the progress of radio transmission. Some ten or twelve patents are the basis of infringement suits which have been prepared for or have reached final hearings during the year, and two patents have been sustained in the Appellate Division of the Federal Circuit Court. The adjudication of these, together with decisions which are looked for in the near future, will do much toward settling the painfully involved patent tangle which has so long vexed radio engineers of the United States. In litigation of another sort the activity of the post office authorities has brought to book a third group of men who were alleged to have used radio-telephony and telegraphy as a basis for fraudulent stock manipulations.

Progress in Design

In the engineering work of radio transmission essential data are being determined continually, although new problems seem to present themselves for solution as fast as the older ones are put aside. Completion of the navy's high-power station at Arlington, Va., near Washington, has given opportunity for investigation of the relative values of sustained-wave and grouped-wave-train transmitters under some sets of conditions, and information on this as well as on the comparative values of several classes of receivers has been gained by a long series of trials. New speculations have been advanced as to absorption and other phenomena which appear to accompany transmission of earthed waves over great distances, and not only have various theories been proposed but several organizations are taking steps toward almost world-wide simultaneous observations of signals and disturbances in such ways that the resulting data should be of vast assistance in arriving at and demonstrating accurate transmission theories. Design in general shows a trend toward standard practice, since various types of apparatus have been in use sufficiently long to show their respective advantages and faults, and, unless further patent complications arise, it seems likely that the products of all manufacturers will become much alike in general principles at least. Standardization through the year has not been confined to a process of evolution in the instruments themselves, since the loose usage of the art's nomenclature has been attacked by the Institute of Radio Engineers, with the result that a "Standard Report" of preferred symbols, terms and definitions is soon to be issued.

Wireless Patents

The year 1913 has been quiet in so far as issue of wireless patents is concerned. Important disclosures as to generators of sustained radio-frequency alternating currents, amplifiers and general receiving methods have been made; but there has been a satisfactory lack of the detail patents, having little or no value, which were so common only a few years ago. Enough inventions have been announced to show a definite trend in the international development of radio-telegraph apparatus, and this is toward signaling with sustained waves wherever possible. The tendency toward the use of continuous forced radiation in conjunction with receivers acting to produce musical "beat" tones by interference between two inaudible frequencies of current is shown, especially in design of plants intended for communications over great distances, where economy in antenna and other investment becomes markedly important. In smaller stations, for shipboard use or for transmission of only a few hundred miles, waves occurring in regular groups of comparatively high frequency and so producing a musical tone at the receiver are becoming nearly universal practice where the ability to signal continuously in spite of atmospheric disturbances is required. Where minimum first cost is of the greatest importance and the best class of service is not required, it is customary to rely upon the older types of slow-spark apparatus for distances of 100 miles or 200 miles.

Transatlantic Radio-Telephony

Transatlantic radio-telephony has again come forward in widespread announcements through the press, but investigation of the two claims made has shown one of them to have been based upon an erroneous translation of "telegraph" and the other to refer to the transmission of a simple musical tone such as might be used in telegraphy. This is not much nearer to actual speech transmission than were the promises which linked Denmark, France and the United States in 1906 and 1907. In its serious development, however, radio-telephony has gained impetus during the past year through the work of European investigators on methods of generating practically continuous waves and modulating them in accordance with vibrations of the voice. Well-authenticated records of transmissions over several hundred miles are available. The practice of this art seems likely to develop in two directions, one pointing toward distortionless speech transmission over greater distances than can be reached commercially by wire or cable, and the other toward short-distance signaling between radio stations which need communicate only occasionally and at which, therefore, a Morse operator involves a prohibitive expense. For long-distance trunk "line" work by radio it is necessary to develop uniformly operating means for modulating the large amounts of radio-frequency power now available from single machines. For small-set service there must be produced an inexpansive, simple and reliable generator of waves suitable for space telephony. At the present time work is being directed along both these lines, so that it is not too much to hope that commercial radio-telephony will become an accomplished fact within the next few years.

Storage-Battery Industry

By Lamar Lyndon

THERE have been no radical changes in storage-battery design or construction during the past year, either in the lead-sulphuric acid or in the nickel-iron-alkaline types.

There has been the usual large demand for the smaller stationary cells for miscellaneous purposes, but very few installations have been made of the larger Planté cells such as were used in the past for the regulation of fluctuating electric loads.

Large Battery Installations

A number of large "stand-by" batteries have been installed on three-wire direct-current distribution systems for insurance of continuous service, and these have practically all been of the pasted-plate type. The use of batteries in this way is becoming increasingly desirable for the important lighting loads of the business, theater and hotel sections of the larger cities, where absolute dependence is now placed on electric lighting. The larger central stations have obtained almost perfect service records through their use. Improvements in such installations have been principally in auxiliary apparatus, and particularly in the large end-cell switches that are employed for voltage regulation.

The steam railroads are continually increasing the number of electrically lighted coaches to meet the demand of the public for this convenience. The various manufacturers are furnishing smaller and less expensive axle-driven generating equipments for this purpose, and improvements in such apparatus have made it possible to use smaller batteries.

The United States Navy has added a number of submarine torpedo boats to its fleet during the past year, and both their size and power show a decided increase. Very large storage batteries are employed for running these boats submerged.

Portable Batteries

The general adoption of electric starting devices for gasoline motor cars has created an enormous demand for the portable batteries used with these equipments. No exact figures are available, but it is probable that there have been furnished more than 500,000 cells for this single field. Even the small, cheaper cars are generally to be provided with electric self-starters in 1914, and the coming year will require a greatly increased output of these batteries.

Many central-station companies have been devoting a great deal of effort to promoting the use of both the pleasure and the commercial electric vehicle, and in many cases they have obtained very gratifying results. The greater cost of the electric vehicle has been a handicap to its wider use, but several manufacturers promise a considerable reduction in the prices, which they propose to obtain by standardizing and producing on a large scale. Such a reduction in price will no doubt greatly accelerate the introduction of these types of vehicles.

Several manufacturers are actively pushing the sale of baggage and freight-handling trucks, and such apparatus promises to have a wide use. The freight and passenger terminals of the larger railroad and steamship lines are rapidly installing these trucks. An increased number of storage-battery locomotives have been placed in service in mining, tunnel and industrial plant work.

The storage-battery street cars in operation in New York City continue to show a gratifying performance, and at last the displacement of the horse-cars on the remaining cross-town lines is definitely in sight.

The sale of the small, inexpensive farm-lighting outfits, comprising a gas engine, generator, switchboard and battery, has been extensive.

A number of Edison batteries in the present form have successfully passed a four-year period of service. Their rugged mechanical construction is a factor in their favor for such vehicles as are subjected to heavy shock. Their heavy first cost, which is about three times that of the lead battery, and the excessive current required for their charge, are handicaps under which they labor.

Electrochemistry in 1913

By E. F. Roeber

THE deep and far-reaching effects of electrochemical research on engineering fields, of which few will think in connection with electrochemistry, have recently been emphasized by the invention of the nitrogen-filled tungsten lamp. And yet this is only the last in a long series of contributions of electrochemistry to illuminating engineering, which includes the incandescent gas mantle, the impregnated-carbon electrodes of the flaming arc, and the invention of the whole range of metallic-filament lamps from osmium to tungsten, the increasingly high temperatures necessitating the use of the electric furnace for the research. If we couple this observation with the fact that this same electric-furnace research with pure rare metals has had an immense effect on alloy steels and their various applications, we have an illustration of the ways in which electrochemical advance in a single field is interlinked with the progress of modern civilization in widely differing directions.

In the field of electrochemical industries proper—those using electric furnaces or electrolytic processes on a large scale—the past year has been characterized, not by salient revolutionary developments, but by a steady conservative and healthy growth, and it is probably for this reason among others that the new tariff act, in spite of the many and considerable cuts in the tariff for electrochemical products, does not appear to have seriously affected the inherent strength of, say, the Niagara Falls electrochemical industries. Truly, they are, in the overwhelming majority, no longer "infant industries."

Developments in Fertilizer Industry

Without entering into any details of these many very different industries, some remarks may be made on two problems of broad, surpassing, timely interest. One relates to developments in the fertilizer industry, the other to the application of electrochemical methods in metallurgy. In the fertilizer industry we have a problem with many ramifications, which seems to become still more complicated by the projected and partly accomplished application of the Ostwald process in connection with calcium cyanamide manufacture.

In several European calcium cyanamide factories the cyanamide is converted by treatment with steam into ammonia for the production of ammonium sulphate. With the Ostwald process, on the other hand, it is projected to work up the ammonia (produced from the cyanamide) into nitric acid and nitrates. If successful on a large scale, this method will bring the cyanamide manufacture into competition with the Norwegian interests making nitrates and nitric acid from nitrogen oxide produced by the Birkeland-Eyde process of electric discharges through air. This latter industry is now essentially Norwegian, as the Badische company has withdrawn from Norway to take up in Germany the production of ammonia for nitrogen and hydrogen by Haber's synthetic process. The much-discussed Serpek process is still in the embryonic state; if it succeeds on a large scale, it will be another source of ammonia, but would be far more important as a producer of cheap alumina and would have a decisive effect on the aluminum industry. This is another example of the peculiar way in which subjects apparently very remote from each other are linked together by chemistry.

The Electric Furnace in the Iron and Steel Industry

In the application of electrochemical methods to metallurgy, the use of the electric furnace in the iron and steel industry remains in the foreground of interest. The production of pig iron from iron ore in the electric reduction furnace is still restricted, and will be for some time to come, to Scandinavia and California; while, starting with furnace designs of surprising similarity, though independently developed, further progress has tended to increase more and more the differences in design of apparatus as well as in the method of operation to suit the local requirements of the two localities. The California product is a soft gray foundry iron.

In the steel industry the electric furnace has three applications. First, the production of high-grade steels, in competition with crucible steel; in this respect the electric furnace makes steady, sound progress. Second, the electric refining of Bessemer converter or open-hearth steel for the production of large-quantity products, like rails of higher quality; in this respect the progress is disappointingly slow, but it is possible that years of experience with the electric steel rails now in use will be required to induce railroad companies to give further orders at a price considerably above that of open-hearth rails. Third, the application of the electric steel furnace for castings, which now attracts considerable attention; it is quite possible that the number of such installations will rapidly increase. The competition between different types of electric steel furnaces is still merrily going on as is evidenced by the news of the last few weeks. Just before Christmas the Heroult furnace at the Harrison works of the Crucible Steel Company of America was put in operation; about the same time the first American steel furnace of the pure Stassano type was started in a southern California foundry, while an order has just been given by a Pennsylvania concern for two Frick furnaces, each of 20 tons—which is large for an induction furnace. In addition, there are several Girod steel furnaces in operation, while the experimental work with the ingenious pinch-effect furnace of Dr. Carl Hering is being continued for steel refining as well as brass and copper melting and very satisfactory progress is reported.

Non-Ferrous Metallurgy

Very much discussed, but not as far advanced commercially, is the use of electrochemical methods in nonferrous metallurgy. Of particular interest at present is the problem of smelting complex zinc ores in the electric furnace, which has attracted many inventors, on which much work and money have been expended, but which seems now to approach a final commercial solution. It is noteworthy, however, that in Western metallurgy the electric furnace is finding now a rather lively competitor in leaching processes, with or without subsequent electrolysis. Much has already been accomplished in the leaching of copper tailings, but much experimental work is also being done on electrolytic zinc.

The hydro-metallurgical treatment of copper ores is rapidly advancing. About a dozen plants are now successfully treating copper ores or tailings by wet methods, and the number will almost certainly increase, for several companies are conducting experiments along this line. As to precipitation, the methods differ, since besides electrolytic deposition, hydrogen sulphide and iron are used as precipitating agents. The interesting plant of the Butte & Duluth Mining Company employs electrolysis with insoluble anodes. It seems not unlikely that this whole development may revolutionize the treatment of carbonate and silicate low-grade ores.

The Electric Zinc Furnace

The statement made above that the electric zinc furnace seems now to approach a final commercial solution is essentially based on the fact that the one great troublesome element in electric zinc smelting—the problem of condensing the zinc vapor to liquid zinc without production of "blue powder"—appears to have been eliminated by a careful scientific investigation of the physical and chemical reasons to which the formation of blue powder is due. The probable success of the electric zinc furnace holds out great hopes for a far more direct treatment of complex zinc ores with improved recovery.

The very great interest which this whole subject attracts was evidenced at the meeting held by the American Electrochemical Society in Denver last autumn, when for the first time Western metallurgists and Eastern electrochemists came together to discuss problems of mutual interest. Quite as interesting had been the spring meeting of the same society at Atlantic City, with its symposium of papers on electroplating, which brought electrochemists and practical electroplaters together for the first time. Both meetings showed that the American Electrochemical Society is successfully fulfilling one of the important functions of every national engineering society, namely, that of a meeting ground where men interested respectively in the practical and theoretical aspects of industrial science come together on a basis of mutual respect and assistance.

Electric Vehicle Progress During 1913

By William P. Kennedy

NOTWITHSTANDING the very pronounced tendency on the part of the purchasing public to refrain from new undertakings involving outlay or investment, the introduction of electric vehicles has continued a steady and healthy progress practically equivalent to that during any similar period in the recent past. This is the most encouraging evidence which could be desired because of the confidence which it must confirm among those interested in promoting the use of this type of machine. However, many of the anticipations current during the earlier part of the year, and which promised to mark a pronounced advance over the accomplishments of the past, have unfortunately not been fulfilled. These were principally an extensive increase in the use of electric trucks by express companies and the probability of the Post Office Department executing its predetermined plan of employing on a large scale electric vehicles in its parcel-post operations. The former has not materialized for conservative business reasons, and the latter was frustrated by the policy of the incoming administration, among the first acts of which was the cancellation of contracts already issued for a considerable number of electric delivery vehicles, which the manufacturers interested submitted to in the belief that by abstaining from an insistence on their rights in the case they would subsequently be favored with equivalent consideration. This has since proved futile, for in spite of the conspicuously superior success with which the other departments of the government have employed the large number of electric vehicles in use, the Post Office Department has persisted in its preference for the purchase and employment of gasoline cars for application well within the range of the electric vehicle.

The electric commercial vehicle has received a great deal of very encouraging attention from the present users of gasoline equipment, prompted by the development of an increased interest in the value of mechanical transportation and a recognition of the evident stability of electric equipment in the hands of large commercial organizations, which are becoming more and more pronounced advocates of its reliability and economy. Skepticism has almost entirely disappeared, and the substantial character of investment already made in this type of car conspicuously attests the conservative confidence which it has earned as an industrial or commercial utility.

Another tendency portending to dissipate the illusion hitherto surrounding the mysterious and unknown characteristics of electric equipment is the extraordinary activity during the past year on the part of gasoline pleasure-car manufacturers to provide their machines with apparatus for starting, lighting, signaling and the performance of other operating functions by electric means. This is certain to have an extensive educational influence in familiarizing the great mass of automobile users throughout the country with the automatic simplicity and reliability of electrical equipment. It is another step in the direction of a more favorable regard for the electric vehicle upon its own merits and will remove one of the greatest obstacles to its general introduction, which has been the collateral development of the gasoline car.

Another very stimulating influence in the general situation during the year just closed has been the cohesion with which all of the several business groups at interest in promoting the advance of the electric vehicle have united in their common purpose. While the central-station organizations in the larger cities and their vicinity have been remarkably vigorous for some years past, the disposition of many in the medium and minor cities has been apathetic, and in some instances peculiarly indifferent to the project which has such vital possibilities for their individual development.

The result of the collective magazine advertising campaigns subscribed to by a great number of these central-station companies and conducted by the Electric Vehicle Association has perhaps been more pronounced in its educational effect upon the minor central station than upon the prospective purchasing public for which it was primarily intended. This is shown by the vigor with which friendly controversy has been conducted at every opportunity afforded by society and association meetings, where the presumed or acknowledged deficiencies of the contending parties in their conduct or qualification to co-operate for the common good have been a constantly recurring and a burning topic. All of which means that there is a widespread awakening and uprising of that stupendous influence, hitherto dormant, which if once co-operatively harnessed and directed can be exerted so as practically to bring the electric vehicle with great rapidity into almost universal employment.

Pleasure Cars

Conditions surrounding the pleasure-car field have not materially changed during the past year. The cars have continued to be introduced at about the same rate, with perhaps some increased activity in the smaller cities, where the influence of co-operative advertising has had a more pronounced effect than in larger cities.

The design of some of the principal makers has undergone slight changes, these particularly in relation to methods of rear axle drive, but beyond the value of these as constituting a difference or having some supposed merit as talking points in influencing purchasers likely to be swayed by the latest trend of fashion no radical alterations have been effected. Thus we have had changes from bevel-gear to worm-gear drive, when opinion seems to prevail that this is not warranted by any difference of serious character. In fact, some manufacturers, having satisfactory proof from their own critical experiments that mechanically the change was not warranted, have made the change in view of the disadvantage they would suffer in marketing their otherwise "old-style" product in the face of the flagrant advocacy of the "new style" possible with the present-day vigor of advertising presentation.

Similar vagaries have influenced changes in methods of control, although there has been a genuine demand for duplicate-control installations in closed vehicles seating four or more people, so that the machine may be operated from a forward or rear seat as may be desired, there being some advantage in the direction of comfort in operating from the rear seat when the car has only one or two occupants.

There has been considerable inclination to extravagance in the finish and equipment of interiors, which perhaps may stimulate purchase by those able to afford the added price necessary for such refinements. But, on the other hand, this general tendency, prompted by the rivalry of competing manufacturers, has the disadvantage to the trade as a whole of restricting sales within the limitations enforced by high price.

The pendulum has been swinging in this direction so persistently and in such a pronounced manner of late years as to prompt reaction toward a lower-priced vehicle provided with such refinements and comforts as are likely to meet the complete requirements of the more conservative class, whose desires are pronounced in the direction of utilitarianism graced with convenience and respectable equipment rather than any degree of ostentation or extravagance. In fact, since the change to meet this demand has become evident in the production of a few makers of machines of this conservative order we are already beginning to hear announcement of the much-desired "popular-priced electric," which is expected to meet with ready acceptance by the great mass of purchasers to whom such an electric vehicle might become as much of a "necessity" as any of the other modern commercial electric utilities enjoying almost universal employment.

This is a logicai anticipation perhaps often repeated, but it is curious enough, in a somewhat psychological way, that before the public would become satisfied with a moderate-priced electric vehicle, naturally having the restricted though reasonable range of activity—or, in other words, before such a machine could become fashionable—the demand for extreme performance capacity and the extreme of luxury and comfort would first have to be met and satisfied.

Low-priced cars with limited range, but such as would meet the every-day requirements of a business man as a convenient means of locomotion, have been available for many years past, but since they were not fashionable and their limitations were in marked contrast with the commodious and expensive electric de luxe in use by "society," those who did purchase and employ the utility type were made to feel so "cheap" or otherwise handicapped and embarrassed by the contrast as to be impelled to discontinue its service.

Automatic Charging Apparatus

One of the fundamental characteristics influencing the successful and satisfactory employment of electric vehicles is that principle of design which anticipates the detrimental influence resulting from permitting the driver to have free scope in his functions of operating the machine and which consequently predetermines and limits these to a rigid and definite method of control, provided with due regard to a rational application of the power equipment, reasonable acceleration and maximum speed consistent with the loads and traffic limitations under which the machine is to be employed. These fool-proof safeguards are the insurance which gives the electric car its well-defined pre-eminence over the gasoline vehicle wherever the employment of unskilled labor is necessary or desirable in the economy of maintenance and operation.

During the past year there has been commendable development tending to secure similar safeguards in the manipulation of battery charging and providing for the automatic performance of predetermined functions wherever convenience or necessity precludes that constant supervision desirable in cautious or exact charging. Apparatus of this type has made considerable headway, particularly in the installation of private garages attached to residences, where its employment enhances the facility and convenience of the electric carriage as a domestic luxury and comfort.

Instruments

Another refinement in the direction of security has been the development in convenient form of performance-indicating and recording instruments whereby attention and supervision is invited and directed toward those inconspicuous though essential details which largely contribute to precise operation. This, when relieved of its usually attendant tedium, brings a compensation which must be measured in terms above the monetary, since it promotes a mental satisfaction, a conservation of human energy and a preservation of property which are entirely above the purely economic rewards attendant upon mere reduction of expense.

The convenience and precision of these instruments, which visually indicate the existing state of battery charge and make evident the range of the charge and discharge on any particular occasion, convey to the owner of automobile equipment covered by such protection the assurance and satisfaction that his property will be carefully preserved and that the danger of damage to it when not immediately under his supervision is reduced to a minimum. The use of this type of instrument has been of considerable benefit in removing the supposed mystery surrounding storage-battery apparatus and has reduced to definite and accurate indication most of the hitherto unknown quantities involved.

Old Equipment

One strong indication of the stability of the electric commercial vehicle is the absence of second-hand cars upon the market. In other words, they are a good, sound investment and those who buy them keep and use them. Moreover, the fact that they usually remain in the service of the original purchaser makes the pedigree, so to speak, of every commercial electric a matter of easy proof, and consequently whenever used cars appear for sale they are easily disposed of. The principal contributing factors to this situation are well-established design, the practical commercial standardization of minor wearing equipment—batteries, tires, chains, etc.—ready availability of this upon the market, as well as the susceptibility to change or modification of this equipment, permitting some latitude or adjustment of capacity to the performance required.

Use for Parcel Delivery

The year 1913 opened with the very gratifying prospect that the disposition on the part of express companies to increase their electric-vehicle equipment would continue to mature to the point where a complete change from horse to machine equipment would be carried into execution, with the electric equipment largely predominating. That this prospect declined with the increasing activity of parcel-post operation and the imminent inclination of the Interstate Commerce Commission in the direction of regulations adverse to the interests of express organizations was beyond question unfortunate for electric-vehicle interests. It postponed the expected opportunity for making the year just closed a banner one and the entering wedge into that confidently expected era of employment on a large scale of electric vehicular equipment for merchandise transportation. With more than $1,500,000 already invested by express companies in this direction and a reasonable expectation immediately ahead of this being increased to $3,500,000, there can be no doubt of the colossal influence of this investment as an example of confidence to the commercial community.

Although this has not yet become an actual realization, it remains a latent potentiality to be released in the near future irrespective of legislative restriction or governmental transportation operations—assuming the likelihood of express companies remaining in existence. In other words, whatever be the future direction of the activities of express companies—expansion or enforced economy—electric-vehicle equipment must necessarily be increased as their dominating utility for city transportation. The lesson has been taught; the experience has been bought and paid for; the transaction has been a satisfactory one; the fact has been established that when applied within the reasonable limits of their capacity and operated under the direction of their own competent executives, intimately familiar with the peculiarities of the apparatus, there is no more economical and reliable device applicable to their requirements than the electric vehicle.

Electric Omnibus Promotion

During the year there has been more or less resuscitation of the fascinating allurements of electric omnibus operations, particularly in New York. At this recurrence of past performances there have been a few added attractions to lend it some novelty, such as a nickel ride, with stress on the charm of a feminine conductor, and there have been even veiled hints of the oft-prophesied new and revolutionary motor equipment. All of which leads us back over a six-year interval of suppressed activity to those operations of similar character occurring in Detroit, Cleveland, St. Louis, Pittsburgh, Philadelphia and a few other places, as picturesquely portrayed in the New York *Sun*, Aug. 8, 1907, under the title "$8,000,000 Baseless Stock." This will prove interesting reading and a possible antidote at this time against the repetition of any epidemic of the same kind.

The genuine advocates of extension to electric-vehicle operation should lend every assistance and co-operation possible to the furtherance of such undertakings as afford self-evident assurance of the rational application of this type of equipment within the range of its capabilities; but it should not be forgotten that the history of the industry has monumental evidence showing that its progress has been more seriously interfered with in the past by unwarranted expansion in the hands of promoters than by any other cause.

There is abundant evidence available to prove the success possible in the application of the electric vehicle to collective passenger transportation, but the cumulative price paid during the past fifteen years in patient sacrifice of many kinds, in persistent energy, in inactive capital investment, in cautious, progressive development and indomitable perseverance, has been too great and too precious to risk a disruptive intrusion at this period of rapacious projectors of questionable enterprises. Eternal vigilance and unrelenting scrutiny are, in this as in so many other matters, the only dependable safeguards.

Industrial Trucks

Of remarkable significance is the progressive development accomplished during the past year in the application of the small so-called industrial truck in the handling of freight at railroad and steamship terminals, as well as to serve as a general utility in industrial establishments. The significance of this application can be measured only by the conspicuous absence of activity of freight transportation organizations in their terminal equipment and facilities. The introductory period necessary to overcome the reluctance to change existing in such institutions seems to have been passed. The preliminary installation of these devices has given such overwhelming evidence of the economy to be effected with their application as to create an almost immediate demand for their employment in great numbers.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Pennsylvania Railroad Contracts with Philadelphia Electric Company for Energy

The Pennsylvania Railroad has announced orally that the contract for the electrical energy for the electrification of its lines between Broad Street station and Paoli, and also between Broad Street station and Chestnut Hill, has been let to the Philadelphia Electric Company. It was said that probably all of the local trains on those lines would be operated by electrical energy before the end of 1914, and that the first electric trains out of Broad Street station would be running about September next.

The contract is for five years. At the beginning the Pennsylvania Railroad will use about 4500 hp, a minimum of 3750 kw, with a load factor of 25 per cent, being specified. The energy is to be furnished for the main line to Paoli and any addition or extension thereto, the railroad company reserving the right to call on the Philadelphia Electric Company for any additional power that may be necessary for its general system from time to time. With the completion of the present work as planned, the Pennsylvania Railroad will have 32 miles of electrified lines in the Philadelphia suburban district. The cost of the energy to the railroad company for the Paoli line for the first year will be about $150,000.

The Philadelphia Electric Company now feeds a load of 35,000 hp daily for the Philadelphia Rapid Transit Company. Mr. J. B. McCall, president of the Philadelphia Electric Company, said that no change or enlargement beyond the usual will be necessary for supplying the energy for the Pennsylvania lines. At present the Christian Street station has a rated output of 115,000 hp, and during the next year the addition of steam turbines will bring this rating up to 187,000 hp. Until the contract between the Pennsylvania Railroad and the Philadelphia Electric Company is actually signed none of its details will be available for publication.

Engineering Congress at San Francisco, 1915

Col. George W. Goethals, chief engineer of the Panama Canal, has consented to act as honorary chairman of the International Engineering Congress which is to be held during the Exposition at San Francisco, Sept. 20 to 25, 1915, under the auspices of the national engineering societies. The professional sessions of the engineering congress will be divided into eleven sections as follows: The Panama Canal, waterways and irrigation, railways, municipal engineering, materials of engineering construction, mechanical engineering, electrical engineering, mining, naval architecture, military engineering, and miscellaneous. On account of the meeting of the International Electrical Congress to be held at San Francisco during the week preceding the engineering congress, the latter's activity in the field of electrical engineering will be limited to consideration of points of contact between electrical engineering and other engineering phenomena and work. The executive officers of the engineering congress are Messrs. W. F. Durand, chairman; W. A. Cattell, treasurer, and E. J. Dupuy, secretary.

A. I. E. E. Midwinter Convention

The second annual midwinter convention of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, New York City, Feb. 25, 26 and 27, under the auspices of the electric power committee.

The general subject of the meeting will be "electric power," and each of the sub-committees of this general committee will present papers on the special branch of this subject under its jurisdiction. The subdivisions adopted are: (1) power stations, (2) power generation, (3) protective apparatus, (4) transmission, (5) distribution, (6) economics, and (7) engineering data. In addition to the technical sessions several entertainment features are to be provided by the New York reception committee.

Electrical Equipment for the Chicago, Milwaukee & St. Paul Railway System

After careful consideration, the Chicago, Milwaukee & St. Paul Railway has decided to use the 2400-volt, direct-current catenary system for the electrification of its Rocky Mountain division, as announced in these columns last week.

No decision has been reached with regard to the type of either the passenger or freight locomotives. The freight locomotives will be required to haul a trailing load of 2500 tons up a 1 per cent grade at a speed of approximately 15 m.p.h. The passenger locomotives will be required to handle a trailing load of 800 tons on level track at approximately 50 m.p.h. and on a 2 per cent grade at approximately 24 m.p.h. The heating for trains will be obtained by means of oil-burning steam boilers, for which ample room will be provided.

All the locomotives, both freight and passenger, will be provided with regenerative control. The air brakes will be used only for stops and in emergencies.

Substations

Based upon the investigation of the locomotive performance on the ruling grades in the electrified zone, it has been decided to install in each substation supplying gradients of over 1 per cent an equipment of three 1500-kw units, two being in operation and the third held in reserve.

For gradients up to 1 per cent energy will be furnished from a two-unit substation containing two 1500-kw motor-generator sets, one 1500-kw unit in operation, with the second as reserve. All substation units are to be of the same size and will comprise a sixty-cycle synchronous motor directly connected to two 750-kw, 1200-volt direct-current generators connected in series for 2400 volts.

Energy will be supplied to the locomotives by means of roller contact with an overhead copper trolley wire at least 24 ft. above the rail. The trolley wire will be of No. 4-0 copper and suspended from a steel catenary cable. This catenary construction will be supported by bracket arms extending from wooden poles.

Arnold on Railroad Electrification

Mr. Bion J. Arnold, of Chicago, who has devoted much study for many years to electric-railway advancement in the United States, and particularly the application of electricity to heavy railroading, in his presidential address before the American Institute of Electrical Engineers, at a joint meeting of the (British) Institution of Electrical Engineers and the Institute in St. Louis during the International Electrical Congress in 1904, said that he was convinced that electricity would be generally used on the main railway terminals of the United States and ultimately on the main through lines for passenger and freight service, but that he did not anticipate that it would always be adopted on the ground of economy in operation, nor that it would be introduced through the voluntary acts of the owners of steam railroads except in special instances. He said further that he did not anticipate that all roads would soon adopt electricity, for the steam locomotive would hold its field in this country for many years to come.

To a representative of the *Electrical World* Mr. Arnold stated recently that he thought that the development of electric railroading had proceeded very much along the lines foreseen in 1904. "The great New York Central terminal electrification in New York City," he said, "is practically completed as originally planned, electric locomotives running out as far as Harmon. The New York, New Haven & Hartford has recently extended its electric system by the electrification of several freight yards in the vicinity of New York, and I understand that it plans to extend its system eastward. The Pennsylvania's extensive electrification in and near its New York City terminal is well known. To say nothing of the interesting and extensive electrifications abroad, a mere mention of the examples in the United States would make an instructive list. Such a list, not complete probably, would include the Baltimore & Ohio tunnel in Baltimore, the Sarnia tunnel of the Grand Trunk (the first heavy-duty single-phase railroad system), the Southern Pacific's suburban lines near San Francisco, the Hoosac tunnel of the Boston & Maine, the Great Northern's Cascade tunnel, the Norfolk & Western's mountain division in West Virginia, the Mount Morris (N. Y.) division of the Erie, the Michigan Central tunnel at Detroit, various electrifications of the Pennsylvania near Philadelphia, a mountain division of the Denver & Rio Grande in Utah, and more recently the announced electrification of 440 miles of the main line of the Chicago, Milwaukee & St. Paul between Avery, Idaho, and Harlowton, Mont., over the Bitter Root, Rocky and Belt Mountains. This last is particularly significant, as it presumably means the ultimate electrification of the entire main line of the Chicago, Milwaukee & St. Paul from Harlowton to the Pacific Coast—a distance of 865 miles, including the line to Tacoma.

"To-day there is no question of the practical operating success of moving heavy railroad trains by electrical energy. The whole matter of the application of electricity to railroading is a question of economics—a question as to when and how rapidly the financial burden can be applied to the railroad company so that it can meet it reasonably and fairly. The principal advantage to the railroad of using electricity is increased haulage capacity in addition to some betterment of economy. The latter consideration, however, in many cases is completely absorbed by the increased fixed charges. Thus the expense of making the change is justified, provided the change is brought about no more rapidly than the railroads can undertake the financing.

"I am of the opinion that where a railroad will take the initiative and make the improvement of electrification for the benefit of the public, and where the necessary investment cannot be justified on financial grounds, it is perfectly proper to increase the rates to justify making the improvement which the public demands, provided the increased rate is confined, so far as practicable, to those benefited by the improvement.

The Terminal Problem

"When we consider the important and pressing problem of the improvement of railroad terminals in our large cities, we encounter a fact well known to railroad men, that in many instances the tracks are duplicated or cross and recross each other in such a manner as greatly to increase the fixed charges and operating expenses of the railroad. Much of this tangle could be eliminated by the development of terminals and entrances to cities along economic lines, and if the terminals could be so remodeled the cost of electrifying them would in many instances be greatly reduced.

"I may add that in my report on the rearrangement and development of the steam-railroad terminals of the city of Chicago, submitted to the Citizens' Terminal Plan Committee on Nov. 18, 1913, I suggested certain modifications in terminal arrangement. I pointed out that it is clear that if efficient development is to be expected within the areas now occupied by the railroads in Chicago, the railroads must agree upon a plan of harmonizing individual interests in a broad plan of co-operative development. One feature of the modifications proposed was the through-routing of suburban lines through the city, with connecting stations, so as to permit any section of the suburbs to be reached from any part of the central business district. The tracks should be depressed and covered where necessary and some form of operation adopted by which this would be permissible.

"If the various steam railroads, say in the city of Chicago, could be induced to co-operate to establish such a system of through-routing of suburban trains, a business would be built up which would become profitable—if not at the start, certainly in the course of a few years. The business of railroads is to serve the public, both by their through routes and by their suburban lines. If the existing structures of the latter can be utilized more efficiently in the public interest than at present, then the improvement should be brought about.

"As to the system to be adopted in any railway electrification, there is no invariable rule. The engineer must have before him in each particular case all the factors of the problem before he can come to a decision. Single-phase, three-phase and direct current all have merits for use under certain conditions. It should be said, however, that no large city should allow different systems to be used within its limits; all should insist upon all steam railroads adopting one system, whatever it is, and using it throughout the city."

Purchase of Electrical Energy

One of the live subjects of the year just passed, and one which will continue to be carefully considered in 1914, is whether an electric-railway company can safely transfer the production of the electrical energy it requires to those who make a specialty of that business, confining itself to its transportation activities. When this question was put the answer was to the following effect:

"It is good economy for the railroad to purchase electrical energy rather than to produce it itself, if an available and efficient electric-service plant is in existence possessing a rating near to or greater than the requirements of the railroad property. An electric-service plant so situated, with the additional railroad load, can operate large generating units and run them nearly at economical load. In other words, such a plant could run its units nearly at the proper rating for economical operation for a greater number of hours daily than could the railroad. In this manner the electric-service plant would be able to reduce the cost per kilowatt-hour for fixed charges and labor compared with what the railroad could hope to do in its own individual plant. Under these circumstances it is more economical for the railroad to purchase energy than to attempt to produce it. By this procedure the railroad would save money and the electric-service company be enabled to make a profit, the amount of each depending on local conditions."

Electric Illumination for Many Community Christmas Trees

Many American cities adopted the plan of erecting community Christmas trees during the recent holiday season. In nearly every case electric illumination formed a conspicuous part of the decorations. Reports from Washington, New York, Boston, Albany, Baltimore, Milwaukee, Columbus, Cleveland, Cincinnati, Detroit, Denver, St. Paul, Minneapolis, St. Louis, Philadelphia, Chicago and other cities gave accounts of celebrations of this description.

In Chicago a 75-ft. built-up tree was erected in Grant Park, near Michigan Boulevard and East Madison Street. This tree was surmounted by an electric-lighted star 3 ft. in diameter, and electric incandescent lamps were also plentifully distributed throughout the branches of the tree. Back of the principal tree was an architectural feature about 200 ft. wide, known as the "trellis." This consisted of a wooden framework concealed by evergreens and arranged in curving form, with wings on each side. There was an arch in each of the side wings and seven smaller arches in the curved portion between. An evergreen tree was placed in each of the large arches and there were seven small trees above the spaces between the arches in the recessed curving portion of the trellis. The whole trellis was about 200 ft. wide and the side wings were about 40 ft. high, the connecting curved portion being about 25 ft. high. Each of the seven small arches contained a triangle supporting eight globes within which were small candles.

CHRISTMAS-TREE DECORATION, CHICAGO

A nearby band stand and the north balcony of the contiguous Art Institute were also especially electrically illuminated. In all, there were about 1100 electric incandescent lamps. This feature of the Christmas celebration in Chicago was due to public-spirited citizens, the Commonwealth Edison Company being a large contributor.

American Economic Association Discusses Public Utility Questions

Public utility questions occupied a large share of the attention of those attending the twenty-sixth annual meeting of the American Economic Association, begun in Minneapolis on Dec. 27. The first session was devoted entirely to the presentation and discussion of a paper on "Control of Public Service Corporations" by Prof. John H. Gray, of the University of Minnesota. President David Kinley, of the University of Illinois, was in the chair, and the attendance at the opening session was about 200.

Professor Gray Attacks Rate Making by Valuation

In presenting a brief summary of a voluminous paper, Professor Gray stated that public service commissions are wrong in making valuation the basis of rate control. He said that public utility commissions are on trial; they will have to win success, or the people will go to public ownership. There is no ground whatever for valuing public utilities. It should be remembered that these utilities are public enterprises in every sense of the word. The relation of the state or sovereign power to them is that of principal and agent. The speaker discussed some of the vagaries of valuations. The rule "a fair return on the fair value of the property used for the convenience of the public" is the finding of the courts. In law the country is now committed to it, but the effort to put this rule into practice leads to chaos.

Private owners are true pioneers. Like other pioneers—say like a man who owns a gold mine—they are unwilling to accept the fair-return dictum of the courts; they still want speculative gains, and they are honest in their belief. The Supreme Court has not laid down any rule for arriving at fair value. Professor Gray ridiculed the cost-of-reproduction-new theory of making valuations. In the last analysis all value ascertained by this method rests on human judgment. The companies, with their combined wealth, hire men of large intellect as experts in rate cases. To such men, in giving their opinion in evidence, more credence is given perhaps than to less able experts representing the side of the public. The speaker cited the Des Moines gas case, where the company is said to have paid $150,000 for expert evidence in a comparatively unimportant case. In the matter of the so-called intangible values the gates are opened for the wildest flights of fancy. Some of these intangible items were reviewed, such as interest during construction, charges for engineering and for general organization, promoters' expenses, contractors' profits, etc. Going value and good will received the speaker's disapproval as elements to be taken into consideration.

The commissions have proved to be but as the fifth wheel to the wagon. The courts have been the controlling bodies. This will continue to be the case until the constitution is changed by a formal action or by interpretation. The theory of principal and agent is the only one upon which to arrive at a satisfactory relation between the public and the utilities. The sovereign state is the principal. After allowing a fair wage to the agency it should have the benefit of all the gains and also stand all the losses. There should be no valuation for rate regulation but history—that is, a statement of outlay of money spent and services rendered—nothing more.

In relation to franchise contracts, Professor Gray gave it as his opinion that the Supreme Court has already discovered that contract ordinances are inconsistent with the modern theories of regulation. He also thinks that "the courts, state and federal, are moving very rapidly to a point where, without any formal reversals, they will find a way to abolish most of the existing franchises by a strained interpretation, which leads to the conclusion that the franchises were invalid from the beginning for lack of power on the part of the municipality."

Early losses should be repaid, but they should not be added to value but rather repaid by higher rates through a reasonable term of years. They should not be capitalized for all time. Professor Gray also declared that the commissions are reviewed by the courts and are not responsible in any proper sense. The courts in their turn are influenced by the findings of the commissioners. The speaker referred to "learned courts and tethered commissions." He cited the Fall River case, where the Supreme Court of Massachusetts not only completely overruled the commission in that state in relation to the issue of stock for extensions where a large surplus existed, but virtually abolished the powers of the commission by ruling that in such matters the commission was acting in a quasi-judicial capacity and must proceed on the same principles as the court would do.

Discussion

Mr. E. W. Bemis, public utility expert, Chicago, urged that courses on rate regulation and the court decisions relating to them be established in universities. He believes that regulation is here to stay and is doing a great deal of good in many directions, such as uniform accounting, control of service, control of rates and the training of men in the study of public-service problems. But regulation has serious dangers. Giving too much of the unearned increment to the companies is one. The state should not ignore the investor, but its chief solicitude should be to protect the consumer. If monopoly earnings are not too large there can be no watered stock. There is great danger, also, in the attitude of commissions toward municipal ownership. The city should have the right to make or lose as it pleases, considering the question of municipal utilities. Mr. Bemis thinks that in relation to regulatory commissions the country is at a stage where it should pause and study.

Prof. J. E. Brindley, Iowa State College, did not agree with Professor Gray that rate-making based on valuation is a fallacy. It is impracticable to fix rates on the basis of a statement of outlay. Some of the statements in Professor Gray's paper were criticised as extreme. Regulating boards should regulate and control, and should not destroy private initiative—"if we are to have private initiative," added Professor Brindley. Professor Gray's principal-and-agent plan, if put into execution, would probably result in poor service, receiverships and state ownerships.

Prof. James E. Boyle, University of North Dakota, said that Professor Gray had presented his criticisms in a striking manner. It was to be regretted that the author did not give more attention to suggesting remedies. At present public ownership of utilities would be a dangerous undertaking. The speaker expressed his belief that private initiative is not due wholly to hope of speculative gains, and he cited the examples of art, literature and science. The plan of one private company owning all the railroads of the country, controlled by the government, and with its earnings guaranteed by the government, looks feasible, but is, perhaps, too radical for the present day. There seems to be an inevitable drift toward public ownership.

Mr. James E. Allison, consulting engineer, St. Louis, and formerly a member of the St. Louis Public Service Commission, thought Professor Gray too pessimistic. He said that the author of the paper set up men of straw to demolish. There is a contractual relation between principal and agent. What that contract is, in the case of public-utility regulations, is the crux of the question. To fix rates there must be a valuation or something to take its place. Original-cost and reproduction-cost valuations often work out about the same.

Prof. William F. Gephart, Washington University, asked if it was indeed true that the time of risk and speculative profits has passed in public-utility enterprises. Utilities that involve risks are planned to-day in large cities and small cities. Commissions do valuable work in improving the character of service as well as in regulating rates. There is a widespread belief that a large portion of public utilities are over-capitalized and charge rates that are too high. This may lead to public ownership, but there will still be difficulties to encounter, for many men believe that governments exist to grant gratuities of some kind. Professor Gephart remarked that there is not much of a constructive character to show as the result of a decade of work by public utility commissions.

Mr. Howard C. Hopson, of the staff of the New York Public Service Commission for the Second District, said that commissions are going back, in making valuations, to the plan based on investment, gradually abandoning the cost-of-reproduction theory. There can be no mathematical formula to be used in working out a rate.

Mr. Roger W. Babson, financial writer, Wellesley Hills, Mass., remarked that theory will have little to do with the settlement of the public utility question. This question will be settled when it is determined who has the larger number of votes, the men who use the utilities or the men who hold investments in them.

In a brief closing speech, Professor Gray declared that commissions have practically arrived at a point where the companies are guaranteed against losses. As to private initiative, he wanted to know if there could be in fact any system of control that would be effective without destroying the opportunity for private gain.

Joint Meetings with Sociologists

The American Sociological Society held its eighth annual meeting in Minneapolis on Dec. 27-30, the date of the convention of the American Economic Association. A joint meeting of the two organizations was held on the evening of Dec. 27. President Albion W. Small (University of Chicago) of the Sociological Society depicted in idealistic terms "A Vision of Social Efficiency." President Kinley of the economists took as his subject "The Renewed Extension of Government Control of Economic Life." He considered present-day economic tendencies and analyzed the effect of welfare legislation, minimum-wage laws, dissolution of trusts, increased taxation on accumulations of wealth and similar evidences of the apparent desire of governments to protect the weak against the strong in industrial affairs.

"Fos Festival" at St. Joseph, Mo.

Applying the rules of simplified spelling to the Greek word "phos," which means "light," a "Fos Festival," or carnival of light, was conducted by the St. Joseph (Mo.) Railway, Light, Heat & Power Company during the weeks preceding Christmas, and proved a great success in stimulating electrical interest locally.

The twenty-one booths at the show, occupied by manufacturers of electrical apparatus and appliances, electric-vehicle builders, local contractors and the electric-service company, were decorated uniformly, the color scheme of the entire Auditorium, where the exhibit was held, being carried out with streamers of white and green bunting illuminated by strings of lamps of the same colors.

Among the direct results of the show was that more than 175 appliances were sold outright, seven of these being household electric ranges. Electric-vehicle men about the show seemed enthusiastic over the "live prospects" they had encountered. A motor-driven tower wagon was sold to the street railway company and a light truck was purchased by a local laundry man.

AUDITORIUM, ST. JOSEPH, MO., DURING "FOS FESTIVAL"

Striking illuminating effects were used in the Auditorium. A night picture herewith shows the 40-ft. revolving Christmas tree with its 1500 green incandescent lamps, and also shows some of the 14,000 tungsten lamps which were used in the decorations about the interior of the building. The streamers of bunting and lamps radiating from the bell in the center of the room were alternately green and white.

Streets leading to the Auditorium were decorated by arches bearing the words "Fos Festival," and by streamers of single tungsten lamps strung over the roadway. These festoons terminated in electrically lighted Christmas trees supported on temporary lighting standards bearing 300-watt green and white tungsten lamps.

In the booth of the central-station company at the Auditorium various appliances and lamps were connected to an electric-sign flasher and to an ammeter calibrated to read directly in cents per hour, so that as each appliance was in turn connected, the meter showed the hourly cost of its operation. Placards and ingeniously placed pilot lamps pointed out which devices were at the time in use and which would be next connected.

Standardization of Public Utilities Service

Dr. Edward B. Rosa, chief physicist United States Bureau of Standards, delivered an address before the section on social and economic science of the American Association for the Advancement of Science at Atlanta, Ga., on Dec. 31, 1913. His subject was "Standardization of Public Utilities Service." Dr. Rosa discussed the present relation of the Bureau of Standards to public utilities and public service commissions. Part of his remarks follow:

An important work may be done in standardizing public utility service, not with a view of requiring all companies to conform to one standard, which would be impracticable, but to have standards that can be adapted to different conditions and that can be used to judge the performance of any given utility.

Obviously, however, no single state commission could undertake to establish such standards of efficiency and performance for all the utilities under all the different conditions found in practice. Neither can it be expected that the utility companies themselves will ever formulate such standards. The only practicable way of accomplishing the desired result is by co-operative effort between the commissions and the utilities of the whole country. And the most practicable way of securing such co-operation appears to be for the federal government to assist in the undertaking. The federal government through the Agricultural Department, the Geological Survey, the Bureau of Mines, the Public Health Service, the Bureau of Education and other bureaus and departments is co-operating with the states in many important lines of work, and such work is done by the federal government, not because the states cannot do it, but because the federal government can do a certain part of it much better than the states, and the co-operation and unity of effort thus brought about are of great value to the country as a whole.

Work of the Bureau of Standards

In the same way the federal government has been co-operating to some extent through the Bureau of Standards with the state commissions and the utility companies in the standardization of practice and of service, but the limited resources of the bureau have permitted only a very limited activity thus far. The need of more extended work of this kind has been so generally felt that the Secretary of Commerce has asked Congress for a larger appropriation for this work, and the national association of state commissioners, and individual commissions as well, have expressed the hope that the appropriation will be granted.

The Bureau of Standards would in that case be able to maintain an able staff of engineers and experts who could carry on investigations that would be of value in the work of regulating intelligently and justly the various utilities. It could serve as technical adviser to the state commissions in so far as they chose to avail themselves of its services, and it would act also as a court of appeals for the utility companies in technical questions. It would, of course, have no legal jurisdiction over any utility, and so would not infringe upon the prerogatives of the state commissions. But the moral influence of its opinion might be of some value to a commission when the public was expecting the impossible or a utility was demanding too much, or to a utility that was required by order or by ordinance to do what was unreasonable.

It would be unsafe to predict exactly what could or could not be done by the Bureau of Standards along the lines indicated, but it seems safe to believe that its work would be as well done and prove as valuable and as satisfactory as the work of this kind that it has done during the past three years. This work has been carried on in a scientific spirit, with no bias for or against the utility companies, with the closest co-operation of engineers and operators of long experience, and with no ambition save to do work that would be of value and that would merit the commendation of unbiased judges.

It appears certain that a large activity of the bureau in the field of public utility regulation, studying the problems coming before state commissions and municipal regulating bodies open-mindedly and yet conservatively, serving as a clearing house of information as well as an agency for investigation and the formulation of results for general use, would be productive of valuable results which would more than justify the cost.

Many of the state commissions recently established have abundant authority but very limited funds to provide an engineering staff. The work of appraisal and inspection is expensive, and the states will have to grant considerable sums for this work even if the federal government co-operates with and assists the state commissions in the way and to the extent proposed. Some state commissions with large appropriations and considerable engineering staffs will require a minimum of assistance from the federal government; but most of the states, at least at the start, are finding great need of such assistance and have expressed the keenest interest in the plans of the Bureau of Standards and a hope that Congress will make it possible to realize these plans.

Rates and Appraisals

The consideration of rates charged for public utility service may be divided into two parts: First, what average rates must be charged in order that the company may have sufficient revenue to pay expenses, provide for maintenance and depreciation, set aside something for surplus or sinking fund, and pay the necessary dividends. Second, how shall these charges be distributed among the different classes of customers for the different grades of service; in other words, what scale of charges is equitable, supposing the total necessary income or average charge for service has already been fixed.

To illustrate, in some places where the charge for electrical energy is 10 cents per kw-hr. for the ordinary small user of energy for lamps and motors, the prices are scaled down as the quality and load-factor are increased (and according to the effect of the load on the station's diversity factor) until for the largest users it is sometimes as low as 2 cents and even in some cases 1 cent per kw-hr. On the other hand, the price of gas to different customers seldom varies by so great a ratio as two to one, and often the rate is the same to all customers regardless of quantity or cost of delivery. There are good reasons why the difference should be less for gas then for electricity, but there appears no sufficient reason why practice should vary as much as it does in different places either in gas or electric rates.

Much intelligent study has been given to the subject of rates, especially by the utilities and a few state commissions, but there is still much difference of opinion concerning both the theory and the practice. Rates are fixed with regard to other considerations besides the cost of the service and the evaluation of such considerations as well as of the cost is difficult indeed. Improper discrimination in electric rates should not be allowed, but a proper discrimination or differentiation is necessary. How to distinguish between what is proper and improper is the main question. It is of great importance that the state commissions co-operate in their study of the problem, and as far as possible adopt uniform methods of determining rates; and the utility companies should welcome such study.

Some engineers regard rates as a very delicate subject and deprecate any investigation that might tend to disturb present conditions. But no one need flatter himself that under any system of efficient public service regulation the subject of rates can be kept in the background. To suggest that it is too delicate to be studied in the open creates the suspicion that there is something to conceal. When there is adequate regulation such a study would be made from the standpoint that whatever hurts the utility company hurts the public, and a system of rates that permits the company to build up its business enables it to give better service to all its customers. In other words, where regulation is adequate and just the interests of the utility and of the public are one, namely, to adopt rates which are just and equitable and which will contribute to the maximum degree to the development of business.

Appraisals are often necessary in connection with the fixing of rates. Generally appraisal engineers are employed by state and city commissions to do this work. As the company whose property is being appraised is necessarily represented in the work, it is desirable that the commission be represented also. The appraisal engineers aim to be just and unprejudiced. To secure the best results it would appear that the commission should be represented by one or more experienced engineers not connected with the appraisal firm. These may be engineers belonging to the commission's permanent staff or they may be engaged for the occasion. Methods and unit values employed by different appraisal engineers should be compared and studied, and as far as possible uniform methods formulated.

The rest of Dr. Rosa's remarks, dealing with other aspects of public utility regulation, will be published next week.

Public Service Commission News

Illinois Commission

The City Council of Chicago passed a resolution on Dec. 29 empowering the law department of the city to bring a suit to test the validity of the act creating the Illinois State Public Utilities Commission. The suit will be instituted to determine whether or not the new commission shall have the right to regulate companies operating within the city of Chicago.

Ohio Commission

Testimony in the first case of valuation for rate-making purposes has been heard by the Public Service Commission of Ohio. Owing to the large number of unexpected issues that came up, the case has been continued until later so as to provide an opportunity for study of some of the points. All of the larger companies in the State were represented at the hearing in order to take part in the discussion of the principles involved. The company directly concerned in the case is the Bucyrus Light & Power Company.

The city of Bucyrus passed an ordinance fixing rates at which the Bucyrus company should furnish energy for light and power. The company objected to the figures and the matter was taken to the commission. Representatives of the commission made an investigation and valuation, while experts representing central stations in various localities have done the same.

One of the first points of contention related to the items that go to make up overhead charges, and on this question testimony was given by Messrs. H. S. West and W. W. Pollock, Cleveland; Mr. F. McCrackin, of the Ohio State University; Mr. V. N. Gurney, of the National Gas & Electric Company, and Mr. L. B. Denning.

Current News Notes

NATIONAL AUTOMOBILE SHOWS.—The National Automobile Shows given under the auspices of the Automobile Chamber of Commerce, Inc., will be held at the Grand Central Palace, New York City, Jan. 3-10, and at the Coliseum and the First Regiment Armory, Chicago, Jan. 24-31. Both shows will have on exhibition passenger cars, motor cycles and accessories.

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OHIO ELECTRIC VEHICLE CENSUS.—More than one-third of the electric automobiles in Ohio are owned by residents of Cleveland, according to State Registrar Shearer, who has completed a part of his annual report. In Cleveland there are 1880 electric vehicles, while the total number in the State is 4115. In 1912 there were only 3610 electrics in the State. The receipts for license tags for these cars in 1913 amounted to $12,345.

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NEW ELECTRICAL CODE OF THE CITY OF NEW YORK.—The Department of Water Supply, Gas and Electricity of the city of New York has just issued its 1913 edition of the Electrical Code of the City of New York. This differs from the National Electrical Code in some respects. In the 1912 edition there were about 110 differences, whereas in the present edition there are only thirty-five differences. Some were changes of phraseology, others were due to local laws, and a few were honest differences of opinion based upon experience in New York City.

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ELECTRIC PLANT IN ARCTIC CIRCLE.—The first electrical plant to relieve the Arctic darkness, which will be erected at the Episcopal Mission at Point Hope, will be designed, built and equipped by Dr. W. E. Temple, head of the electrical engineering department of the University of Pennsylvania. The site on which the plant will be erected will be 100 miles north of the Arctic Circle. A huge windmill will be the prime mover, as the velocity of the wind at Point Hope is said to be rarely less than 20 miles an hour, but an auxiliary gasoline motor is to be installed. The mission at Point Hope contains about 400 inhabitants.

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ITALIAN EDUCATOR'S TRIBUTE TO NEW YORK'S "WHITE WAY."—The thing that appealed must notably to Dr. Maria Montessori, the famous Italian educator, on her first visit to America was the illumination of the city streets. She said: "When I came into New York harbor, I was amazed, dumbfounded. But when I drove through the streets words would not show my feelings. I imagined for a moment that a great festival must have been under celebration, and I emphatically declare that the greatest emperor of modern times could not enter Italy under such wonderful illumination. What could I say when I found that turning night into day was only the usual thing in the great cities of your wonderful country?"

* * *

SPECIAL COURSE IN TELEPHONE ENGINEERING AT LEWIS INSTITUTE.—A special course in telephone engineering, to consist of evening lectures, will be given at Lewis Institute, Chicago, beginning Jan. 5. The work will be in charge of Prof. Arthur Bessey Smith and Mr. Fred R. Quayle, engineers of the Automatic Electric Company, Chicago. Students entering the course are required to have a working knowledge of the fundamental principles of alternating currents. The course will be given on Monday and Wednesday evenings and will comprise twenty lectures, beginning with "Speech Transmission, Acoustics and Switching," followed by "Transmission by Local Battery," and proceeding with lectures relating to both manual and automatic systems, the twentieth lecture being entitled "Toll Boards, Including the Working of Manual with Automatic."

* * *

EXAMINATION FOR ASSISTANT ELECTRICAL ENGINEER.—A civil service examination for assistant electrical engineer of the Public Service Commission of the First District of New York will be held on Jan. 17. Applicants must have had at least seven years' engineering experience in electric railroad work, preferably with rapid transit or heavy electric traction lines. Appointees will have to handle a considerable amount of work in connection with theoretical computations on the design of electric railroad equipment, and should be familiar with and experienced in the design, selection and installation of electric railroad motors, etc. The position carries with it a salary of from $1,801 to $2,100 per annum. Applications must be sent not later than Jan. 7. Address New York State Civil Service Commission, Albany, N. Y.

* * *

SERVICE IN DENVER AND PUEBLO COMPLIMENTED.—During the first week in December that part of the State of Colorado contiguous to Denver was visited by one of the most severe snowstorms in its history, trying the souls of public officials and especially of the public utilities. The Denver *Post* in its issue of Dec. 8 complimented the Denver Gas & Electric Light Company by printing the following appreciation on the front page: "For the people the *Post* wishes to express their thanks for the very excellent and uninterrupted efficient services of the gas and electric-light and telephone companies during the storm." The Pueblo Commerce Club also sent a letter to H. M. Byllesby & Company complimenting the Pueblo management of the Arkansas Valley Railway, Light & Power Company for the service given during the snowstorm in Pueblo and other Colorado cities.

* * *

SOCIETY MEETINGS

NORTHWESTERN CEDARMEN'S ASSOCIATION.—The annual meeting of the Northwestern Cedarmen's Association will be held at Escanaba, Mich., Jan. 27 and 28. Mr. H. E. Boucher, 743 Lumber Exchange, Minneapolis, is secretary of the association.

* * *

WESTERN SOCIETY OF ENGINEERS.—The annual meeting and dinner of the Western Society of Engineers will be held in the Red Room of the Hotel La Salle, Chicago, Jan. 7, 1914. On the following evening, Jan. 8, there will be a smoker and meeting in the rooms of the society, 1735 Monadnock Block, Chicago.

* * *

JOINT MEETING OF JOVIAN ORDER AND ELECTRIC CLUB, CHICAGO.—Acting upon invitation, members of the Electric Club had luncheon with the Jovian Order at the Hotel Sherman, Chicago, Dec. 29. After the meal Mr. Homer E. Niesz, chairman, introduced Mr. E. E. Rines, of Peoria, Ill., who announced that through the efforts of the Jovian Order in Peoria an electrical show would be held in that city March 9 to 15, 1914. In a few brief remarks, Mr. C. B. Scott, of the bureau of safety of the Middle West Utilities Company, outlined the work of the bureau in protecting the company's men and its apparatus from accidents and in establishing safe operating practice. The speaker of the day, Mr. Alexander Shane, told how the co-operation of the workmen in the various departments of the Middle West Utilities Company was being sought. He stated that the fundamental principle underlying accident prevention was to be found only in educating the men to protect themselves.

The 150,000-Volt Big Creek Development—I

World's highest operating voltage employed to transmit 120,000 kw from the high-head plants of the Pacific Light & Power Corporation to the city of Los Angeles, 240 miles distant

On account of the hydraulic head utilized, the amount of power developed, the distance and voltage of transmission and the provisions for regulation upon the lines, the recently inaugurated Big Creek development of the Pacific Light & Power Company, of Los Angeles, Cal., represents one of the most advanced contributions of the engineer to the welfare of civilization, illustrating on its economic side the most skilful conservation of natural resources and on its technical side the solution of problems on an unusual scale even for the Pacific slope.

Although the exact opposite of the great development at Keokuk as regards hydraulic features, the Big Creek installation stands in the same class of great engineering undertakings for electrical supply placed in operation in 1913. Preliminary service was begun on Nov. 8 without a single hitch in the operation of the system, about 18,000 hp being transmitted over the first of two high-tension lines between Big Creek and Los Angeles at a test pressure of 135,000 volts. The lines are designed for 150,000-volt service and will transmit an aggregate of about 160,000 hp. They will be completed in the near future. The entire project has been designed and constructed for the Pacific Light & Power Corporation in less than two years by the Stone & Webster Construction Company, of Boston, Mass.

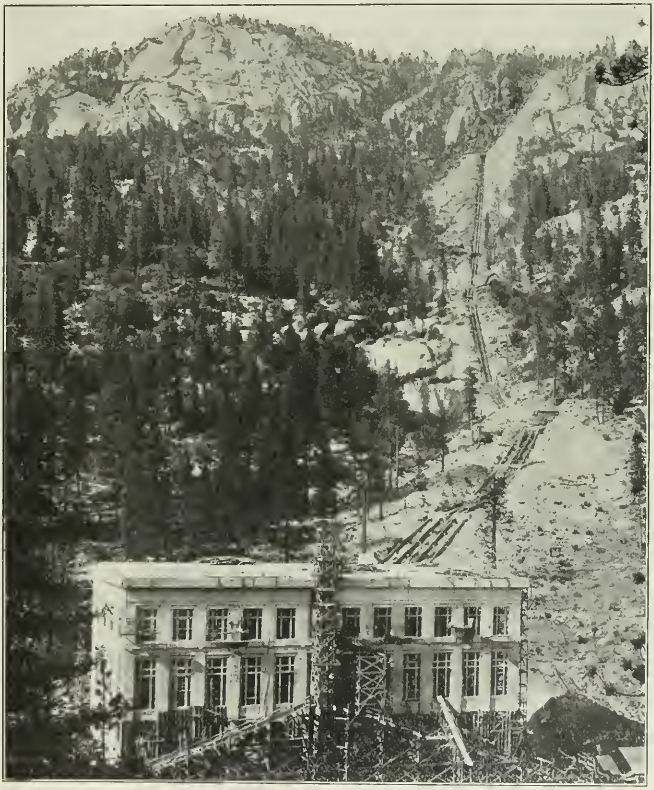


FIG. 1—POWER HOUSE NO. 1, BIG CREEK DEVELOPMENT, PACIFIC LIGHT & POWER CORPORATION

Location of Development

The development is located in the Sierra National Forest, about 70 miles east of Fresno, and the permit granted by the United States Department of Agriculture for the project is the largest ever accorded by the government. Ultimately four power houses, two reservoirs and 25 miles of concrete-lined tunnels will be built. The permit covers the development of 350,000 hp, allowing twelve years for the complete work. The initial step in the development comprises the installation of two power houses, four concrete dams, two tunnels, two 240-mile transmission lines of the steel-tower type, substation and switching-station facilities, and a 56-mile standard-gage railroad. The general plans were outlined in the *Electrical World* of Sept. 7, 1912, page 480, and the development has been pushed along the general lines there described. A notable record for rapid construction was made in connection with the railroad, which was built through mountainous country in 165 days, including the work of location, purchase of rights-of-way, the securing of government permits and actual construction.

Big Creek, with its tributaries, rises in the Sierra Nevadas and drains an area of about 88 sq. miles, the watershed being at an elevation of over 7000 ft. at all points. The annual rainfall is over 80 in. and the run-off about 50 in. Big Creek has a fall of about 4000 ft. in 6 miles from a natural basin in the mountains above Big Creek Falls. This drop is utilized in two plants, the effective heads on the wheels being 1900 ft. for Plant No. 1 and 1780 ft. for Plant No. 2. The average daily flow is about 300 cu. ft. per second. In the natural basin a reservoir with an initial capacity of about

53,000 acre-ft. has been formed by the construction of three dams built to an elevation of 6915 ft. By raising the dams to an elevation of 6965 ft. the capacity of the reservoir will be increased to about 120,000 acre-ft. The utilization of this increased storage capacity with the natural flow of the stream will require the ultimate installation of at least four units in each plant, two of which are being installed for the initial development.

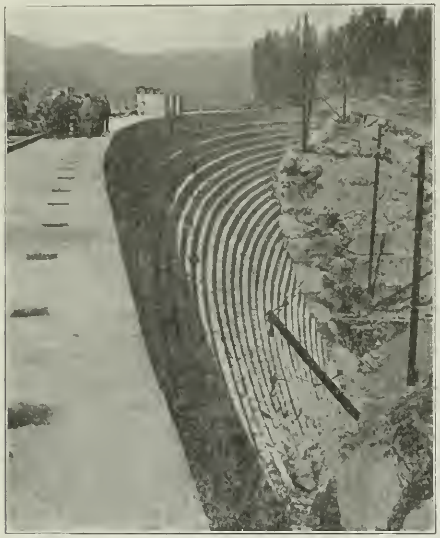


FIG. 2—DAM NO. 1, THE LARGEST OF THREE AT THE UPPER BASIN

The mountains which mark the northern and eastern boundaries of the reservoir rise to elevations of 10,000 ft. and 11,000 ft., with only a small section below 9000 ft. The southern and western divides are comparatively low and offer little obstruction to the warm, moisture-laden winds from the Pacific, which are unable to cross the peaks to the north and east without a heavy precipitation. The completed reservoir is to be 6 miles long, 1.5 miles wide and about 150 ft. deep. On account of the high heads developed it is estimated that this storage reservoir will carry 120,000 kw at 50 per cent load-factor for 240 days.

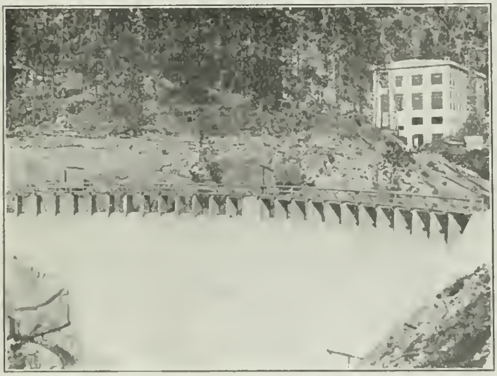


FIG. 3—DAM AT POWER HOUSE NO. 1

Dams and Hydraulic Features

The three dams at the basin outlets are concrete and masonry structures of the gravity section type, the largest dam, No. 1, closing the discharge of the basin to Big Creek itself. This dam is 132 ft. high to the crest, 812 ft. long on top, and contains 59,000 cu yd. of cyclopean concrete. It is built with straight ends and a curved center section, arched on the upstream side. The upstream face is vertical, the downstream face being built with steps to give a better bond for the new concrete when the dam is raised to its ultimate height.

The present dam is 80 ft. thick at the base and 12 ft. wide at the top, provision being made for flashboards 5 ft. high. In the ultimate development the dam will be 119 ft. thick at the base and 16 ft. wide on top; the vertical upstream face will be continued, and the downstream face will be straight, except for a vertical curve of 72.5-ft. radius from the crest about 40 ft. downward. The other two dams are of the same general design, one containing 27,200 cu. yd. and the other 31,300 cu. yd. of masonry, the lengths being 1015 ft. and 450 ft. Granite is the characteristic structure of the mountains around the development and the dams all rest upon solid foundations of this material, the depth of excavation below the original ground surface varying from 20 ft. to 90 ft.

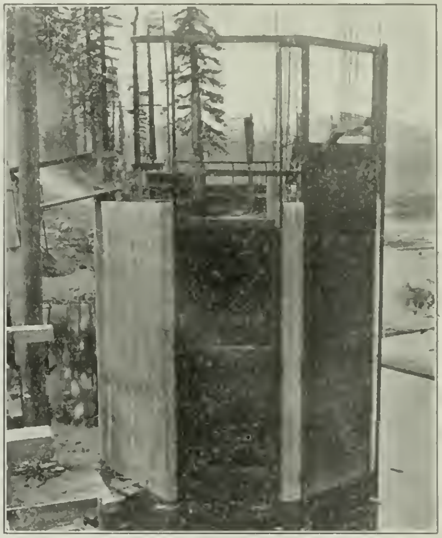


FIG. 4—INTAKE TO TUNNELS

Discharge Tunnel and Pipe Lines

At No. 1 dam the water is drawn into the conduit system through an intake tower. The latter is of reinforced concrete 104 ft. high and 20 ft. in inside diameter built near the northerly end of the dam. On its upstream faces the tower is provided with three sets of screens 7.5 ft. wide and extending to the top of the tower, which has walls 2 ft. thick. The screens are provided with motor-driven rakes covering their entire area. In the center of the rear wall of the tower is the 9-ft. outlet to the discharge tunnel, equipped with a heavy gate of the Coffin type, operated from the top of the tower through two stems. The gate can be opened or closed against a head of 140.5 ft., corresponding to the ultimate height of the dam. The disk of the gate is of cast steel and the frame is of cast iron, all wearing surfaces being of bronze. Just above the main gate is a 24-in. by-pass gate by which the water pressures in the basin and tunnel can be equalized when the main gate is shut. The by-pass gate discharges into a 36-in. air shaft extending from the top of the tower to the tunnel, and a ladder is installed in the shaft to facilitate inspection of the tunnel.

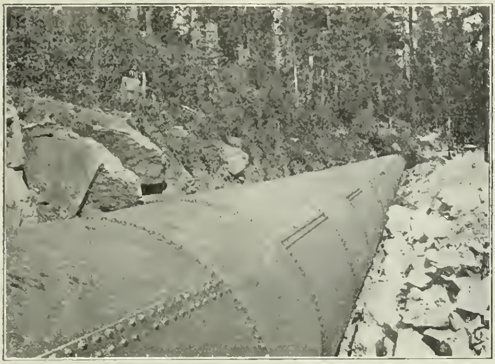


FIG. 5—84-IN. FLOW PIPE

There are three 42-in. hand-operated sluicegates in the center of the dam, by which the reservoir can be emptied. Racks are provided in front of the gates for screening service.

The discharge tunnel, 3880 ft. long and 12 ft. in diameter, connects at its lower end with a 108-in. pipe line. The pipe extends 400 ft. into the tunnel and the section of tunnel containing it is concrete-lined and large enough to permit inspection of the outside of the pipe. Outside the tunnel portal the 108-in. pipe connects with a steel-plate Y having two 84-in. outlets, one of which is blanked for future service.

Four main units aggregating 80,000 hp in generating plant No. 1 will be supplied with water by one 84-in pipe line. This pipe is laid on a grade of 7.5 ft. per 1000 ft. and is 6480 ft. long from the tunnel outlet to the top of the canon in which the plant is situated. The pipe line is carried on concrete saddles placed 35 ft. apart, and the elbows are anchored by reinforced-concrete blocks. An earth covering of 12 in. minimum is placed throughout the line. Manholes are provided at 2000-ft. intervals. The 108-in. pipe has a steel shell 0.5-in. thick, with double-riveted longitudinal and single-riveted circular seams, a shoe plate being provided on the outside courses for sliding the pipe into the tunnel. The 84-in. pipe varies in thickness from $3/8$ in. to $1/2$ in., the longitudinal seams of the thinner plate being part double-riveted and part triple-riveted according to local conditions, while those of the thicker pipe are double-riveted.

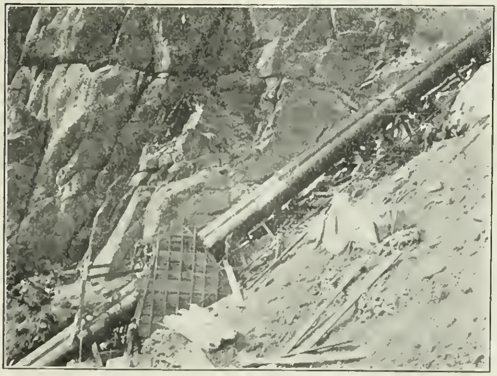


FIG. 6—PENSTOCK ON HILLSIDE, PLANT NO. 1

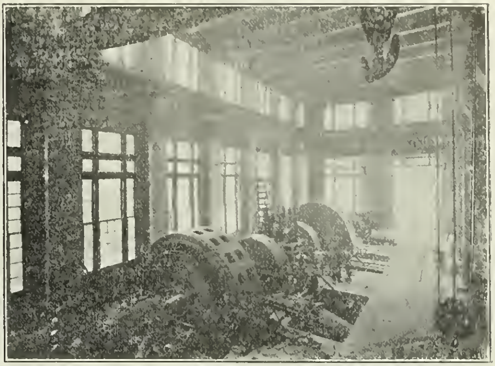


FIG. 7—INTERIOR OF GENERATOR ROOM

At the top of the slope and 1942 ft. above the first generating station the flow pipe opens into four 44-in. outlets, each two of which will connect with a penstock leading to the generating units, the others being blanked. Near the top of each penstock is a 42-in. gate valve equipped for both hand and motor operation with remote control from the power house. Just below the gate valves are two 24-in. standpipes, one in each line. These standpipes extend up the mountain side a distance of 425 ft. and terminate in two vertical surge tanks 3 ft. in diameter and 35 ft. high. The tanks are anchored into concrete foundations, 10 ft. deep, 7.5 ft. wide at the top and about 11 ft. wide at the bottom, by four cast-iron brackets held in place by foundation bolts 5 ft. long. The tanks are cross-connected by steel latticework near their tops.

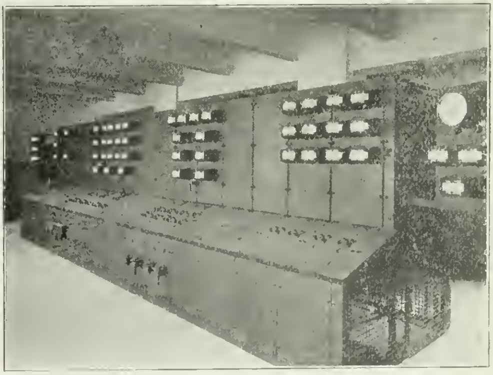


FIG. 8—BENCHBOARD AT STATION NO. 1

The two penstocks run parallel at a distance of about 7 ft. to a point 800 ft. above the power house, where each divides into two 26-in. pipes, each smaller pipe serving one runner of a waterwheel unit. The penstocks are built in 30-ft. sections of lap-welded steel pipes varying in diameter from 42 in. at the top of the slope to 24 in. at the wheel inlets, the thickness ranging from ⅜ in. to 1 3/16 in. The circular joints are riveted for pressures up to 1460 ft., but for greater pressures are flanged and bolted.

Each main unit consists of a 175,000-kva generator directly connected to two impulse wheels of 10,000-hp rating each, the wheels being overhung outside the bearings carrying the shaft. Apart from operating under one of the highest heads thus far developed, these wheels are the largest of their type ever built. They are 94 in. in diameter on the impulse circle and each contains nineteen cast-steel buckets held in position on a nickel-steel wheel disk by three pressure-fitted bolts. The water for turning the wheel disks is directed upon the buckets by means of a stationary nozzle with a governor-controlled needle valve.

Regulation of each unit is obtained by two oil-pressure governors, each of which independently controls the movement of one needle valve. The shaft speed may also be controlled by manipulating the governors by hand, and the needle valves are also connected with a remote electric speed control operated from the power-house switchboard. The governor arrangement permits operating either wheel of the unit without the other at the maximum efficiency, so that fractional loads can be handled with economy.

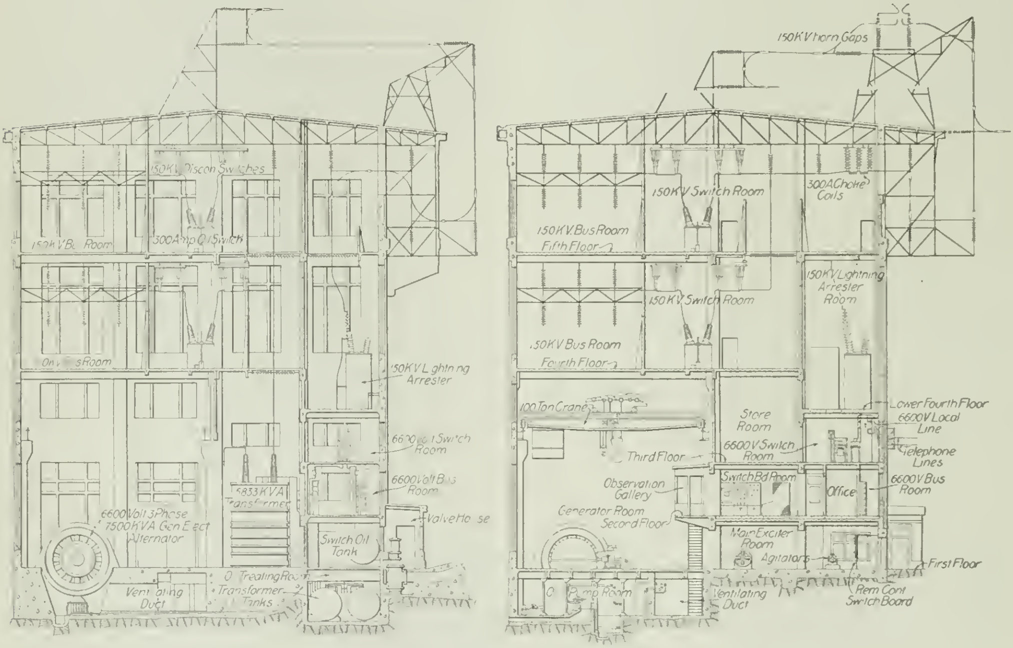


FIG. 9—CROSS-SECTION OF POWER HOUSE

Each of the governors operates a pressure regulator which automatically by-passes the water at times when the needle is closed with an automatic adjustment providing for slow closing in order to prevent excessive rises in pipe-line pressure. The pressure regulator is connected to the inlet pipe back of the nozzle, and when adjusted to act as a water-saving device it will open for a given pressure rise, closing automatically only when the pipe-line pressure returns to normal. The regulator has the same discharge capacity as the nozzle, the water issuing from it having its velocity reduced by an energy absorber, after which it flows into the tailrace below the main wheels. The tailrace is lined with steel to take care of the erosion which otherwise would result from the discharged water.

The weight of the impulse wheel disk, the reacting force from the jet striking on the buckets with a velocity of 300 ft. per second, and the weight of the generator rotor are all carried on two 20-in. by 64-in. ring-oiling, water-cooled, self-aligning babbitted bearings. The main shafts are of hollow, forged nickel steel, 20 in. in diameter at the journals and 27 in. in diameter at the rotor, their over-all length being about 29 ft. The normal speed of each unit is 375 r.p.m. All governors and main bearings are supplied with oil from a system of piping connected with a central plant in the basement, the apparatus of which is in duplicate. There are two 2½-in. rotary, single-stage oil pumps arranged for both electric and hydraulic drive and equipped with suction and pressure tanks. It is planned to operate the pumps by motors for the greater part of the time.

The oil flows from the suction tanks to the pumps, where its pressure is raised to 200 lb. per sq. in. It flows into the pressure tanks and thence to the operating valves and cylinders of the governors, returning to the suction tanks through filters. By means of an automatic by-pass valve the oil is merely circulated through the piping system when the pressure exceeds a predetermined value, so that the motors are not obliged to run at maximum output except when the pressure is below normal. The lower side of each main bearing is connected to the pressure side of the oiling system through a reducing valve, so that forced lubrication can be had when starting the unit, this being discontinued after the oil rings attain sufficient speed to take care of lubrication.

Each governor is provided with a load-limiting device so that each wheel cannot furnish more than a predetermined amount of power. This device allows the governor to close the gates when the speed goes above normal and when the demand upon the wheel is less than that of the maximum for which the governor becomes blocked. A safety device is provided to close the needle valve in case of breakage of the belt driving the governor fly-balls. The valves for controlling the water supply to each nozzle are hydraulically operated and are of special design to meet the high head involved. Their operation is safeguarded by providing a hand-operated pump to supply water pressure at times when a pipe line may be empty.

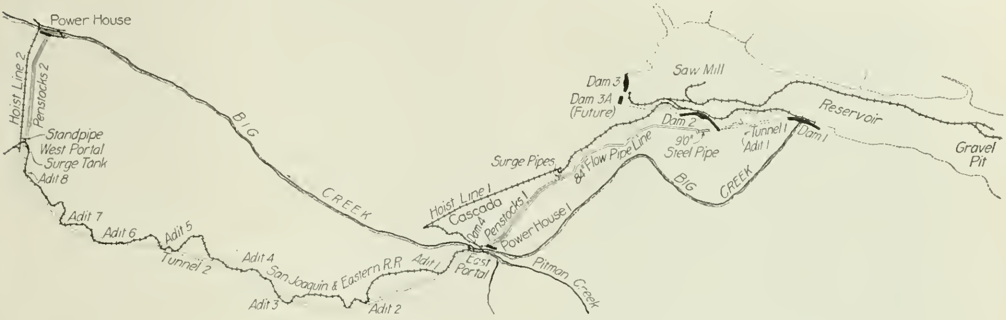


FIG. 10—GENERAL PLAN OF SITE

Two exciters are at present installed, both being designed for ultimate combined motor and waterwheel drive. In the initial installation one exciter is motor-driven and the other is hydraulically operated. The wheel design provides for a single runner 47 in. in diameter with twenty-four buckets inclosed in a steel-plate housing, the generator being mounted on a horizontal shaft with a common bedplate. The maximum jet diameter is 1 5/16 in. and its speed 300 ft. per second.

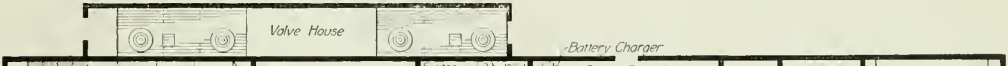


FIG. 11—PLAN OF POWER HOUSE

The exciter wheel nozzles are stationary, with hand-adjusted needle valves. Speed regulation can be obtained by either hand manipulation or automatic governor control, and when the load decreases the jet is deflected from the buckets by a steel hood operated by the speed-controlling devices. The water for the exciter wheels is supplied by an 8-in. header pipe cross-connecting the four pressure lines, each wheel nozzle being served through a 6-in. branch. The valves are designed for a working pressure of 1000 lb. per sq. in., all having been tested to 1500 lb. Each weighs 20,400 lb. and all are located in a special valve house adjoining the main power station building.

Generating and Switching Equipment

The generating equipment, electrical apparatus and high-tension buses are housed in a reinforced-concrete and structural-steel building measuring 171 ft. long, 84 ft. wide and 103 ft. high. On the first floor are the generating units, the exciters, step-up transformers and separate compartments for station service transformers, rheostats, a storage battery for switch operation and an oil-tank installation. The building is of sufficient size to house three generating units and their auxiliary equipment. The pipe lines pass from the valve house under the operating-room floor to the wheels, and the steel-lined tailraces are located immediately under each, opening directly into the river from the side of the building.

The main operating room is 168 ft. long by 43 ft. wide and is served from end to end by a 100-ton Cleveland electric traveling crane. The main switchboard, which is of the bench type, is located on a gallery in the center of the operating room, immediately above the exciter bay, and by remote control it governs the generators, transformers, switch operation and auxiliary control of governors and exciter motors. In the exciter bay, on the generator-room level, is a remote-controlled exciter and generator field board, to which are brought exciter and generator field leads. A small upright switchboard on the gallery takes care of the storage battery, lighting and local interior power service.

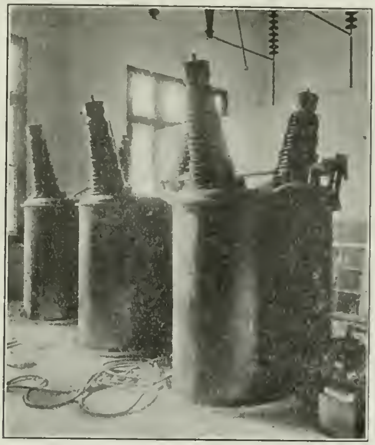


FIG. 12—150,000-VOLT OIL SWITCHES

In case of trouble on any section of the apparatus, an alarm system calls the operator's attention by both bell and lamp signals, a special trouble lamp being installed on the panel from which each piece of equipment is controlled. The upper portion of the station is given over almost entirely to oil-switch and bus installations. The step-up transformers are situated in bays on the generator-room floor level at the rear of the generating units. A railroad track extending into the generating room for about 30 ft. permits easy handling of them and of other heavy machinery during installation or repairs. The basement is laid out to give free access to the oiling system and other auxiliary equipment below the main floor. Water for cooling bearings, transformers, oil in suction tanks and other service is supplied by an independent piping system from tanks outside the station.

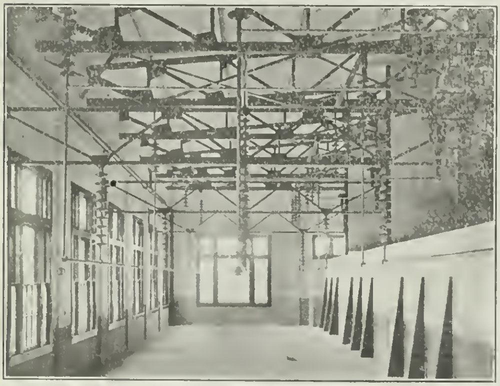
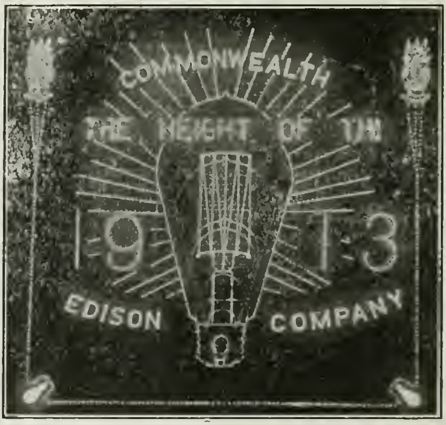


FIG. 13—150,000-VOLT BUS STRUCTURE, POWER HOUSE NO. 1

The second and concluding instalment of this article will include descriptions of Power House No. 2 and its 150,000-volt bus construction, operation of the transmission lines carried on nine-disk suspension-type insulators, provisions for switching at an intermediate substation, and the operation of the receiving substation, 9 miles from Los Angeles, where two 15,000-kva synchronous condensers are installed to neutralize the power-factor and voltage effects introduced by the capacity reactance of the long transmission lines.

Indicating the Decreasing Price of Electric Service

A spectacular and effective roof sign has been added to the number of these conspicuous advertising devices in use in Chicago. It has been placed by the Commonwealth Edison Company on top of the company's building at 28 North Market Street, and a shifting legend spells out the following message: "The increase in the amount of electric light $1 will now purchase as compared with 1896 and intervening years is shown by the height of these lamp outfits. Phone Randolph 1280." By the use of the "motograph" this message is run across the sign like some gigantic stock ticker in letters 6 ft. high. In the meantime the sign demonstrates the growth of the Commonwealth company's electric service, starting with the smallest lamp (which is visible in the accompanying picture entirely included in the base of the larger lamp) and changing step by step for succeeding years, indicating in large figures with each lamp outline, until the great tungsten lamp 50 ft. high stands forth in impressive outlines. While this is going on the torches on each side are flaring in a realistic manner and borders of light in different colors are running back and forth along the outlines. The sign was produced and built by the Federal Sign System (Electric), Chicago.



SPECTACULAR SIGN INDICATING DECREASING PRICE OF ELECTRIC SERVICE

The Commonwealth Edison Testing Laboratories

Elaborate equipment provided and organization perfected for performing tests, "starting," supervising meters, making investigations, and affording technical consultations

WHILE the average electrical reader has heard a great deal about the large turbine units and other spectacular features of the plants of the Commonwealth Edison Company of Chicago, he probably knows little of the company's operating and maintenance work, although these departments embody features which are in their own way of no less interest.

In the *Electrical World* of Sept. 27, 1913, an account of the company's load-dispatching system was given, details of the routine of putting apparatus into service and cutting it out being included. Incidentally some of the duties of the "starting engineer" were mentioned. This official may, for the present purpose, therefore, serve as a connecting link between the dispatching and testing departments, for the starting engineer is attached to the latter's staff. As his title indicates, he has charge of starting up new or repaired equipment, a very important phase of the testing department's work.

The testing department is quartered in a large brick building, somewhat less than 140 ft. by 60 ft. in dimensions, situated at the rear of the North Market Street office building of the Edison company. One of its floors houses the laboratories and contains the offices of the chief testing engineer and his staff of fifty or more assistants. The plan of the floor is shown in an accompanying sketch. On the east side of the building, which is indicated at the top of the drawing, are the high-tension room (containing a 10-kw, 50,000-volt testing transformer and a 150-kw, 30,000-volt testing transformer) where insulators, insulating materials, etc., are tested; the meter and supply room, where a very large assortment of meters and other apparatus is kept in condition ready for instant use; the stock room for supplies of all kinds, and the photometer room.

The large general laboratory for general calibration, transformer, motor and other machine testing occupies a considerable part of the west side of the building. Partitioned off from this general laboratory but accessible to it are the oscillograph room, commercial calibration room and standardizing room. The chemical laboratory has ample quarters in the southwest corner. The remainder of the floor affords the office space for the staff, and is provided with conveniences for working up and filing reports.

The Laboratory Equipment

Before examining in detail a few of the more novel testing devices a general glance at the laboratory equip-

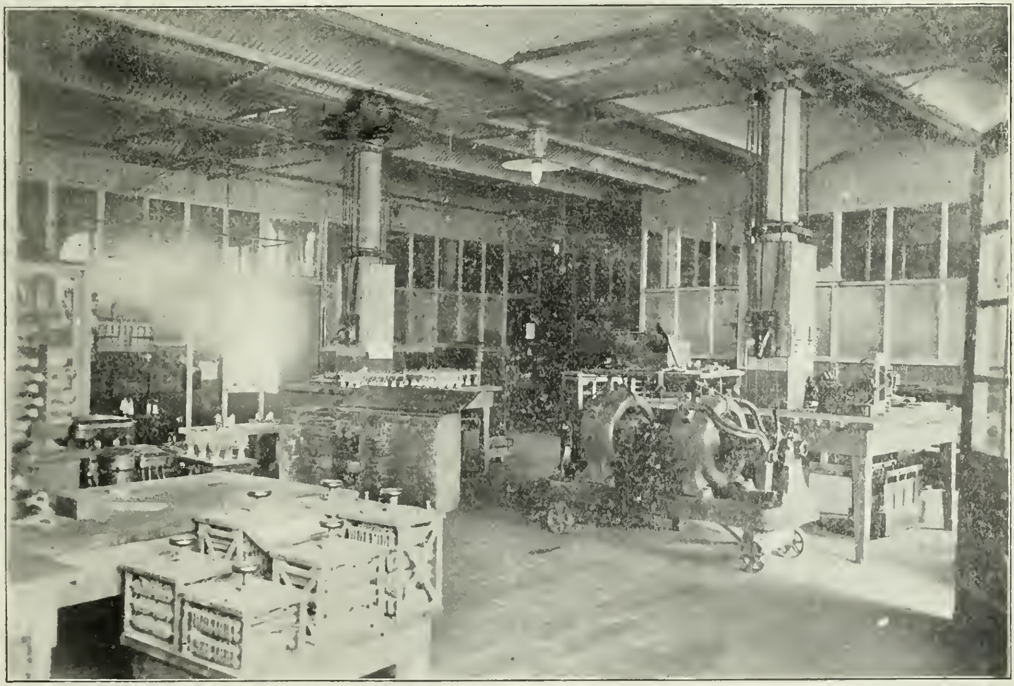


FIG. 1—GENERAL TESTING LABORATORY, COMMONWEALTH EDISON COMPANY, CHICAGO

ment may be of interest. Fig. 1 is a view in the general laboratory looking toward the oscillograph room and showing along with other equipment a portable motor-generator set for furnishing large currents at low voltages. Fig. 3 shows the oscillograph room, looking toward the meter and supply room. This oscillograph equipment is one of the most useful devices in the laboratory.

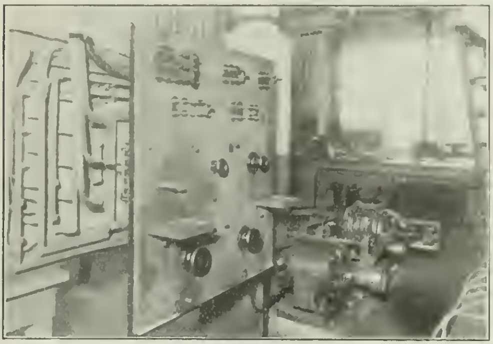


FIG. 2—VARIABLE-FREQUENCY TESTING SET

Fig. 7 shows a transformer-testing switchboard designed to reduce the time and labor required to make routine tests. Current and pressure leads are brought to the back of the board from the transformer room at the rear, permanent connections being made to the switch studs. The low-tension switches are mounted on the front of the board, while the high-tension switches are mounted on the back, being operated from the front by means of hard-rubber rods working in slots. The board is equipped with both alternating-current and direct-current incoming leads, the latter being used in making resistance measurements. Instrument studs are arranged at the bottom of the board, and studs at the top permit the ready insertion of resistance in the various circuits. Each pair of studs is otherwise short-circuited by means of a single-pole switch. With this board excitation, core-loss, no-load-ratio check, polarity check and load-back tests can be made. By a simple change in connections load-loss and impedance tests can also be made. The use of this board has greatly simplified the routine of transformer tests, of which a great many are made each month.

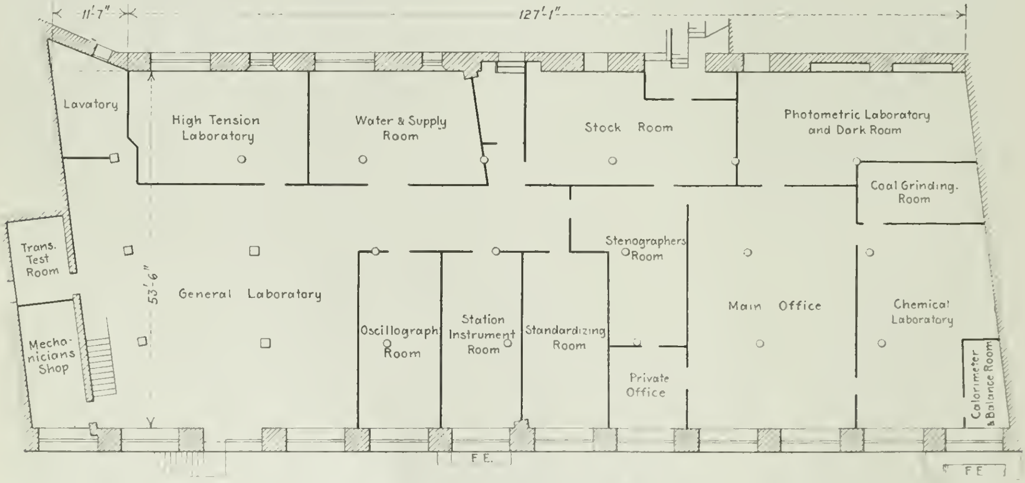


FIG. 3—PLAN OF LABORATORIES AND OFFICE

A variable-frequency, high-frequency motor-generator set with its switchboard are shown in Fig. 2. This unit furnishes current for the transformer tests. In Fig. 6 is shown a 10-kw, 50,000-volt testing transformer for use in making insulation tests.

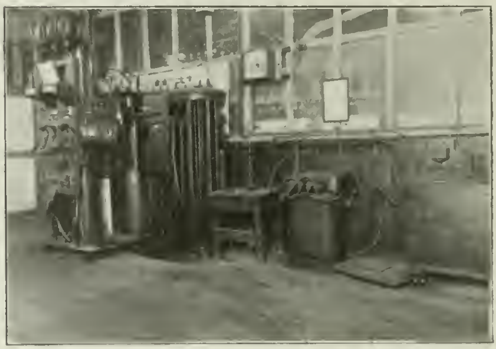


FIG. 4—HIGH-TENSION TESTING TRANSFORMER

Energy for alternating-current testing is furnished from three sources—the regular 60-cycle distribution system; a special connection to the 25-cycle supply for the Market Street substation, and a 40-kw generator provided with eight collector rings. By means of this arrangement two-phase, three-phase or six-phase current can be obtained. Instruments can also be tested at various power-factors by using one set of rings for current and others for voltage.

One corner of the general laboratory is occupied by the "heavy current" testing apparatus. This consists essentially of a set of heavy copper busbars through which direct or alternating current can be sent and to which apparatus to be tested can be clamped. There are two buses, each of two-ply, 0.5-in. by 4-in. copper bars, substantially mounted on an 8-ft. table. Heavy steel sliding clamps facilitate connection of instruments to the bars. The direct-current supply is from a battery of two 5000-amp-hr. storage cells located under the housing. The terminals of the cells are brought out to a switchboard by means of which the cells can be used singly, in series or in parallel. Charging is done by means of the portable motor-generator set shown in Fig. 1, which can also be connected direct to the busbars.

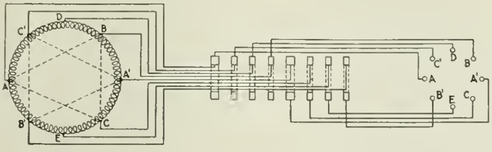


FIG. 5—CIRCUIT DIAGRAM OF EIGHT-RING TESTING GENERATOR

Direct current is measured by a 5000-amp water-cooled shunt seen on the floor at the right of Fig. 8. The current supply is controlled through three 2000-amp rheostats, one of which is adjustable.

On the alternating-current end of the testing table current is supplied at 25 cycles or 60 cycles from a company substation. It flows through an induction regulator to a 50-kw transformer having 220-volt and 110-volt primaries and 2200-volt and 1100-volt secondaries, and to a lowering transformer with 2000-volt and 1000-volt primaries and 20-volt and 10-volt secondaries. By means of a switchboard, containing four double-pole, double-throw switches, two front and two back, various combinations of connections can be made. The high-tension switches are mounted on a separate panel in the rear and are operated by hard-rubber rods. By means of the regulator and the transformers the busbar pressure can be varied from zero to 20 volts. The secondary winding of the transformer is connected directly to the busbars and has a current-carrying capacity of 5000 amp.

Development of the Testing Department

A résumé of the development of the present testing department will serve to explain in the most logical way its functions and responsibilities. It came into existence in 1898 under the then general inspector, Mr. F. R. Jenkins, as an adjunct to the inspection department. An Armour Institute instructor, Mr. T. P. Gaylord, was put in charge of this work, and Mr. Stephen Gardner was transferred from the drafting department to assist him. Transformer and lamp tests were then undertaken in a small room.

The engineering department gradually transferred motor testing, switchboard-instrument checking and miscellaneous work to the new department, and by March, 1899, some twenty-five pieces of apparatus had been secured for these purposes. This apparatus included a Weston laboratory standard voltmeter and a Weston standard ammeter with shunts, which were considered the pressure and current standards of the company.

During the summer of the same year new temporary quarters were occupied and provision was made for lamp sorting, photometering of exchanged lamps and testing practically all line transformers. Before the end of the year, after several changes in the personnel of the staff, Mr. G. N. Eastman was put in charge of the laboratory and Mr. R. F. Schuchardt, now electrical engineer of the company, was transferred from the statistical bureau, bringing with him the work of checking switchboard station instruments previously in service.

In the early nineties instrument checking had been done spasmodically by the engineering department, but in 1899 it was turned over to the statistical bureau as a matter for constant attention, and Mr. Schuchardt was assigned to it. For some time no attempt was made to correct meter inaccuracies; instead, stickers were pasted on the meter cases giving the errors found on checking. In extreme cases the instruments were returned to the makers for calibration.

In 1900 the laboratory was again moved, this time into larger quarters in the enlarged Edison building, and the cleaning and testing of returned lamps was handed over to another department to give more time for testing. The important tests then undertaken were on the "G. I." constant-current series arc-lamp system, on the grounding of four-wire three-phase circuits, on Nernst lamps, on 2000-volt inclosed fuses, and on the general transmission system of the company. The force was gradually enlarged for this work and included a mechanician.

Notable among the original ideas developed under Mr. Eastman between 1900 and 1902 were those resulting in a simplified instrument for making cable-fault locations by the Murray loop method; a compensating-coil arrangement for utilizing a length of copper cable or busbar as the shunt in the correct measurement of large direct currents by the Munich shunt method; the adaptation of Weston switchboard ammeters for use as reverse-current relays; a special design of electroscope for the indication of the pressure "high-tension" charge, and an insulating compound.

In 1902 Mr. E. O. Schweitzer, the present head of the testing department, was transferred from general inspection work and at first engaged in improving the quality of work done on the alternating-current switchboard instruments. The laboratory was again moved, this time to the basement of the Masonic Temple, and the stock of switchboard instruments was intrusted to its care. At this time the present system of buying all instruments with blank scales was inaugurated. This notable advance in meter practice gave very satisfactory results, because changes in station design between the times of ordering and installing meter equipment entailed no additional expense for calibration; emergency orders could be filled exactly in from two or four hours, and calibrations were more satisfactory than before, as the instruments after calibration were not subjected to the jars incident to shipping. At this period also Mr. Eastman began tests upon small carbons for arc lamps which soon became important enough to be transferred to a small special laboratory.

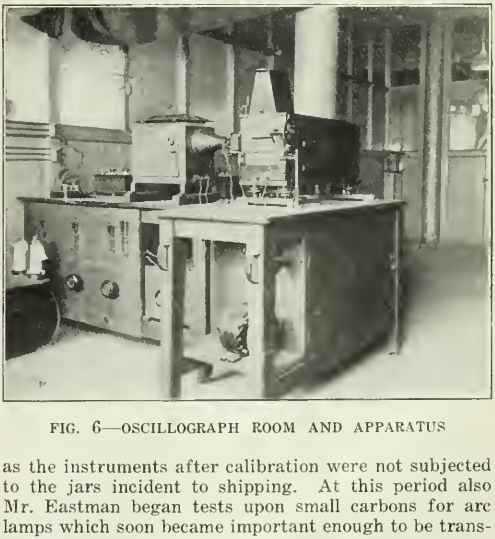


FIG. 6—OSCILLOGRAPH ROOM AND APPARATUS

As the laboratory grew, more and more work was taken over from the engineering department, including the work of "indicating" steam engines in isolated plants, which was for some years thereafter shared with the contract department. In 1903 the "starting-engineer" system was definitely founded under instructions from Mr. L. A. Ferguson, vice-president, and the laboratory force was increased by several men whose duties included checking up connections and testing the characteristics of new apparatus under the direction of the starting engineers. By 1905 the staff had grown in numbers to seventeen.

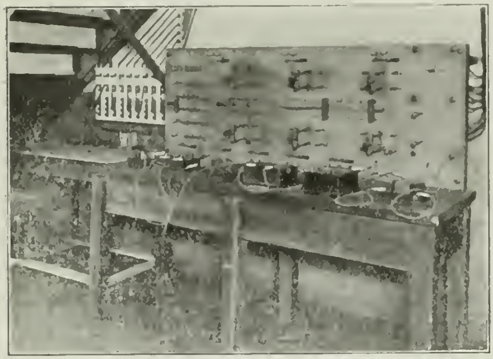


FIG. 7—SWITCHBOARD FOR ROUTINE TRANSFORMER TESTS

In 1905 new quarters were again assigned to the laboratory and the testing department was officially organized, replacing the "inspection department laboratory," as it had been called up to that time. As a tangible effect of the laboratory's work the first important publications began to appear at about this time, when Mr. Eastman read papers on the characteristics of inclosed-arc lamps and the use of small carbons before the Western Society of Engineers, and on protection and control in large high-tension alternating-current systems before the International Electrical Congress.

The work of the testing department now began to develop rapidly. Successful tests were made on the proper adjustment of frequency changers for parallel operation and the best methods of starting these units; the station-meter work was systematized, a plan of periodical checks was put into operation, and a complete card index of the metering apparatus connected to the system was prepared. The starting engineering work was gradually absorbed until deputies from the department came to be held responsible for the initial starting of all apparatus.

Coal testing and other chemical work was also taken on in 1905 and this, under Mr. C. H. McClure, gradually resulted in the present well-equipped chemical laboratory. This coal testing had been started by Mr. W. L. Abbott in 1897 in the engine room of Station No. 1 and the union of the chemical and the engineering testing work was, therefore, a logical step.

By 1907 the staff had grown to thirty-seven members, so that more room was needed and the laboratory began to expand into its present space, which was completed by the fall of 1908. In this period important testing, under Mr. N. J. Conrad, was going on at the Fisk Street Station, especially in the study of heat tests by means of a new type of exploring coil mounted in the large turbo-alternators. This study led to important changes in the design of the machines and to increases in their output. An investigation of surge phenomena in the 20,000-volt transmission system was also conducted and resulted in an A. I. E. E. paper by Messrs. Junkersfeld and Schweitzer. The meter test at this time also resulted in the invention of special attachments and improvements for watt-hour meters which have already had an important effect upon rates.

In 1909 Mr. Schweitzer became acting head of the testing department and Mr. W. A. Durgin was appointed his assistant. In the four years since then many important researches have been made and others are under way. The chemical department undertook the testing and renovation of transil oil until all oil required for the system is now regularly treated. Many new methods of testing were developed, the most important probably being the exploration method for the location of faults in underground cables described by Mr. Durgin at the 1910 N. E. L. A. convention.

In the early part of 1911 a test was run on a 12,000-kw unit in the Fisk Street Station to investigate the short-circuit characteristics of a turbo-alternator under various conditions with and without external reactance. This research provided material for two A. I. E. E. papers, one by Messrs. Schuchardt and Schweitzer on the use of power-limiting reactances with large turbo-alternators, and the other by Messrs. Durgin and Whitehead on the transient reactions of alternators.

Chief among other researches at this time was an extensive study of the heating of low-tension feeders, the results of which showed the feasibility of increasing their rating with an attendant saving in copper investment. As a result of the demand for a device to communicate continuously to a distance the value of a direct electrical measurement, a method for doing this was developed by Mr. O. J. Bliss and communicated by him to the A. I. E. E. in June, 1912. Among other inventions have been a lubricating brush for use on rotary converter collector rings, an oil-flow meter, and a graphite contact for contact-making voltmeters.

Present Organization and Work

As at present organized the testing department comprises the following sections: (1) testing engineering, (2) deputy starting engineering, (3) meter engineering, (4) operating engineering, (5) development of new devices and contributions to electrical knowledge, and (6) technical consultations. The duties of these several sections can be best seen by some illustration of what they do in every-day work.

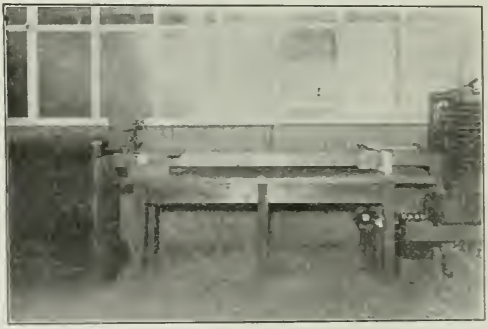


FIG. 8—BUSBARS CARRYING HEAVY CURRENT FOR TESTING PURPOSES

In the testing-engineering laboratory motors are tested for efficiency, rating and general operating excellence; heating apparatus is tested for consumption, efficiency and adaptation to the intended use; lamps, both incandescent and arc, are photometered and subjected to life tests, and new distribution transformers are investigated for efficiency, regulation and heating.

Distribution transformers injured in service are examined, the appropriate shop orders are issued for repairs, and the repaired transformers are again tested and sent out. During 1912, 274 preliminary and 396 final tests were thus made, the arrangement of testing apparatus already described making such large numbers of tests practicable.

Outside the laboratory, periodic heat tests on all large generating units are made to determine when the fields should be removed and the machines cleaned, this work having been rendered possible by the exploring coils contained in the armature windings. In the operation of the generators the accumulation of dirt in the ventilating ducts requires careful watching, an increase in heating as great as 100 per cent having been indicated by exploring-coil tests. Similarly transformers are regularly tested to determine when the cores have "aged" to a point where replacement is desirable.

In conjunction with the chemical laboratory tests are made on insulators, tape, galvanized material, lubricating oil, paint, rubber gloves, conduit, sleeves and lugs. To indicate the extent of this work it may be stated that in 1912 1530 insulators, 1300 pairs of rubber gloves, samples representing 5800 cable-junction sleeves and junction-box lugs, and 290 tanks of new insulating oil were tested. Fouled transformer oil was cleaned, dried and tested to the extent of 125 gal. per day. About forty samples of coal were tested per month in connection with its purchase on a heat-value basis.

In addition to routine tests such as those outlined special tests of the greatest variety have been made. Among those are the loss of coal in storage, the sanitary condition of drinking water, prospective customers' steam-plant load curves, causes of dissatisfaction with customers' motor equipments, reasons for unsatisfactory character of illumination or other applications of the company's service, cause of abnormal heating of new units in power plants (found to be due to "green" insulation and remedied by gradual increase of load for the first week or so), cause of heavy unbalancing of load on railway lines, and many others.

The deputy starting engineers, ten in number, have been kept very busy owing to the rapid increase in the capacity of the system. During 1912 they tested for the company two 20,000-kw generators, thirteen rotary converters from 2500 kw to 500 kw in rating, one 2000-kw frequency changer, nine very large transformers, two 8000-amp storage batteries, and three exciters and boosters. A number of large machines were also partly tested for railway customers.

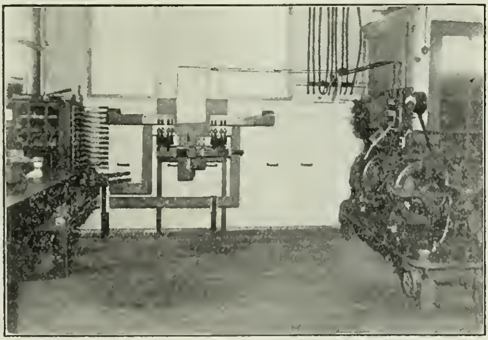


FIG. 9—HEAVY-CURRENT TESTING EQUIPMENT AND PORTABLE MOTOR-GENERATOR

In the meter work a stock of 1500 new and second-hand instruments is cared for in the laboratory and a record is kept of each of the 8000 meters, instrument transformers and relays owned by the company. All new meters are equipped with hand-drawn scales, and movements are readjusted and placed in accurate calibration, similar work being done on second-hand instruments. The output of these is about 100 per month. Some eighty instrument transformers are each month tested for insulation, continuity, polarity, etc., and about fifty relays are adjusted and set before installation. In the attempt to keep the meter practice up to date new devices are developed as required and new forms of meter and auxiliary apparatus are tested and investigated. Among recent original devices are the signal relays for the 60-cycle overload-relay operating bus and for the regulator limit switches. Original schemes of measurements proposed by the engineering department are checked for correctness of theory. The primary standards kept in the standardizing laboratory include Weston cells, potentiometers, a comparator, and an assortment of standard resistors and bridges, all of which are sent for frequent calibration to the National Bureau of Standards. Portable instruments are repaired by the standardizer.

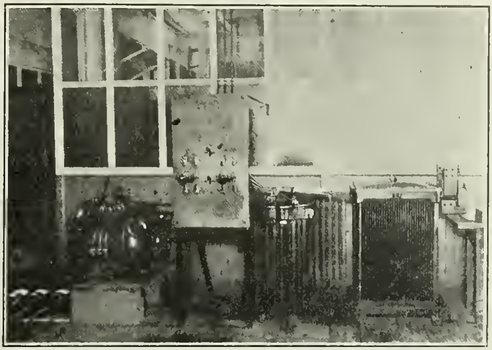


FIG. 10—VOLTAGE REGULATOR, TRANSFORMER AND SWITCHBOARD FOR HEAVY-CURRENT TESTING

The operating engineering work consists in continual tests for the engineering and operating departments to determine the condition of apparatus as to deterioration, reliability and efficiency. Along these lines tests on industrial transformers, generators, ventilating systems and split-pole rotaries have been recently completed. Occasional researches are also made to determine unknown hazardous conditions, and men are furnished to co-operate with the operating department in such emergencies as line breaks and system shutdowns. During the past two years stations and substations have been comparatively free from serious emergency troubles and the greater part of the work has been on fault location in cable break-down. The method mentioned earlier has been so useful that of forty-eight "locations" made in 1912 but one was a failure. Tests were made also to determine the best procedure for parallel operation of stations, many others to assist in adjusting feeders for proper circuit regulation, and others in adjusting relay settings throughout the distribution system.

The work of development has already been referred to, while that of consultation speaks for itself. Obviously the testing department engineers are in an excellent position to act in a consulting capacity to all other departments of the company and to its customers.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Getting Electrical Christmas Shoppers to Buy Early

During the holiday season just closed the Brooklyn Edison company sold nearly $10,000 worth of electrical appliances to local customers, practically tripling the sales records of the preceding year. Features of this Christmas campaign were the "early shopping" accomplished and the large sales made during the first weeks of December—results attained by issuing invitations to 10,000 of the company's best residence customers to visit the electric shop for a special Christmas display held during the week of Dec. 8 to 13.

CHRISTMAS DISPLAY IN THE BROOKLYN EDISON SHOP

The year before practically no sales were made during the earlier days of December, thus resulting in a rush Christmas week which taxed the facilities and staff of the appliance sales department. Profiting from this example, the Brooklyn company this year issued 10,000 invitations for its advance exhibition of electrical gift things, which was set two weeks before the holidays proper. For the occasion the company's electric shop was ornamented with Christmas greens and with a huge electrically lighted Christmas tree, and electrically cooked refreshments were served to all comers. Meanwhile display advertisements were carried in the local papers emphasizing the idea of making the 1913 Christmas an electrical event in the household.

As the result of its "early shopping" encouragement, the company sold $350 worth of appliances daily during the week of the exhibit, while for the following week the daily sales rose to $550. On the Wednesday preceding Christmas, as was to be expected, the greatest business was done, nearly $1,500 being taken in. In general, these figures represented from three to four times the sales made during the preceding year, in addition to the advantage gained in getting the bulk of the business out of the way during the earlier weeks of December.

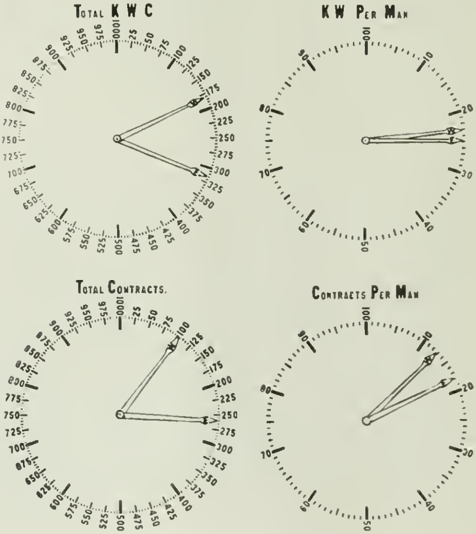
One of the features of the Christmas sales at Brooklyn was the large number of Christmas-tree lighting outfits disposed of. For several weeks the company carried newspaper advertisements emphasizing "the safety idea" in Christmas-tree lighting, and as a result of its campaign in this direction it disposed of about 500 miniature-lamp outfits. Most of these were of the eight-lamp size.

Methods of Handling the Cleveland Sales Organization

Thirty-three lighting solicitors besides motor-service and special salesmen are at present employed in securing new business for the Cleveland (Ohio) Electric Illuminating Company, and it has been said of these men that they are members of one of the best selling organizations in the country. Methods used in handling such an organization are interesting.

The entire force is divided into two sections according to the geographical location of each man's territory in the city. Each section is headed by a captain, who is himself a solicitor. As the dividing line of the sections separates the city into east and west halves, the two competing companies of solicitors thus constitute the "east" and "west" teams.

Fig. 2 shows how the records of the rival sections are kept from day to day. These four charts which hang in the offices of the solicitors are reset every morning to read the total kilowatts connected, the total contracts, the kilowatts per man and the contracts per man. Letters "E" and "W" on the heads of the arrows tell which team is in the lead. In connection with these team-record charts two "high-man" diagrams are used. Opposite the names of each salesman are set two colored



Total K W C

K W Per Man

Total Contracts.

Contracts Per Man

FIG. 1—TEAM-RECORD CHART

buttons sliding on strings, their position indicating the total sales made by each man and the total kilowatts connected through his efforts. The card to the right marks the number of contracts secured and the number of gas installations displaced. A bonus system in force in connection with these charts awards the salesman a certain amount for each contract secured besides netting him an additional $1 for each gas displacement. The bonus is paid monthly, deductions being made, however, for business discontinued within a year.

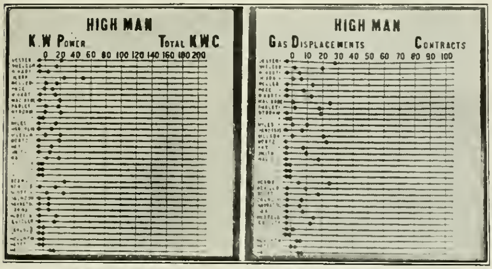
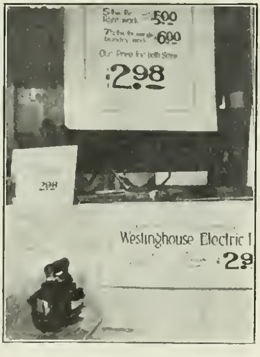


FIG. 2—"HIGH-MAN" RECORDS IN USE BY CLEVELAND SALES STAFF

Reports of the solicitors are made as brief and as few as possible, for, says Mr. M. E. Turner, general contract agent for the company, the characteristics of a good salesman and a good clerk are very seldom found combined in one man, and what the company wants is salesmen. The men are therefore asked to put the maximum time on actual selling and to spend as little as necessary in telling of visits made in which no business was secured. Only reports of results are wanted. A check on absences from duty is furnished by daily time slips.

Featuring Electric Irons in a Boston Drug Store Show Window

An electric flatiron campaign was recently conducted in one of the Washington Street store windows of the Riker-Janes drug houses in Boston, a special mark-down price of $2.98 being made on irons of the 5-lb. and 7.5-lb. sizes. As shown by the accompanying photograph, the display was the main feature of the window, and it consisted of a 5-lb. iron mounted on an ironing board 30 in. long. This iron was moved back and forth, by an arm carried through a central slot and oscillated by a crank and pulley installation driven by a 0.125-hp, 110-volt motor run on Edison service. The iron was operated at thirty reversals per minute and the display attracted sufficient attention, with the accompanying advertising signs, to enable the store to sell 100 irons in a week.



ELECRIC FLATIRON DISPLAY IN DRUG STORE

Advantages of Electric Vehicles in Municipal Truck Haulage

An elaborate report has been completed by the efficiency division of the Chicago Civil Service Commission in an effort to give the city scientific management in the cleaning of its streets and the collection of garbage and refuse. One portion of the report relates to the adaptability and economy of motor trucks for hauling refuse and the crushed stone used in repairing streets. For affording comparison of gasoline and electric trucks the accompanying tabular statement is presented.

GASOLINE TRUCK	ELECTRIC TRUCK
(a) Greater average speed possible.	(a) More efficient where short haul with many stops is encountered.
(b) Can be run continuously night and day.	(b) More efficient within its limits of operation, which approach from 50 to 60 miles per eight-hour day.
(c) Essential outside of the radius of operation of the electric truck.	(c) More economical motive power.
(d) Can do more work in a given time if speed restrictions do not interfere.	(d) Less average per cent maintenance and repair costs.
(e) To care properly for batteries requires the services of a man more difficult to obtain than in the case of gasoline motors.	(e) Less per cent depreciation.
(f) Less balking on unimproved streets.	(f) Requires less skill to drive.
	(g) Affected less in winter by temperature.

In making an estimate of the cost of hauling, the following assumptions as to cost of operation, interest and depreciation on investment have been taken into account:

Interest on investment.............................4 per cent
Insurance and fire liability (gasoline), 3 per cent..$70 per annum
Insurance and fire liability (electric), 3 per cent...$63 per annum
Garage ....$25 per month
Compensation of driver (3-ton truck)..............$80 per month
Depreciation on gasoline truck, estimated life 75,000 miles, on truck value, minus tires.
Depreciation on electric truck, estimated life 100,000 miles, on truck value, minus tires.
Tires—Depreciation based on guarantee, 8000 miles.
Contingencies—Covering interest on general operating stores, repair materials, general superintendence, etc., 2 per cent of the first cost.
"Antiquasion"—Estimated as a fixed charge, it being a factor which decreases the value of equipment owing to improved methods in the science of construction, 5 per cent.
License—State license paid by the city, $4 per year for 3-ton truck.

OPERATING VALUES

Taken from actual results obtained in the operation of 14 standard gasoline trucks, 100 electric trucks and data obtained from the Massachusetts Institute of Technology, Experimental Work.

Size of Truck	No. of Miles per Gal. for Gasoline Cars	No. of Kw-hr. per Mile for Electric Cars
2-ton	5.00	0.741
3-ton	3.92	0.903
4-ton	3.20	1.064
5-ton	2.70	1.225

Assuming that a 3-ton truck is loaded to full capacity, an estimate was made of the cost per mile of hauling refuse as compared with the present cost of hauling by two-horse garbage wagons, which are now hired by the city at $5.50 a day. The results of these analyses are shown in Fig. 1. It will be noted that the cost of operating the electric truck is cheaper than that of the gasoline truck for all lengths of haulage and is cheaper than the $5.50 per day horse-drawn vehicle for hauls over 2 miles in length and the $6 per day horse-drawn vehicle for hauls over 1 mile in length.

Tests have been made during the year on the use of motor trucks for hauling crushed stone and material for street-repair work. The conditions of such work are generally favorable, as the time required to load and unload is relatively small, the travel of the truck is confined almost entirely to streets, and the maximum length of haul is within the province of electric trucks.

Curves showing miles per day, cost per ton-mile and cost per ton delivered for different lengths of haul in street-repair work on horse-drawn, gasoline and electric trucks are given in Fig. 2. These curves show that the use of motor trucks is more economical than that of the horse-drawn vehicles when they are used for a period of at least 300 days a year. If the period in which the transportation equipment is used is less than 180 days each year, which is the minimum period in which street-repair work will be made during any year, the use of the horse-drawn asphalt wagon is more economical, while the use of horse-drawn crushed-stone wagons is less economical than any type of motor truck. The curves further show that in order that the cost of using electric trucks instead of asphalt wagons shall be equalized the electric truck must operate at least 230 days a year and the gasoline truck must operate at least 260 days each year. Under favorable conditions the motor trucks will be more economical than horse-drawn vehicles for the transportation of crushed stone and asphalt, and the use of electric trucks will show a probable saving of about 25 per cent.

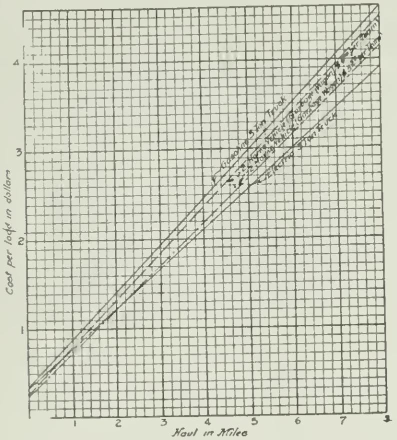


FIG. 1—COMPARATIVE OPERATING COSTS OF HORSE-DRAWN WAGONS AND MOTOR TRUCKS IN HAULING GARBAGE

Among the conclusions reached as the result of the division's study of the economy and adaptability of motor trucks for hauling garbage and other city refuse are the following:

1. That at the prevailing cost of team hire the saving by the use of electric trucks for hauling garbage in such wards as have a considerable haul would amount to 5.1 per cent of the cost of removing such garbage by teams.

2. That if the cost of teams were increased to $6 per day the total estimated saving by using motor trucks for hauling would be about $15,775 per year, or 12.3 per cent of the estimated cost of teams at $6 per day.

3. That, inasmuch as these estimates are computed on the eight-hour-day basis, and as the present working period of garbage teams rarely amounts to eight hours per day, the working period being often as low as six hours, the saving would exceed the percentage given.

4. That the more economical power truck has been found to be the electric one. This is governed in a measure by the low rate of cost of electrical energy from the Sanitary District to the city for off-peak energy, and by the fact that the collected data on the electric truck have shown lower per cent rates for depreciation, maintenance, repair and insurance than those for the gasoline truck.

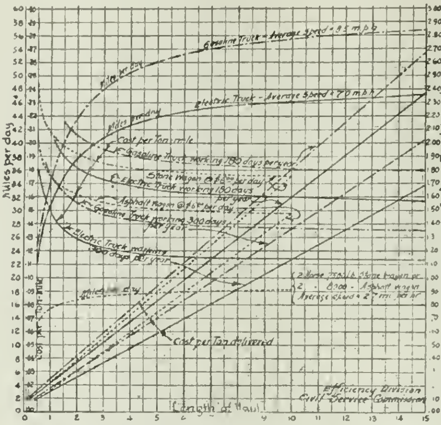


FIG. 2—COMPARATIVE OPERATING COSTS OF HAULAGE IN STREET-REPAIR WORK

5. That the haul below which an electric truck carrying 3 tons would not be economical when measured against a team at $5.50 per day is found to be about 1.8 miles and when measured against a team at $6 per day is 0.8 mile.

Long-Hour Burner in Jeweler's Window

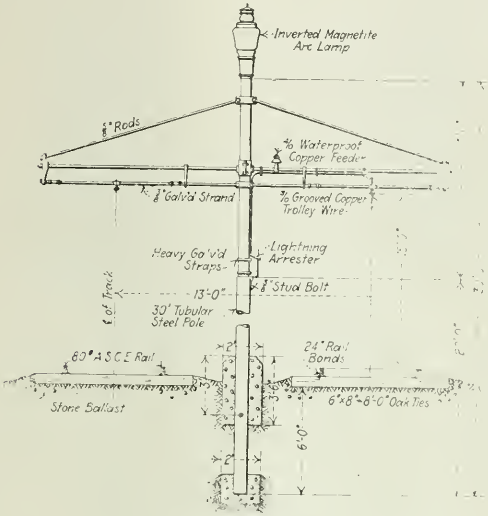
The lighting of sidewalk clocks provides an excellent long-hour use of central-station service, this class of business being desirable even on the small scale illustrated in the accompanying halftone. A Cambridge (Mass.) jeweler whose shop is much frequented by college students burns an all-night 25-watt lamp just above his window chronometer. At the ordinary 10-cent rate the lamp yields the local central station about $7.50 per year, and the jeweler finds the advertising value of the expenditure well worth while.

ELECTRIC LAMP ILLUMINATING CLOCK DIAL ALL NIGHT

Illumination and Wiring

Combination Trolley and Lighting Poles in Cleveland Suburb

Shaker Heights Village, a residential suburb of Cleveland, Ohio, now being improved by a real-estate development company, has been equipped with a street-lighting system in which General Electric inverted-type magnetite-arc lamps are mounted at the tops of the trolley poles in the center of the street. The lamps are placed on alternate poles, making them approximately 200 ft. apart. The thoroughfare being lighted in this way is a 120-ft. boulevard and the arc lamps are raised about 25 ft. above the roadway. Energy is supplied through underground circuits.



COMBINED TROLLEY-WIRE SUPPORT AND LAMP POST

As an economical measure the method of concreting the bases of the poles on this job is worthy of notice. To give the pole stability 1.5 ft. of concrete was placed at the base. Then, after filling the hole with about 2.5 ft. of earth, the concreting was resumed to a point 12 in. above the surface of the ground. In this way the pole attains stability and is protected from the action of the earth and moisture at the top of the ground where most rusting occurs.

The design and construction work on this line were done by the Cleveland (Ohio) Construction Company.

Signal Lamps Bring Prolix Speakers to Time

The transactions of a professional convention held recently in New York City were speeded up considerably with the aid of a system of electric signal lamps which served to warn prolix speakers before they exceeded their time limits. At the beginning of the session it was announced that to each member taking part in the discussion would be allowed five minutes in which to express his views. Mounted on the platform in plain view of both the speaker and his audience was a pair of incandescent lamps, one colored red, the other green. At the end of the fourth minute the green "cautionary" signal was lighted, thereby giving the speaker warning that he must close his remarks in the next sixty seconds. Then at the end of the five minutes the red lamp flashed its danger signal, unmistakably "flagging" the train of oratory and clearing the way for the next speaker.

Cost of Installing Luminous-Arc Ornamental System

Since early summer, a "white-way" system has been in operation at Green Bay, Wis., consisting of twenty-four General Electric 4-amp luminous-arc lamps. This ornamental lighting system extends over a distance of two 750-ft. city blocks, or a total of 1500 ft. Posts are installed on both curbs at intervals of 60 ft., being placed opposite each other. At the cross street lamps are placed on each corner. Plans are now being made to install sixty more of these luminous-arc units, extending the present white-way system over five other blocks in the business district.

The present twenty-four lamps are supplied with energy from a seventy-five-lamp rectifier, being connected into the same circuit with the forty-eight lamps of the local series magnetite street-lighting system. For the installation of this ornamental lighting system complete, ready to turn on, the cost was as follows:

1500 ft. No. 6 steel-taped cable	$333.30
Ornamental posts	492.00
High-tension cut-out switch for post	96.00
24 4-amp luminous-arc lamps	840.00
Cementing posts and bolting to curb	158.00
Chiseling trench, laying cable in curb, and all necessary labor, including tunneling streets	540.00
	$2,459.30

For the twenty-four posts installed the cost complete has averaged approximately $103 per post. The items above entered were taken from bills and are accurate. While the item of labor is a little high, this heavy construction cost is accounted for by the necessity of tunneling from curb to curb beneath an asphalt-paved street at two different points. In order to lay the cable it was also necessary to chisel between the concrete curb and the sidewalk throughout the entire 1500-ft. distance. This cable is laid at a depth of 4 in. and is covered with concrete. The method of installing the posts consisted simply in chiseling out, for a depth of 1 in., some of the concrete in the sidewalk to the size of the base of the post. The bolts were then anchored in place, and concrete was poured in the space, the posts being erected while the concrete was fresh. The resulting construction gives the post a solid foundation, besides making a workmanlike job in mounting the base flush with the sidewalk. The cable runs were made before the posts were installed, enough cable being left at each position to make the required connection to the cut-out switch in the base of the post. Access is gained to this switch by means of a hinged door placed in the base.

The cost of installing Green Bay's ornamental lighting system is being paid for on a monthly-payment plan by the White Way Lighting Club, an organization of merchants along the street benefited. The company agreed to install the system for $2,400, the merchants to repay this outlay in three years at the rate of $66.67 per month. In addition to these instalments on the erection cost, the operating charge runs $80 per month, based on a net rate of 5.9 cents per kw-hr. The lamps are burned daily from dusk to midnight, which is equivalent to 2000 hours per year. As each lamp consumes about 300 watts, the company figures its own income at $40 per year per lamp, including maintenance, breakage, glassware, etc. Following are the figures for the cost of operating and maintaining the system, which agree closely with the preliminary estimates furnished by the manufacturers:

Energy for 300-watt lamp, 2000 hours per year, at 5.9 cents per kw-hr	$35.40
Trimming and labor per lamp per annum	2.00
Electrodes per lamp per annum	1.40
Repairs per lamp per annum, covering five years' test	0.20
Rectifier tubes per lamp per annum	0.33
Average glassware renewals per lamp per annum	0.69
Total cost of energy consumed and maintenance per lamp per annum	$40.02

As an alternative to the luminous-arc system an installation of tungsten ornamental lighting was first proposed for Green Bay, using five-lamp posts, each carrying five 100-watt lamps. At an operating cost of $6 per post the expense for twenty-four posts would have been $144 per month, or $1,728 per year. For a five-year period the cost would total $8,948. In such a tungsten lighting system, however, approximately forty posts would have been required to take the place of the present twenty-four-post luminous-arc system. With the latter posts, costing $3.34 per month to operate, the yearly expense is but $960, making the expense for five years $4,800.

Combination Lighting Posts at Hudson, N. Y.

The incandescent street-lighting system just completed at Hudson, N. Y., to replace an installation of inclosed-arc lamps has several novel features well adapted for use in cities of this class as evidenced by the approval of the local public.

On the principal business streets ornamental iron poles are used, each carrying two 60-cp lamps. The posts are spaced at an average distance of 110 ft. on each side of the street, with poles opposite except at street intersections, where a diagonal layout is adopted. Each of the 860 lamps used is inclosed in a 13-in. opal globe.

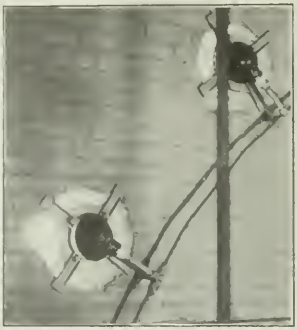
COMBINATION LIGHTING POSTS AT HUDSON, N. Y.

The new poles carry the line wires, trolley spans and transformers formerly supported on wooden poles. The lamps are fed from a series circuit, the wires entering the top of the iron pole through a special two-piece terminal provided with porcelain tubes. The wires are brought down inside of the pole and out at the lamp through one hole into a hollow ornamental casting. This casting is clamped around the pole and supports the bracket arms besides furnishing means for concealing the wires. On less important streets the existing wooden poles are retained, being equipped with extra heavy brackets for supporting the lamps. In the parks, for summer use only, forty-five three-lamp iron poles fed from underground conduit are to be installed.

The contract for this ornamental street lighting was awarded to the Albany Southern Railroad, the details and installation having been looked after by Mr. R. P. Leavitt, who was formerly the electrical superintendent of that company.

Springfield (Mass.) Clock-Tower Lighting

A notable feature of the recently completed municipal group of buildings on Court Square, Springfield, Mass., is the illumination of the great clock which has been installed in the campanile tower at a height of over 200 ft. above the street. Each of the four sides of the tower is provided with a clock face about 14 ft. in diameter, and at each numeral, from 1 to 12, inclusive, a conical-shaped opening has been left in the brickwork. On the inside of the tower, as illustrated in the accompanying illustration, 7-in. aluminum-finish Holophane steel reflectors are set at the center of each numeral opening, being lined up by a metal ring secured to the wall by ribbed lugs. Inside each reflector is a 60-watt tungsten lamp wired from a circular conduit as shown, the total connected load of the clock numerals being 2.88 kw.

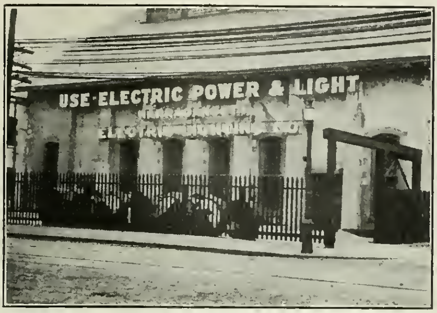


METHOD OF ILLUMINATING FIGURES ON CLOCK DIAL

The clock hands are rotated about a center equipped with five 40-watt lamps set behind a ground glass. The minute hands, 10 ft. long, are each lighted by five pairs of "linolite" lamps rated at 50 watts each, or 500 watts per hand; and the hour hands, 7 ft. long, are marked with three pairs of "linolite" lamps of the same size. The connected load resulting from the lighting of the clock centers and the hand outlines is 3.2 kw, making a total load of about 6 kw for the clock dials complete. On the top of the tower, 300 ft. above the street, is a ball equipped with thirty-two 150-watt lamps arranged to flash the hours and quarters in red and white bulbs, the flasher being operated by the Betts & Betts main clock mechanism in the tower. Energy for this service is supplied by the United Electric Light Company, and the wiring installation was made by the M. B. Foster Electric Company, of Boston, Mass.

Advertising on the Storehouse

Although its principal storehouse is somewhat off the paths of retail business, the Narragansett Electric Lighting Company, of Providence, R. I., is a stanch believer in the gospel of electric-sign advertising. To turn the storehouse wall into a "business getter," the company has installed the sign shown in the accompanying halftone, and the results by day and by night have justified the trouble. The sign is 65 ft. long and 9 ft. high, and its letters contain about 500 10-watt, 110-volt lamps, the individual letters being 18 in., 24 in. and 30 in. high. The use of these different sizes helps to attract attention by daylight, and few passers-by go through the street without looking at the wall of a building otherwise of a type common in New England mill construction. Although the wording of the sign is usual, the proportions are more than ordinarily effective. The accompanying schedule of the number of lamps per letter furnishes convenient data.



ADVERTISING ON STOREHOUSE, PROVIDENCE, R. I.

TABLE SHOWING NUMBER OF LAMPS IN SIGN LETTERS

18-in. letters														
Letter	N	A	R	G	S	E	T							
Number of lamps	11	8	11	9	10	9	7							
24-in. letters														
Letter	E	L	C	T	R	I	G	H	N	O	.			
Number of lamps	9	6	8	7	11	4	10	9	11	8	1			
30-in. letters														
Letter	U	S	E	L	C	T	R	I	P	O	W	&	G	H
No. of lamps	11	11	13	8	10	8	13	5	12	12	17	20	12	12

Recent Telephone Patents

The selective system patented by Mr. R. F. Spamer, of New York City, and assigned to the Western Electric Company, is designed for use with railway dispatch systems. The novelty consists in controlling the application of the step-by-step signaling impulses by the simultaneous operation of an impulse-producing relay with a line relay. When the step-by-step mechanism operates it causes the desired line relay and the impulse-producing relay to operate synchronously, applying energy from the battery to the desired line. By the use of this method the lines are left free from any step impulse mechanism, except during selection.

Another patent assigned to the same company for a dispatch system has been granted to Mr. E. R. Gill, of Yonkers. N. Y. The particular feature in this system lies in arranging the circuits so that each tower man may signal others as required but yet the circuit be under control of the message man when he requires it. Indicators show visibly the condition of the line.

Most receiver-supporting arms are adapted to hold a receiver permanently, but in the one invented by Mr. A. Wetzel, of Los Angeles, Cal., the receiver clamp consists of a receptacle from which the receiver may be readily transferred to the hood switch when not in use. The supporting arm consists of the usual links and clamps for holding the receiver against the ear of the user.

There has been patented by Mr. W. O. Beck, of Ridgefield, N. J., and assigned to the Western Electric Company, a special arrangement of shelf support for steel wall telephones, the object being to provide a shelf support which may be mounted with a minimum amount of extra labor. The shelf support, therefore, takes the form of an auxiliary backboard of sheet steel with flanged edge. Two lugs project from the top flange, which are adapted to hoop into slots in the bottom flange of the bell box. The holes near the base of the shelf-supporting backboard register with the lower mounting holes of the regular backboard.

With multi-party lines there is frequent interference, owing to the listening in of non-wanted stations. This causes not only interference but waste of battery energy. Mr. A. R. Nelson, of Janesville, Cal., has endeavored to overcome this by arranging an interlocking device between the hook switch and the generator crank. The result is that the transmitter battery circuit is not closed upon the rising of the hook switch until after the line has been found idle and the generator crank has been turned.

Letters to the Editors

Daylight and Artificial Light

To the Editors of the Electrical World:

SIRS:—The editorial on "Daylight and Artificial Light" in your issue of Nov. 29, page 1091, raises a number of interesting questions on a subject which, as you say, should be further investigated. Without, by any means, assuming to answer definitely all of the questions propounded, I think some of the most important ones are explained by facts within our present knowledge.

Artificial light may differ from daylight, as received through windows, in any one of the following respects: (1) color, (2) direction, (3) area of source (generally called diffusion), and (4) quantity.

As to color, we may doubt whether there is any marked difference in the comfortable character of daylight and artificial light due to this cause, for, as stated in your editorial, a wide variation daily takes place in the color of daylight without any noticeable change in its comfortable and satisfactory qualities.

When we come to direction, however, there is usually a very important difference. Daylight is usually received through windows at one side or the other of the work. In other words, we have a large light-giving surface, the sky, casting light on the work at a decidedly oblique angle in the case of ordinary desk work or reading.

With artificial lighting by the methods ordinarily employed, we may have any one of the following conditions: A source of light of high intrinsic brilliancy or surface brightness (and therefore of small area) may be placed close to the work. Or smaller light sources may be placed at various positions above the worker, casting light upon the work. Under any such conditions there will be positions where specular reflection from various surfaces will be annoying on account of the small size and great surface brightness of the light-giving source.

If, on the other hand, an indirect system of lighting is employed, the light-giving surface is mainly a large patch of ceiling located above the work. While conditions will be greatly improved by increasing the size and reducing the surface brightness of the source of light in this way, the disadvantage of its position above the work is still somewhat apparent in the specular reflection or glare from horizontal surfaces, such as polished desk and table tops and papers lying on desks. Glare of this kind is frequently not recognized by the ordinary observer, but is nevertheless very apparent to the expert and may be the cause of considerable eye strain.

The area of the light-giving source with daylight is fairly comparable with the area in an indirect artificial lighting system, but there is, of course, a large difference between daylight and artificial lighting from small high-brilliancy sources commonly known as direct lighting. It is the area of the source which determines what is usually called diffusion of the light. If the source is large, such as the sky visible from a window or a ceiling, we usually call the light "diffuse."

An indirect-lighting system, so planned that most of the light is received from comparatively small areas of the ceiling above each fixture, is one which is likely to produce much less comfortable illumination than an installation in which the light is spread almost evenly over the ceiling. This is because the bright spots on the ceiling tend to produce uncomfortable specular reflection from polished surfaces.

In my opinion, it would have a most unfortunate effect on current practice in illumination design were the idea to get abroad that when putting in an indirect-lighting system the effort should be made to give more definite direction to the light than is now the case in the majority of installations of this kind. Indeed, I feel very strongly that the effort should be in the other direction.

To put the matter in another way, if we are to imitate daylight more closely we must have greater uniformity in the brightness of the light-giving surfaces, since approximate uniformity usually characterizes the sky within the range of a window.

As to quality of daylight, there are, as your editorial points out, immense differences between different parts of the same room, and also, it might have been added, from moment to moment at the same spot in a room. We must remember that daylight values of illumination are usually much higher than the minimum which may be comfortably used for working purposes, whereas artificial lighting intensities are for economical reasons held down near the lowest values at which work can be comfortably done. This fact alone is responsible for some of the faults found with artificial light as compared with daylight and to some extent may answer the puzzling question as to why a given degree of artificial lighting is sometimes less satisfactory about dusk, when it is first used, than it becomes later in the evening. Probably the facts are in many cases that the artificial lighting provided is barely sufficient for comfortable work and is, besides, miserably arranged, so that it is not until the user has fully forgotten the better daylight conditions and has become fully accustomed to the less satisfactory artificial lighting that he can get along without protest.

Although it is a common saying that a mixture of daylight and artificial light is bad and that the change from daylight to artificial illumination should be made at once by pulling down the shades and depending on artificial light altogether, I have seen so many cases where this tradition could be disregarded with comfort that I am inclined to put it in the same class with the exploded theory that "night air is dangerous." Doubtless there is some foundation for both traditions in certain observed facts. But I have yet to see a case where the mixture of daylight and artificial light was less satisfactory than the artificial light alone, unless the artificial light required a change in the user's position which was disregarded. I am not prepared to say that such cases do not exist, but as a general rule when there is complaint about the combination of daylight and artificial light it is high time to begin an inquiry into the defects of the artificial lighting. If the artificial lighting has defects that begin to be apparent even before the assistance of daylight is withdrawn, they are very likely to continue to make trouble after dark.

A careful study of this question of diffusion during the last few years has convinced the writer that, leaving aside the question of quantity, the superiority of good daylight over artificial light for most reading and work lies in its direction combined with the large sky area of the source and the minimizing influence which such direction and area have upon the glare of specular reflection from surfaces on which one may be doing close work. The phenomenon tersely summed up as "glare from paper" is responsible for an immense amount of eye fatigue and discomfort, due in part to the paper employed and in part to the direction and diffusion of the illumination on the paper.

Between conditions of glare from paper or other polished surfaces which are so bad that they cannot be tolerated and conditions of absolute comfort and freedom from such glare there exists a wide middle ground where glare, although present in so small a degree as to be generally unnoticed, is nevertheless enough to produce considerable eye strain. Such insidious conditions may therefore cause much more damage than would glare in a degree so pronounced as to force the reader to seek a change of position to avoid it.

With daylight illumination through windows, the angle from which the light comes, together with the large light-giving sky surface available, causes the greatest possible freedom from the pernicious effect described.

Chicago, Ill. J. R. Cravath.

Central Stations and Public Good Will

To the Editors of the Electrical World:

Sirs:—As the result of experience in contracting for house wiring and the installation of apparatus and the sale of gas and electrical appliances, I feel that from the standpoint of good will public utilities would be considerably ahead in the long run if they confined themselves to the sale of gas and electricity and left all contracting and sale of appliances to the local contractors and dealers. It would be necessary, of course, to supervise the work of the contractors and dealers and to assist them, to the end that the consumers should receive proper treatment and that the sale of gas and electricity be properly encouraged.

On account of the growth of the municipal and government ownership idea and the appointment of state public service commissions, it would seem very important that the public utilities remove from themselves such parts of their organization as are not directly related to the manufacture and sale of energy and as may be the cause of dissatisfaction and complaint. I should be pleased to see a discussion started in your columns that will bring out an expression of opinion from public utilities over the country.

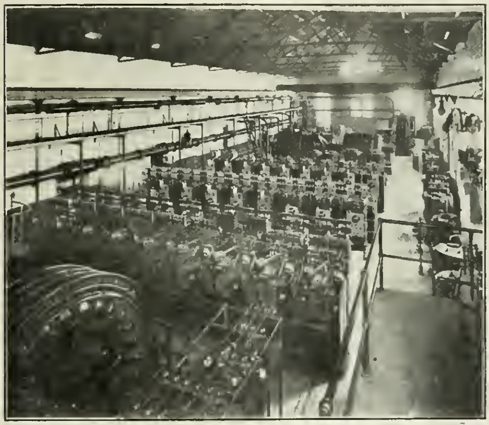
New York. R. D. Williams.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

A 12,434-Hour Rectifier-Tube Record

Few electric-lighting plants have regularly obtained such long lives from rectifier tubes as does the Public Lighting Commission of Detroit, Mich. From records kept for this municipal system, it was found that one tube operated satisfactorily for 12,434 hours and 30 minutes, although it had been guaranteed for only 500 hours. Another, guaranteed for the same life, lasted 10,047 hours and 55 minutes. Seven tubes had a life of more than 100,000 hours, and eight lasted over 8000 hours. The average life of tubes used at this plant is 2939 hours and 16 minutes. This record includes tubes in use up to Nov. 1, 1913, those which have been allowed to rest and then had renewed life, and those which have been discarded.



DETROIT MUNICIPAL PLANT ENGINE ROOM, SHOWING MERCURY-ARC RECTIFIERS

This remarkable tenure of life for rectifier tubes is attributed to the careful attention and treatment which they receive at the Detroit plant. Each tube when in use is immersed in an oil bath which is kept at a constant temperature of 80 deg. Fahr. by coils through which water circulates. The attendants have become so skilled in adjusting the flow of cooling water that the temperature remains practically constant. The temperature of each bath is observed and water adjusted every fifteen minutes.

The tubes are equipped with automatic shakers which restore the arc in case a tube drops its circuit, but these shakers are never allowed to continue rocking the bulb without the cause being investigated. Generally the tube is found to be in need of a rest, and if this is the case it is replaced by a fresh tube and itself treated to renew its usefulness. The method which has seemed to give the best results is to wash the tube in warm soapsuds, next thoroughly drying it, and then baking it in an oven. The washing is declared to remove deposits from the inside of the glass, and the baking anneals the glass and relieves static strains. The tubes are then allowed to rest for a length of time, after which they are found in condition to give satisfactory service again in most cases.

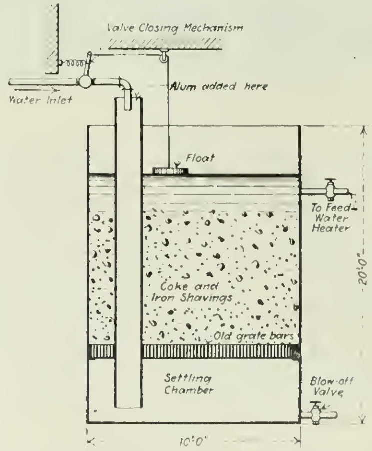
Weaknesses in rectifier tubes are generally denoted by their dropping their circuits. When the lamps on the circuit are the cause of this phenomenon it is considered good practice to equip the tubes with static dischargers. Then when the circuit is dropped the resulting surge of current and rise in voltage is taken care of by the discharger.

Mr. Frank R. Mistersky is general superintendent of the Detroit public lighting system. Thirty-one seventy-five-lamp rectifiers are in use at the main station and ten or more are installed in the substations.

Home-Made Water Purifier

In the upper Ohio valley the fact that steel mills and other industrial plants empty their refuse into the rivers renders the already impure water practically unfit for use in steam boilers. Accordingly, Mr. E. B. Sever, superintendent of motive power for the East Liverpool (Ohio) Traction & Light Company, devised the accompanying scheme for ridding make-up water of most of its impurities.

An old condenser mounted in a pit has been remodeled to act as a purifier. Water enters at the top and, flowing through a leading-in pipe, is conducted to the bottom of the chamber. Grate bars discarded from the boiler room have been arranged to form a shelf in the tank at a distance of about 3 ft. from the bottom. On this shelf are supported coke and iron and steel turnings from the car shops of the company.



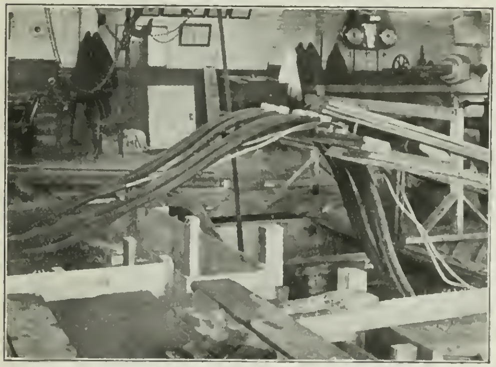
WATER PURIFIER IN CONDENSER PIT

About 1 lb. of alum is introduced at the leading-in pipe each hour, while a plentiful supply of lime is kept in the purifier at all times. When the device was first installed lime in liberal quantities was put in the boilers themselves as the water in the river contains considerable acid. For removing all solid matter from the water the spongy mass formed by the alum is found to work well with the 10-ft. coke and iron filter, which has been tamped into the tank to form a fairly compact mass.

A float acting against a spring automatically controls the opening and closing of the inlet valve, keeping the water supply at an almost constant level.

Handling Heavy Cables While Plant Is Rebuilt

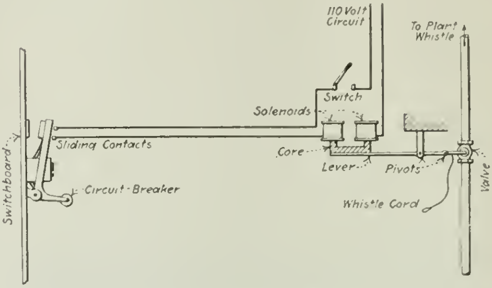
In the construction of an industrial power plant it became necessary to relocate the switchboard and to install a turbo-generator on foundations directly in front of the original location of the panels. Pending the movement of the board to its new site the concrete foundation had to be built for the new generating unit, but difficulties were encountered in doing this on account of the presence of pairs of 2,000,000-circ. mil cables running through the space assigned to the new foundation. In order to enable the forms for the foundation to be placed in position a base panel was cut out of the switchboard and the cables were raised to the position shown in the photograph. Here they were clamped temporarily by porcelain insulators screwed into cross-pieces of 3-in. x 6-in. timber. In turn these cross-pieces were fastened at their ends to similar timbers braced at points near the front and bolted to the floor at the rear. In this way the slack of the heavy cables, aggregating 4,000,000 circ. mils per leg, was cared for and the foundation was poured without delay to either the existing service or the subsequent setting up of the generating unit.



HANDLING 2,000,000-CIRC. MIL CABLES DURING PLANT RECONSTRUCTION

Whistle-Alarm Attachment for Circuit-Breaker

Although in nearly every modern station some sort of circuit-breaker alarm is used, the idea of employing the plant whistle as a telltale to inform the operators that an overload has tripped a breaker is rather unusual. The diagram shown herewith illustrates how this principle has been applied in the Steubenville (Ohio) plant of the Tri-State Railway & Electric Company. Metal parts of the breaker in the open position complete the 110-volt circuit, which includes an electromagnet. When the latter is energized from this 110-volt source, its movable poles are pulled upward. This action transmitted through the lever to the whistle valve allows steam to escape and blow the plant whistle.



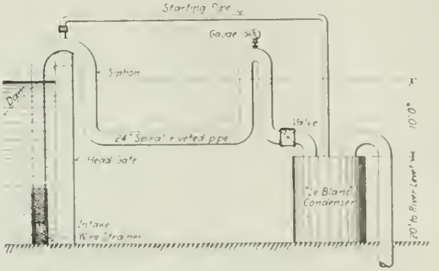
WHISTLE-ALARM ATTACHMENT FOR CIRCUIT-BREAKER

The fact that the whistle makes such a loud noise is said to be a large factor in accelerating the movements of the men who are supposed to restore the circuit to operation. As the whistle can be heard at the office of the chief engineer, it also affords an easy check on the interval of time elapsing between the moment at which the breaker opened and the time it was closed.

Siphon Condenser Intake

Tunneling under a dam or headgate for a condensing-water intake is no small piece of work, and the expense involved may be quite large. A less costly and yet altogether satisfactory solution of this problem has been worked out, however, at the plant of the Fallston (Pa.) Beaver County Light Company. When the installation of an extra condenser unit became necessary a large siphon constructed of 24-in. spiral riveted pipe was placed over the headgate at one extremity of the dam. A pipe line of the same size was continued to the Leblanc condensers.

With all lines connected, the problem of starting the water over the bend in the siphon was met by running a small pipe from the top of the bend shown in the illustration back to the condenser. The condenser pumps then being started created a partial vacuum in the 24-in. pipe, causing water from the river to be forced into the siphon. When the pipe line was filled the valve near the condenser was opened, allowing a continuous flow into the condenser.



SIPHON CONDENSER INTAKE AT FALLSTON, PA.

Experiments with the starting pipe showed that if the small pipe was left open while the condenser pumps were in operation much better results were obtained, and when measurements were made it was found that the vacuum which it was necessary for the pump to maintain had been reduced by about 4 in. or 5 in. The explanation will be apparent from the sketch, since the siphon is using the effective head on the condenser and is assisted by the action of the condenser pumps on the small pipe which is removing all air from the pocket that would otherwise be formed at the top of the bend in the siphon. The pipe at the right of the condenser shows a proposed outlet which will give a 20-ft. fall to the river.

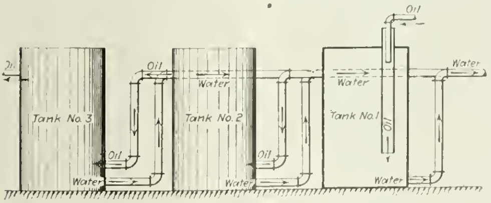
Cleaning Iron and Steel by Electricity

A method recorded for cleaning oil and grease from the surface of sheet-iron or steel stampings or sheets, preparatory to galvanizing or plating the latter, is worthy of note. An electrolyte is prepared consisting of a pound of caustic potash and two ounces of potassium cyanide to each gallon of water. The metal to be cleaned is immersed in this solution and an electric current passed through it. A pressure of 6 volts to 10 volts is required and a power of about 250 watts per square foot of surface to be cleaned. The current is kept on for a period of five to ten minutes, when a film of bluish-white metal is seen on the cathode. The polarity is then reversed and in a few minutes the metal is found to be clean and bright. This process is said to be cheaper and more effective than hand cleaning.

Multiple-Tank Gravity-System Oil Filter

An inexpensive oil filter in the station of the East Liverpool (Ohio) Traction & Light Company, embodying the ideas of the chief engineer for the company, Mr. J. S. Murphy, has been giving excellent results during the past year. As shown in the accompanying drawing, the apparatus consists of three tanks mounted in the same horizontal plane. Oil entering at the top of tank No. 1 is conducted down to a point near the bottom. Here the action of gravity impels the oil to rise while the tendency of the water is to remain below. As will be seen, the pipes which carry off the waste water and the separated oil are at the same level, so that when the tank becomes full water and oil will flow from the two outlets simultaneously.

Some water is still retained by the oil after it has passed the first tank, but as the process is repeated in tanks No. 2 and No. 3 the percentage of moisture and other impurities remaining is reduced to a value which is practically negligible when the oil is used as an engine lubricant. All pipes carrying waste water are connected at the same level as are those which conduct the oil from one tank to the other. This home-made oil filter, it is estimated, has saved fifteen barrels of oil since it was placed in operation less than a year ago.



MULTIPLE-TANK GRAVITY OIL FILTER

Single-Phase to Three-Phase Transformation

In a step-down transformer system connected star to delta, if a transformer is open-circuited on the high-tension star side, thereby leaving only two transformers in circuit on one side, will the delta connection still give three currents displaced in phase by 120 deg. on the low-tension side? Apparently there are only two transformers across one phase on the high-tension side, which would have to transform from single-phase to three-phase. If this can be done, I should like to know how the displacement of 120 deg. between phases is obtained. J. J. B.

When one main lead of a three-phase system is opened the other two operate as though they were the two leads of a single-phase system. Such a system cannot deliver three-phase energy, whether the transformers are connected in delta or in star. When three transformers are delta-connected one of the transformers (but not the connections to one main lead) may be removed without changing the system from three-phase to single-phase. Moreover, a system may continue to operate as though polyphase when receiving energy from a single-phase source, if the energy is utilized to drive machinery which in itself converts from single-phase to polyphase. For this purpose stationary transformers are unsuited; energy storing—that is revolving—machinery is required. Electric locomotives for the Norfolk & Western Railroad electrification will utilize revolving machinery for converting the received single-phase energy into polyphase energy for the propelling motors. The scheme employed was described in our issue dated Aug. 23, 1913.

Transformer-Generator Unit

We have a new 100-kw, 60-cycle, three-phase generator, wound for 2300 volts, and also an older 50-kw, single-phase machine of the same frequency, but wound for 1150 volts. We want to use the large machine for the night peak load and the small one for the day load and the off-peak load. What will be the loss by stepping up the emf with a transformer from 1150 volts to 2300 volts? We do not desire to go to the expense of scrapping the old generator, which is in good condition but cannot be changed to 2300 volts, and buying a new generator of the same size, while a second-hand generator of that size will cost as much or more than a transformer. If the transformer loss is only 2 per cent or 3 per cent, we believe the transformer method to be the cheapest under the circumstances. We have a 50-hp engine for the small generator and a 150-hp engine for the larger one, but think it cheaper to use the small outfit for off-peak load rather than run the larger engine half loaded. W. D. C.

Your plan for operating your 1150-volt, 50-kw generator at 2300 volts is entirely feasible. A well-designed two-coil, 50-kw transformer, to step up the voltage from 1150 to 2300, would have a copper loss of about 11 watts per kilowatt and an iron loss of about 6 watts per kilowatt, the total loss therefore being about 800 watts. The loss would therefore be about 1.6 per cent. An even more advantageous plan would be to employ a so-called auto-transformer, which is connected as though it consisted of one coil operated to deliver 2300 volts but tapped so as to permit energy to be fed into it at 1150 volts. For this purpose there could be purchased a one-to-one ratio 25-kw transformer, each coil being designed for 1150 volts and the two coils being connected in series for delivering 2300 volts. This transformer would probably have a copper loss of about 12 watts per kilowatt and an iron loss of about 6 watts per kilowatt, the total loss, therefore, being 450 watts. When operated in this way the loss would be somewhat less than 1 per cent. Therefore, instead of purchasing a 50-kw transformer having a loss of 1.6 per cent, you could purchase a 25-kw transformer having a loss of only 0.9 per cent. This transformer could well be connected permanently to the generator and the two could be operated as a unit just as though the generator were built for 2300 volts.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

International Standardization of Electrical Machinery.—A. R. Everest.—A paper read at Birmingham giving a review of the work of the International Electrical Commission on standardization of electrical machinery. The rules so far adopted are based on considerations of the highest safe temperatures for various insulating materials, the joint effect of time and temperature, and also the probable difference between observable temperature and maximum internal temperature. From these considerations an international agreement was reached regarding the permissible limits of temperature for various insulating materials employed in modern electrical machinery. In connection with these permissible temperature limits, rules have been provided regarding the proper determination of the temperature of the cooling air, a knowledge of which is necessary to ascertain the temperature rise, which must not be exceeded at the rated load of the machine. Finally, rules are provided dealing with the differences which may exist between the temperature rise on test and under service conditions due to variations in the cooling temperature and the barometric conditions. Following are the limits of observable temperature adopted by the commission for different insulating materials:

	Deg. C.
Non-impregnated cotton	80
Impregnated cotton or paper (general)	90
Impregnated cotton, single-layer field coils, stationary or moving	95
Impregnated cotton, stationary coils, solidly impregnated throughout	95
Impregnated cotton, rotor and stator windings having the slot portion solidly impregnatel or molded	95
Enameled wire (without cotton)	105
Mica, micanite, asbestos (general)	115
Mica, micanite, single-layer field coils, stationary or moving	120
Mica, micanite, stationary coils, solidly impregnated or molded	120
Windings permanently short-circuited:	
Insulated	100
Non-Insulated	110
Commutators, slip-rings	90
Bearings	80

Permissible limits of temperature are useless to the designer except in conjunction with information regarding the cooling temperature, since the difference between these two values is the "temperature rise" which the machine may create when carrying its rated load. The I. E. C. rules now require that the maximum and not the average temperature of the cooling air shall be stated, but agreement has not been reached regarding an international standard-reference air temperature. Although the I. E. C. recommends that "wherever possible the temperature of the cooling air should be stated and the machine constructed for this cooling condition," it is also proposed to establish a value which shall be taken as the maximum temperature of the cooling air when no specific information is available. At Berlin a majority of the delegates, including those from Great Britain and the United States, desired to set this reference temperature at 40 deg. C., while a minority desired 35 deg. C.—London *Electrician*, Dec. 12, 1913.

Single-Phase Mercury-Vapor Rectifier.—J. Epstein.—An account of the experience obtained in practice with a 240-volt, 360-amp mercury rectifier which has been in use in a German foundry since December, 1911. The apparatus is reliable and has converted so far 275,000 kw-hr. The rectifier supplies energy to motors without a storage battery. Details are given of the efficiency obtained, with an analysis of the different losses.—*Elek. Zeit.*, Dec. 11, 1913.

Commutator as Frequency Changer.—H. Meyer-Delius.—The first of a series of articles on polyphase commutator motors. In the present instalment the author discusses the commutator as a frequency changer. Two quarter-phase machines, identical in all respects save that one is provided with a commutator and the other with slip-rings, are taken for illustration. It is first assumed that the rotors are blocked and the stators excited from a polyphase line of constant potential and frequency, the voltage and frequency across the brushes on the commutator and across the slip-rings being noted. The rotors are then allowed to revolve at half synchronous speed and the voltage and frequency are again investigated. Direct current is next impressed on the revolving rotors and the resulting action discussed, a slightly different commutator machine being assumed in this case. Other conditions of excitation are considered and the involved phenomena are pointed out in each case.—*Gen. Elec. Review*, December, 1913.

Transformer Designs.—M. Vidmaer.—A long mathematical paper in which the author gives the outline of a simple theory for dimensioning the cross-section of the yoke of a transformer and for selecting the sheet iron employed in its construction so as to make the cost a minimum.—*Elek. u. Masch.* (Vienna), Nov. 30, 1913.

Lamps and Lighting

Lamp Output in Germany.—F. Fasolt.—The first part of a review of the statistics prepared in connection with the German lamp tax. The number of carbon incandescent lamps made in 1910 was 26,000,000; in 1911, 25,000,000, and in 1912, 21,000,000. The number of metallic-filament lamps made in 1910 was 42,000,000; in 1911, 47,000,000, and in 1912, 76,000,000. The number of Nernst lamps made in 1910 was 249,000; in 1911, 131,000, and in 1912, 78,000. The weight of arc-lamp electrodes formed of pure carbon averaged 8,000,000 kg during each of the last three years, and that of impregnated carbon electrodes averaged 2,600,000 kg per year.—*Elek. Zeit.*, Dec. 11, 1913.

Radiation from Carbon Lamps.—Lummer.—An abstract of a paper read before the German Illuminating Engineering Society on the determination of the law of total radiation from carbon incandescent lamps by means of the observed true temperature of the carbon filament. One of the important conclusions of the paper is that the carbon filament radiates as a "gray body." A "gray" body is one that radiates always less than a "black" body, but for each wave-length the percentage difference between the two radiations is the same, besides being the same for all temperatures.—*Elek. Zeit.*, Dec. 11, 1913.

Gas-Filled Incandescent Lamps.—A note on a recent British patent (No. 27,432, 1912) of the British Thomson-Houston Company and the Allgemeine Elektricitäts

Gesellschaft of Germany. A quantity of gas at very low pressure is kept constant throughout the life of the lamp by previously impregnating a porous body with the gas-producing material and inserting this in the lamp. For example, a very small tube of silicic acid and an organic binder are boiled in chloride of copper and then dried and drawn into wire, which is mounted in the lamp.—London *Elec. Eng'ing*, Dec. 11, 1913.

Vacuum-Tight Seal for Lamps.—A note on a recent British patent (No. 18,300, 1912) of the British Thomson-Houston Company and the General Electric Company of this country. A low-expansion glass is mixed with progressively larger quantities of silica to make a series of melts. The glass is finely powdered and ground quartz is added. The different glasses resulting are used successively from the quartz tube until a glass having the same expansion as tungsten is available. A tungsten or molybdenum leading-in wire fused into this makes a vacuum-tight seal.—London *Elec. Eng'ing*, Dec. 11, 1913.

Effect of Ultra-Violet Rays on the Human Eye.—An abstract of a paper by Schanz read before the German Illuminating Society in which the author recommends that lamp rays of short wave-lengths be absorbed, as can be done by means of euphos glass. The necessity of doing so was questioned in a discussion. Voege claimed that a special protective glass for ultra-violet rays was unnecessary. Lamps should be so suspended that direct glare is avoided. Indirect or semi-indirect illumination is particularly recommended.—*Elek. Zeit.*, Dec. 11, 1913.

Fluorescent Light.—W. S. ANDREWS.—An address on radio-luminescence. After describing the production of fluorescent light by certain substances, a number of the common elements are named whose compounds possess this light-giving property. It is then shown that such compounds, the light from each of which possesses an intrinsic predominating color, can be made to produce light of a useful color, in a few cases closely approaching daylight. The substance is placed in a tube with a gas furnishing a complementary color and is subjected to the influence of an electric discharge. The remainder of the paper is given over to a description of a number of experiments concerning the properties of the light emitted by various fluorescent and phosphorescent substances.—*Gen. Elec. Review*, December, 1913.

Generation, Transmission and Distribution

Two-Phase-Three-Phase Transformation. — H. DE PISTOYE.—After having discussed in a former article the Scott system in which a two-phase magnetic circuit is used, the author now describes the Leblanc system employing a three-phase magnetic circuit. While the Leblanc system seems to be theoretically superior in most cases, yet its advantage is so very slight that in practice both systems must be considered as equivalent. Under certain conditions, however, one or the other system may be preferable. For instance, for a two-phase distribution system operating at very low voltage in an electrochemical plant the Scott system is advantageous, while in a three-phase distribution system of the same character the Leblanc system is preferable.—*La Lumière Elec.*, Dec. 6, 1913.

Electric Drills.—An illustrated article on recent improvements in electric drills.—*Mitt. Siemens & Halske*, November, 1913.

Powdered Coal.—G. A. ROUSH.—An illustrated description of a new powdered-coal burner of W. R. Dunn. —*Metall. and Chem. Eng'ing*, January, 1914.

Traction

Single-Phase Traction and Telephone Lines.—G. GIROUSSE.—The conclusion of his illustrated article in which simple means are discussed for overcoming the disturbing effects of single-phase lines on telephone lines in the neighborhood.—*La Lumière Elec.*, Dec. 6, 1913.

Electric Railways.—The conclusion of the illustrated article on the electrical equipment on railways. This instalment deals with automatic circuit-breakers, brakes, couplings between cars, etc.—*Mitt. Siemens & Halske*, October, 1913.

Railway Electric Signaling.—H. M. JACOBS.—There are now in general use three systems of railway signaling, viz., mechanical, electro-pneumatic and all-electric. Except for a brief explanation of the principles of the mechanical and electro-pneumatic systems, this article is concerned only with the all-electric. On steam roads direct current for signaling is mostly employed, both rails being insulated from block to block and made to serve as conductors. On direct-current roads only one rail is sectionalized in some cases, and where the voltage drop due to the propulsion current is troublesome, special polarized relays are used. On still other direct-current roads alternating current is used for signal purposes, with operating relays that are unaffected by direct current. The most recent practice employs both rails for propulsion-current and alternating-current signal purposes, the rails being sectionalized at block ends and connected by impedance bonds which offer negligible resistance to the propulsion current but sufficient impedance to the signal current.—*Gen. Elec. Review*, December, 1913.

Installations, Systems and Appliances

Electricity Supply in Large Cities.—G. KLINGENBERG. —A long abstract of a paper read before the (British) Institution of Electrical Engineers. After giving a short account of the methods at present employed in London, Berlin and Chicago for the generation and distribution of electrical energy, a discussion of the factors determining the cost of energy supplied to consumers is undertaken. Consideration of the operating conditions in the London, Berlin and Chicago plants permits figures of comparative costs to be deduced, and these apparently indicate that the most economical arrangement is to employ a few large stations. The application of this idea to the conditions now prevailing in London is discussed, and some figures for the cost of conversion of the present arrangements to a scheme of this kind are given. The various factors which have an effect on the results are also enumerated. In the discussion which followed Messrs. Snell, Ferranti, Tapper and others discussed the London situation.—London *Electrician*, Dec. 13, 1913.

Resistance Divisions for Series-Motor Operation.—E. R. CARICHOFF.—An article, illustrated by diagrams, presenting a graphical method to simplify the apportioning of the amounts of resistance that should be connected to the points of a series-motor controller to insure the motor's best operation. A description of the method of laying out the diagrams is given, along with a mathematical proof of their correctness. The usual superiority of graphical methods over arithmetical ones is brought out in connection with the application of series-parallel operation.—*Gen. Elec. Review*, December, 1913.

Extinguishing the Arc on Breaking a Contact.—W. BURSTYN.—A long translation in abstract of his recent German paper, which has already been abstracted in the Digest, on a new method of extinguishing arcs and its applications to switches and interrupters.—London *Electrician*, Dec. 12, 1913.

Wires, Wiring and Conduits

Electric Valves as Protective Apparatus.—G. GILES. —An illustrated article the object of which is to refute an experiment recently published by Gierlich. This experiment had been thought to show the inefficiency of the Giles electric valve as a protective apparatus, but the present author claims that the experiment was faulty because the apparatus was not properly adjusted.—*Elek. Zeit.*, Dec. 11, 1913.

Electrophysics and Magnetism

Gamma Rays.—E. Rutherford and H. Richardson.—The authors have analyzed the gamma radiations emitted by the radium products radium B, radium C, radium D and radium E into a number of groups of different penetrating powers. They have now also examined the thorium products—viz., mesothorium 2, thorium B, thorium C and thorium D—and the actinium products by a similar method and have obtained results of the same general character as in the case of radium. The gamma rays of these substances consist of distinct groups of rays absorbed exponentially by aluminum and differing widely in their absorption by matter.—*Philos. Mag.*, December, 1913.

Electrochemistry and Batteries

High-Temperature Laboratory Furnace.—E. F. Nothrup.—An illustrated description of a new high-temperature electric laboratory furnace using artificial graphite as the heating element. This furnace permits a particularly exact temperature control.—*Metall. and Chem. Eng'ing*, January, 1914.

Electrostatic Concentration.—H. C. Parmelee.—An illustrated article on the concentration of complex sulphide ores from the Mary Murphy mine in Colorado. The problem is a rather complicated one, and the system includes electrostatic separation of zinc-iron middlings for the production of zinc concentrates.—*Metall. and Chem. Eng'ing*, January, 1914.

Ozonators.—A. Vosmaer.—A concise illustrated description of various different ozonator designs both with and without solid dielectrics between the electrodes. The systems of Schneller, Tesla, Otto, Vosmaer, Siemens, Gerard and Vohr are described and illustrated.—*Metall. and Chem. Eng'ing*, January, 1914.

Units, Measurements and Instruments

Torque Meter.—H. H. Broughton.—The author describes three methods of measuring the angle of twist of a torque-meter spring and gives detailed particulars of a spring torque meter of simple and inexpensive construction. An account of a number of interesting tests is included. With one exception the instruments used in the author's laboratory are of the spring type on account of the torque—5-lb.-in. units to 1000-lb.-in. units—being too small to give a sufficiently large angle of twist to a straight strip of spring steel. In the instrument in which a 30-in. length of 0.5-in. square steel is twisted the maximum torque to be measured is 5000 lb.-in. units, and the speed of 50 r.p.m. makes it imperative to use an electrical method of measuring the angle of twist. The arrangement is shown in Fig. 1. The brush b_1 can be moved till the narrow metal contacts c and c_2 in the disks D_1 and D_2 make contact simultaneously with the brushes b_1 and b_2, thus completing the circuit and causing G to deflect. The angle through which b_1 has been rotated is recorded by the pointer P on the scale S. In the electro-optical method a disk provided with a pointer is fixed to the driving shaft, and a second disk, graduated on the rim, is secured to the driven shaft in such a position that the pointer overlaps the scale. A spark-gap connected to the secondary terminals of an induction coil is suitably mounted in the neighborhood of the scale, and the primary circuit of the coil is interrupted for a brief period each revolution by a break in the continuity of a contact disk mounted on the shaft (the break is exactly in line with the pointer). During this period the spark which bridges the gap illuminates the scale, and a continuous stationary image is impressed on the eye. Compared with the optical method, however, both the arrangements described above are crude. In this method the angle is determined by means of the arrangement shown in Fig. 2. To one shaft S is secured a disk A which carries a ring-shaped celluloid scale B, and to the other shaft S_1 two disks C and D are fixed, one of which, C, has a narrow radial slit s and the other a window w and a radial slit S_1, in line with the slit s in C. The width of the window is about equal to 15 deg. of arc. On illuminating the scale from the back an observer looking through s sees a broad arc of the celluloid scale and at the same time a bright streak due to the slits s_1, which serves as an index and eliminates parallel errors. With the apparatus in motion the three disks are at rest relatively to one another as long as the torque is constant, and it is evident that a clear view of part of the scale will be obtained. At all speeds above 300 r.p.m. the observer sees a stationary scale and pointer, and the angle of twist can be read with ease. A slight variation of torque, such as the application of a finger to the shaft, causes the scale to take up a new position with respect to the pointer. Details are given of the construction of a torque meter and the results of tests made with it.—London *Electrician*, Dec. 12, 1913.

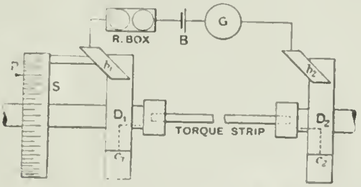


FIG. 1—ELECTRICAL METHOD OF DETERMINING THE ANGLE OF TWIST

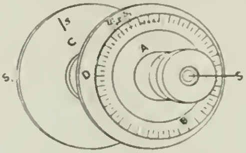


FIG. 2—DIRECT METHOD OF DETERMINING THE ANGLE OF TWIST

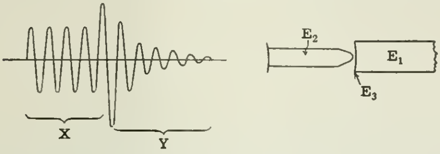
Magnetic Tests of Sheet Iron.—F. Goltze.—The author has applied the Zickler method for determining the hysteresis and eddy-current losses in sheet iron from the latter's maximum permeability and elastic resistivity, and finds errors of about 10 per cent as compared with the wattmeter method. He therefore prefers the latter method for practical tests. Zickler in his reply agrees with the author concerning this conclusion, but points out that his object was not to supplant the wattmeter method.—*Elek. u. Masch.* (Vienna), Dec. 7, 1913.

Testing of Alternators.—In a continuation of the long illustrated serial on shop-testing of electrical apparatus, the discussion of tests of alternating-current generators and synchronous motors is continued. The present instalment deals with the determination of efficiency from losses, temperature tests, methods of loading, compromise load, phasing-out of alternating-current generators and synchronous motors, special tests, and the drying of alternating-current generators and motors.—*Elec. Jour.*, Dec. 11, 1913.

Capacity Measurements.—K. Haubner.—The author gives a simple derivation of the approximate formula which is usually employed in connection with Maxwell's bridge method for capacity measurement.—*Elek. u. Masch.* (Vienna), Dec. 7, 1913.

Telegraphy, Telephony and Signals

Wireless Telegraphy.—The first part of an illustrated article on Dubilier's wireless telegraph and telephone apparatus. A high-frequency generator is first described by which trains of waves are set up having a tendency to be particularly undamped for a certain period, and then damped or quenched for a further period; that is to say, a combination of waves is produced in each train as shown in Fig. 3. In all the apparatus heretofore designed for producing undamped oscillations, except the rotary high-frequency generator, the discharge takes place between electrodes stationary or movable, but in order to produce powerful oscillations the discharge is strained either by an air blast, by cooling, by rotation or by a magnet. To produce undamped oscillations of a constant amplitude it is necessary that the surface area of the electrodes and the distance between them should remain constant or nearly so. In the Dubilier apparatus the electrodes are connected as shown in Fig. 4, in which it will be seen the distance between them is always the same, although the arc is constantly strained. By making the electrodes large and by revolving them constant oscillations of the highest possible amplitude with a given primary voltage can be produced, for the arc is strained to the greatest extent. If the spokes or inner electrodes are coned as shown in Figs. 4 and 5, so that there is always an equal active surface area, and the end of the outer electrode is given a cylindrical surface as shown in E_1 (Fig. 4), then the arc between these two electrodes will first give undamped oscillations as in the part marked x of Fig. 3; but when the electrode E_2 arrives at the bottom of the electrode E_1 (namely the point E_3) the arc will be suddenly broken, and, owing to the inductance coils B, B' (Fig. 5) and to the voltage of the generator A, the condenser C will suddenly be charged to a much higher potential than that given by the undamped oscillations. After the arc is broken, the oscillating circuit E_2 C D (Fig. 5) is open, so that radiation takes place as with a quenched spark. In Fig. 5 A is a generator, B and B' are choking coils, C is a condenser, E_1 is a fixed electrode and E_2 is a rotary device carrying a series of electrodes E_3 which pass rapidly across the end of the electrode E_1. By giving the rotary device a speed of 1500 r.p.m., or twenty-five revolutions per second, thirty spokes or electrodes being used, 750 trains of waves per second are obtained. Recent advances in the construction of portable apparatus by Dubilier are then described. The article is to be concluded.—London *Electrician*, Dec. 12, 1913.



FIGS. 3 AND 4—CHARACTER OF OSCILLATION AND DETAIL OF FIXED AND MOVABLE ELECTRODE

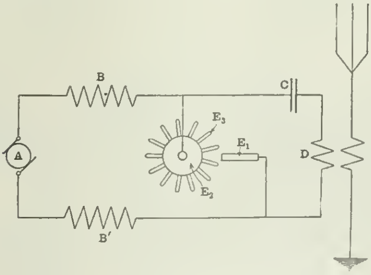


FIG. 5—DIAGRAMS OF CIRCUITS WITH ROTATING SPARK-GAP

Miscellaneous

United States Tariff Bill and Germany.—H. OESTREICHER.—A review of the new American tariff bill and its relation to the German electrical industry. While it is stated that the average tariff on electrical products of 40 per cent has been reduced to 28 per cent, the duty is still believed to be prohibitive for German competition since "the American electrical industry can sell its products in the United States at a price 30 per cent less than its German competitor."—*Mitt. Siemens & Halske*, November, 1913.

Refractory Insulating Material.—A note on a recent British patent (No. 25,370, 1912) of the British Thomson-Houston Company and the General Electric Company of this country. Silica, carbon and rutile are heated in an electric furnace until reduction takes place. The sublimate is condensed. A mixture consisting of fifteen parts silica, twelve parts carbon and twenty parts rutile, treated in a "smothered-arc" furnace, is claimed. The sublimate has a flaky, laminated structure and contains silicon, carbon, oxygen and titanium. Its apparent density varies from 0.06 to 0.16 and the real density is about 2.56.—London *Elec. Eng'ing*, Dec. 4. 1913.

Apprenticeship.—An outline of the apprenticeship courses on the Werner works of Siemens & Halske.—*Mitt. Siemens & Halske*, October, 1913.

Book Reviews

MICA. Its History, Production and Utilization. By Hans Zeiller. London, England: D. Jaroslaw. 85 pages, illus.

A very interesting little book dealing with mica from many different standpoints, the electrical engineering aspect being kept in the background by the wealth of other material. The chapters of the book deal with the following subjects: Introductory, historical, physical properties, chemical properties, geological occurrences, production and working, applications and statistics. The book will commend itself not only to electrical workers, who are brought closely into touch with this valuable substance, but also to all classes of the reading public.

OVERHEAD ELECTRIC POWER TRANSMISSION. Principles and Calculations. By Alfred Still. New York: McGraw-Hill Publishing Company, Inc. 310 pages, illus. Price, $3.

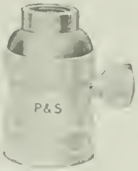
A good practical engineering treatise on the construction and operation of overhead transmission lines, from the electrical engineering standpoint. The eight chapters of the book deal with the following topics: Introductory, principles, economics, electrical calculations, lightning protection, continuous-current transmission, mechanical principles, supports. A series of seven valuable appendices follow on special and less simple detailed subjects. The treatment is clear and well adapted for electrical engineering students. The chapter on the Thury system gives perhaps the best account of that system in the English language which has yet appeared.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed
Manufactured Products of Interest to Electrical Readers

Porcelain Socket

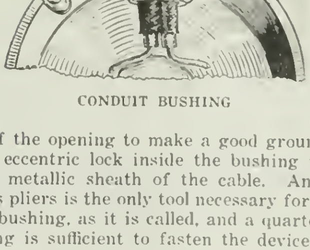
The Pass & Seymour Company, Syracuse, N. Y., has put on the market a new porcelain socket which is an addition to the line of interchangeable porcelain sockets already manufactured by the same company. The socket is equipped with a 0.5-in. aluminum cap, and as illustrated herewith has a key which is used for snap-switch operation.



INTERCHANGEABLE PORCELAIN SOCKET

Metallic Conduit Bushing

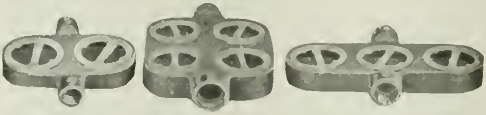
The Fullerton Electric Company, 109 West Twenty-sixth Street, New York, is placing on the market a steel conduit bushing which is illustrated herewith. This bushing is so constructed that it can be inserted quickly in the opening of a box from the outside and can be clamped tightly by means of a lock-nut with a sharp edge which will cut through the enamel on the box and make a perfect ground. This lock-nut works on saw-toothed threads cut in the bushing. Two sets of tempered spring fingers of different lengths are provided, the shorter fingers butting against the inner surface of the box and the longer ones being compressed against the wall of the opening to make a good ground connection. An eccentric lock inside the bushing is used to clamp the metallic sheath of the cable. An ordinary pair of gas pliers is the only tool necessary for installing this Jiffy bushing, as it is called, and a quarter turn of the bushing is sufficient to fasten the device firmly to the box.



CONDUIT BUSHING

Pipe Taplets

The pipe taplets shown in the accompanying illustrations are designed for use where several different circuits controlled from the same point run for some distance in the same direction. By installing at the control point one of these "gang" type taplets which will hold two, three or four switches, the necessity of using two, three or four conduit lines all the way from the distributing box is eliminated, and the wires for all the circuits may be carried in one conduit to the point where they are to be separated. Either X-pipe or T-pipe taplets are used at the points where the circuits branch off.

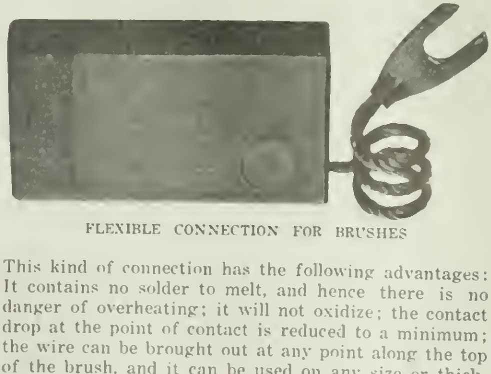


FIGS. 1, 2 AND 3—TWO, FOUR AND THREE-GANG PIPE TAPLETS

These taplets are the product of the H. T. Paiste Company, Thirty-second and Arch Streets, Philadelphia, Pa.

Flexible-Cable Connections for Carbon Brushes

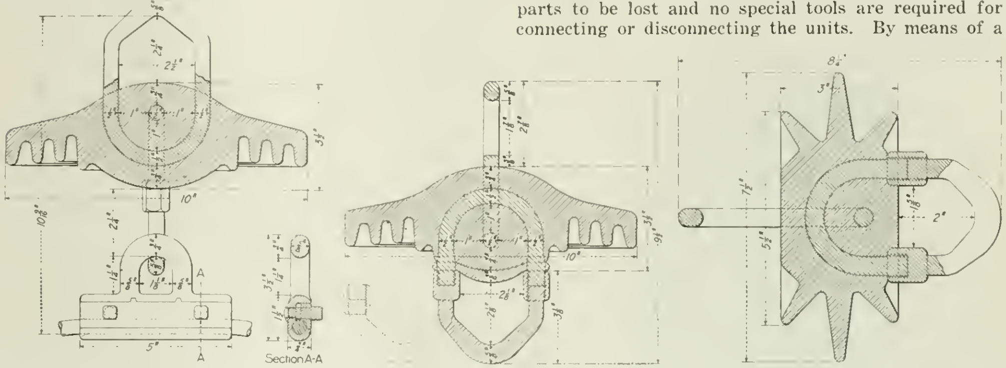
The National Carbon Company, Cleveland, Ohio, is manufacturing a "pigtail" connection for carbon brushes, which is shown in the accompanying illustration. A counterbored hole is drilled in the brush, and the cable is inserted into the smaller part of the hole from the top. The end of the cable is spread out fan-like in the counterbore; a conducting cement is then tamped in, which after hardening makes a strong mechanical connection. The cement used does not shrink away from the wall of the hole; there is no danger, therefore, of loosening and weakening the connection. This kind of connection has the following advantages: It contains no solder to melt, and hence there is no danger of overheating; it will not oxidize; the contact drop at the point of contact is reduced to a minimum; the wire can be brought out at any point along the top of the brush, and it can be used on any size or thickness of brush.



FLEXIBLE CONNECTION FOR BRUSHES

Line and Strain Insulators

The line and strain insulators illustrated herewith were invented by Mr. Louis Steinberger and are being put on the market by the Electrose Manufacturing Company, 60 Washington Street, Brooklyn, N. Y. Each insulator is made up of an integral and uniformly solid mass of insulating material with a strain or suspension member embedded therein. The latter is interlinked in such a manner that even if all the insulating material should be removed or destroyed, it would be impossible for the line to fall to the ground.



FIGS. 1, 2 AND 3—INSULATOR WITH LINE CLAMP ATTACHED, SUSPENSION-TYPE INSULATOR, SHOWING MECHANICAL DETAIL, AND STRAIN-TYPE INSULATOR

TEST VOLTAGES

	7.5-in. Disk Strain Insulator, Volts	10-in. Disk Strain and Suspension Insulator, Volts
Line voltage	25,000	25,000
Rain arc value	55,000	55,000
Dry arc value	74,000	100,000
Puncture value, under oil	120,000	150,000

The line clamp has a smooth bore for gripping the wire or cable, thereby preventing crystallization and the possible breaking of the conductor at or near the clamp.

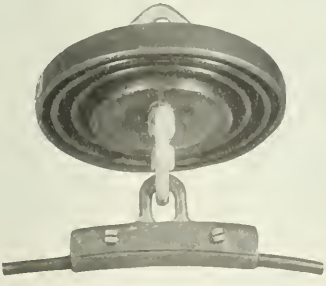


FIG. 4—SUSPENSION-TYPE INSULATOR WITH LINE CLAMP

The clamp is designed to grip conductors of various diameters. It is light in weight, but it is sufficiently strong to break the conductor before any slippage can take place. The metal parts of these insulators are made of galvanized drop-forged steel.

The disk strain insulators are made in sizes having diameters of 5.5 in., 7.5 in., 10.5 in., 12.5 in. and 14.5 in., and the disk strain and suspension insulators in diameters of 8 in., 10 in., 12 in., 14 in. and 16 in. The accompanying table gives test values obtained with the 7.5-in. disk strain insulator and the 10-in. disk strain and suspension insulator.

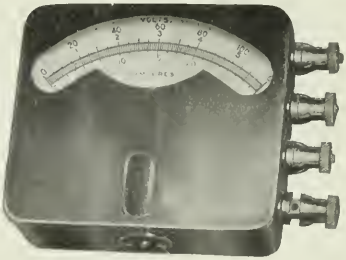
In addition to the excellent electrical characteristics of the insulators, they possess many desirable features from the mechanical point of view. There are no loose parts to be lost and no special tools are required for connecting or disconnecting the units. By means of a plain wrench, a nail or even a piece of wire two or more units may be connected or disconnected in a fraction of a minute.

Close-Reading Pocket Meter

A pocket meter of the direct-current moving-coil, permanent-magnet type, with 120 scale divisions, has been designed and is being put on the market by Mr. Louis M. Pignolet, 78 Cortlandt Street, New York. The scale is 3.25 in. long, and the instrument is of convenient pocket size, being but 4.5 in. long, 3.25 in. wide and 1.25 in. deep.

The moving element is light in weight, reducing to a minimum the friction between its pivots and the jewels. The pivots are carefully polished and ground to a small radius so that ordinary shocks will not cause injury to the jewels or the pivots themselves. Highly polished sapphire jewels are used.

Voltmeters or volt-ammeters can be adjusted for resistance measurements, the resistances being 250 ohms for 0 to 3, or 3.25 volts; 500 ohms for 0 to 6, or 6.25 volts, and so on in the same proportion for the higher voltages. Voltmeters can be provided with scales reading 0.025, 0.05, 0.10, 0.25, 0.5, 1.0 and 2.0 volts, and ammeters with scales reading 0.01, 0.05, 0.10, 0.25 and 0.5 amp. The instrument is inclosed in a hand-sewn solid-leather case.



POCKET METER

Transformers for Mill Service

The transformer illustrated herewith is one of nine units installed in one of the mills of the United States Steel Corporation. These transformers are designed particularly for heavy steel-mill service, and they operate continuously twenty-four hours a day with frequent overloads. The units are of the twenty-five-cycle water-cooled, core type and are rated at 2000 kva, being designed for 22,000 volts high tension and 2200 volts low tension.

2000-KVA TRANSFORMER FOR MILL SERVICE

The core type was used because of its mechanical strength, which enables the apparatus to stand up under the heavy stresses often met with in operation while at the same time securing the maximum cooling effect from the circulating oil.

Several hundred separate oil ducts traverse the interior of the coils of the windings. These ducts are so spaced that no part of the copper is more than 0.25 in. from free circulating oil. The completed windings are impregnated solidly and are sectionalized so that the coils may be removed without destroying the whole winding. These transformers have a high reactance, which acts as a protection against surging or "shorts" on the secondary lines.

Each of the nine units is designed to carry a normal full load of 18,000 kva with an increase in temperature of 40 deg. C., and a load of 36,000 kva for a period of two hours without injuring any part of the transformer. Such an overload of 100 per cent for a period of two hours is said to take care of any ordinary peak load. This overload capacity is declared to result from the circulating oil reaching every part of the interior of the windings through the hundreds of oil ducts provided. The hotter the windings become from overload, therefore, the faster the oil travels in dissipating the heat.

In order to prevent the windings becoming distorted on account of sudden rushes of current, surging or "shorts," the coil support is made an integral part of the top and bottom yoke laminations, and separate fittings, bolts, springs or wooden wedges are therefore unnecessary.

The core is rectangular in shape and is made of silicon steel. Oil channels are provided through its interior at points where the maximum cooling effect may be obtained from the circulating oil. These channels are arranged so that the warm oil flows upward. The transformer tank is made of boiler plate. All the seams and joints are welded and no rivets are used. The transformers are shipped with the oil, core and coils in the tank complete, to eliminate the necessity of drying out the windings before installation. The tank rests on a cast-iron pedestal, and two eye-bolts pass through the cover of the pedestal, for lifting the entire apparatus.

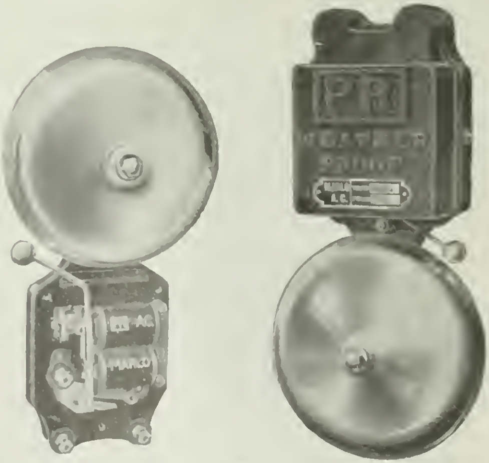
The original installation in the steel mills referred to was made three years ago, and consisted of six 2000-kva transformers. Three duplicate units have been added recently to bank with the six already in service. Each unit weighs approximately 42,200 lb. and they are said to be among the largest core-type transformers in this country.

The transformers described are the product of the Pittsburgh Transformer Company, Pittsburgh, Pa.

Transformer Bells

The bells illustrated herewith are being put on the market by the P R Manufacturing Company, Detroit, Mich., and are used with bell-ringing or sign-lighting transformers. They are manufactured in sizes ranging from 2.5 in. to 12 in. In external appearance these bells are similar to those developed by the same company for use with batteries or 110-volt direct-current or alternating-current circuits.

In Fig. 1 is shown a "Marlo" bell for interior work with the cover removed, disclosing the working parts. The bell is equipped with enameled-wire magnets, laminated cores, two sets of binding posts and carbon contact points. The armature is hinged and has flexible rear adjustment and a sliding-spring contact. The device is mounted on a wrought-metal base which is heavily embossed. For the 5-in. to 12-in. sizes the base is approximately 12 in. long and 6 in. wide. The bell is provided with a sheet-metal cover finished in "Bauerbarff." The "Marlo" bell shown in Fig. 2 is designed for outdoor operation. It has a cast-iron weather-proof cover which incloses the entire base. The back is covered with a thick insulating compound which is impervious to moisture. An apron can also be provided to protect the striker arm and gong.



FIGS. 1 AND 2—TRANSFORMER BELLS FOR INDOOR AND OUTDOOR SERVICE

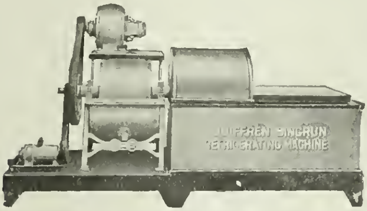
A cheaper type of transformer bell known as the "Eclipse" is manufactured by the same company. It does not have two sets of binding posts or a pivoted armature, but in other respects it is similar to the "Marlo."

When operating small bells on the same circuit with large bells the transformer connections should be arranged to give a secondary voltage of from 12 volts to 24 volts. Special windings can be supplied for 25-cycle, 30-cycle, 40-cycle, 50-cycle or 60-cycle alternating current. The transformers should be located as near the bells as possible to prevent excessive voltage drops in the secondary circuits.

Refrigerating Machine for Household Use

The refrigerating apparatus shown in the accompanying illustration was invented by Abbé Marcel Audiffren, a French professor of physics. It is called the Audiffren-Singrun refrigerating machine and is manufactured in America by the H. W. Johns-Manville Company, New York. The machine is small and simple in construction and is particularly adapted to family refrigeration. Neither ammonia nor carbonic acid is used, and temperatures can be secured lower than those obtained with ice. A dry cold results, which is more sanitary than that obtained with ice. The machine is also designed to make ice in small quantities if desired.

In appearance the Audiffren-Singrun refrigerating machine resembles a large dumbbell with a pulley on the end. It consists of a shaft having a hollow drum on one end, another drum at the middle, and a pulley at the other end, the latter being connected by a belt to a small motor. The machine is supported horizontally by two bearings, one on each side of the drum at the middle of the shaft. When the machine is revolved in these bearings the end drum becomes cold and the drum at the middle becomes warm. Water is supplied to cool the latter, while the cooling effect of the end drum is used to refrigerate brine (common salt and water), which is circulated through cooling coils that may be placed wherever convenient.



HOUSEHOLD REFRIGERATING APPARATUS

The liquid is evaporated in the drum at the end of the shaft, and the gas resulting from this evaporation is drawn into the middle drum through a passage in the shaft. The gas in this middle drum is compressed and returned to the liquid state after giving out its heat. It is then allowed to pass back to the end drum through a second passage in the shaft to be re-evaporated and to go through a similar cycle of operation.

The working parts of the machine are hermetically sealed within the drums and are lubricated by a bath of oil, which together with the refrigerant is applied in the factory and remains permanently inside the drums.

A refrigerator equipped with cooling surfaces is supplied with one of these machines. These surfaces are kept cool by the brine pumped from the machine. The apparatus is designed so that it starts and stops automatically under the control of temperatures in the refrigerator being cooled. The ice frozen by these machines is made from the same supply from which the drinking water is drawn.

Portable Electric Tools

The electric portable buffer shown in Fig. 1 is operated through a flexible shaft by a small motor and is used to polish brass signs and metal work in offices, hotels and engine rooms. For burnishing silver and other light work a ⅛-hp motor is used with either alternating or direct current, and for heavier work a 1/6-hp motor is provided for use on alternating current and a ¼-hp motor for direct current. As shown in the illustration, the motor can be carried easily in one hand and the work done with the other. Buffing wheels measuring 2 in. by 3 in. and 3 in. by 1 in. are used for the lighter work, while a 4-in. by 1-in. wheel is available for heavier service.

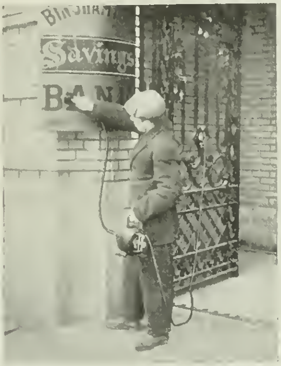


FIG. 1—ELECTRIC BUFFER USED IN POLISHING METAL SIGNS

In Fig. 2 is shown a tool-post grinder used in grinding centers, dies, cutters, etc., arranged either with or without hand feed. This device will do both internal and surface grinding. Motors are supplied for operating on either alternating or direct current at 110 volts or 220 volts. The machine is equipped with a 0.375-in. by 6-in. emery wheel, an internal grinding attachment, 10 ft. of flexible cord and a plug to fit any standard lamp socket.

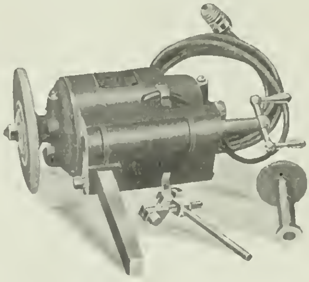


FIG. 2—ELECTRIC TOOL-POST GRINDER

The electric breast drill illustrated in Fig. 3 is used with standard-sized drills up to 5 in. in diameter. The switch is placed in the handle. The reduction gears are designed so that power is transmitted equally from opposite points on each gear. For alternating current with 110 volts or 220 volts the device weighs 22 lb. It is 15.5 in. high including the chuck, and 13 in. without. The diameter of the body is 5.75 in. and it will drill holes up to 0.5 in. in diameter in iron or steel and

0.75 in. in diameter in hard wood when equipped with a Jennings bit. The equipment for 110-volt and 220-volt direct current weighs 20 lb. It is 16.5 in. high with the chuck and 13.5 in. without. The diameter of the body is 5.75 in. and it will drill holes up to 0.5 in. in diameter in iron or steel and 1 in. in hard wood with a Jennings bit.

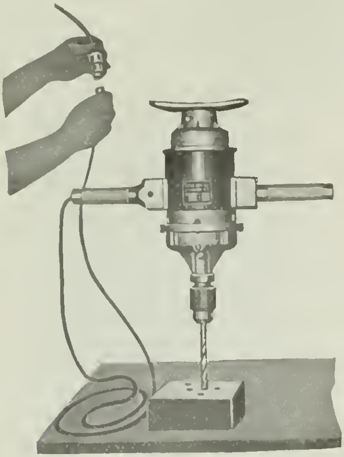


FIG. 3—ELECTRIC HAND DRILL

These tools are the product of the Stow Manufacturing Company, Binghamton, N. Y.

Electric Equipment for Mining Company

The property of the National Copper Mining Company in the Coeur d'Alene district of Idaho is being equipped with electric machinery supplied by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. An aggregate of 300 hp in induction motors will be used at the mine, the largest unit being a 200-hp machine for driving an air compressor. The mill, which has been designed and is being built by the General Engineering Company, Salt Lake City, Utah, will also be driven by induction motors with a total of 600 hp.

Electric haulage will be used underground to handle the ore, which will also be transported from the tunnel mouth to the mill over an electric railway. The run from the adit to the head of the mill is about 10,000 ft., and in this distance there is a drop of 450 ft., necessitating a grade of 4.5 per cent on the railroad. The railroad is built along the side of Dead Man's Gulch; it has a 24-in. gage and is laid with 30-lb. rail. The ore will be transported down this railway in trains of from eight to twelve cars, each car carrying from 4 tons to 5 tons of ore. The equipment is designed to handle a tonnage of 500 tons in two shifts of eight hours each. The average haul within the tunnel will be about 5000 ft. and the grade on this inside run will only be 0.5 to 1 per cent. A 4-ton electric locomotive will be used for work inside the tunnel. This locomotive can be operated in tandem with another 4-ton unit for hauling ore from the mine to the mill. It was originally intended to install a gravity tram to take care of the transportation of the ore from the adit to the mill, but a careful investigation proved that an electric railway could handle the ore considerably cheaper on the steep grade involved. The installation cost of the railway is a little less than the estimated installation cost of an aerial tramway.

The electric haulage system has been designed by Mr. F. Cushing Moore, chief engineer of the National Copper Mining Company, in conjunction with the engineers of the Westinghouse company.

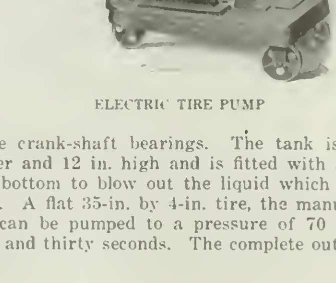
Storage Battery Equipment

At the Wisconsin State Fair held recently at Milwaukee the Edison Storage Battery Company, Orange, N. J., had on exhibition a lighting equipment for small rural installations. The instrument panel, the automatic voltage controller, and a bank of lamps, the last-named being supposed to represent the lighting equipment of a typical farmhouse installation, were mounted on a large table with a mahogany finish. The automatic controller kept the voltage at the lamps normal at all times, whether the battery was being discharged or charged. A voltmeter with a double-throw switch was mounted in the middle of the rear of the board, and showed the voltage of the line between the controller and the dynamo when the battery was being charged and also the voltage of the line across the lamps after its regulation through the controller.

A gasoline engine and dynamo were placed alongside the table, and the battery rested on a shelf beneath. A simplified charging panel was also mounted on the back of the demonstration table and was equipped with one double-pole switch with fuses, an ammeter and an underload cut-off for opening the circuit in case the engine should stop, thereby preventing the battery from discharging into the dynamo and running it as a motor.

Automobile-Tire Pump

The portable electric tire pump shown herewith is the product of the United States Electrical Tool Company, Cincinnati, Ohio. A 0.5-hp motor, which can be connected to any convenient lamp socket, is used to drive the apparatus. The switch for stopping or starting the machine is located on the motor. Lubrication is provided by means of grease cups on the cylinder and the crank-shaft bearings. The tank is 6 in. in diameter and 12 in. high and is fitted with a pet-cock at the bottom to blow out the liquid which condenses therein. A flat 35-in. by 4-in. tire, the manufacturers claim, can be pumped to a pressure of 70 lb. in one minute and thirty seconds. The complete outfit weighs 130 lb.



ELECTRIC TIRE PUMP

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Moloney Transformer Activities in Canada and United States.—The Canadian Moloney Electric Company, with capital of $150,000, was superseded on Nov. 28, 1913, by the Moloney Electric Company of Canada, Ltd., with capital of $300,000. The home office of this company is in Windsor, Ontario. The parent company is the Moloney Electric Company, of St. Louis, with a capital of $700,000, so that the total for the two companies is now $1,000,000. The doubling of the capital of the Canadian company indicates the growth of the business in Moloney transformers in the Dominion.

Large Increase in Sale of Heating Appliances Recorded.—From G. M. Stuart, president of the Stuart-Howland Company, of Boston, Mass., comes a letter telling of the large increase in business of that concern during the past year. In it he says: "We have within the last year added seven traveling salesmen to our sales force; and our sales have largely increased, notwithstanding the somewhat less favorable conditions which prevail in the trade throughout the territory we cover. We have been specializing on line material, fixtures, tungsten lamps and electric heating material, and our business in the latter line has increased more than 5000 per cent in five years. In other words, the sales on all kinds of electric heating material for the last year were more than fifty times what they were five years ago."

Manufacturers' Association Inaugurates Export School.—An "export school" has been establshed at the New York headquarters of the National Association of Manufacturers, where employees of its members may receive such theoretical and practical instruction in exporting as to allow them wider success in the field of international trade. The school represents part of a movement to boom the export business and place this country on a par with England and Germany in this field, and its inauguration, almost simultaneously with an effort on the part of the Bureau of Foreign and Domestic Commerce to extend the benefits of the consular service, is evidently in response to a general demand for an increased outlet for American goods. At present two courses are offered—elementary export trade and foreign exchange—which are given on Tuesday and Friday evenings respectively. Over fifty have enrolled for these courses, which consist of lectures by Vincent Gonzales, the Latin-American and banking expert of the association. The preliminary effort has been so well received that there is some talk of extending the course to include all of the subjects of large importance in connection with foreign trade.

Profit-Sharing Plan Continued.—The following letter, sent out recently to employees of the Detroit Insulated Wire Company, of Detroit, Mich., tells of the practice of that concern in regard to the division of its profits with its employees. The letter reads: "The company is pleased to announce again that as a result of our combined effort it is able to make distribution of a portion of its profits to its employees, as in former years. Salaried employees who have been in our employment continuously for twelve months or more will receive a donation of 1 per cent of their entire salary for the period ended Dec. 15, 1913. Hourly rate employees who have been in our employment continuously for twelve months or more will receive a donation of 2 per cent of their entire wages for the period ended Dec. 10, 1913. The company cannot guarantee similar donations from year to year, but it is hoped a distribution can be continued. This reward is for faithful and continuous employment in order to emphasize the fact that continuity of service is mutually profitable. As heretofore, we are depositing the amount of the donation to the credit of each employee in the Michigan Savings Bank, and to each employee will be presented a pass book or deposit slip with the donation entered therein or thereon. It is hoped that for your benefit you will permit the deposit to remain, adding to it from time to time out of your wages. An employee with a bank account is worth more to his employers than one without, for the reason that it encourages thrift and industry. Your pass book or deposit slip will be handed to you on Wednesday, Dec. 24, at quitting time."

Recent Westinghouse Orders.—A number of public utility companies are mentioned in the latest report of the Westinghouse Electric & Manufacturing Company as purchasers of electrical machinery and equipment. The Greenville (Tex.) Railway & Light Company has ordered through the Albert Emanuel Company one 200-kw, 600-volt direct-current, three-phase, 60-cycle, compound-wound, self-starting rotary converter, together with a switchboard for controlling the same. From the Salt Lake & Utah Railway Company, Salt Lake City, Utah, an order has been received for six 250-kw, 750-volt direct-current, three-phase, 60-cycle, self-starting rotaries; six 150-kva, single-phase, 60-cycle transformers and two switchboards of seven panels each. An order has been placed by the Chambersburg & Shippensburg Railway Company, of Chambersburg, Pa., for one 200-kw, 600-volt direct-current, three-phase, 60-cycle, self-starting rotary converter; three 75-kw, single-phase, 60-cycle transformers and one control switchboard. The Sand Springs Railway Company, Tulsa, Okla., has ordered one 200-kw, 600-volt direct-current, two-phase, 60-cycle self-starting rotary converter; two 110-kva, single-phase, 60-cycle transformers and a switchboard for the control of the same. An order for one 500-kw, 600-volt direct-current, six-phase, 60-cycle, self-starting rotary converter, three 185-kva, single-phase, 60-cycle transformers and a control switchboard has been placed by the Greenville (S. C.) Traction Company. The House of the Good Shepherd, Boston, Mass., has purchased one 100-kw, 125-volt, compound-wound, direct-current, engine-type generator. Two 110-kw, 250-125 volt, three-wire, compound-wound, engine-type generators, with field rheostat and balance coils, are being made for the Seattle (Wash.) Lighting Company.

Transmission Line Tendencies During 1913.—Hubbard & Company, of Pittsburgh, Pa., manufacturers of pole-line hardware, give the following summary of the tendencies they have noticed in their field during the past year: "We have noted during 1913 an increasing tendency toward the use of the highest grade of material obtainable. More and more companies are calling for braces, bolts, rods and clamps made in accordance with either the A. T. & T. or N. E. L. A. specifications. Nearly all of the larger operating companies in the central-station, telephone and telegraph fields have appointed committees, composed of practical construction men, to standardize the methods and materials used in such work, and these bodies, together with the large engineering societies, have done much to promote the general use of a better grade of line hardware. The most remarkable feature of the year's developments, however, is the rapidity with which steel is replacing wood. Although most apparent in high-voltage lines, this change is affecting all overhead construction. In transmission work there is a very urgent call for a steel pole of moderate cost, which, spaced 200 ft. or 300 ft. apart, will furnish a permanent type of construction at about the same cost as the old short-span wooden-pole lines. The majority of new lines of less than 60,000 volts are limited to a single circuit, the practice being to follow a separate route when an additional circuit is necessary. This arrangement greatly favors the use of a steel fixture, combining arms, braces, and, in the lower voltages, pins and ground-wire supports. These fixtures give permanence and safety to construction work at a cost which is actually less than that of a good grade of wood construction, owing in part to the lower cost of installation on poles. There is a noticeable tendency in recent practice to increase the wire spacing for a given voltage, probably on account of a desire to raise the voltage at some future time. About 90 per cent of the lines recently built are equipped with overhead ground wires, and many companies are installing such protection on all their older lines, as its efficacy seems to have been proved, assuming the wire to be properly clamped to a well-designed bayonet. In some quarters there is an objection to the use of grounded metal arms, which is met by tying the ground wire on a small insulator screwed on a steel-spring thread on the end of the bayonet. When desired, the ground wire is used as the neutral of a four-wire three-phase system. The clamp pin is rapidly replacing the wooden and malleable types for all kinds of high-tension and low-tension service with wooden arms, because its use develops the full strength of the arm instead of half the strength, as in the old type of pin. There are no holes to allow water to reach the heart of the arm and cause decay and splitting, and the saving in maintenance charges will pay for the pins many times. In one large system clamp pins are used exclusively, and on this account the fir cross-arms used are guaranteed by the supplier to last twenty years. We intend to place on the market in a short time a metal arm designed to replace the wooden article and possessing the advantages of safety, permanence and low cost. Series tungsten street lighting, already crowding the arc lamp, has received an additional impetus through the development of the nitrogen-filled type of tungsten lamp. The present-day policy of supplying power to all sizes of consumers has produced some problems in the proper supporting of transformers on poles, and the best solution seems to be to use angle and channel steel platforms for one or more poles, depending on the size and number of units required." Hubbard & Company have experienced an increase of 107 per cent in their business for the first eleven months of 1913 over the figures for the corresponding period of 1912. This increase compares with 62 per cent for 1910, 78 per cent for 1911 and 98 per cent for 1912, the percentages indicating in each case the increase in sales figures over those for the preceding year.

First Aid to Exporters Planned.—The Bureau of Foreign and Domestic Commerce, a subdivision of the Department of Commerce, has opened an office in the custom house, New York City, and will shortly open offices in Chicago, New Orleans and San Francisco. An experienced member of the staff of the bureau will be in charge in each city for the purpose of giving information concerning the work of the bureau and to assist merchants and manufacturers in the development of foreign trade. The publications of the bureau will be on file, and these offices will be made sources of information and assistance to all desiring to cultivate export business. A special feature of the work at these offices, which will undoubtedly interest business men and commercial organizations generally, is an arrangement made with the consular service whereby consuls who are in this country on leaves of absence will visit the offices of the bureau and make them places for meeting business men interested in their particular fields. Advance notice of these consular visits will be given through the daily trade reports of the bureau, by special notices to business houses which have filed their names with the bureau as interested in some special field, and through notices to the trade and commercial organizations of the city and district in which the office to be visited is situated. It is planned also to have the commercial agents of the Department of Commerce use these offices in the same way as the consuls for laying their information before interested parties in person. The above plans are expected to carry a twofold benefit. In the first place, they will enable the merchant or manufacturer to get in closer personal touch with the particular foreign field in which he is specially interetsed and to ask questions which will draw out the details of primary interest to himself. Secondly, the personal contact with these exporters is expected to be of large benefit to the consuls and commercial agents, giving them the best possible idea of the questions of primary interest to the exporters in their respective fields, and thus enabling them to make the best of their opportunities when abroad. In other words, as stimulators of international trade, it is coming to be realized that these representatives should be kept in fairly close contact with the trade conditions of both the foreign and the domestic fields. To further this educational work it is planned, in addition to the innovations previously mentioned, to have these commercial representatives, while in the United States, attend important conventions of trade conferences of persons or organizations interested in the special lines of investigation in which they are engaged. This will give the representative the same insight into general trade conditions that the personal interviews will give as to individual needs, and it will be supplemented by visits to the important centers of production of the product or products in which he is particularly interested.

Employees' "Suggestion Plan" of the Automatic Electric Company.—In recognition of helpful suggestions made during the past year, fifty employees of the Automatic Electric Company of Chicago, manufacturer of automatic telephone apparatus, were presented with watch fobs at a banquet given by the firm's employees on Dec. 22, 1913. The presentations were made by Joseph Harris, president of the Automatic Electric Company, who thanked those who had won recognition for the interest they had displayed in their work. Mr. Harris also took occasion in the course of his remarks to congratulate all present upon the success that had come to them during 1913, saying that in quality and volume of output the past twelve months had been the most satisfactory since the beginning of the manufacture of automatic telephone apparatus twenty-two years ago. The "suggestion plan" has been the means of materially improving the shop methods of the Automatic Electric Company's factory, adding to the efficiency of the organization and eliminating many causes of waste and expense. The entire plant was planned and systematized by efficiency experts of recognized ability, but in numerous cases it has been found that the "man on the job" has been able to improve certain details of that system. In its original form the "suggestion plan" consisted simply of an invitation to all employees to submit to the factory superintendent any ideas which might occur to them from time to time which would, in their opinion, improve the existing methods of production. Printed forms were supplied upon which to outline the suggestion. After inspecting them the factory superintendent refers the suggestions to engineers, who investigate and report upon any changes in design involved and the probable future yearly demand for the particular articles affected. Estimates are also made as to the cost of new machines, tools and fixtures required, the saving per unit and the total yearly saving. Upon these reports the factory superintendent bases his decision to accept or reject the suggestions. The advantages of the plan are twofold. By it the company secures the benefits of the employees' observations at small extra expense, while at the same time the employees whose suggestions are found of value have the honor of wearing the medals presented and of seeing their suggestions put to practical use.

NEW YORK METAL MARKET PRICES

	Dec. 22		Dec 29	
Copper:	Bid	Asked	Bid	Asked
Standard, spot*	....	....	14.37½	to 14.87½
	Selling prices		Selling prices	
	£ s. d.		£ s. d.	
London, standard, spot*	64 3 9		66 6 3	
Prime Lake	14.50	to 14.75	15.25	to 15.50
Electrolytic	14.12½	to 14.37½	14.75	to 15.00
Casting	13.87½	to 14.12½	14.50	to 14.62½
Copper wire base	15.50	...	16.00	.
Lead	4.00		4.15	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.25		7.25	
Spelter, spot	5.15	to 5.25	5.30	to 5.35
Tin, spot	36.62½	to 37.00	37.62½	to 37.87½
Aluminum				
Prompt delivery	18.50	to 19.00	18.50	to 19.00
Future	18.50	to 19.00	18.50	to 19.00

*COPPER EXPORTS

Heavy copper and wire	13.50	13.50
Brass, heavy	8.75	8.75
Brass, light	7.75	7.75
Lead, heavy	3.95	4.05
Zinc, scrap	4.37½	4.37½

*OLD METALS

Total tons to Dec 29	26,658

*From daily transactions on the New York Metal Exchange

Corporate and Financial

Ohio Utility Plans Stock Increase.—At the annual meeting to be held in Akron, Ohio, on Jan. 24, the stockholders of the Northern Ohio Traction & Light Company will be asked to authorize an increase in the 6 per cent preferred stock of the company from $3,000,000 to $5,000,000. They will also be asked to approve the directors' plan, providing for the payment of the normal income tax on all of the company's bonds. This will prevent deductions on coupons deposited for collection.

Two Operating Companies in the Northwest Prospering.—A short note received from the Aberdeen (S. D.) Light & Power Company and the Columbus (Neb.) Light, Heat & Power Company tells of satisfactory increase of business for both concerns during the past year. The first-named company put a new steam plant into operation last January and is contemplating the possible need for an additional generating unit during 1914. The second company has enjoyed an increase of 20 per cent in its connected load during 1913, and to help take care of the increase a third unit, consisting of a cross-compound condensing engine directly connected to a 500-kva alternator, was added to the plant equipment during that year. About 100 hp additional load has been contracted and will be connected in the early spring months. This company reports that electric cooking devices are attracting some attention at the present time in its territory. Willis Todd, Omaha, Neb., is general manager of both companies.

Philadelphia Electric Company Gains Large Customer.—For some time it has been expected that the Pennsylvania Railroad, in providing for the electric power requirements in connection with its proposed electrification plans, would turn to the Philadelphia Electric Company as the cheapest and most reliable source. It is only just announced officially, however, that this policy will be carried out. The contract with the electric company calls for a minimum of 3750 kw for the electrified section of the main line, but it is estimated that the actual consumption during the first year will be very largely in excess of that figure. At the present time the electric company's largest customer is the Philadelphia Rapid Transit Company, which has recently increased its contract to 35,000 kw. The above and other growing demands for electric service will be partly cared for by the installation of what will be the largest single unit generating sets in the world, which have been ordered by the Philadelphia Electric Company from the General Electric Company. These units, rated at 35,000 kw and 30,000 kw respectively, will call for the erection of an entire new generating station in Philadelphia.

Montana Power Company Planning Increased Generating Equipment.—The Montana Power Company was incorporated a year ago, as a consolidation of a number of hydroelectric properties operating in Montana. It owns a number of steam and hydroelectric generating stations and has undeveloped water-power sites, with a total estimated capacity of 280,000 hp. The transmission lines of this company connect the cities of Butte, Great Falls, Billings, Livingston, Bozeman and Lewiston, Mont., and other towns in the neighborhood, and electrical energy is furnished by it for use in the copper mines of the district and for the operation of electrified mountain sections of steam railroads in addition to the other more familiar and usual applications. In order to take care of the increased demand for power which will fall upon this company when the electrification of the Chicago, Milwaukee & St. Paul Railway is completed, it is planning the development of several of its water-power sites. Financially the company is in very good condition. Its initial dividend was paid on April 1, 1913, and it is estimated that the net earnings for the current year will be over $2,500,000. The outstanding capital stock of the company is $49,634,000 common and $9,700,000 preferred. Its bonded debt amounts to $15,146,000.

New Milliken Brothers Company Formed.—Milliken Brothers, Inc., is the name of a new corporation just formed for the purpose of taking over the plants of the old concern by the same name and continuing its business. The operating management of the former company is retained by the present one, which will have $1,000 000 quick assets, in addition to the real estate, buildings and equipment acquired from the old company. Provision has been made for increasing the equipment of the plant, so as to render possible a larger production, and the present plans contemplate active pushing of both the domestic and export trade. The new company is prepared to bid on all kinds of structural steel work, including buildings, bridges, tanks, transmission-line towers and other similar applications. The location of the fabricating plant of the company is at Milliken, Staten Island, N. Y., and the offices of the concern are at 5 Nassau Street, New York. Its officers are William Salomon, president; Francis Dykes, vice-president; G. E. Barrett, secretary, and A. A. Cannon, treasurer. The board of directors consists of J. S. Bache, F. G. Corning, Thomas Denny, Francis Dykes, C. McK. Lewis, W. B. Parsons, William Salomon, W. J. Saunders and C. B. Tyler. The former Milliken Brothers company was incorporated in New York on May 16, 1902, and on Jan. 10, 1906, it took over the steel business established in 1857 by Samuel Milliken, Jr. In February, 1913, the company went into the hands of receivers in default of a small payment to creditors and of payment of interest on the first mortgage bonds outstanding at that time. Committees were then formed to protect the interests of the stockholders and the bondholders. At the time the concern went into the receivers' hands it had an authorized and outstanding capital of $5,500,000, of which $3,000,000 was in 7 per cent cumulative preferred stock. There were also outstanding at this time $3,000,000 of first convertible sinking fund gold bonds, bearing interest at 6 per cent, and $3,691,982 of ten-year adjustment notes.

Semi-Annual Report of the Colorado Power Company.—The report of the Colorado Power Company for the six months ended Sept. 30, 1913, includes an extended review of the operating and industrial conditions in the territory served by G. H. Walbridge, president of the company, as well as a statement of the financial condition of the concern by its treasurer, D. E. Houston. Mr. Walbridge said in part: "The company acquired the properties and franchises of the Central Colorado Power Company and the Leadville Light & Power Company, free of encumbrance, on April 14, 1913. It acquired the stock of the Salida Light, Power & Utility Company, free of encumbrance, on July 21, 1913. This stock was purchased by the bankers for the benefit of the Colorado Power Company on March 1, 1913, and was turned over to the company at cost and interest on July 21, 1913. It is expected that the physical property and franchises of that company will be transferred ultimately to the Colorado Power Company. During the past six months the companies have secured power contracts estimated to produce an annual gross revenue of about $110,000, and have lost business due to suspension of operations by retail power customers yielding an annual revenue of about $17,000, giving an estimated net annual increase from new business secured of about $93,000. About one-half of the above net increase will come from a contract with the American Smelting & Refining Company, covering the supply for ten years of all power used by the Arkansas Valley Smelter, near Leadville, Col. Of the total power required, only one-sixth has been in operation, and for but four months out of the period. The full revenue from this contract will not begin until February, 1914, the delay being caused by necessary changes in adapting the smelting machinery for electric drive. A contract with the Denver City Tramway Company was signed late in 1911, from which an annual revenue of about $35,000 is expected. Various delays incident to the purchase, installation and adjustment of necessary lines and special transforming apparatus prevented the commencement of full service until about Sept. 1, 1913. The company's physical property has been well maintained and is in excellent condition, and its service has been further improved and continues to be satisfactory to customers. A considerable amount of work has been done in further strengthening troublesome points in the main transmission lines by the addition of towers and stronger cables." The capital liabilities of the company, as shown in the report of the treasurer, amount to $15,555.000, including $11,000,000 of common and $425,000 of preferred stock and $4,130,000 of first mortgage 5 per cent bonds outstanding. The gross operating revenue for the period covered by the report amounted to $333,876, with an operating expense of $107,237, so that a net revenue of $226,639 was realized.

Business Notes

The Greenwich Sales Company has recently opened offices at 257 Broadway, New York, and will represent in the metropolitan district manufacturers of electrical specialties. T. E. D. Ritchie is sales manager of the company.

Barnes & Kobert, of New Haven, Conn., have just appointed R. H. Harper as sales manager. Mr. Harper was formerly manager of the railway department of the Western Electric Company, 463 West Street, New York City.

The Hurley Machine Company, of Chicago, Ill., has just opened a new retail store in New York City, on the ground floor of the Flatiron Building, which will be devoted exclusively to the sale of its washing and wringing machines and vacuum cleaners.

John Bellamy Taylor, formerly associated with the General Electric Company as engineer in its foreign department, has established a consulting engineering practice of his own, with offices at 100 Broadway, New York, and an office and laboratory at Schenectady, N. Y. His field will embrace telephone, telegraph and power transmission engineering.

The Underwriters' Laboratories have recently opened an office in London, England, under the supervision of Messrs. Heap & Digby, consulting electrical engineers. The address of this office is 48 Westminster Palace Gardens. Its establishment resulted from a demand on the part of British manufacturers for a convenient inspection service under the rules by which electrical material and apparatus are specified in Canada.

The Richmond Electric Works, of Richmond, Va., are making preparations to expand their field during the coming year. A New York office has been opened in the Hudson Terminal Building under the direction of C. W. Kragh, whose territory will include New York and Connecticut. The Barber-Dwinnell Electric & Manufacturing Company, of Kansas City, Mo., has just been appointed district sales agent for the same concern, covering the States of Kansas and Nebraska and the western portion of Missouri.

The Standard Underground Cable Company, of Pittsburgh, Pa., has made the following organization changes in consequence of the death of Mr. J. R. Wiley, for nearly twenty years Western manager, with headquarters at Chicago. E. J. Pietzcker, formerly Southwestern sales manager, is now also Western manager in charge of both the Chicago and St. Louis offices of the company; W. M. Rogers has been made assistant Western sales manager, with headquarters at Chicago, and R. C. Houck assistant Southwestern sales manager stationed at the St. Louis office.

New Industrial Companies

The Electric Time Service Company, of Ansonia, Conn., has been incorporated by Clifford B. Burr, Charles G. Burr and Kathryn Burr, all of Derby, Conn. The company is capitalized at $3,000.

The Electrical Safety Device Manufacturing Corporation, of Albany, N. Y., has been incorporated with a capital stock of $20,000 by H. W. Nichols, W. Addison and L. Germain, 552 Fifth Avenue, Brooklyn, N. Y.

The Utilities Engineering Company, of Grand Rapids, Mich., has been incorporated with a capital stock of $25,000 to do a general consulting engineering business for public utility corporations. The incorporators are E. M. Diane, A. L. Snyder and others.

The Multi-Signal Company, of Kittery, Maine, has been incorporated with a capital stock of $100,000 to manufacture and deal in electric signals and articles connected therewith. H. Mitchell is president and H. A. Paul is treasurer, both of Kittery, Maine.

The Utility Motors Corporation has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000 to manufacture and deal in gas engines, motors, etc. The incorporators are H. E. Latter, W. J. Maloney and O. J. Reichard, of Wilmington, Del.

Trade Publications

Oil-Break Switches.—High-voltage oil-break switches are the subject of Bulletin A4176 of the General Electric Company. Type F, Form K-15, which is illustrated and described, may be operated by any one of several methods referred to in the bulletin.

Storage-Battery Industrial and Mining Locomotives.—The General Electric Company has issued Bulletin A4131, describing its storage-battery locomotives. The bulletin contains an outline of the general conditions under which the use of such locomotives is desirable or advantageous.

Calendar.—The H. M. Hirschberg Company, of 39 East Twentieth Street, New York, has issued a very attractive calendar, peach with rose trimmings on a background of scarlet, which explains by inference the superiority of the "Siemens" flaming-arc lamps and "Plania" carbons which that company imports.

Voltage Regulators.—The Thompson-MacArthur Company, Buffalo, N. Y., has issued an illustrated bulletin fully describing the Thompson automatic voltage regulators. Results of tests with curves and tables showing economies obtained are also given. The bulletin is made up of twenty pages inclosed in an attractive cover.

Fuses.—The Chicago Fuse Manufacturing Company, 1014 West Congress Street, Chicago, Ill., has issued a folder referring to its "Union" non-arcing inclosed fuses and cutouts and its automobile fuse box. The circular contains a list of prices of refilled fuses and a tabulation of the saving effected by having blown fuses refilled.

Water-Tube Boilers Compared.—The Heine Safety Boiler Company, St. Louis, Mo., has issued a pamphlet which is a reprint of a paper read before the Associated Engineering Societies at St. Louis by Mr. C. R. D. Meier, general sales manager of the Heine company. Comparison is made of the heights of seven different water-tube boilers and of the floor areas required by these various types arranged in batteries. A discussion is also presented of the money saved through the reduced area and height requirements of certain types of boilers.

Electrical Fixture.—A pamphlet issued by the T. R. Almond Manufacturing Company, Ashburnham, Mass., illustrates the Flexo lamp. This lamp is of the portable type, the arm is flexible and can be adjusted to any angle or position, and the rays of light may be directed where most desired. The device is suitable for office, home, school or factory, because of its great convenience and economy. Another interesting pamphlet on the same device is entitled "Light on the Light Question." The application of the Flexo lamp to various machines is illustrated.

Counting Machines.—The National Scale Company, Chicopee Falls, Mass., in a twenty-two-page pamphlet illustrates different types of its machines adapted to weighing various classes of material. These machines are said to give a quick and accurate count of any commodity without the use of tabulated figures or weights, mental calculation or figuring of any kind. The results in pieces, dozens or gross are obtained with accuracy. Its method of operation is described. In another pamphlet recently issued an extended list of some of the users of these scales is given, including a large number of electrical manufacturers.

Industrial Lighting.—The engineering department of the National Lamp Works of the General Electric Company, Cleveland, Ohio, has published a comprehensive bulletin (No. 20) on industrial lighting. This publication deals with the various factors that must receive consideration in the design and operation of an industrial lighting installation. The effects of voltage conditions on the operation of lighting units are clearly explained. Curves showing the performance of incandescent lamps in actual practice are given; different types of reflectors are discussed at length along with their distribution curves; the effect of accumulation of dust on reflectors of different types is illustrated graphically; the principles of illumination design and the method of figuring operating costs are clearly outlined, and the application of modern methods of illuminating engineering is shown by a number of illustrated installations with complete data on each. The information is concisely presented.

Personal Mention

Mr. J. H. Hart, Salem, N. J., has been appointed president of the Pennsgrove (N. J.) Electric Light, Heat & Power Company.

Mr. Samuel Insull, president of the Commonwealth Edison Company, sailed for England on Tuesday of this week for a three weeks' trip.

Mr. Julius G. Koppel has been appointed electrical superintendent of bascule bridges of the Canadian Pacific Railway at Sault Ste. Marie, Ont.

Mr. L. W. Dawley, formerly manager of the De Queen (Ark.) Ice & Light Company, has become associated with the Paris (Tex.) Ice Company.

Mr. Paul Fesoli, of Glens Falls, N. Y., has been appointed manager of the Granville (N. Y.) Electric & Gas Company, vice Mr. T. E. Smith, resigned.

Mr. H. L. Richardson has been elected superintendent of the Sussex Light & Power Company of Laurel, Del., vice Mr. C. C. Stephenson, resigned.

Mr. P. T. Hanscom, electrical engineer of the Great Western Power Company of San Francisco, Cal., has severed his connection with the company.

Mr. Fred Eggleston has been appointed superintendent of the Union Springs (N. Y.) Light & Power Company, assuming part of the duties of Mr. G. W. Hull, resigned.

Mr. R. S. Hale, of the Edison Electric Illuminating Company of Boston, sailed for Europe last week on a honeymoon trip. He was married on Dec. 23 to Miss May N. Wilson, of Boston.

Mr. Leslie R. Hicks has resigned as superintendent of the Fall River (Mass.) Electric Light Company and joined the engineering force of Messrs. Lockwood, Greene & Company, of Boston, Mass.

Mr. Charles B. Kelsey, president of the American Public Utilities Company of Grand Rapids, Mich., has been unanimously chosen for president of the Grand Rapids Association of Commerce.

Mr. George W. Hull has resigned as manager of the Union Springs (N. Y.) Light & Power Company and accepted a position with the Central New York Gas & Electric Company at Clyde, N. Y.

Mr. R. B. Mateer has resigned from the commercial department of the Great Western Power Company of San Francisco and accepted the post of commercial agent of the Southern Sierras Power Company at Riverside, Cal.

Mr. C. P. Myrick has been appointed general manager of the San Domingo (Hayti) Electric Light Company and has severed his connection with the Abington & Rockland Electric Light & Power Company, of North Abington, Mass.

Mr. Walter L. Mulligan, manager of the United Electric Light Company, Springfield, Mass., was presented with a large silver loving cup by the members of the United Electric Light Company's Employees' Relief Association on Dec. 19.

Mr. J. E. Harsh, treasurer and new-business manager of the City Light & Traction Company, of Sedalia, Mo., and formerly connected with Doherty companies at Joplin, Mo., and Denver, Col., has been appointed manager of the Salina (Kan.) Light, Power & Gas Company, vice Mr. W. E. McFadden, resigned.

Mr. D. L. Evans, superintendent of the Sisterville (W. Va.) Electric Light & Power Company, has resigned to accept the position of line chief of the Consolidated Light, Heat & Power Company of Huntington, W. Va. Mr. Evans was formerly connected with the Monongahela Valley Traction Company of Fairmont, W. Va.

Mr. George C. Richards, former Jovian statesman, has been presented by the Chicago Jovian League with engrossed resolutions of thanks expressing the appreciation of his fellow Jovians for his services in bringing about better Jovian relations in Chicago, in the formation of the local organization and in conducting successful rejuvenations.

Mr. A. D. Furlong, for the past two years general manager of the Union Railway Gas & Electric Company, Springfield, Ill., has been appointed general manager of the Saginaw & Bay City utilities companies in Michigan as successor to Mr. J. A. Cleveland, resigned. Previous to his connection with the Springfield company, Mr. Furlong was general manager of the Pontiac (Mich.) Power Company.

Mr. H. M. Waite, until recently city engineer of Cincinnati, has been appointed city manager of Dayton, Ohio. Under the new city charter the city manager, who receives a salary of $12,500 a year, is the administrative director of municipal affairs under the supervision of a commission of five members. Mr. Waite is a graduate of the Massachusetts Institute of Technology. His experience has been gained largely in railroad work.

Mr. John S. Wise, Jr., who has been manager of the Harwood Electric Company of Hazleton, Pa., has been appointed general manager of the Lehigh Navigation Electric Company, Hauto, Pa. Mr. Wise has been at the head of the Harwood Electric Company since its formation and was retained in that capacity on the consolidation of the Harwood Electric Company and the Lehigh Navigation Electric Company. His headquarters will remain at Hazleton, Pa.

Mr. John A. Cleveland, for the past two years general manager of the Saginaw, Bay City and Flint interurban lines and of the gas, electric and railway systems of Saginaw City and Bay City, Mich., has resigned and accepted an advisory position with Hodenpyl, Hardy & Company, controllers of the Commonwealth Light & Power Company. Mr. Cleveland was the guest of honor on Dec. 23 at a farewell dinner given by the various heads of the departments in Saginaw and Bay City at the Sagniaw Club.

Mr. Wallace W. Ryder has been appointed general manager of the western division of the Western Union Telegraph Company, with headquarters at Chicago, vice Mr. T. P. Cook, retired. Mr. Ryder was born at Aurora, Ill., April 6, 1865. He entered the service of the Chicago, Burlington & Quincy Railroad in 1883, and, after holding various clerical positions in the freight and telegraph departments, was appointed superintendent of telegraphs on Sept. 1, 1893. His jurisdiction was extended over the entire Burlington system on May 1, 1900. On Jan. 1, 1910, he was appointed general superintendent of telegraphs on the New York Central system west of Buffalo, and on Oct. 1, 1912, he was appointed manager of the railway department of the Western Union Telegraph Company.

W. W. Ryder

Mr. Gerard Swope, general sales manager of the Western Electric Company, has been nominated by the Alumni Association of the Massachusetts Institute of Technology as a term member in the corporation of the Massachusetts Institute to serve five years. Mr. Swope, who was graduated with the class of 1895, entered the employ of the Western Electric Company at Chicago in that year. He spent a year in various departments of the shops and in 1896 entered the power apparatus engineering department as designing engineer. He organized and was the first manager of the St. Louis house, opened in January, 1901, and at the beginning of 1906 was transferred to Chicago as power apparatus manager, in charge of the sales, manufacturing and engineering of the power apparatus business of the company. In 1908 Mr. Swope became general sales manager with headquarters at New York, in charge of all branches of the company's commercial work in the United States and foreign countries. He was elected vice-president in January, 1913. Mr. Swope is a member of the Engineers', Railroad, City, Technology and Economic clubs of New York, the Union League Club of Chicago, the American Economic Association, the Society for Electrical Development, the American Institute of Electrical Engineers, the American Statistical Association, the National Electric Light Association, the American Academy of Political and Social Science, the National Society for the Promotion of Industrial Education, the Rutgers Club of New Brunswick, N. J., and the Electrical Manufacturers' Club.

Construction

New England

SEARSPORT, MAINE. — Negotiations have been closed whereby the property of the Searsport El. Co. will be taken over by the Penobscot Bay El. Co., of Bucksport. The local power plant will be operated until it can be connected with the trunk line of the Penobscot company, which extends from the power plant at Teddy Pond to Belfast and runs within about one-half mile of the town limits. A. C. Hopkins, of Belfast, is local manager.

WATERVILLE, MAINE.—A movement has been started in the towns of Ripley, Exeter and Garland to secure the extension of the transmission lines of the Central Maine Pwr. Co., of Waterville, to those towns; a similar movement has also been started in Silvers Mills. Six miles of line would have to be erected to reach Ripley and 12 miles of new line would be necessary to connect Exeter and Garland with the system.

HARRISVILLE, R. I.—The Blackstone Valley Gas & El. Co., of Woonsocket, has submitted a proposition to the Harrisville fire district offering to furnish electricity for lighting the streets of the village at $27 per lamp per year; also to furnish energy for commercial lighting.

HARTFORD, CONN. — The Board of Contract and Supply has awarded the contract for erecting 141 double-lamp posts and 113 single-lamp posts and furnishing all fixtures, and electricity for maintaining same, until June 1, 1918, to the Hartford El. Lt. Co., as follows: For 141 double lamps, at $11,280; 113 single lamps, $6,215, making a total of $17,495.

Middle Atlantic

ELMIRA, N. Y.—The Public Service Commission has granted the Elmira Transmission Corpn. permission to erect high-tension transmission lines from the Riverside power plant through the towns of Horseheads and Big Flats in Chemung County, and in Corning in Steuben County. The company already has secured franchises from these towns.

FORESTPORT, N. Y.—A 24-in. S. Morgan Smith vertical waterwheel, with steel case, operating under a 10-ft. head, and steel flume 4 ft. in diameter, 68 ft. long, concrete dam and forebay, has been recently installed in the local electric-light plant, owned by George Farley. The wheel is regulated by a Sturgess waterwheel governor, manufactured by the Ludlow Valve Mfg. Co., of Troy, N. Y.

TONAWANDA, N. Y.—The City Council is considering the question of installing a new street-lighting system in the business district. The Tonawanda Pwr. Co., of North Tonawanda, furnishes the street-lighting service here. Frank M. Gordon is manager.

BANGOR, PA.—The Town Council has granted the Industrial El. Lt. Co. a franchise to construct and operate an electric-light system in this borough.

HUNTINGDON, PA.—Bids will be received by the Board of Education of the Huntingdon Borough School District until Jan. 14 for the erection of a 12-room school building in the Fourth Ward. Separate bids will be received for construction of building, heating and ventilating, plumbing, electrical work and seating. Plans and specifications may be obtained from G. G. Harman, secretary of board, or J. Herbert Hall, architect.

MARCUS HOOK, PA.—Arrangements have been completed by the Beacon Lt. Co., of Chester, which recently erected a substation here, for furnishing electricity to the American Viscose Co., besides furnishing energy for lighting the streets of the borough and for private residences. The company proposes to extend its distributing lines to the suburbs of Marcus Hook as soon as possible.

MILFORD, PA.—The Shohola Falls Hydro-Electric Co., of Milford, has filed a notice of increase in capital stock from $6,000 to $4,500,000. The company proposes to develop the water-power of the Delaware River at Belvidere and at other points. The company has already purchased considerable land where it expects to erect dams and power stations.

PHILADELPHIA, PA.—The Pennsylvania R. R. Co. has entered into a contract with the Philadelphia El. Co. for electricity to operate its suburban electric-car service between Paoli and Chestnut Hill for a period of five years. Energy will be supplied from the main station at Christian Street Wharf, Schuylkill River. The Pennsylvania R. R. Co. will erect a substation on the opposite side of the river and the power company will carry its lines across the river. The contract calls for 3150 kw, with a load-factor of 25 per cent use of said energy.

READING, PA.—The Reading Transit & Light Co. has given notice of its intention to apply for authority to increase its indebtedness from $750,000 to $50,000,000. The proposed increase will be used to provide funds to extend its operations.

SUSQUEHANNA, PA.—The contract for construction of the building for the new electric plant for the Susquehanna Electric Construction Co. has been awarded to Williams & Richardson, of Scranton. The building will be 130 ft. long and 38 ft. wide, one story high, and will cost about $9,000.

WASHINGTON, PA. — The Borough Council has granted the Relief El. Lt., Ht. & Pwr. Co. a franchise to construct and operate an electric-light plant in Washington.

WASHINGTON, PA.—The Relief El. Lt., Ht. & Pwr. Co. has applied to the Council of East Washington for a franchise to furnish electricity for lamps and motors in that town. Robert R. Reed is manager.

BALTIMORE, MD.—The installation of a new electric emergency signal system for the Police Department is under consideration.

LONACONING, MD.—It is reported that the Home El. Lt. Co., of Lonaconing, is planning to remove the equipment from its plant to the plant of the Lonaconing El. Lt. & Pwr. Co.

MANASSAS, VA.—The contract for construction of the proposed municipal electric plant has been awarded to Sterrett & Fleming, Evans Building, Washington, D. C. C. R. C. Johnson is chairman, and N. Wilson Davis is engineer.

WASHINGTON, D. C.—Bids will be received at the office of the electrical engineer in charge of automatic scales, Treasury Department, Washington, until Feb. 11, for furnishing and installing, complete, automatic weighing and recording scales. For details see proposals columns. C. S. Hamlin is assistant secretary.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 31 for construction of two steel towers and concrete foundations at the navy yard, Washington, D. C. Plans and specifications may be obtained on application to the bureau or to the commandant of the navy yard named. The cost of the work is estimated at $12,000. H. R. Stanford is chief of bureau.

North Central

FLUSHING, MICH.—The plant of the Hart Milling & Pwr. Co. was completed and placed in operation Dec. 1, 1913.

GRAND RAPIDS, MICH.—Governor Ferris has signed the water-power amendment to the city charter, which provides for obtaining the water-power rights in the Grand River either by purchase or condemnation, and this amendment will be submitted to the voters at the spring election. The city may then either preserve the water-power rights or destroy the dams for flood protection. A bond issue of $450,000 to pay for the river rights must also pass to make the charter amendment effective.

HASTINGS, MICH.—The Thornapple Gas & El. Co., of Hastings, has completed the installation of an electric distribution plant in Caledonia and is now furnishing electrical service there. L. W. Heath is manager.

MACKINAC ISLAND, MICH.—The Municipal Wtr., Lt. & Pwr. Co., of Mackinac Island, has purchased a 200-kw generator and two switchboards from the General Electric Co. Orders have been placed with the Allis-Chalmers Co. for a 200-kw directly connected generating unit, consisting of an engine and generator (60 cycles, 2300 volts, 150 r.p.m.), to be delivered Feb. 1, 1914. A. T. Doherty is secretary.

MUNISING, MICH.—Preparations are being made by the Munising Paper Co., it is reported, to install a 400-kw generator and a 650-hp engine in its power plant.

NORTHVILLE, MICH.—The Board of Public Works has recently completed a water-power plant (about 50 hp) to be operated in connection with the municipal steam-driven station. Samuel Wilkinson is superintendent.

WAKEFIELD, MICH.—Bids will be received by John Avery, clerk, until Jan. 10 for furnishing material and construction of substation, also for furnishing and installing all material and equipment for overhead distributing system, including switchboard, instruments and meters. Plans and specifications may be seen at the office of the clerk, or at the office of Charles Smeeth, engineer, Ironwood, Mich. Complete sets of plans may be obtained upon application to J. W. Bedell, president of the village, or from the clerk, for which a deposit of $5 will be required, to be refunded upon return of plans.

ALLIANCE, OHIO.—The City Council has killed the ordinance providing for the sale of $15,000 in bonds by the people for a municipal electric-light plant and at the same time voted down a measure to enter into a new contract with the local Alliance Gas & Pwr. Co.

CANAL DOVER, OHIO.—Application has been made to the State Utilities Commission by the County El. Co., operating in Canal Dover, New Philadelphia, Uhrichsville and Dennison; the Twin City Trac. Co., operating a street-car service between Uhrichsville and Dennison; the Midland Pwr. & Htg. Co., of Cambridge, operating an electric railway between Cambridge and Byesville; the Newcomerstown El. Lt., Ht. & Pwr. Co., of Newcomerstown; the Coshocton Lt. & Htg. Co., of Coshocton, and the Lafayette Lt. & Pwr. Co., of Lafayette, to consolidate under the name of the Ohio Service Co., to be capitalized at $1,000,000. These properties are owned by the Brooks interests, of Scranton, Pa., which are now building a large power plant at Coshocton.

CANTON, OHIO.—Preliminary plans are being prepared by the United Engineering & Construction Co., Schofield Building, Cleveland, for the proposed municipal electric-light plant. The cost of the plant is estimated at $70,000. Ray Herbert is director of public service.

CLEVELAND, OHIO.—Bids will be received by W. H. Kirby, secretary to the director of public service, No. 204 City Hall, Cleveland, until Jan. 14, for piping for the municipal electric-light plant. Plans and specifications may be obtained in the office of the engineer of construction, Room 419, City Hall, Cleveland. W. J. Springborn is director of public service.

CUYAHOGA FALLS, OHIO.—Plans are being considered by the Board of Public Affairs for improvements to the municipal electric-light plant. New boiler equipment will soon be needed as well as new piping and transmission apparatus.

DEFIANCE, OHIO.—The light committee of the City Council has submitted an estimate for the installation of cluster lamps in the business district to replace the arc lamps now in use.

McCOMB, OHIO.—A 150-hp Brownell tubular boiler is now being installed in the municipal electric-light plant. A. Keel is clerk of Board of Public Affairs.

MINERAL CITY, OHIO.—The Federal Clay Product Co., of Mineral City, is contemplating the installation of a 1000-hp electric power plant and is asking for prices on different appliances for same. Water-tube boilers with superheaters will probably be used. The installation of three engines of 450 hp, 300 hp and 150 hp respectively is under consideration. These may be compound condensing, or a turbine may be used for the largest unit and simple engines used for the smallest units. The engines are to be directly connected to alternating-current generators, of 300 kw, 200 kw and 100 kw respectively (60 cycles, three-phase, 440 volts). The company also expects to purchase some motors. In the issue of Dec. 20, under Canton, Ohio, the company was reported to be contemplating the construction of a new building and installation of a 1000-hp power plant.

WEST MILTON, OHIO.—L. A. Pearson, owner of the local electric-light plant, has recently completed a 5-mile extension to the town of Phillipsburg. Further extensions will probably be made in the spring.

WILMINGTON, OHIO.—The Ohio Public Utilities Commission has authorized the Dayton Pwr. & Lt. Co., of Dayton, to issue $125,000 in bonds and $50,000 in capital stock, the proceeds to be used to purchase the property of the Wilmington Wtr. & Lt. Co.

WOOSTER, OHIO.—The Wooster El. Co. is now installing a 250-kw Allis-Chalmers generator and engine (directly connected), with all necessary equipment.

YOUNGSTOWN, OHIO.—Plans have been completed by the Mahoning & Shenango Ry. & Lt. Co. for extensions to its system in connection with the large power plant recently erected in Lowellville, involving an expenditure of about $250,000. The plans provide for increasing the output of the Lowellville plant by 10,000 hp; also for doubling the transmission lines all through the valley. Youngstown, Sharon and New Castle will all be connected with high-tension transmission lines. R. P. Stevens is president of the company.

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Increase in Electrical Exports The returns of the Foreign Bureau of the Department of Commerce and Labor as to foreign trade in the month of October are once more encouraging from the statistical standpoint, but the various figures are so scattered that it still remains a most difficult if not impossible task to correlate and mass the electrical data as a unit. An agency so pervasive refuses to recognize, or eludes at every opportunity of escape, the stiff categorical summaries of a tariff drill sergeant. Anyhow, it soothes, satisfies and stimulates to note that during October, which was a desperately dull and doleful month for trade in general, electrical exports that cannot be classed possibly anywhere else and respond to every acid test showed a material advance over the outgo for the corresponding month for the preceding year. When we remember how much nicer and better the year 1912 was than 1913, it must be conceded that to gain at all in a general period of backsliding is, to use a choice classic phrase, "going some." It appears that the total export of electrical apparatus and supplies, in a list severely expurgated of most things that could swell it, was $2,516,583, as compared with $2,078,501 a year earlier. Such gains are not to be despised, but in these chastened days no one sits in the seat of the scornful. The ten-month totals show up equally well. In 1911 the figure was $15,596,575; in 1912 it was $18,755,966, and in 1913 it rose to $23,720,072. If some one in the department will only restore to us our lost provinces, we can exhibit a gain far better than that for even an off year.

New England Electrical Statistics Interesting statistics of the central stations of New England are presented elsewhere in this issue. They show a decade of steady growth in one of the oldest sections of the country possessing water-powers transcending in importance all other natural advantages contributing to New England's industrial development. Census figures show that two-fifths of the total power derived from waterwheels by manufacturing establishments in the United States is found in New England and that one-fourth of the total power of all kinds used in New England factories is supplied by waterwheels. Fully 60 per cent of the minimum water-power available in her streams is now being utilized. It would appear therefore that her manufacturing industries are already supplied with cheap power, and this should be taken into consideration in any survey of central-station growth. Her cities are old and they have enjoyed the advantages of central-station service from the start. Therefore large increases cannot be expected. On the contrary, owing to consolidation of properties the tendency should be the other way, and this trend is shown clearly in the returns published in this issue. From an engineering viewpoint the data on steam and water-power growth reveal the influence of the steam turbine and also of the hydroelectric transmission plants. Strangely enough, New England, which has no coal and possesses plenty of water, shows a greater increase in steam than in hydraulic equipment during the last five years. Coal, despite its high price, still triumphs. Inasmuch as some knew and many surmised that the arc lamp in its present form would have to give way to the more efficient incandescent lamp, the government figures on that point should be conclusive. Most remarkable are the gains shown in the use of electric motors, which increased more than fivefold during the decade. The figures both in the aggregate and by states warrant much study.

Electric Parcel-Post Delivery The success which has attended the use of electric trucks in post office operations in New York and other cities, and in the delivery service of express companies and department stores, is basis for urging the extensive use of battery-driven vehicles for parcel delivery in the newest branch of the government postal service. Ten-month comparative tests of gasoline and electric cars in parcel-post service recently conducted by the Indianapolis post office, as noted in these columns, showed a saving of one-fifth in operating costs in favor of the electric vehicles. This interesting official test under parcel post conditions only serves, of course, to confirm the knowledge, already familiar to those charged with the package-delivery problems of large private corporations, that for short-haul, frequent-stop service the electric wagon has no competitor. Its reliability in use and its durability in surviving the hardships of postal service is attested, too, by five years' experience with these cars in the transportation of the New York mails, while the friendly attitude of officialdom toward electric transportation is evidenced by the extensive application of "electrics" in other government departments. The Government Printing Office, the Bureau of Engraving and Printing, the Bureau of Buildings, the navy and the Bureau of Insular Affairs are, for example, all making successful use of large fleets of electric trucks. The last-named even has a number of these vehicles in the Philippines, where they are employed in the novel service of hauling water under the severe climatic conditions of those tropical islands. Concerning the wider use of electric vehicles in parcel delivery it cannot be doubted that the post office officials charged with the heavy task of instituting a great country-wide system of parcel transportation are giving the most careful attention to the complex problems of terminal delivery, and it also goes without saying that, actuated by the spirit of "efficiency" which has been taken as the watchword of the present administration, they have watched with keen appreciation the records of economy and service being made by electric trucks in both government and private package-delivery duty. That the electric truck will on its merits win general recognition for parcel delivery its stanch adherents feel thoroughly confident; and in the central-station field the far-reaching significance of such an attainment as that foreshadowed should awaken the imagination and enlist the interest of the small-town manager as well as the big-city utility corporation, for, besides the incidental charging business assured from the postal vehicles themselves, general electric parcel-post delivery would in numerous communities prove to be the opening wedge of a healthy local electric-truck development.

Signaling to Moving Trains

From the very beginning of induction and other forms of space telegraphy inventors have proposed scheme after scheme intended to permit communication between fixed points and trains in motion. More than twenty-five years ago a magnetic induction system was successfully put into practice on one of the Eastern railways but was not found of especial practical value. The inception of radio-telegraphy gave impetus to those who were working on train telegraphy, since by its use the need of the long induction-wire paralleling the rails was obviated; and as late as 1907 patents were issued describing various ambitious arrangements of telegraph instruments, cab signals, automatic train stops, etc., controlled by "wireless." Invariably these depended for their operation upon filings coherers or other elements which would be equally unreliable under severe service conditions. These devices did not prove useful in the operation of railroads and never met continued or extended application. A few pseudo-wireless methods, such as that using a stream of conductive liquid projected from the locomotive to a wire or third-rail running along the tracks, have been brought forward, but each appears to have lacked some element essential to reliability. It has remained for one of our Eastern railroads to apply radio apparatus of recent design to the old problem, and within only the last few weeks results have been secured which indicate the desirability of extending the work to permit signaling to and from express passenger trains at all times throughout their runs.

On page 89 of the current issue Mr. John L. Hogan, Jr., describes the wireless telegraph plant and services of the Delaware, Lackawanna & Western Railroad. The results achieved speak for themselves, and it seems hardly necessary to comment upon the manifold uses to which the system should be applicable in the practice of railway operation. From the engineering viewpoint the data given are especially interesting, for apparently there is no reason why the general method might not be put to advantageous use elsewhere. It would seem, however, that there are involved a number of problems not yet so well settled as to permit efficient design of future plants intended for train communication. The form of antenna used on the cars would seem to function more as an electrostatic reservoir than as a radiator or absorber of ether waves, and the ease with which signals were received when the train was entirely underground suggests that in the transmission of messages earthed ether-waves are less concerned than are high-frequency current groups traveling by way of the earth and rails. The "swinging" of signal intensity which is so pronounced may be due to any or all of several causes, and definite investigation of these should result in a further knowledge of the mechanism of radio signaling by grounded waves. With the facilities for experiment which are now at hand it is hoped that a thorough series of tests will be made, and that study and correlation of the data obtained will do much to clear up some of the ever-mysterious phenomena involved in the transmission of radio-frequency electrical impulses.

Graphical Methods of Representing Color Values

In the *Elektrotechnische Zeitschrift* of Nov. 13, 1913, Dr. L. Bloch contributed an article suggesting an industrial method of defining numerically and representing graphically the color values of any particular illuminant, such as a tungsten-filament incandescent lamp at a specified power consumption. We abstracted the article in our Digest shortly after its appearance, and also commented upon it editorially. Briefly to recapitulate, the method involves the use of a photometer head, provided with three selected oculars, having tinted glass screens of red, blue and green, which could be used successively in the comparison of a test lamp against a standard lamp. A complete photometric measurement thus involves three such measures, or groups of measures, one with each color screen, or color filter, in front of the observer's eye. The measurements are similarly made on standard daylight against the same standard lamp. In this way red-green and blue-green ratios are determined both for the test lamp and the daylight. The two pairs of ratios are then divided, each by each, to produce final resulting ratios of red-green and blue-green, as between the best lamp and daylight. In the case of a lamp that might happen to have precisely the same color as the standard daylight, these final resulting ratios would be 1.00 for both red to green and blue to green.

In a more recent article published in the *Elektrotechnische Zeitschrift*, by Erich Jasse, the graphic presentation of the Bloch measurements is discussed with relation to Maxwell's color triangle. Herr Jasse shows that the Bloch ratios, by a simple numerical treatment, can be assigned to definite positions within a Maxwellian equilateral color triangle. To recapitulate the facts briefly, standard white light occupies the middle point of such a triangle, with pure red, blue and green at the three respective corners. Reddish lights run toward the red corner, bluish lights toward the blue corner and greenish lights toward the green corner. Consequently, any point on the Bloch rectangle co-ordinate plan corresponds to a definite point inside the Maxwell equilateral plane triangle.

Maxwell's triangle has been used by several observers to designate lamp color values, and especially by Dr. H. E. Ives. Herr Jasse plots on a Maxwellian triangle not only fifty-three observations of Bloch on different kinds of industrial lamps, but also about a dozen similar observations by Ives. He shows that they differ in a definite manner—namely, that the Ives values lie more toward the green and less toward the blue. It is hard to define what standard cloudy daylight means, and the more carefully we try to define it the more cloudy our efforts are apt to become. Instead of our taking daylight as standard for the center of our color triangles, it will probably be advisable to make up a definite "artificial white" light in the laboratory and put that in the bull's-eye, letting the infinite varieties of daylight fall where they will. The quality of daylight is not strained.

The World's Longest Transmission Line

The second and concluding portion of our account of the Big Creek plant in this issue is devoted in the main to the line and substation equipment. The second generating plant so closely resembles the first that it may be passed over very briefly. The 150,000-volt transmission line, however, is notable in many of its features. In the first place, it is in complete duplicate, consisting of two steel-tower lines, erected 80 ft. apart, each carrying a single three-phase circuit, the wires of which are supported in a single horizontal plane, each by nine disk insulators in series. The towers used are of very moderate height, only 43 ft. to the cross-arm from which the suspension insulators are carried, and are placed also at moderate intervals, being on the average 660 ft. apart. The line wires are carried rather low, as little as 25 ft. in the center of the spans, a height which would seem precariously low in a more thickly settled country. The general nature of the structure, however, is such as to give unusual stability to the line, and as the circuits are on a private right-of-way 150 ft. wide, the lack of height may be justifiable. The spacing between wires is at the record figure, 17.5 ft., and wherever necessary the wires have a tension mooring to the structure through a string of nine insulator disks to check lateral swaying.

It is interesting to note how the fear of inductance due to wide spacing has disappeared as these long circuits have been instituted. In fact, added inductance is rather a good thing in view of the unavoidable capacity effects. The line wires themselves are of unusual size and character, being aluminum cable laid over a stranded steel core. The over-all diameter of the cables is 0.95 in. and the weight about 2 tons per mile. Each pole line carries on its top a galvanized-steel cable serving as a ground wire in accordance with general practice. The total length of this transmission line is 241 miles to the Los Angeles substation.

The substation equipment possesses some interesting features enforced by the very high voltage and the large amount of energy which must be dealt with. The high-voltage busbars in both the generating and the receiving stations, for instance, are of 2-in. wrought-iron pipe with all fittings carefully rounded off to decrease the chance of coronal discharge. The large diameter of the line conductors tends to lessen trouble from this particular source. The switching appliances for the operation of this system are somewhat formidable and seem rather intricate. Indeed, it is fairly safe to predict that so far as service conditions go the switchboard will require at least as much care as the rest of the generating plant. Energy is received from the generators at 6600 volts, passes to the third floor of the station to the oil switches, and then back to the second floor to the duplicate busbars, from which the transformer banks are operated. There are also two sets of 150,000-volt transfer busbars connected by remote-control oil switches, and still other switches are installed to connect either high-tension bus to either transmission line. Each of the main 150,000-volt oil switches occupies 1200 cu. ft. and weighs 14 tons. It would be rather interesting to know the cost of the switching apparatus and of the space required to contain it as compared with the cost of the generating units. The time seems almost to have arrived in high-tension work at which the generators and prime movers become a comparatively insignificant part of the show. This is, indeed, one of the interesting economic problems involved in the use of extreme voltage.

A striking feature of the main substation equipment is the installation of two 15,000-kva synchronous "condensers" to compensate for the capacity effects on the long lines. These machines will doubtless at times prove very convenient, but we have a suspicion that when the load is really taken aboard they will not be used to any large extent. Line capacity has been one of the terrors at all stages of the growth of electrical transmission, yet as experience has been acquired in the course of progress this lion in the way has usually shrunk to the dimensions of a domestic cat. It is only on lines considerably longer than anything yet attempted that the voltage rise due to capacity may be reasonably expected to reach a figure calling for extreme measures. However, since good regulation and continuity of service are of fundamental importance in all transmission work, one must look leniently on extraordinary precautions even though eventually they may prove needless.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

National District Heating Association

The sixth annual convention of the National District Heating Association will be held at Rochester, N. Y., May 26, 27 and 28. Among the papers to be presented are the following: "Use of Bleeder Turbines in Connection with Steam Heating," by Mr. R. D. De Wolfe, Rochester, N. Y.; "Manufacture of Welded Iron and Steel Pipe," illustrated by moving pictures; "Hot-Water Heating Under Forced Circulation," by Mr. Thomas Donahue, Lafayette, Ind.; "Expense of Operating Centrifugal Pumps Versus Double-Acting Pumps," by Mr. A. C. Rogers, Toledo, Ohio; "Some Effects of Utility Regulation as Affecting District Heating," by Mr. D. L. Gaskill, Greenville, Ohio, and Mr. H. Almert, Chicago, Ill.; "Effects of Superheated Steam on Heating Systems," by Mr. Davis S. Boyden, Boston, Mass.; "District Heating for Small Towns and Cities of 10,000 Population and Under," by Mr. L. T. Mason, Hornell, N. Y.; "Heat Losses from Buildings of Latest Construction," by Mr. H. Byers Holbrook, New York; "Preferred Practice in Heating Buildings," by Mr. E. L. Wilder, Rochester, N. Y.; "Advantages of Central Station Heating Over Individual Plants," by Mr. N. M. Argabrite, Elwood, Ind.; "Customers' Steam-Heating Systems," by Mr. H. R. Wetherell, Peoria, Ill.; "Commercial Steam Heating in New York City," by Mr. George W. Martin, New York. President S. Morgan Bushnell, Chicago, is also scheduled for an address, and Mr. A. D. Spencer, Detroit, Mich., will report for the meter committee; Mr. A. P. Biggs, Detroit, Mich., for the record committee; Mr. D. S. Boyden, Boston, for the educational committee, and Mr. Byron T. Gifford, Grand Rapids, for the station operating committee. Mr. D. L. Gaskill, Greenville, Ohio, is secretary-treasurer of the National District Heating Association.

Meeting of Electrical Contractors of Missouri

The thirteenth semi-annual meeting of the electrical contractors of the State of Missouri was held in Kansas City, Mo., Dec. 20. An experience meeting at the Coates House was followed by a banquet during which matters pertaining to the contracting business were discussed. Mr. F. B. Uhrig, district manager of the Western Electric Company, spoke at some length on the objects and aims of the Society for Electrical Development; Messrs. B. S. Cowie, J. H. Ross, C. J. Sutter and W. L. Hutchinson spoke from the viewpoint of contractors, and Messrs. C. H. Talmage, P. B. Chaney and K. G. Rennie voiced the views of the jobbers. During the meeting a resolution protesting against the letting of the electrical work of the State Capitol of Missouri to a plumbing contractor who had included the electrical work in his bid for the plumbing and steam heating was passed. The Electrical Union in Kansas City and also the Electric Club of Kansas City were asked to second the action of the Contractors' Association, inasmuch as it was considered a bad precedent to have the electrical work done by any other than an electrical contractor. The meeting adjourned to convene on the Monday preceding the holding of the meeting of the National Electrical Contractors' Association in Detroit in July of this year.

Electric Starting and Lighting Practically Universal on Automobiles

The fourteenth annual National Automobile Show was held at the Grand Central Palace, New York, Jan. 3 to 10 inclusive. In all there were 352 exhibits, 255 of which were made by accessory manufacturers, eighteen by gasoline-car makers and six by electric-vehicle manufacturers. The total number of cars exhibited was 492, the lowest-priced being $395 and the highest-priced selling at $7,200. No commercial cars were shown.

In gasoline-car design several changes have been made which are of interest to the electrical fraternity. There appears to be a general tendency toward clearing the running boards and exterior of the cars of all apparatus, which has resulted in supporting storage batteries beneath the cars or in some place where they are inconspicuous. Electric horns have in many cases been mounted inside the hoods with their funnels opening near the radiator. Side lamps have been eliminated to a great extent by using lower-powered head lamps or employing the usual types with special dimming devices. The general tendency is to obtain a stream-line body, and where accessories interfere they have been made to conform with the lines of the car or have been placed elsewhere.

Electric gear shifts are being tried on a few cars. On one type of car the process of selecting the speed ratio is done mechanically, while the final operation of meshing the gears is by a solenoid magnet. Considerable attention has been given to the protection of starter, lighting and ignition wiring on some cars, all wires being inclosed in flexible conduit. Because of the low voltage popularly used for electric cranking the starters and switches are being mounted very close together, if not in a unit, to avoid excessive line drop.

Electric starters are now used on over 90 per cent of the American models, as against 47 per cent last year. About 62 per cent gear into the flywheel, 15 per cent connect with the front end of the engine shaft through gears and silent chains, and the remainder connect with the timer gear, etc. The reduction in the weight of starting devices has been considerable, being as great as 20 lb. in some cases. Electric lighting has become practically universal even on the inexpensive cars. About 89 per cent are electrically lighted in comparison with 50 per cent of last year.

From records compiled 1,127,940 automobiles were in use last year, an increase of 605,001 over the registration figures of 1911. New York still leads with a total of 133,000 registrations; Illinois is next with 95,000, and Ohio is third with 87,000. Pennsylvania, Iowa, Indiana, Massachusetts and New Jersey follow in the order named.

Output of Large Generating Systems

The accompanying table gives statistics on the output, peak load and load-factor of the generating stations of the Niagara Falls Power Company, Commonwealth Edison Company, New York Edison Company, Philadelphia Electric Company, Edison Electric Illuminating Company of Boston and the Edison Electric Illuminating Company of Brooklyn. Data on the same stations for the year 1912 were published in our issue of January 11, 1913. The Commonwealth Edison system still has the highest peak load and the largest output of the purely central-station systems, chiefly because of its great railway load. It is worthy of note that the yearly output of the Commonwealth Edison Company, which is given approximately, and that of the Niagara Falls Power Company are almost equal.

DATA ON LARGE GENERATING SYSTEMS

System	Peak Load in Kw.	Date of Peak Load	Yearly Output in Kw-hr	Yearly Load-Factor, per Cent
Niagara Falls Power Company	133,800	Dec. 8	949,886,570	81
Commonwealth Edison	271,000	Dec. 15	950,000,000	42–43
New York Edison	225,902	Dec. 23	685,947,000	34.7
Philadelphia Electric	76,133	Dec. 11	229,529,589	34.4
Boston Edison	63,131	Dec. 16	179,990,611	32.5
Brooklyn Edison	48,400	Dec. 23	139,737,007	33

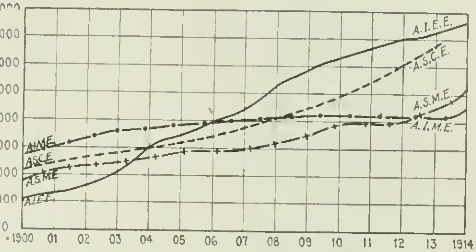
The figures of the latter cover the combined output of the Niagara Falls Power Company and the Canadian Niagara Power Company, which virtually compose a single system, the stations being operated in parallel. During the eleven months from January to November inclusive it was necessary for the Buffalo company to purchase energy elsewhere to meet its demand, but during the month of the December the entire Buffalo demand was taken care of by the Niagara Falls Power Company. The load-factors of the Edison companies in New York, Philadelphia, Boston and Brooklyn, it will be noted, did not vary greatly during the year, and in this connection the peak load, total output and load-factor of the Niagara Falls Power Company are of particular interest. All companies show substantial increases in output. The Commonwealth Edison, owing to large accessions of railroad load during the year and an increase of nearly 50 per cent in the commercial business contracted for, shows an increase in output of between 18 per cent and 19 per cent.

The Philadelphia Electric Company, owing to large railway loads secured, experienced the largest percentage gain in output during the year (approximately 25 per cent), while New York, Boston and Brooklyn show increases of about 11 per cent. The increase in output of the Niagara Falls Power Company is over 9 per cent.

Growth of the National Engineering Societies

From a position in 1900 least in point of membership among the four national engineering societies, the American Institute of Electrical Engineers has in fourteen years attained an enrolment of 7600 members, outstripping that of any of its older sister organizations. The accompanying curves show graphically the last fourteen years' growth of the Institute, the American Society of Civil Engineers, the American Society of Mechanical Engineers and the American Institute of Mining Engineers.

The relative positions of the mining and electrical engineers at top and bottom of the list respectively have been interchanged, it will be noted, although in 1900 the mining institute had more than twice the membership of the Institute of Electrical Engineers. It was in 1903 and 1904 that the latter enjoyed its most rapid growth, passing in 1906 the mining engineers, and since that time the electrical engineers' enrolment has always been the largest among the four societies. The American Institute of Electrical Engineers now enjoys an income of $105,000 per year.



GROWTH OF NATIONAL ENGINEERING SOCIETIES

Electrical Energy Imported Into the United States

The reports, returns and statistics of the inland revenues of the Dominion of Canada for the year ended March 31, 1913, which were recently published by the government, contain some very interesting statistics on the electrical output of certain stations in Canada. A feature of the report is that part dealing with the export of electrical energy from Canada to the United States.

ELECTRICITY EXPORTED FROM CANADA TO THE UNITED STATES

Name of Company	Kw-hr. Generated	Kw-hr. Exported to United States	Kw-hr. Used in Canada
Ontario & Minnesota Power Company, Fort Frances, Ont.	22,328,033	21,233,520	1,094,513
Canadian Niagara Power Company, Niagara Falls, Ont.	336,762,830	325,775,842	10,986,988
Electrical Development Company, Niagara Falls, Ont.	210,807,408	55,034,200	155,773,208
Ontario Power Company, Niagara Falls, Ont.	539,237,558	254,286,580	284,950,978
Maine & New Brunswick Electric Power Company, Aroostook Falls, N. B.	2,431,516	2,371,446	63,070
British Columbia Electric Railway Co., Vancouver, B. C.	121,071,571	282,383	120,789,188
Western Canada Power Company, Vancouver, B. C.	21,461,255	3,259,693	18,191,562
Total	1,254,103,171	662,243,664	591,849,507

There were on March 31, 1913, seven companies exporting electrical energy, and three more were preparing to do so. In fact, the different hydroelectric enterprises operating near the border line sold in the aggregate more electrical energy to the United States than was sold for home consumption. The three companies which were prepared to export energy were the Cedar Rapids Power Company, of Soulanges, Quebec; the Electrical Distributing Company, of Windsor, Ontario, and the Sherbrooke Railway & Power Company, of Sherbrooke, Quebec. Data on the seven companies exporting electricity are given herewith. It will be noted that the bulk of the energy imported is brought across at the Niagara frontier line and used in New York, which absorbed more than the Province of Ontario.

Chicago Meeting of the Independent Telephone Association

The Independent Telephone Association of America opened its first convention in Chicago on Jan. 7 with about 200 in attendance. The association was formed in October, 1913, by representatives of independent companies. Mr. E. B. Fisher, Grand Rapids, Mich., in his presidential address urged competition in telephone service. Mr. C. B. Randall, St. Paul, Minn., outlined the qualifications fixed for members of the association. Any company may join if the American Telephone & Telegraph Company does not hold a substantial financial interest in its stock. Alderman Merriam, of Chicago, addressed the convention on the work of public service corporations. Addresses were made on the subjects of liability insurance and on accounting matters.

New England Central-Station Statistics

Preliminary figures of the forthcoming quinquennial report of the central stations of various states have been given out by the Bureau of the Census, Department of Commerce. The statistics relate to the years ended Dec. 31, 1912 and 1907, and June 30, 1902, and cover both commercial and municipal electric-light plants. They do not include electric plants operated by factories, hotels, etc., which utilize the energy generated, those operated by the federal government and state institutions, or plants that were idle or in course of construction. The data on central stations of the New England States are published herewith, and for convenience information for the entire New England States has been combined in Table I.

The figures as presented show that during the five-years 1907-1912 there were substantial gains in the industry. Although there was an increase of only three stations, the increase in gross income was $10,646,937 (57 per cent). The increase for the decade 1902-1912 was 174 per cent. Corresponding expenses show increases of 70 and 170 per cent respectively. The total horse-power installed indicates gains of 72 per cent during the five-year period and 160 per cent for the ten-year period. There was a decrease in the number of steam units, although a rather substantial increase in their aggregate rating. The decrease in the number of steam units is reported from Massachusetts and Rhode Island and would appear to indicate the influence of the steam turbine on steam-generating equipment, and also the effect of hydroelectric transmission companies. The rating of station generators increased 78 per cent during the five years and 217 per cent during the decade.

There were 879,272,535 kw-hr. of energy generated during the year 1912, an increase of 85 per cent over 1907 and of 225 per cent over 1902. It is evident that the arc lamp cannot meet the onslaught of the incandescent lamp, for there was a decline in its use of 20 per cent during the 1907-1912 period, the probability being that the greatest rate of decline occurred during the last few years. From the returns by states it will be noted that arc lamps held their own up to the census of 1907 and that at that time there were substantial increases in their number over the 1902 census.

Large gains are shown both in the number and aggregate rating of motors installed, not only during the decade, but during the 1907-1912 period. It is noteworthy that whereas arc lamps showed a decline of 20 per cent and other lamps an increase of 70 per cent during the five-year period, the horse-power rating of motors during the same period showed an increase of 153 per cent. The increase for the decade, 529 per cent, is even more startling, showing, as it does that the manufacturing establishments of New England appreciate the value of central-station service for industrial purposes. This large increase in the number of motors had its effect on the incomes of the company as shown in the income account, although some of the difference may be attributed to the general reduction in rates for electrical energy over the period. The first half of the decade showed an increase in gross income for light, heat and power of 72 per cent, whereas the last half of the decade showed an increase in gross earnings of 55 per cent.

According to the census of 1910, the population in New England was 6,552,745, apportioned as follows: Maine, 742,371; New Hampshire, 430,572; Vermont, 355,956; Massachusetts, 3,366,416; Rhode Island, 542,674; Connecticut, 1,114,756. The gross earnings per capita for all of New England are, therefore, $4.50, which is a fair figure considering that all of the population is taken into account, and not just that portion of it within reach of central-station circuits. In a census of thirty-one stations operating in the State of Iowa, published in the *Electrical World*, May 17, 1913, it was shown that the gross income per capita for that number of stations was $5.74 in 1912; the gross earnings of twenty-six stations in the same state in 1910 was $4.36, and for 1908 $3.93 per capita. In the above Iowa censuses only that portion of the population served was taken into consideration.

TABLE I—CENTRAL-STATION STATISTICS OF NEW ENGLAND STATES

	1912	1907	1902	Per Cent Increase 1907-1912	Per Cent Increase 1902-1912
Number of establishments	368	365	314	0.9	17.0
Commercial	311	314	279	—0.9	11.5
Municipal	57	51	35	12.0	63.0
Income	$29,307,441	$18,660,504	$10,697,077	57.0	174.0
Light, heat and power	$28,129,882	$18,123,382	$10,504,638	55.0	167.0
All other sources	$1,177,559	$537,122	$192,439	100.0	512.0
Total expenses, including salaries and wages	$21,414,431	$12,575,595	$7,953,633	70.0	170.0
Total number persons employed	7,352	5,088	3,673	44.0	100.0
Total horse-power	715,810	415,794	275,133	72.0	160.0
Steam and gas engines (including turbines):					
Number	610	634	623	—4.0	—2.0
Horse-power	526,743	281,550	183,496	87.0	187.0
Waterwheels.					
Number	511	462	295	11.0	70.0
Horse-power	208,501	130,731	62,171	60.0	235.0
Kw rating of generators	514,889	289,388	162,789	78.0	217.0
Output of stations, kw-hr	879,272,535	473,802,067	247,727,501	85.0	255.0
Estimated number of lamps wired for service:					
Arc	44,682	56,041	47,017	—20.0	—5.0
All other varieties	7,957,913	4,678,690	2,425,235	70.0	228.0
Stationary motors served.					
Number	55,042	23,841	12,736	130.0	332.0
Horse-power	391,308	154,720	62,163	153.0	529.0

Considering the showing made by the various states during the decade as given in Table II, Maine showed a decrease of 17.3 per cent in the number of arc lamps wired for service and an increase of 135.4 per cent in all other varieties of lamps. In the case of the aggregate income of seventy-nine establishments there was an increase of 195.3 per cent. There were also gains in total horse-power reported of 260.3 per cent and in the rating of generators of 284.3 per cent. The output of stations increased 432.5 per cent and the horse-power rating of motors 405.4 per cent.

In New Hampshire the fifty-nine establishments showed a gain in gross earnings of 180 per cent. Station outputs increased 362 per cent and the number of motors served 371. Arc lamps fell off 34 per cent.

Vermont showed a decrease in the number of arc lamps of 29.6 per cent with an increase in other lamps of 150.9 per cent. The gross earnings of the operating companies showed an increase of 141.8 per cent, and the horse-power of motors an increase of 750.2 per cent.

Massachusetts companies experienced a gain in income of 154.1 per cent, with a gain in corresponding expenses of 147.4 per cent. The rating of waterwheels increased 174. per cent and the rating of steam-gas engines 183.6 per cent, although there was a decrease in the number of such engines of 19.8 per cent. Stationary motors showed a gain of 540.2 per cent in rating. The decrease in the number of arc lamps during the decade was 1.9 per cent, while the increase in other varieties of lamps was 229 per cent over the arc.

TABLE II—CENSUS RETURNS OF NEW ENGLAND BY INDIVIDUAL STATES

	MAINE			NEW HAMPSHIRE			VERMONT		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of establishments	79	81	52	59	56	51	61	60	52
Commercial	75	77	50	56	52	50	48	47	41
Municipal	4	4	2	3	4	1	13	13	11
Income	$2,044,280	$1,453,016	$692,350	$2,326,998	$1,422,345	$832,322	$1,173,851	$841,701	$485,505
Light, heat and power	$1,740,858	$1,324,648	$668,575	$2,199,468	$1,321,296	$826,176	$1,128,287	$795,391	$461,898
All other sources	$303,422	$128,368	$23,775	$127,530	$101,049	$6,146	$45,564	$46,310	$23,607
Total expenses, including salaries and wages	$1,577,938	$1,181,255	$571,089	$1,596,152	$912,214	$554,967	$824,443	$682,003	$333,853
Total number of persons employed	629	502	340	578	422	294	340	297	242
Total horse-power	89,683	57,880	24,889	84,228	46,784	28,096	50,363	38,566	23,857
Steam and gas engines (including turbines):									
Number	61	75	57	67	52	44	42	39	37
Horse-power	19,745	17,043	11,080	27,291	20,375	12,690	15,091	9,969	7,561
Waterwheels:									
Number	175	132	54	115	101	78	99	101	80
Horse-power	69,938	39,766	13,046	56,937	25,404	15,406	35,272	28,472	16,296
Kilowatt rating of dynamos	58,757	39,290	15,291	57,768	31,917	17,777	29,468	21,854	11,442
Output of stations, kilowatt-hours	117,092,565	66,136,651	21,987,700	126,593,970	55,258,921	27,377,793	56,552,977	29,923,333	22,374,060
Estimated number of lamps wired for service:									
Arc	1,863	3,187	2,254	1,900	3,510	2,879	1,080	1,866	1,534
All other varieties	481,748	443,192	204,632	397,491	301,734	170,541	404,151	306,245	161,106
Stationary motors served:									
Number	2,258	1,304	525	1,958	1,061	415	1,966	776	273
Horse-power	32,535	19,372	6,437	18,488	10,231	4,583	23,695	9,778	2,787

TABLE II (CONTINUED)

	MASSACHUSETTS			RHODE ISLAND			CONNECTICUT		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of establishments	117	120	114	8	7	7	44	41	38
Commercial	87	96	97	7	6	6	38	36	35
Municipal	30	24	17	1	1	1	6	5	3
Income	$16,111,496	$10,749,240	$6,340,944	$2,305,176	$1,724,659	$1,026,407	$5,345,640	$2,469,543	$1,319,549
Light, heat and power	$15,801,050	$10,602,498	$6,244,882	$2,204,999	$1,627,190	$985,595	$5,055,220	$2,452,359	$1,317,512
All other sources	$310,446	$146,742	$96,062	$100,177	$97,469	$40,812	$290,420	$17,184	$2,037
Total expenses, including salaries and wages	$11,651,739	$7,065,197	$4,708,732	$1,654,848	$1,052,695	$803,161	$4,109,311	$1,682,231	$981,831
Total number of persons employed	3,954	2,672	2,024	511	450	274	1,340	745	499
Total horse-power	350,780	188,335	124,213	50,499	27,986	17,600	90,257	56,243	28,389
Steam and gas engines (including turbines):									
Number	292	319	364	23	32	28	125	117	93
Horse-power	326,300	170,714	115,069	48,059	25,500	15,650	90,257	37,949	21,446
Waterwheels:									
Number	58	58	41	13	16	11	51	54	31
Horse-power	24,480	16,781	8,933	2,440	2,263	1,925	19,434	18,045	6,565
Kilowatt rating of dynamos	252,732	135,924	90,624	38,509	21,040	12,139	77,655	39,363	15,516
Output of stations, kilowatt-hours	386,254,294	219,425,607	125,813,392	62,106,528	35,651,323	23,436,435	130,672,201	67,406,232	26,738,121
Estimated number of lamps wired for service:									
Arc	28,238	33,869	28,790	4,419	5,970	5,161	7,182	7,639	6,399
All other varieties	4,687,246	2,655,303	1,420,963	640,769	385,329	196.188	1,346,508	586,887	271,805
Stationary motors served:									
Number	37,191	15,877	9,663	3,690	2,082	989	7,979	2,741	871
Horse-power	228,868	81,246	35,749	28,186	12,917	6,236	59,536	21,146	6,371

The gain in gross earnings of the companies in Rhode Island during the decade was 125 per cent. There was a marked decrease in the number of steam and gas engines and also in the number of arc lamps in service, a loss of 17.9 per cent in the case of the former and of 14.4 per cent in the case of the latter. The increase in horse-power rating of steam and gas engines was 207 per cent, and stationary motors showed an increase of 352 per cent in rating.

Connecticut showed a substantial gain in the income of operating companies of 305 per cent; the rating of generators increased over 400 per cent and the output 388 per cent. There was an increase in the number of lamps other than arc lamps of 395 per cent, and the horse-power rating of motors installed during the decade showed a remarkable increase of 834 per cent.

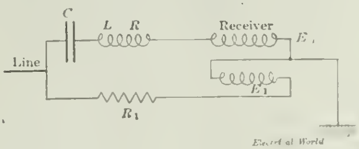
One would expect that the great manufacturing states of Massachusetts, Rhode Island and Connecticut would show greater incomes per capita than the others. However, New Hampshire shows the greatest income per capita of the New England States, the income exceeding that of Massachusetts and Connecticut (which have approximately the same income per capita) by 12½ per cent. Rhode Island is the fourth state on the basis of income per capita, Vermont the fifth, and Maine the last. The income per capita of New Hampshire exceeded that of Maine by nearly 100 per cent.

Avoiding Telephone and Telegraph Disturbances from Single-Phase Lines

Mr. G. Girousse, engineer of telegraphs, France, discussed in the Dec. 6, 1913, issue of *La Lumière Electrique* several methods that are available for minimizing the disturbance produced by single-phase distribution systems upon telephone and ground-return telegraph circuits. Four remedies are available, namely, the use of compensating devices, the shifting of such circuits to pole lines at least 1 mile distant from the high-tension route placing them underground and doubling them by adding return wires. All remedies but the first are rejected by M. Girousse as too costly. He states that for telegraph lines very satisfactory results have been obtained with the following inexpensive schemes as first tried in the latter part of 1911 on the 6000-volt, twenty-five-cycle Maritime Alps, the 10,000-volt, twenty-five-cycle Haute Vienne and the 12,000-volt, twenty-five-cycle Oriental Pyrénées single-phase systems. Since then complete installations have been made for the first two lines named, and the equipments for the Oriental, Haute and Basse Pyrénées lines will soon be in place.

Protection of Telegraph Circuits

As shown in the accompanying wiring diagram, use is made of a receiver wound with two coils having the same number of turns and connected differentially. One of the coils is in series with a condenser *C* and a self-inductance *L;* the other is in series with a resistance R_1. As the telegraphic current is continuous, it does not traverse the former coil, and consequently the receiver acts in the normal fashion.



CIRCUITS OF DOUBLE-COIL RECEIVER

If the two circuits present the same resistance and the same reactance, the disturbing alternating current will divide in two parts alike in amount and phase, and consequently the receiver will not be disturbed. It is clear that these conditions are satisfied theoretically when there is resonance between the capacity *C* and the self-inductance *L* for the frequency of the disturbing current, and that *R*, the resistance of the self-inductance coil, is equal to the resistance R_1. When the conditions are carefully determined in advance, an arrangement of this kind will give good results without readjustment from time to time.

Protection of Telephone Circuits

Telephone circuits require both good insulation and minimum inductance. The insulators should be of the industrial type with large petticoats instead of the present French type with two bells. The petticoat insulators are much easier to maintain, particularly in cleaning, and they cost little more. The insulating points on telephone circuits which leave most to be desired are the underground sections which until lately have been freely installed at crossings with heavy current transmission lines. These underground sections, especially at the junctions with aerial lines, constitute the weakest points of a telephone circuit and should be avoided wherever possible.

It is also necessary to take certain precautions at the telegraph offices, for it is useless to insulate the line carefully if the office equipment suffers ground losses. To remove the interurban circuits from the bad influences due to losses either on the lines or the inside equipments, it is best to isolate the circuits by means of transformers. Excellent transformers which insulate against high-tension current are now available.

On some of the existing installations the interference with lines within the influence of induction from single-phase track circuits has been caused frequently by carbon lightning arresters. The extreme sensitiveness of these arresters is usually a valuable quality, but when their nearness to single-phase circuits causes excessive operation, the particles of carbon become detached. Disintegration causes leakage to ground which cannot be neglected. Therefore, it is desirable to replace such apparatus by arresters of either the horn or the vacuum type. This change will prevent the destruction of the arresters, but it is still necessary to provide means for avoiding shocks. If transformers were used, they would protect the office force but they would not protect the workmen on the line. In order to eliminate all dangerous high tensions, grounding discharge coils should be installed. These coils should be of the Cailho type which are used for telegraphing on telephonic circuits. As ordinarily made, this coil is not intended to take care of the high-voltage currents induced by single-phase circuits. A modification for the latter purpose, known as the Perego coil, has given good results on the circuits of the Oriental Pyrénées lines.

M. Girousse stated that the single-phase lines as usually installed to date offer grave difficulties to telephone and telegraph circuits. It is desirable that these troubles be made negligible. While it is difficult to make the above changes on existing lines, the methods described do permit the satisfactory operation of telephone and telegraph circuits at a very small additional expense.

Parcel-Post Delivery with Electric Trucks in New York City

Twelve of the electric trucks in the service of the New York post office are now engaged exclusively in delivering to addressees large and heavy packages sent through the parcels post. Accompanied by their drivers these vehicles are leased to the post office on the basis of a working day of eight hours out of a given ten, after which an extra charge is made for overtime. Each wagon when in service is in charge of a post office carrier who directs the driver where to go and himself attends to making the actual deliveries. The electric truck thus becomes in effect a huge portable "mail-bag" for the carrier assigned to the route. Only the heavier and bulkier parcels, of course, are thus delivered by truck, all lighter packages being handled by deliverymen on foot where feasible. In addition to these electric trucks, a number of horse-drawn wagons and several gasoline trucks are also in use for parcel delivery in the metropolitan district.

The twelve electric trucks referred to (some of which are illustrated in the accompanying halftones) make deliveries from nineteen postal substations. Service was begun in January of last year coincident with the inauguration of the parcels post, seven vehicles being used during the first months. Later this number was increased to fifteen, but with the cessation of service in the Bronx and Westchester County, three of the wagons were transferred to other duties, leaving the present "even dozen" in parcel-post service. These trucks are of General Vehicle Company manufacture and are all 1000-lb. wagons, with the exception of a 1-ton truck used to convey bulky matter from the Madison Square postal substation. The type of light wagon found preferable for parcels-post delivery duty is seen to advantage in the foreground of Fig. 1, which shows a number of these electric delivery cars standing in front of the Lawrence Street garage of the Motor Delivery Company, which furnishes the trucks and drivers to the post office.

During the month of December, 1913, the twelve electric trucks of the company were in service twenty-seven days, traveling altogether 7111 miles and delivering 98,243 parcels. At this rate the parcel-post truck fleet covered an average distance of 263 miles per day, or 22 miles per individual vehicle. Deliveries were made at the rate of 3628 parcels per day, or about 303 per day per vehicle. The average distance traveled per package delivered was 0.0724 mile, or 382 ft. At the rental paid by the government for this delivery service the average cost per parcel was 3.3 cents, not including, however, the salary of the carrier who accompanied the truck on its rounds and made the actual deliveries to addressees. Generally similar values were obtained for the same service during November.

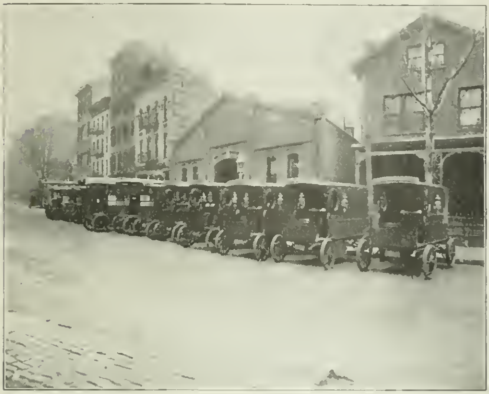


FIG. 1—ELECTRIC TRUCKS FOR PARCEL-POST DELIVERY, NEW YORK CITY

In addition to the electric wagons herein referred to, which as noted are employed exclusively for parcel-post delivery, a number of larger electric trucks are used for mail haulage between the New York City depots and postal stations. Some of these cars have been in service five or six years, having been used twenty-four hours a day and every day in the year during much of this period. Such mail service, according to those familiar with its requirements, is one of the most exacting to which commercial trucks can be applied, but has been negotiated with flying honors by the "electrics."

FIG. 2—INTERIOR OF LAWRENCE STREET GARAGE

The parcel-post wagons above described are leased to the post office by the Motor Delivery Company, New York, of which Mr. C. H. Bardwell is president.

Coolidge Patent on Ductile Tungsten

On Dec. 30, 1913, there was issued to Dr. William D. Coolidge, Schenectady, N. Y., a patent on "Tungsten and Method of Making the Same for Use as Filaments of Incandescent Electric Lamps and for Other Purposes." The serial application in this case, filed June 19, 1912, was in part an extension of four prior applications, the earliest under date of July 2, 1906. The invention covered by this patent is the now well-known ductile tungsten for incandescent-lamp filaments and other uses, which was discovered in the research laboratory of the General Electric Company. The following description of the process and the properties of the resulting material is drawn from the patent specification:

The tungsten of the prior art was obtained in the form of a steel-gray to black powder, having a fusing point at about 3200 deg. C. The metal itself, as produced in lamp filaments manufactured by the extrusion or "squirted" process, was invariably brittle and refractory and unsusceptible of being wrought or drawn into wire. The new process of making wrought or ductile tungsten is divisible into two stages, the preparation of an ingot or billet of tungsten and the working or fabrication of the ingot to desired shape. Commercially pure tungstic oxide (WO_3) is first dissolved in ammonia water, forming ammonium tungstate, then purified by crystallization over a steam bath, washed with distilled water, dried, and next decomposed by moderate heat—400 deg. to 500 deg. C.—which drives off the ammonia and leaves purified tungstic oxide. This is heated in a gas furnace for about five hours, in a covered Hessian or Battersea crucible, after which it becomes coarser and of higher density and contains new matter which is probably volatilized from the crucible, consisting largely of alumina and silica. The effect of these substances is found to be most beneficial when present to the extent of from 0.8 to 1.5 per cent. The material is then ground, and the firing operation repeated, if necessary, with a new crucible each time.

The next operation is performed in a tube of porcelain or fused quartz, having a diameter of 1.5 in. and a length of 24 in. This tube is packed nearly full of tungstic oxide except for spaces at each end and is gradually raised in a period of six or seven hours to a temperature of from 900 deg. to 1150 deg. C. Crystallinity in the metal powder is avoided by the slow raising of the temperature. Pure dry hydrogen is passed through the tube meantime for a period of from, say, six to fifteen hours. In this operation the tungstic oxide, or so-called "yellow oxide," is progressively reduced to the blue oxide, then to the brown oxide and then to the pure metal.

This powdered tungsten is next compressed in hydraulic presses, of great strength and rigidity, into sticks which, for example, may be ¼ in. square and 6 in. long. When removed from the mold the stick is slid gently onto a strip of molybdenum or tungsten and placed in an electric furnace of porcelain or alundum, and fired in a hydrogen atmosphere at, say, 1200 deg. C. for a period of from ten minutes to one hour, or long enough to make the stick sufficiently strong to permit handling readily. Next the stick is sintered in a closed vessel ordinarily of copper, containing a hydrogen or other reducing atmosphere; an electric current is passed through the stick to bring it to a blinding white heat (about 2800 deg. C.). In the case of the ¼-in. rod the preferred method is to sinter with an alternating current of from 1700 amp to 1800 amp for fifteen minutes. The stick is thereby sintered into a slug of coherent metal.

The next step is the hot mechanical working, first in a special swaging machine. The billet is preheated to a temperature of from 1300 deg. to 1700 deg. C before its introduction between the swaging dies, through which it is passed very rapidly, with only a slight reduction in each pass. This operation is repeated numerous times, and after five passes the ¼-in. billet has become a circular rod 0.210 in. in diameter. There are ten steps in reducing this to a diameter of 0.060 in., the method of hot-working before mentioned being followed throughout. In six or seven more passes the diameter becomes reduced to 0.030 in. The temperature of the rod, which was at white heat in the early stages, is reduced to a yellow-red heat at a diameter of about 0.040 in. When a diameter of 0.030 in. has been attained the metal is ductile at room temperature.

Further reductions are accomplished by hot-drawing, with diamand dies heated to from 600 deg. to 650 deg.C., and the wire at a red heat. The diameter is reduced in this way, by 1-mil drafts, to 0.014 in.; then, by 0.5-mil drafts, to 0.0055 in.; next, by 0.25-mil drafts, to 0.004 in.; then by 0.2-mil drafts to 0.002 in., by 0.1-mil drafts to 0.0014 in., and finally by 0.05-mil drafts to a diameter of only 0.0005 in., or 0.5 mil.

The inventor states that the form of tungsten which he has produced is a new product differing radically from any form of tungsten heretofore obtained Not only is it pliable and ductile at room temperature, but it is strong and tough. It is said to be substantially non-oxidizing in moist air at ordinary temperatures and resists the action of acids to an unusual degree. Its specific gravity is higher than that of sintered tungsten and in certain samples has run to from 19.15 to 19.3. The tensile strength is exceedingly high, being found in certain samples of 0.001-in. diameter wire as high as from 600,000 lb. to 650,000 lb. per sq. in. It is non-magnetic, not easily corroded, and is elastic and resilient.

Methods of working the metal by hammering, forging and rolling are also described. The inventor states that the heat treatment is one of the particular features of his invention, too high a temperature at the outset, or much over 1500 deg. C., tending to prevent the change from crystalline to fibrous structure under mechanical working, and set up a reverse change. Later the temperature may be reduced to some 1200 deg. C. or lower, as the mechanical working progresses and the desired properties commence to appear. The somewhat elaborate preparation of the metal for the swaging process, the inventor states, is necessary in order to bring it into a favorable molecular condition for the ensuing treatment and working.

The use of the Battersea crucible, as before described, is claimed to render the metal when fabricated into lamp filaments immune to the tendency to "offset," or crystallize along a transverse section and develop a shear or offset at this weak point. Unless so treated, the metal when used at high temperatures tends to revert to the crystalline form.

The patent contains thirty-four claims, among which the following are suggestive and typical:

"1. The process of producing tungsten having a fibrous structure which consists in repeatedly hot-working a crystalline body of tungsten until the crystalline structure is broken down and a fibrous structure developed.

"2. The process which consists in agglomerating tungsten powder, sintering the body thus formed, subjecting it to repeated hot-working, and continuing such hot-working until the body remains ductile when cold.

"8. The method of producing pliable tungsten wire for lamp filaments, which consists in first producing a body of tungsten in a sintered state and free from oxygen carbon and other impurities which would render the body unworkable mechanically and then subjecting this sintered and purified body to mechanical working many times repeated, with gradual reduction in diameter and elongation in length.

"12. The process which consists in reducing tungsten oxide to coarse tungsten powder, agglomerating said powder into a coherent porous body, heating said body to drive out impurities and sinter the body, and then subjecting the body to hot mechanical working.

"14. The process which consists in forming a body of tungsten powder containing additional material which will prevent coarse crystallization of the tungsten at high temperature, sintering the body and then subjecting it to hot mechanical working.

"22. The method of securing a ductile metal body without previous melting of the metal, which consists in producing a compact body of metal from divided metalliferous material, consolidating said body by heating to a temperature less than the melting temperature and such as to produce a body of metal non-ductile when cold, subjecting the body to repeated mechanical working while in a heated condition, and continuing the working until the body is ductile without the application of heat.

"26. Substantially pure tungsten having ductility and high tensile strength.

"29. An incandescent electric lamp having a filament formed of ductile tungsten.

"34. Wrought tungsten, a solid coherent material characterized by the presence of crystals deformed by mechanical working."

One of the interesting features of this patent is its history in the Patent Office. The primary examiner rejected the entire application on the ground of prior disclosures in British patents No. 21,513 of 1906, No. 3174 of 1907, No. 16,530 of 1907 and No. 24,179 of 1906. The examiner also held that certain claims should be divided, under another application, and that some of the other claims were duplicates in patentable effect. In a decision of the board of examiners-in-chief, filed on Nov. 15, 1913, the citation of the first three British patents named above was rejected on account of their having been filed subsequent to July 2, 1906, the earliest filing date in the Coolidge application. The members of the board also dismissed the other contentions of the primary examiner except as to duplication of claims, and the latter ruling was over-ruled by the examiner-in-chief, so that the original application was finally allowed intact.

Discussion of Nitrogen-Filled Lamps at Boston

At the December meeting of the New England Section of the Illuminating Engineering Society Mr. L. A. Hawkins, engineer of the research laboratory of the General Electric Company, gave a lecture on the nitrogen-filled lamp and its possibilities. After reviewing in considerable detail the investigations leading to the production of the so-called "half-watt" lamp, the speaker discussed the study of evaporation problems in relation to filament life and diameter, automatic compensation of the filament for local variations in temperature, usefulness of spiral filaments, heat losses and bulb deposits. He also exhibited the latest forms of lamps, including the high-current lamp requiring 0.40 watt to 0.45 watt per mean hemispherical candle-power and smaller units adapted to stereopticon and head-lamp work.

It was pointed out that in using series lamps on lines subject to current fluctuations a compensator designed with a saturated core is desirable. The compensator provides a reactance which shunts the lamp in case it burns out. A 6.6-amp lamp is now being developed giving 1000 mean hemispherical candle-power with a power input of 750 watts. In the larger sizes the lamp casings are ventilated and diffusing globes are desirable. A 350-watt, 450-cp lamp is being developed for projector work. Other gases are being tested for the bulb filling, notably argon, which has a lower heat conductivity than nitrogen and a slightly less rate of evaporation. No radical change in lamp design is likely to follow the use of argon or mercury vapor.

Mr. Hawkins said that while the nitrogen-filled lamp joins issue with the arc lamp, the latter is probably much further from its ultimate possibilities than the nitrogen lamp. A specific consumption of 0.2 watt per cp is close to the melting point of the tungsten filament, whereas such limitation does not exist in the efficiency development of the arc lamp. No fear exists in well-informed circles that the arc lamp will be driven from the field. Both types will contribute to better service and longer life of illuminants. The time has passed when any fear need be felt by the development of any new and useful electrical appliance.

Discussion

Dr. Louis Bell, Boston, said that the absence of relation between the diameter of the filament and the loss of heat from it is the fundamental point in the nitrogen lamp's success. In the older days an inert gas was used to stop oxidation in lamp bulbs instead of to prevent evaporation. He said that in Europe last summer he had seen lamps ranging from 500 up to 5000 cp in size and pointed out the increased life tending to result from the use of lamps with long chambers and spherical bulbs. A life of from 800 hours to 1000 hours is reported on lamps of 600 cp to 1000 cp designed for multiple operation on small currents. Dr. Bell pointed out that his own tests had shown specific consumptions of 0.65 watt to 0.75 watt per cp in bare lamps designed for multiple service. In the globes a loss of 15 to 20 per cent more occurs, so that the initial consumption of the lighting unit is apt to be not far from 0.75 watt per candle in present designs of lamps. This may possibly be increased by the use of argon. As the efficiency of the modern arc lamp begins about where the nitrogen-filled lamp leaves off, the effect of the latter on the former is bound to be problematical. The speaker stated that he had recently seen an arc lamp in Paris with a consumption of 0.175 watt per mean lower hemispherical candle-power and had verified this figure by careful inquiry and examination of the original tests. The nitrogen-filled lamp is an efficient and powerful unit particularly adapted to alternating-current suburban districts, but there is no doubt that the modern arc lamp and its developments will still be used under favorable conditions in much of the practice of the future.

Mr. Alexander Macomber, Tenney Companies, Boston, spoke of the extensive development in glassware and shades likely to result from the intense brilliancy of the filament in the nitrogen lamp. Chairman C. A. B. Halvorson, Jr., Lynn, Mass., touched upon the possibilities of the nitrogen lamp in indirect lighting. Mr. George H. Stickney, General Electric Company, urged doing everything possible to improve the illumination furnished by existing equipment, absorbing more light in devices which make the light pleasant. Improved diffusion is demanded all along the line. The nitrogen lamp's freedom from adjustment is a valuable point. Used in head-lamp service on railroads where the laws are restrictive, for automobile service, for small moving-picture machines and in projectors for homes and schools, the nitrogen lamp is bound to give a good account of itself. Semi-indirect and indirect lighting is coming with these lamps.

Closing the discussion, Mr. Hawkins said that the efficiency of the compensator is about 95 per cent at 60 cycles, if designed only as a voltage transformer, its power-factor being from 98 to 99 per cent. To get shunt protection and to reduce the current fluctuations on the line, the efficiency is reduced to 90 per cent and the power-factor to about 90 per cent. The compensator lowers the specific consumption about 0.06 watt per candle-power. The 750-watt, 110-volt, 6.6-amp lamp has a life of about 900 hours at a specific consumption of 0.7 watt per cp, whereas the 20-amp lamp, at 0.5 watt consumption, gives a life of about 1800 hours. For prolonged rises in voltage these lamps are more sensitive than vacuum lamps, as the filaments are run closer to the melting point. So far as sudden surges of one second or less go, the nitrogen lamps, especially of the high-current type, stands the variation better than the vacuum lamp. The only effect of temperature is that if the lamps get too hot they blacken on account of an increase in the amount of water vapor given off. One of these nitrogen lamps will run at a temperature of nearly 200 deg. C. near the top of the lamp, so that proper ventilation is most essential.

The nitrogen lamp has no effect on house lighting, but opens a new field for incandescent-lamp service. Its probable life depends on the size of the filament and the efficiency. On high-current lamps a commercial life well above 1000 hours can safely be predicted. For lower current lamps a small change in efficiency affects the life to a large extent. The lowest current thus far used is in applications for projector work, where 3-amp size or lower are employed. The life is correspondingly shortened to about 200 hours, but this is not important in this particular class of service. For general illumination at least 5 amp must be employed. The nitrogen lamp has a candle-power depreciation due to evaporation. This has been tested to be 80 per cent of the initial lumens after 2000 hours' service. Much can be done in designing, however, to change this one way or the other. Under ordinary vibration the filament stands up well, and its softness and ductility when hot are favorable to long life.

Standardization of Public Utilities Service

On page 30 of our issue dated Jan. 3, 1914, was printed a part of a paper read by Dr. Edward B. Rosa, chief physicist United States Bureau of Standards, before the American Association for the Advancement of Science at Atlanta, Ga., on Dec. 31. The rest of the paper, explaining in further detail the ideas of Dr. Rosa on the "Standardization of Public Utilities Service," follows:

Monopoly and Regulation

Public utilities are no longer regarded as private business corporations, entitled to charge all the traffic will bear and to make all the money they can. On the contrary, they are now regarded as of a public character, enjoying a monopoly of the market but owing a duty to the public and entitled only to a reasonable return on their investments. Their duty to the public consists in rendering safe and adequate service at just and equitable rates. In return the utility is entitled to protection of its investment and to such dividends that the stockholders will have no just cause for complaint and that money may be had whenever necessary for extensions and improvements. Under this system, if a city wishes to own a given utility or all of its utilities, it may not build anew and disregard the property rights of existing utility companies, but should purchase such properties at fair valuations. Neither should a city grant a franchise to a second company which proposes to compete with the first, even though it were offered a valuable consideration for such franchise. The justification for all this, of course, is that one company with all the business of a given utility can usually render better service than two or more could do with the business divided between them.

Thus it appears that the utility company is guaranteed a monopoly of the business, protection of its capital and a fair rate of return thereon. It in turn is expected to render the best service possible for the charges made; if a more expensive service is required than the company can afford to give, the public must pay higher rates. To secure good service and good management, competent managers and superintendents and operators must be employed, and the rates paid by the customers of the utilities (whether it be for gas or electricity or water, or for telephone or street-car service) must be high enough to permit good salaries and good wages to be paid. In short, the public pays all the expenses of operating the utilities, including salaries of officers, wages of employees, cost of expert engineers, dividends on capital, taxes, waste due to inefficient management if there be such, graft or commissions on purchases if any, and the expenses of the public service commission which regulates the utilities, and it gets in return such service as the utilities render at rates from which there is no appeal except to a public service commission where there are such commissions. In more than half of the states of the Union commissions are now established.

It is therefore no wonder that under these circumstances there is an urgent public demand for competent and adequate regulation of public utilities by public service commissions, such regulation comprehending not only the adoption of rules specifying the service that shall be rendered and fixing or approving the rates that shall be charged, but including also effective inspection to see that the service corresponds with the requirements and that the management is competent and efficient.

It may appear to some that a public service commission is going beyond its proper sphere when it inquires into questions of efficiency of management and honesty of administration. But if it be conceded that the stockholders are to receive a fair return on their investment, and the public is to get no better service than the company can give consistently with such dividends, it is readily seen that any loss due to inefficiency of process or apparatus or to incompetent or dishonest management comes mainly, if not entirely, out of the public rather than from the officers or stockholders. Hence the supervision and control by the public service commissions must be detailed and far-reaching if the public is to realize the full measure of protection which the system is designed to afford.

Such regulation corresponds with the view that "the fundamental relationship existing between the public and its public utilities is that of principal and agent." Of course, it is not expected that such regulation can be realized everywhere at once. It will require years to develop the new system to a state approximating completeness and perfection. In the meantime all degrees of regulation may be expected, down to the merest beginnings in which rules are adopted and reports received but inspections are scant and rates are scarcely considered.

Quantity and Quality of Service

The principal elements which determine the value of service as well as of commodities are quality and quantity; in some cases the time and rate of delivery are also important elements. The quantity may be measured by meters—for example, gas meters, electric meters or water meters—or by count or time as in telephone service, or by the number of rides or distance traveled as in street railway service. It is comparatively easy to measure quantity of service in most of these cases, although effort and vigilance are needed to insure satisfactory meter accuracy and to adjust errors and satisfy complaints. But to specify the quality of service and to determine what (under given conditions) is good service and to ascertain whether the quality of service that has been specified is actually rendered is a much more difficult matter.

There is no absolute standard of quality of public utility service. In general, the better the service the more it costs, although the difference in cost between good and indifferent service is not the same under different circumstances. Thus in a large city continuity of service and uniformity of voltage in electric lighting may be secured at a smaller relative increase in cost than in a smaller city, and the requirements as to continuity of service and quality of transmission may be higher in an underground telephone system than in an overhead system. Aside, however, from any question of difference in quality of service due to different conditions, it is difficult enough to specify what constitutes safe and adequate service under average conditions, and very few public service commissions and very few utility companies have as yet attempted to do this for the electric utilities.

For gas service it has been done more or less successfully for many years, and many cities have ordinances which specify the service required, and in some cases gas inspectors make systematic tests to ascertain whether the service specified is being furnished, and often fines are imposed if it is not. The Bureau of Standards has made an extended study of the subject of specifications for manufactured gas and gas service, and a detailed report on the subject has been published. But no corresponding publication has been issued for electric service.

A similar thorough study of the electrical utilities should be carried out, and the requirements of good service under varying conditions formulated, and the relation between improved quality of service and the increase in the cost of the same determined. It is easy to make rules as to meter accuracy or as to variations of voltage at customers' premises or as to interruptions of service. But in framing such rules the possible increased cost of the service should be taken into account. The life of electric lamps and their candle-power vary greatly with a change of voltage, and hence good service requires steady voltage. This involves good construction, competent operation, correct instruments and careful inspection or voltage surveys.

Again rules with regard to frequency of street railway service, percentage of passengers seated in rush hours, character of cars and quality of the heating, lighting and ventilation of the same must all be made in view of the expense involved, for the public cannot get any more than it pays for, and under ideal regulation the requirements are so made that the public gets the maximum of service, considering quantity and quality, for every dollar expended.

Rates and Specifications

If a telephone company, for example, alleges that its rates are fair for the kind of service it is giving, and that its management is competent and progressive, there should be some well understood standards of performance by which to judge the said company and to determine whether the claim is justified. Again, if an electric light and power company claims that its relatively large capital investment is due to superior machinery and more spare units than usual and better construction than the average, there should be standards of service as to efficiency and continuity and uniformity by which to determine whether such a claim is justified. A still more important reason for such standardization of service is that managers and directors of utility companies may know more definitely the kind of service they should strive to give the public and have a definite guide in planning extensions and improvements. Better service will generally involve more expensive equipment and more intelligent and hence more expensive labor.

Whether a manager is spending the stockholders' or the public's money, it is very desirable that as definite service specifications as possible be formulated for his guidance both in the equipment and in the operation of his plant.

This does not mean that such rules need be carried to unnecessary extremes, but that in a careful and conservative way, and with the co-operation of the utility companies, rules be prepared which are both reasonable and progressive. It would thus be possible for utility companies that chose to do so to conform to requirements so fully as to leave in the way of enforcement little for the commissions to do. In other words, they may be largely self-regulating, just as other corporations may obey the law voluntarily if the law is sufficiently clear and explicit so that it can be readily understood. For the information of the public it is also of importance to have such specifications, that it may be generally known what the companies are expected to do.

Managers of utilities can report their performance to the municipalities or public service commissions, and they can receive public credit for good performance as well as criticism for poor performance. Such specifications would serve as a guide to inspectors. Good inspection without them is hardly possible. In short, it seems as necessary for the public utilities to be standardized as to service and efficiency and to have regulations or specifications adopted for each class of utilities as it is to have specifications written to accompany contracts for other kinds of service.

Bureau of Standards

To make it clear why the Bureau of Standards is the proper federal agency to undertake this work it is desirable to explain briefly what the bureau is and how it does its work, and to give some examples of work of the kind proposed that it has already done.

The Bureau of Standards is a national standardizing and research institution, working chiefly in the fields of physics and chemistry and of electrical, mechanical and civil engineering. It is one of the newest of the federal bureaus and is not as well known as some of the others.

Foods and drugs, as you know, are studied and tested by the Bureau of Chemistry of the Agricultural Department; geological problems are studied by the Geological Survey; the problems of mining and the economic treatment of minerals are studied by the Bureau of Mines; meteorological problems and weather prediction are studied by the Weather Bureau, and a score of other bureaus have their various fields of activity.

But outside of all these there is a vast amount of work both of investigation and testing in connection with scientific and ordinary weights and measures, electrical and magnetic instruments and measurements, both scientific and commercial; photometric testing; thermometers, pyrometers, calorimeters and other heat-measuring instruments, optical instruments and light measurements, inorganic chemistry and the preparation of standard samples used in analysis; the testing of all kinds of structural materials, and of paper, textiles, etc., and the preparation of standard specifications and improvements in methods of testing.

It will be seen from what has been said that the bureau is investigating and testing many of the instruments used by the public utility companies, and it has an unrivalled equipment for such work. It has also investigated some of the problems of the utility companies and has an organization ready to take up further work as soon as the funds are provided to enlarge its staff.

The Bureau of Standards always seeks information at first hand, and in studying utility problems it works in the field as well as in the laboratory and freely consults those having valuable experience. As a national bureau it has the advantage of getting information from all parts of the country and from all classes of engineers and operators. Its engineers and experts are unbiased and absolutely independent and there is less likelihood of prejudice from personal interest or preconceived notions than if the investigations were of a local character.

Investigations Now in Progress

Reference has already been made to the investigations of the bureau on the measuring instruments used by utility companies, such as gas and electric meters, and electrical testing instruments, calorimeters, photometers and the methods of measurement and testing employed, as well as to the investigations of the bureau on the manufacture and distribution of illuminating gas.

One phase of the subject of gas manufacture that has received considerable attention is the most economical heating values for different kinds of gas. At the present time the bureau is making a study of this question with reference to gas made from crude petroleum as it is done on the Pacific Coast, this study being undertaken at the joint request of the Public Service Commissions of Oregon and California and a committee of the gas companies of the coast. The results of this study will be utilized by the state commissions in fixing the requirements of their respective states as to the heating value of the gas.

An extended study has been made of the damage caused to gas and water pipes, lead cable sheaths and reinforced concrete by the electric currents of street railways as they flow through the ground on their way back from the cars to the power houses, and of methods of preventing such damage, and very valuable results have been obtained. The handling of this subject by public service commissions is perhaps not expressly authorized by law, but as it is a case of the electric current used by one utility destroying the property of others it is of concern to these commissions, and the methods employed by the bureau are applicable generally.

An extensive study of the life hazard in electrical practice is now being made by the bureau (acting in co-operation with certain engineering societies) with a view of formulating rules of construction and practice to reduce the danger to employees and the public arising from electric light and power circuits. The use of electric power is constantly increasing, and the danger arising from lack of proper care in construction or operation is not alone to station operators and linemen but also to the unsuspecting public. Hence the importance of standardizing methods of construction and operation as far as practicable, so as greatly to reduce the danger, and formulating rules to that end that can be adopted by cities and public service commissions.

Closing Sessions of the American Economic Association

The sessions of the American Economic Association meeting at Minneapolis, following the opening meetings reported in our issue dated Jan. 3, 1914, were devoted mainly to the subjects of railroad rate-making, syndicalism and trust legislation.

Syndicalism

At the morning session of Dec. 30 Dr. John Graham Brooks, of Cambridge, Mass., gave a summary of his paper on "Syndicalism." This movement is a part of the great reaction all over the world against capitalism, the imperfections of the parliamentary system and the law's delays. If capitalization is as rotten as syndicalists generally believe it to be, there would seem to be some logic in their action. One of their plans is to arrange preliminary strikes by "direct action" leading up to a general strike later. Another feature of their plan contemplates an ideal state of labor co-partnership without the complicated organization of force based on law. If the existing order has failed as charged, possibly syndicalism may be justified as a sort of stinging whip from without to awaken society to the need for better things. The syndicalists believe that labor will eventually control capital. Syndicalism may be called, perhaps, the guerilla section of a great world-wide revolutionary movement. However, as so far put forth, syndicalism does not deserve an instant's serious consideration. It is important as indicating a tendency which may deserve serious study. When the trades union movement was first agitated the opposition to it was much more bitter and drastic than the criticism which is now applied to the Industrial Workers of the World. The Grange, also, was ridiculed forty years ago when it advocated regulation of railroads, parcels post and income tax and other commonplaces of to-day. The Grangers heralded a great truth, but the American people generally were too stupid to listen to it when the Granger agitation was attracting attention. Economists should give serious attention to the movement called syndicalism with open minds to see if it does not contain some measure of truth. There may be some great social changes coming to which the public may have to adapt itself.

Discussion

Prof. Karl F. Theodor Rathgen, of the Colonial Institute of Hamburg, Germany, disagreed with Dr. Brooks. Syndicalism is essentially a growth of the Romance nations, partly because in these nations there have been no great trades union organizations. It has very little hold on German workingmen. It is the socialism of the small workshop, not of the large enterprise. The movement will split up into one portion which will go into trades unions and into another that will gradually disintegrate because it underestimates the persisting force of society as organized at the present day.

Prof. M. B. Hammond, Ohio State University, declared that it is true that the trades unions have done little for unskilled labor, but the syndicalists have no well thought-out method of reform. Their methods can create annoyance but apparently nothing else. But, weak as syndicalism is in its philosophy, it nevertheless excites sympathy. It is no worse, perhaps, than the corruption existing as the result of capitalism.

Prof. R. F. Hoxie, University of Chicago, was opposed to a mystical concept of syndicalism and said that there has been a tremendous over-estimate of the strength of this upheaval in the American labor movement. The syndicalistic character of the Industrial Workers of the World, even, is not altogether established. Furthermore, that body has been a flat failure.

Prof. E. D. Howard, Chicago, Northwestern University, did not think that the Industrial Workers of the World is the forerunner of a revolution.

Mr. Roger W. Babson, Wellesley Hills, Mass., said that it is well to have concentrated wealth worried as much as possible, and syndicalism does this. Sooner or later there will be a fight between inherited wealth and creative ability. This may be the fight of the syndicalists. Mr. Babson compared the extremists under discussion to those taking part in John Brown's raid before the civil war. Their efforts may also be compared to a fire alarm which may possibly arouse the middle class of American society to put out the fire.

Prof. F. S. Deibler, Northwestern University, thought that syndicalism is only the more radical expression of the social discontent. It is probable that the radical elements will fail to get on well together.

The Trust Question

Professor Gray, of the University of Minnesota, presided at the closing session on the afternoon of Dec. 30. The principal paper was by Prof. Willard E. Hotchkiss, Northwestern University, on "Recent Trust Decisions and Business." In regard to the enforcement of the Sherman law the speaker said it may be a question whether the Attorney-General, with due regard to his oath of office, can in the future safely fail to take cognizance of specific acts of prima facie violation when the court has already established the illegality of similar practices. In the main the enforcement of the Sherman law has had, and still has, a patriotic and beneficial purpose. However, the serious need of a definition for "fair competition" is clear. Professor Hotchkiss thinks that "whenever there is a clear issue between immediate business peace and ultimate business standards ultimate standards must have the right of way." The impelling forces toward the formation of the great industrial trusts were market control and the profits of organization; business efficiency had little to do with the matter. The real question to-day is, "Have the trusts "made good"? The speaker devoted considerable attention to the efficiency of trusts and concluded that the alleged superior efficiency of combinations has not yet been established. He considered efficiency in the productive rather than the acquisitive sense. One good result of government trust activity has been to break the spell of the trusts in the public mind. The government is in possession of tremendous power, for the use of which there are comparatively few effective legal checks. Business welfare is bound to depend in many instances upon political responsibility and the character of officers rather than upon concrete legal restraints.

Discussion

Prof. E. Dana Durand, of the University of Minnesota, advocated an amendment to the Sherman law defining the limitations of fair competition. Of investigating the trusts, he said, there is no end. The amount of time and labor necessary for anything like a full investigation is enormous, and if such an investigation should be made, extending over a period of perhaps twenty years, its conclusions might be questioned at the end of that time. Inasmuch as the trusts took in most of the efficient concerns in the various lines affected, it would be unfair to compare them with the concerns remaining outside. But if a trust is efficient, should it be continued merely on that ground? Nearly all of the great combinations are artificial concerns. Railroads are recognized as monopolies, but to regulate monopoly of the manufacturing industry is a far different proposition. Another question to be asked is, If the trusts are dissolved, can competition be restored?

Professor Durand held that it can be in the long run. At any rate, no new combination could be formed. It is to be remembered that a combination may be all right if it has no monopolistic power. The bringing of a suit for the dissolution of a trust or for violation of the Sherman law should not rest in the discretion of a single individual. There should be a permanent government industrial commission to advise the Attorney-General and the Supreme Court.

Prof. W. A. Rawles, Indiana University, said that most of the trust's power for evil has sprung from its artificial advantages. He favored exhaustive investigations by an interstate industrial commission, believing that the wide divergence of opinion on the trust question must be due to lack of data. He advocated the amendment of the patent laws and federal control over industrial capitalization and accounting.

Dr. F. L. McVey, president University of North Dakota, said that the present government could hardly be held responsible for the slow-down in business. He considered the present slackening in business as inevitable from the history behind the anti-trust movement. "Big business" is doubtless a legitimate present-day development, but it should be put on an efficiency, not a speculative, basis. Reasonable pooling of combination and supply may be permitted.

Prof. J. E. LeRossignol, University of Nebraska, said that he does not see that the public has received any immediate beneficial effects from the dissolution decisions of the United States Supreme Court. He thought it better to tax trusts than to control them.

Prof. G. E. Putnam, University of Kansas, advocated the establishment of some standard of certainty in the law as to what constitutes unfair methods. The question of the efficiency of the trusts is still open. Some combinations have a reason for existence, especially where prices are subject to sharp fluctuations. The speaker asked if the dissolution of the trusts will not result in pooling, which is difficult to detect, and which may tend to become permanent if there is sufficient at stake. He suggested government price regulation, properly limited, in the case of some combinations engaged in interstate commerce and advocated the establishment of an interstate bureau of industrial commerce, with limited power of control, and adapted to advise with the Department of Justice.

In closing, Professor Hotchkiss said the investigation of the trust problem must go on. He did not say that all trusts are inefficient, although the weight of recent economic opinion seems to lean that way. In relation to the comparison with public service corporations, he asked if the monopoly of anthracite-coal production has not essentially the attributes of the public-service corporation.

The paper by Dr. B. H. Meyer, of Washington, D. C., member of the Interstate Commerce Commission, on "Railroad Rate-Making," will be abstracted in a later issue.

Other Business

At the business sessions of the American Economic Association two resolutions of some general interest were adopted. One introduced by Prof. Frank A. Fetter, of Princeton University, provides for the appointment of a committee of three to examine and report upon the present situation in American educational institutions as to liberty of thought, freedom of speech and security of tenure for teachers of economics. The second resolution, introduced by Prof. E. Dana Durand, of the University of Minnesota, requests the government to send official delegates to international meetings or congresses of scientists of acknowledged reputation where European countries are officially represented. The executive committee of the association was also instructed to consider the possibility of dividing the society into Eastern and Western sections.

Dr. John H. Gray, professor of economics in the University of Minnesota, was elected president of the association, and Prof. A. A. Young, of Cornell University, was elected secretary and treasurer. The next annual meeting will probably be held in Princeton, N. J.

Public Service Commission News

Illinois Commission

The five members of the new State Public Service Utilities Commission of Illinois have been appointed by Governor Dunne. Mr. James E. Quan, of Chicago, the chairman, is a personal friend of the Governor and has been engaged in the wholesale grocery business. His present appointment is his first public office. He is a Democrat. Mr. Richard Yates, of Springfield, lawyer, is fifty-three years old and was Governor of Illinois from 1901 to 1905. He is a Republican. Mr. Frank H. Funk, of Bloomington, was formerly State Senator. He was the Progressive party candidate for Governor in 1912. Mr. Walter A. Shaw, of Chicago, is a civil engineer and a member of the Western Society of Engineers and the American Waterworks Association. He has been a member of the Rivers and Lakes Commission of the State and has been president of the American Engineering & Construction Company of Chicago. Mr. Shaw obtained his college degree as civil engineer from Valparaiso University. He has done engineering work in connection with sewerage in Chicago and Louisville. He is a Democrat. Mr. Owen P. Thompson, of Jacksonville, is a lawyer and resigned as presiding justice of the Fourth Appellate District of the State to accept appointment as a member of the board. He is a Democrat.

The commission will have headquarters in Springfield, but will also have an office in Chicago and will divide its time between the two cities.

Massachusetts Commission

The Massachusetts Public Service Commission has denied the petition of the Berkshire Street Railway for authority to build a line up Mount Greylock, the highest peak in the State. The board points out that the line would be used only for a short period yearly, that the interest charges upon its estimated cost of $1,100,000 would amount to $55,000 per year, and that the line could not pay a proper return without excessive fares.

Maryland Commission

The Consolidated Gas, Electric Light & Power Company of Baltimore has notified the Maryland Public Service Commission that it cannot furnish electric service along the Liberty Pike from Rockdale to Randallstown without heavy loss. The demand upon the company to provide the service was made by the Roslyn Grange and several individuals who alleged that a contract had been made by the Patapsco Electric Company to furnish this service. The Patapsco company was acquired by the Consolidated system.

New Jersey Commission

The Board of Public Utility Commissioners of New Jersey has issued an order authorizing the Public Service Railway to sell $620,000 first mortgage bonds of the North Hudson County Railway at not less than 99½, under a system of competitive bidding. The board recently refused to sanction the sale of this issue at 97 to the Fidelity Trust Company, holding that in justice to its stockholders the company was obligated to obtain as high a price as possible.

Current News Notes

GROWTH OF ELECTRIC SERVICE IN CHICAGO.—During the year 1913 the Commonwealth Edison Company increased its total connected load by the equivalent of about 2,400,000 50-watt units. Of this nearly 61,000 hp is due to increase in the railway load. The number of customers increased 31,098, or 17 per cent, and the output of energy for commercial lighting and power increased 22 per cent. The total connected load is equivalent to more than 13,000,000 50-watt units. The total rating of generating stations is about 350,000 kw.

* * *

EXAMINATION FOR ASSISTANT ELECTRICAL ENGINEER.—An examination for assistant electrical engineer in New York State hospitals, departments and institutions will be held on Jan. 17. Candidates who are graduates in mechanical or electrical engineering must have one year's practical experience in electrical work or in the operation of stationary steam engines and electrical machinery. The salary is from $480 to $900 per annum and maintenance. Further information may be had from the State Civil Service Commission, Albany, N. Y. No applications mailed after Jan. 7 will be accepted.

* * *

PROGRESS ON BOSTON EDISON WELFARE BUILDINGS.—The Edison Electric Illuminating Company of Boston has recently issued a twenty-page illustrated booklet outlining the features of the Welfare Buildings now under construction at the company's service headquarters on Massachusetts Avenue, Boston, and emphasizing the policy of the company with regard to their use. The company now has about 2000 employees in its 700 sq. miles of territory and is rapidly pushing the construction of three buildings specially designed to facilitate the work of the Welfare Bureau. The group consists of a library, a recreation building and a combined auditorium and dining hall, all being of fireproof construction, with terra-cotta block walls of cement finish, slate roofs and concrete foundations. The equipment of the buildings will provide practically every convenience common to the best clubs and ample provision will be made for indoor and outdoor sports. The auditorium will seat 600 persons and 400 when set up as a café.

* * *

SOCIETY MEETINGS

METER CONFERENCE OF O. E. L. A.—At Cleveland, Jan. 16, the meter committee of the Ohio Electric Light Association will hold a meeting for men interested in meter work, to which all public-service companies in the State are invited to send representatives. The session will be held in the Cleveland Electric Illuminating Company's new meter building, 6512 Carnegie Avenue, and Mr. J. T. Kermode will tell of the meter methods of the Cleveland company.

* * *

WISCONSIN ELECTRICAL CONTRACTORS.—The annual meeting of the Electrical Contractors' Association of Wisconsin will be held in the Hotel Wisconsin, Milwaukee, on Jan. 12, 13 and 14, beginning at 2 p. m. on the first day. The afternoon session of Jan. 13 will be open, and prospective members as well as jobbers and manufacturers or their agents are invited to attend. Mr. Albert Petermann, 626 Lloyd Street, Milwaukee, is secretary of the association.

* * *

MEETING OF NEW YORK STATE ELECTRICAL CONTRACTORS.—The Electrical Contractors' Association of New York State will hold its annual meeting at Shanley's in New York City on Jan. 20. There will be a closed session in the morning and a reception in the afternoon. During their stay in the city the delegates will be the guests of the Metropolitan Electrical Contractors' Association of New York City, which will provide a luncheon in the afternoon and a theater party followed by a supper and smoker in the evening.

* * *

MEETING OF PHILADELPHIA SECTION, I. E. S.—The Philadelphia Section of the Illuminating Engineering Society will meet Jan. 16, 1914. A paper, "Deficiencies of the Method of Flicker for the Photometry of Lights of Different Colors," will be presented by Prof. C. E. Ferree, and Dr. J. N. Rhoades will present a short paper on "A Reflecting Marker for All Books." As usual the meeting will be preceded with a dinner at the Engineers' Club, at which place the meeting of the section will also be held.

* * *

ELECTRIC CURRENTS AND NERVE IMPULSES.—In an address before the Society for Experimental Biology and Medicine, New York, Dec. 17, Dr. A. C. Crehore and Mr. H. B. Williams discussed the rate of travel of electric currents in conductors containing distributed capacity, considered with relation to the propagation of nerve impulses. A definite fraction of a second is, for example, required for a sensory impulse to travel from the finger tip to the brain, and the authors showed that the speed attained is exactly the rate of movement to be expected of an electric charge traversing a cable with similar distributed capacity.

* * *

INSTITUTE OF RADIO ENGINEERS.—On Jan. 7, at the annual meeting of the Institute of Radio Engineers, held at Columbia University, New York, officers for the coming year were announced at follows: Dr. L. W. Austin, president; Dr. J. S. Stone, vice-president; Mr. J. H. Hammond, Jr., treasurer; Mr. E. J. Simon, secretary, and Messrs. R. H. Marriott, J. L. Hogan, Jr., R. A. Wiegant and G. Hill, members of the board of managers. Following the election of officers Mr. R. H. Marriott read an interesting paper on the subject of range variation in wireless telegraphy. His paper was notable in being based entirely on observations taken in connection with regular commercial operation. Mr. Marriott's paper was discussed by Dr. Stone, Mr. Hogan and Dr. Lee DeForest.

* * *

MEETING OF WESTERN SOCIETY OF ENGINEERS.—At a joint meeting of the electrical section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers on Dec. 29, Mr. H. W. Young, of the Delta-Star Electric Company, Chicago, presented a paper entitled "Moderate-Capacity Outdoor High-Tension Substations." The author told of the increasing need of substation apparatus designed to serve farmers, small-motor customers and villages along the routes of high-tension lines, and gave descriptions of types of apparatus employed, illustrating many of the examples with lantern slides. Concerning continuity of service with present types of transmission equipment, Mr. Young said that interruptions under ordinary conditions are less frequent than those experienced by operators of independent plants. The paper was discussed by Messrs. O. Wingard, E. W. Allen, L. L. Perry, William B. Jackson, H. B. Gear, J. R. Cravath, L. N. Boisen, F. C. Van Etten, M. G. Lloyd and D. W. Roper. The report of the nominating committee, signed by Messrs. R. F. Schuchardt, J. R. Cravath and William B. Jackson, was read, announcing nominations for officers of the electrical section as follows: Chairman, Mr. F. J. Postel; vice-chairman, Mr. H. M. Wheeler, and member of the executive committee, Mr. E. W. Allen.

The 150,000-Volt Big Creek Development—II

Construction of 150,000-volt buses in station and arrangement of high-tension oil switches—Steel-tower transmission lines with nine-disk suspension insulators—Large synchronous condensers in substation

THE Big Creek development of the Pacific Light & Power Corporation (as noted in the first section of this article, which appeared in these columns last week) employs a line potential of 150,000 volts to transmit an ultimate output of 120,000 kw to the city of Los Angeles, 240 miles distant. In the preceding section a general description was given of the system of dams, reservoirs, pipe lines, penstocks and power houses, particular reference being devoted to Power House No. 1.

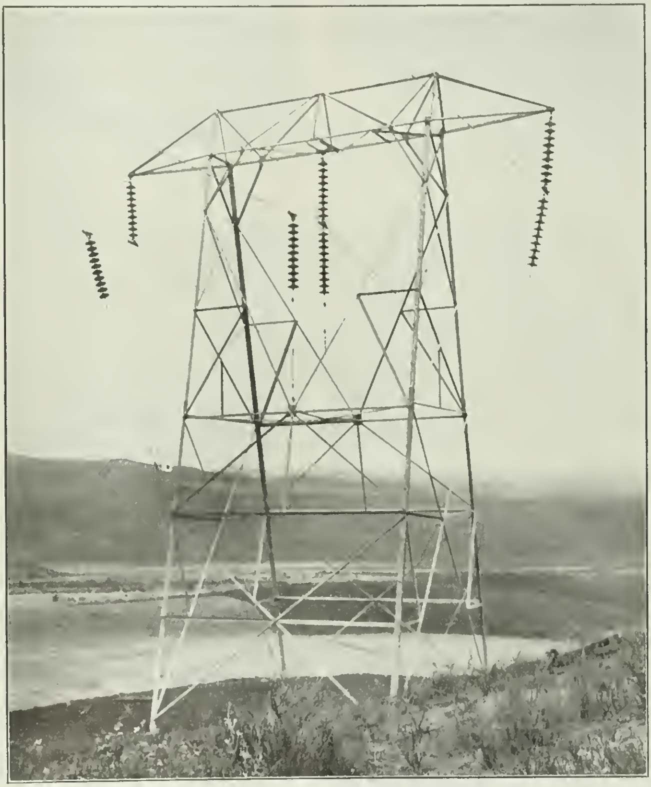


FIG. 14—150,000-VOLT TRANSMISSION-LINE TOWER, SHOWING NINE-DISK INSULATORS AND METHOD OF TYING DOWN CONDUCTORS

The tail-water from this upper plant, supplemented by the discharge of Pitman Creek, which empties into Big Creek from an adjacent watershed at a point about 1000 ft. above Plant No. 1, is impounded behind a dam of the arched type, 288 ft. long and 73 ft. high, which has been thrown across Big Creek about 500 ft. below Plant No. 1. Its crest elevation is 4805 ft. Provision for flashboards has been made as in the other dams, and a sluiceway controlled by a 72-in. gate is provided. This dam diverts the flow of water into a second tunnel 12 ft. in diameter and 21,300 ft. long, driven through the native granite on a grade of 3.2 ft. per 1000 ft. and provided at its entrance with a gate and screen similar in general design to those at the headworks of the first tunnel.

The tunnel ends in a concrete-lined surge tank 120 ft. high. The water flows from this tank through an outlet controlled by a gate 9 ft. in diameter into a 108-in. pipe 250 ft. long which connects at its lower end with a pair of pressure pipes leading to the units in Power House No. 2. With the exception of a difference of two fewer buckets in the wheels, the hydraulic features of the second station are so nearly the same as at the first station that further description is unnecessary. As stated above, the head on the second station is 120 ft. lower than that on the first, but the units are of the same rating, and on account of the greater amount of water required per horse-power of output the second station will have one less machine in the final development of the project.

In each station each pair of waterwheels drives a 50-cycle, 6600-volt revolving-field type generator of 17,500-kva rating at the normal speed of 375 r.p.m., this being the continuous rating of the generator. The generators are the largest of their type thus far built and are sufficient in size to give 21,000 kva for one minute and 25,000 kva momentarily. The design permits the operation of each rotor at 100 per cent excess speed without excessive strain upon the rotating parts. The weight of each generator in Plant No. 1, including the shaft but excluding the waterwheel runners, is 292,250 lb., the rotor, shaft and wheel runners weighing together over 200,000 lb.

From the generators the leads are carried in conduit to the 6600-volt oil-switch room located on the third floor of the station, and thence to 6600-volt duplicate buses on the second floor. All 6600-volt buses are installed in separate concrete chambers with individual cells for generators, transformers and other apparatus. One bank of main transformers is provided for each generating unit, but the switching connections are such that either bank may be operated from either

6600-volt bus and the high-tension sides may be thrown upon either of two sets of 150,000-volt transfer buses by the operation of suitable remote-controlled oil switches. Connections may be made between either high-tension bus set and either of the two transmission lines, through additional oil switches.

Each main transformer is rated at 5833 kva and is of the single-phase, oil-insulated, water-cooled type, one spare unit being provided. The primaries are connected in closed delta and the secondaries in Y, giving 86,700 volts per phase and 150,000 volts between five wires. The neutral of the Y is grounded, but the transformers are insulated for operation ungrounded, so that the full transmission pressure of 150,000 volts may be used with or without the ground. The neutral ground is connected through a current transformer which operates an alarm system in case of any decided unbalancing.

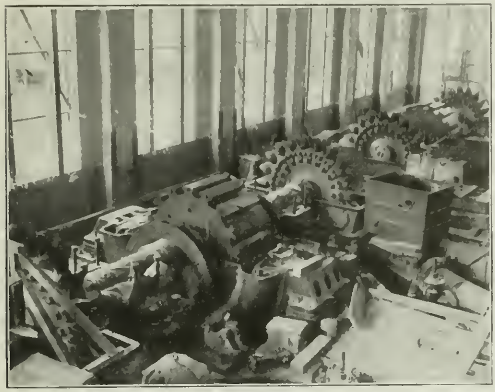


FIG. 15—WATERWHEEL UNITS NOS. 1 AND 2 IN POWER HOUSE NO. 2

To provide flexibility in the high-tension bus and switching system it was necessary to utilize two separate floors in the upper part of the plant for proper housing of the bus equipment. The buses are all of 2-in. wrought-iron pipe and all connections are of 1.25-in. pipe. These large diameters were used, and the corners of metallic line fittings were rounded off, to reduce the chances of corona loss. The high-tension leads from the transformers are carried upward in vertical runs to strain insulators supported from the roof framing, horizontal strain insulators of the multiple-disk type being used on each side of the conductors at each floor level to stiffen the construction. The standard spacing of horizontal 150,000-volt buses is 8 ft. The outgoing lines are carried through choke coils near the roof and pass out of the building through wall openings protected by canopies. Interior bushings are not used.

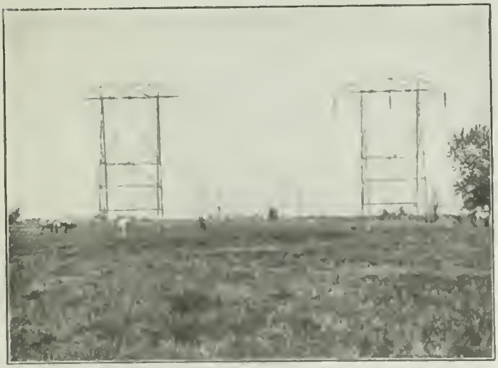


FIG. 16—DUPLICATE 150,000-VOLT TRANSMISSION LINE

FIG. 17—TRANSMISSION-LINE SPANS, SHOWING CHARACTER OF COUNTRY TRAVERSED

The plant is equipped with aluminum-cell lightning arresters and the usual horn-gaps, the former being installed in a compartment above the 6600-volt oil switches, and the latter on insulators carried on a steel tower located on the roof. Outgoing lines are dead-ended on strain insulators attached through special structural steel framing to the building frame. The arresters in Plant No. 1 have dead and grounded tanks, and the horn-gaps, which are equipped with indicators, are operated by mechanical remote control.

The 150,000-volt switches are installed in independent three-pole units surrounded by concrete compartments which practically inclose the equipment. Corridors are formed by wall openings of sufficient size to enable any switch unit to be removed and the bus chambers for high-tension service are separated from the switch compartments by a concrete barrier 12 ft. high.

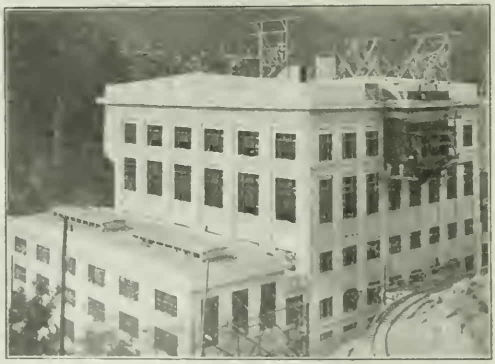


FIG. 18—EAGLE ROCK SUBSTATION

The exciter generators, rated at 150 kw, operate at 750 r.p.m. and are of the interpole compound-wound type, each being capable of exciting two main generators. The machines are designed with shunt windings arranged so that the halves can be connected in series for self-excitation at 250 volts or in parallel for excitation by smaller generators on a separate basis. Two sets of regulating exciters are installed, each consisting of a 250-volt motor-driven exciter controlled by a Tirrill regulator, connected in series with a 125-volt exciter without a regulator. By differential connections a voltage range from 125 to 0 is secured.

The electrical equipment of Plant No. 1 was furnished by the General Electric Company, and that of Plant No. 2 by the Westinghouse Electric & Manufacturing Company. The generators, transformers and oil switches in each station were designed for similar service. In Plant No. 1 all 150,000-volt oil switches are of the manufacturer's "K-21" type, each consisting of three single-pole elements mounted in separate tanks, the space occupied being 6 ft. by 20 ft. by 10 ft. Including the oil, the weight of one of these switches complete is 14 tons, and the total weight of each transformer in Plant No. 1, with oil, is 79 tons. The 6600-volt switches in Plant No. 1 are of the "K-3" type. All the oil switches in the 6600-volt and 150,000-volt circuits belonging to this station are of the non-automatic type.

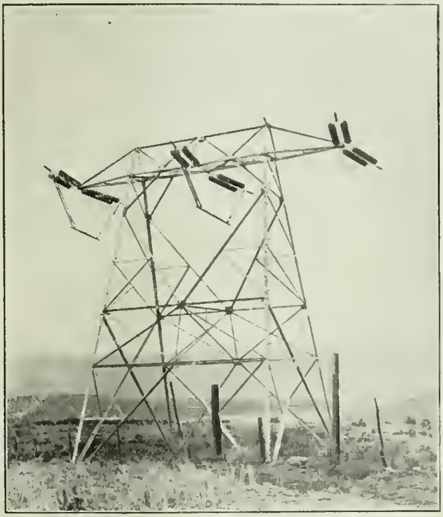


FIG. 19—ANCHOR TOWER

In Plant No. 2 the 6600-volt switches are of the manufacturer's "C" type and the 150,000-volt outfits of the "GA" type. The transformer and 150,000-volt switch weights in this station are respectively 45.5 tons and 30 tons. Both stations are designed to accommodate apparatus built by either of the two foregoing manufacturers in making future extensions. The impulse-wheel units, governors and regulating equipment, hydraulically operated gate valves and central oiling system in each plant were designed and manufactured by the Allis-Chalmers Manufacturing Company, of Milwaukee, Wis.

The exciters in Plant No. 2 are rated at 200 kw each, two being used. These machines are of the non-interpole type, but are compound-wound with two shunt circuits on a common set of poles. The series winding is used in connection with hand regulation from the remotely controlled exciter switchboard, but normally one of the two shunt windings is connected across the armature and self-excited through the customary rheostat, the other winding being separately supplied from a sixty-cell storage battery controlled by a special Tirrill regulator. The bus connections are the same in general arrangement as in the first station, and in both disconnecting switches are installed on each side of every oil switch carrying high voltage. The two outgoing lines from station No. 2 are multiplied into those from the first station without local switching. Interior 220-volt three-phase service for motors, etc., is available in each station. The lighting is handled by a 220-110-volt three-wire system. The plants are illuminated by tungsten lamps throughout and the intensity of illumination varies from 3-ft. candles in the generator room and on the switchboard gallery to 1.5-ft. candles in the basement.

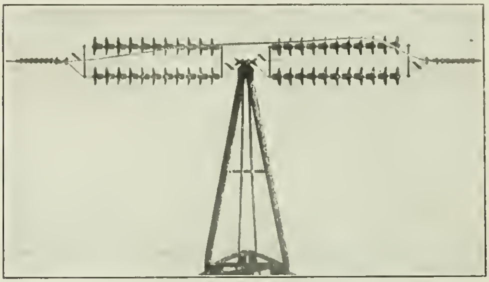


FIG. 20—INSULATOR CONSTRUCTION AT ANCHOR TOWER LOOKING UPWARD

150,000-Volt Transmission Lines

The transmission lines from the Big Creek development are among the most notable thus far operated, both on account of their great length and the extremely high voltage employed. From Big Creek to the Los Angeles substation, formerly called the Eagle Rock substation, the distance is 241 miles. There are two steel-tower lines, each carrying a three-phase circuit with the conductors in a horizontal plane, the towers being spaced 660 ft. apart except in regions exposed to sleet, where the spacing has been shortened.

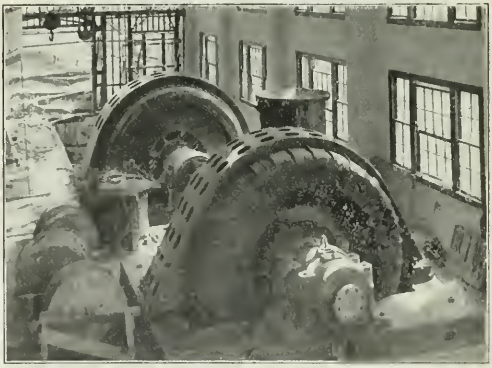


FIG. 21—SYNCHRONOUS CONDENSER IN EAGLE ROCK SUBSTATION

The towers are of the Milliken type, over 3400 having been used. Conductors are sagged for a minimum clearance of 25 ft. above ground. The towers are carried on structural-steel foundations extending about

6 ft. into the earth. The principal members of these foundation structures are 6-in. by 3.5-in. angles.

The lines are placed 80 ft. apart on centers on a right-of-way 150 ft. wide. About 65 per cent of the towers are standard, each weighing 5600 lb. The standard height from the ground to the cross-arm is 43 ft. The conductors are carried by Locke No. 2565 insulators, nine disks being used in series on suspensions. On angle and anchor towers two sets of eleven disks each are used in parallel on each side of the tower. Each disk unit has been given a dry flash-over test of 90,000 volts and a rain test at over 56,000 volts.

Data on Line Construction

More than 6,000,000 lb. of cable was required for the two lines. The conductor is of aluminum with a steel core, the outside diameter being 0.95 in. and the weight per mile 4058 lb. The core is composed of seven strands of double-galvanized plow-steel wire 0.105 in. in diameter per strand, and the maximum stress figured for the conductor is 7500 lb. The standard towers were designed to withstand the pull resulting from the breakage of two conductors on the same side of a tower, and anchor towers were designed to meet the condition of all three conductors broken on one side, with a broken ground wire, and a pull at right angles to the line sufficient to permit their use as angle towers for making a line turn of 60 deg. A seven-strand galvanized Siemens-Martin steel cable of 7.5 tons ultimate strength is used as a ground wire. The conductors are spaced about 17.5 ft. apart horizontally. The line crosses the Sierra Nevada and Tehachapi ranges at altitudes of from 4500 ft. to 5000 ft. and also traverses a rolling country. The large diameter of the conductor is an important factor in the elimination of corona losses.

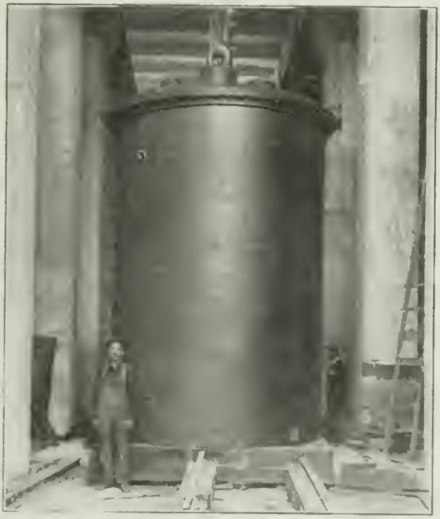


FIG. 22—4500-KVA TRANSFORMER REDUCING FROM 150,000 VOLTS TO 18,000 VOLTS

At Bakersfield, Cal., 135 miles from the generating plants, is situated a concrete and steel switching station at which the incoming and outgoing transmission lines may be cross-connected or parallel through oil switches. Plans are made for a future transformer installation here and for handling an additional 150,000-volt line. The present installation of oil switches is of the non-automatic, hand-operated type, but remote control will be employed later.

A receiving substation has been built about 9 miles from Los Angeles, the building being a 168-ft. by 110-ft. reinforced-concrete structure housing the two incoming lines from Big Creek, transformers, compensators and synchronous condensers utilized in voltage regulation.

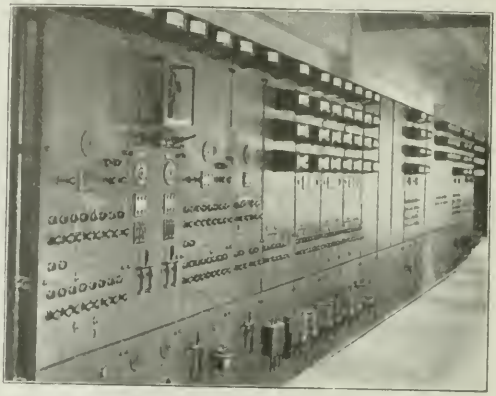


FIG. 23—MAIN SWITCHBOARD AT EAGLE ROCK SUBSTATION

The distribution system includes both 72,000-volt and 18,000-volt lines, and ultimately the substation will care for three incoming lines and two 72,000-volt and six 18,000-volt feeders, besides housing four 15,000-kva synchronous condensers.

The substation is five stories in height and is so laid out as to be readily extended. There are at present four 13,500-kva transformer banks supplying energy from the 150,000-volt buses to the 72,000-volt and 18,000-volt buses. Two 15,000-kva synchronous condensers are run off the 18,000-volt buses through banks of three 5000-kva transformers delivering 6600 volts to the condensers. Each condenser is equipped with a direct-connected exciter, and a future 3000-kw direct-current generator for railway service may be attached.

In order that pressures of 150,000 volts may be maintained at both ends of both transmission lines the synchronous condensers must each supply 12,300 kva lagging and the generators 11,750 kva. The voltage rise due to line capacity without condensers is 9.3 per cent at no load. The General Electric Company furnished all the 150,000, 72,000 and 18,000-volt switching equipment, the main switchboard, one rotary condenser, six transformers and auxiliary apparatus. One synchronous condenser, the remaining transformers and auxiliary apparatus were provided by the Westinghouse Electric & Manufacturing Company.

The transformers are interchangeable, and all are of the oil-insulated, water-cooled type. The substation is divided into sections according to the line and bus voltage handled, with a central assembly aisle served by an 85-ton electric traveling crane. The Big Creek system is operated in parallel with two 50,000-volt lines from the Kern River plant of the company through compensators of 10,000-kva total capacity. The buses are arranged in duplicate to give increased flexibility, but on account of the space requirements of the delta-delta connections of the transformers it was necessary to use 72,000-volt cable in the transformer room. Iron pipe is employed for buses and for the other high-tension connections. The only automatic switching equipment is that used on 72,000-volt and 18,000-volt feeders.

Radio Service on the Lackawanna Railroad

Service operation of the radio-telegraph equipment used for communicating between moving trains and stations along the route of the "Lackawanna" Limited. By John L. Hogan, Jr.

THE problem of signaling from fixed stations to moving trains has been attacked from many angles, with varying degrees of success. By the use of commercial radio-telegraph equipment the officers of the Delaware, Lackawanna & Western Railroad have succeeded in maintaining communication between the New York to Buffalo "limited" and the wireless stations at New York, Scranton, Binghamton and Buffalo. The equipment which makes this possible, and especially the outfit installed aboard the train, is proving of great interest.

On the roof of the Scranton (Pa.) depot the railroad electrical staff has erected a tower 60 ft. in height, giving a total elevation of about 150 ft., and from this to the 175-ft. stack at the shops, 750 ft. away, is slung a four-wire flat-top antenna. Lead wires are brought from the eastern end over the edge of the building to the operating room on the second floor, as may be seen in Fig. 2. In the station the telegraph department has installed a 2-kw radio-telegraph equipment purchased from the Marconi company. The transmitter includes a Crocker-Wheeler motor-generator, which is installed in the basement and which, running at 1750 r.p.m., converts the sixty-cycle, three-phase central-station energy into 500-cycle energy at 250 volts for the radio outfit. The 500-cycle current is led through a sending key to a transformer, where the emf is stepped up to about 20,000 volts and is used to charge a bank of six copper-plated Leyden jars (total capacity 0.024 microfarad), which discharge 1000 times per second through a multiple-plate quenching spark-gap in the usual manner, giving a high-pitched musical spark. Inductively coupled transmitting circuits are used, the radio-frequency transformer and inductances being wound of strip copper in flat spiral form, clock-spring fashion. A hot-wire ammeter in the antenna circuit shows a reading of about 12 amp when the station is sending on a wave-length of 1600 m. The natural period, capacity and radiation resistances of the antenna have not yet been measured.

The station is fitted with a small control panel carrying voltmeter, ammeter, wattmeter, frequency meter and generator field rheostat. The motor-generator is started and stopped by two signal relays operated by a small hand switch. The receiving tuner is of the inductively coupled type, with a switch for connecting the detector circuits directly to the antenna for "picking up" under broad tuning adjustment. The detector used is of the double crystal form and requires very little attention. Not much trouble is experienced from interference, so that the broad-tuned circuit is used almost altogether for working with Binghamton and the train. It is found that the signals are somewhat reduced by insertion of the receiving transformer, but on the direct coupling messages from Binghamton (62 miles away) may easily be copied on a typewriter. The station has been inspected and licensed by the United States Department of Commerce and has had assigned to it the call letters *W T P*.

At the Binghamton (N. Y.) station two 175-ft. self-supporting steel towers have been erected 400 ft. apart. A four-wire flat-top antenna stretches between these and has its lead wires taken from the middle point. The apparatus is installed on the upper floor of the Binghamton depot and comprises exactly the same units as used at Scranton. Fig. 1 shows the change-over hand

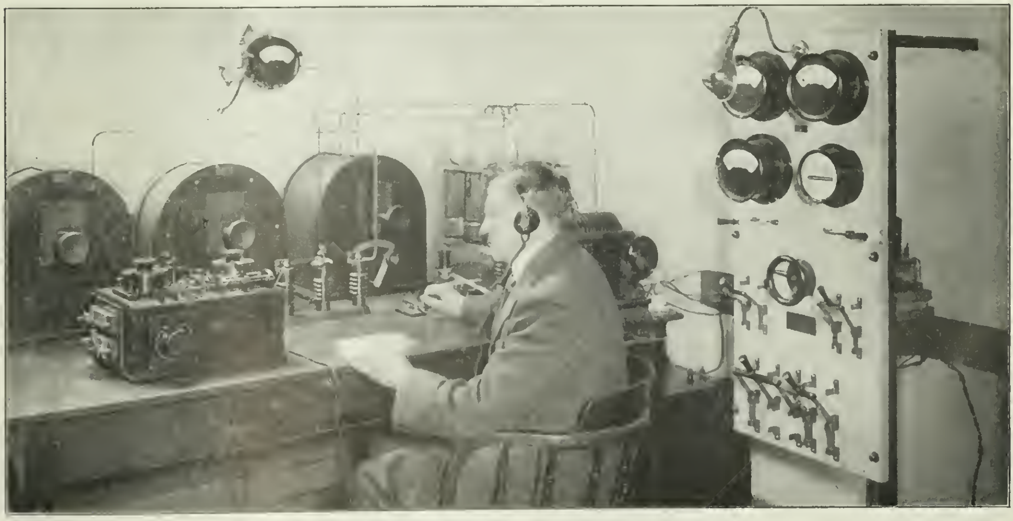


FIG. 1—INSTRUMENTS AT BINGHAMTON STATION

switch (on the table just to the right of the receiving tuner) used to transfer the antenna from sending apparatus to receiver. The quenching gap and blower are seen just behind the operator. In this station also the transmitter is of the 500-cycle musical-spark type. The call letters used are *W B T.*

On the "Lackawanna limited" the antenna is formed from four rectangles of wire, each of which is carried on insulators at the corners of one of the four forward cars. These insulators and their supporting posts can be seen in detail in Fig. 4, which also shows the link connection used between cars. The four-car aerial as a whole forms a "flat top" about 250 ft. long, 10 ft. wide and 12 ft. above the rails. The wires clear the steel cars by less than 2 ft., so that the radiating power of the system must be very small. A lead is taken from the middle of the antenna through the roof of the third car into a small compartment which contains the telegraph apparatus as shown in Fig. 3.

The instruments aboard the train are similar in principle and operation to those at Scranton and Binghamton, but are of only 1-kw rating. A Crocker-Wheeler motor-generator was rewound to operate on 30 volts direct current from the car-lighting generator, which carries on its line a set of storage cells. Drawing about 40 amp, this motor-generator provides 270-cycle alternating current at 250 volts for the radio transmitter, which includes a ten-unit quenching gap, three glass-jar condensers of 0.004 microfarad each, and the usual radio frequency transformers. No radiation ammeter is provided, but the antenna current is stated to be about 35 amp. In consideration of the probable high capacity and low equivalent resistance of the train aerial, this large value is not surprising, though it indicates an antenna resistance well below 1 ohm. Fig. 3 shows how the receiving tuner, of the type described above, is mounted on the wall of the operating compartment. The train equipment has not as yet been inspected by the government but the call letters *W H T* are used temporarily.

For the first few trips after the stations were put in operation it was not found possible to communicate between the train and Scranton or Binghamton further than 6 miles or 8 miles, and at some points even within that distance it was impossible to exchange signals until the train moved into a more favorable position. In the course of several weeks' experiments a greater familiarity with the instruments, together with a few substitutions and readjustments, permitted continuous extension of the signal range. It is now possible to communicate with stations in New York until the train reaches Dover, N. J., about 40 miles out. Fifty-three miles further, after passing Stroudsburg, Pa. signals may be sent from the train to Scranton, about 50 miles away, and from that time on Scranton is able to read all that is sent by the train operator. Signals from Scranton are first picked up when the train is near Tobyhanna, about 30 miles away. Shortly after passing Scranton, signals may be exchanged with both that station and Binghamton, and then with the latter only until Owego is left behind. After passing about 30 miles from Binghamton no telegraphing is possible until the train passes Mount Morris, N. Y., when the commercial station in Buffalo may be reached.

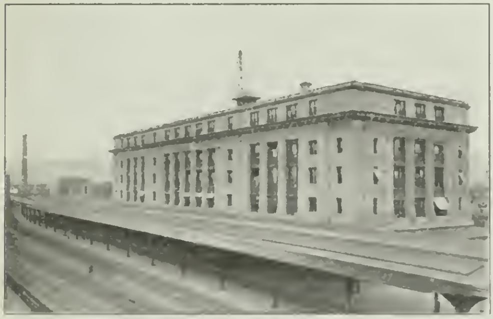
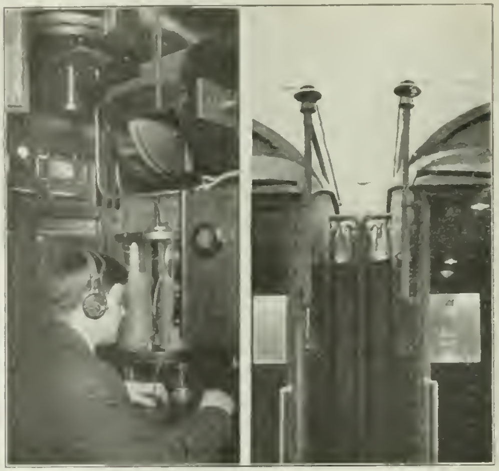


FIG. 2—TOWER AND AERIAL AT SCRANTON



FIGS. 3 AND 4—INSTALLATION ON TRAINS AND ANTENNA SUPPORTS AND CONNECTIONS

On Dec. 21, 1913, through the courtesy of the telegraph and telephone department of the Delaware, Lackawanna & Western, the writer observed the train and Scranton outfits in operation, and telegraphed from the train while approaching Scranton, listening to signals from the train while it passed on from Scranton to Binghamton. The novelty simply of telegraphing by radio while slipping over the rails at 50 miles an hour or more is striking enough, but probably the most astonishing point is the ease with which the high-pitched spark signals may be read in spite of the roaring and snapping wind and rail noises which are heard on any train in swift motion. Perhaps still more interesting is the rapid variation of signal strength which takes place as the train winds in and out along the valleys and among the steep hills east of Scranton. With location and direction of travel favorable the signals may be several hundred times audibility, and then, within only ten or fifteen seconds, a turning which places the train broadside to the transmitter or behind a screening hill may so weaken the received impulses that it is necessary to squeeze the earpieces tight against one's head to hear the dots and dashes at all. When passing under a steel bridge the signals were noted to weaken greatly and immediately afterward to regain normal strength, possibly because of the detuning effect of a change in the antenna's effective capacity. When nearly a mile from Scranton the train ran through a tunnel probably from 600 ft. to 800 ft. in length and 60 ft. below the earth's surface, yet Scranton's signals were received without interruption and with only slight decrease in loudness, even when the train was entirely underground. In receiving signals transmitted from the train in motion the same irregular changes in intensity are observed. It has not yet been determined whether these are due to the changes in the bearing of the train and the consequent altering of the directive effects as regards a communicating plant, to the constantly changing configuration and character of the land between the two stations, or to some other cause.

The railroad officials have already found use for the radio service in the ordering of a relief train conductor, and in another instance of a locomotive to replace one which had broken down. Moreover, a spare car to accommodate unexpectedly large passenger traffic has been secured by wireless, and a physician has been called to attend a passenger suddenly taken ill while the train was in motion. Commercial messages for passengers have been sent, and in one instance a telegram was transmitted to Scranton and a reply received within fifteen minutes while the train was still some 20 miles out. In spite of the value of this service, the radio is felt to be more directly applicable to the transaction of railroad business between fixed points during sleet storms or other periods of wire trouble, and with this in view the Lackawanna is planning further installations along its lines. Other railroads are becoming more definitely interested than in the past and are considering the use of radio for emergencies. It may be, however, that the Delaware, Lackawanna & Western, which had the first complete telephone train-dispatching equipment, will also be the first to erect a comprehensive radio break-down service.

Extending Generating Station to Increase Capacity

An interesting bit of engineering history centers around the recent completion of an extension to the steam generating station of the San Joaquin Light & Power Company, at Bakersfield, Cal.

The main plant at Bakersfield was built in 1910 to provide temporary relief for the overtaxed hydroelectric station of the company on the Kern River about 15 miles distant and also with the idea of furnishing eventually a reserve source of electrical energy to supplement the hydroelectric sources then in operation and planned for the future.

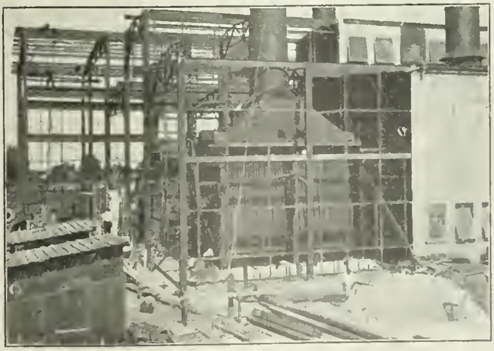


FIG. 1—EXTENSION TO BAKERSFIELD STEAM PLANT

The contract for building this main steam plant was given to J. G. White & Company, and ground for the station was broken on Aug. 26, 1910. On Sept. 28 boilers were received and the temporary turbine arrived three days later. Operation began on Nov. 18, exactly eighty-four days after work was started.

In order to carry out the plan for immediate relief the steam plant was placed in operation before the steel for the building had been received, and for a time the structure presented the very unusual spectacle shown in Fig. 2 of an outdoor steam generating station. During this interval the boilers were entirely without shelter and the turbine was covered only by a temporary shed to protect it from injury from rain or building operations.

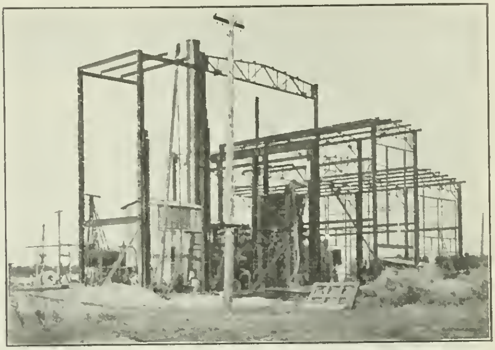


FIG. 2—STEAM PLANT OPERATING BEFORE HOUSING WAS COMPLETED

At the close of 1911 the rating of the main station was 9000 kva, representing the aggregate of two units of 2500 kva and 6500 kva respectively.

Early in 1913, after two seasons of light rainfall, and in view of the rapid growth of the demand for electrical energy in the territory served by this plant, it became evident that additional generating capacity could be advantageously provided, and on April 1 an order was placed for a third unit of 7800-kva rating. Four additional boilers of 604-hp rating, together with transformers and other auxiliary equipment, were purchased, and the plant was completed and put into operation in the latter part of October. The extension of 60 ft. on the turbine room and 40 ft. on the boiler room which it was necessary to build in order to accommodate the extra equipment is shown partially completed in Fig. 1. The work described was done by J. G. White & Company, New York City.

Leonard Patents on Compound Motor Starters

A large proportion of present-day motor starters are what are known as "compound motor starters," that is, a type in which there is combined in one mechanism a motor starter with "no voltage" release and also a resistance for weakening the shunt field and operating at any desired higher speed. About ten years ago it was the general practice in motor starters to have armature control alone and to have the "no voltage" magnet in the shunt-field circuit. But in modern practice it is customary to employ both armature control and field control, so arranged that the two controls are "fool-proof," that is, must necessarily be employed in their proper order. Furthermore, in modern practice the "no voltage" magnet is in parallel with the shunt-field winding instead of being in series with it, so that the wide variation in the shunt-field current for purposes of speed control will not affect the reliable performance of the "no voltage" magnet.

On Nov. 4, 1913, three patents, Nos. 1,077,613, 1,077,-

614 and 1,077,615, broadly covering the automatic features of compound starters, were issued to Mr. H. Ward Leonard. In the specification of each of these patents occurs the following outline of the requirements of a satisfactory starter:

"The controlling apparatus for such motors should have the following characteristics: First, an overload protective device which will positively and with sufficient promptness open the circuit to the motor if under any conditions of starting or operation a current greater than a certain predetermined amount should flow in the motor circuit. Second, this overload device must be such that the motor can be safely and simply started up again by the operator without loss of time and without expense. Third, a 'no voltage release' or electro-responsive device which will automatically act if the supply voltage fails, or is reduced to a very low point, to protect the motor against the risks due to a sudden rise to full voltage, and such 'no voltage' device shall be dependent upon the volts upon the motor armature and shall be independent of any current through the motor. Fourth, a device by the manipulation of which the operator can readily change the speed of the motor gradually and over a wide range, so that, for example, a cutting tool can be worked in the most efficient manner at any speed and cut within the capacity of the motor. Fifth, a starting rheostat. Sixth, interlocking or functionally related mechanism, or equivalent arrangement of mechanism, which will insure the proper sequence of adjustments, and whereby it will be impossible for the operator to start the motor while the motor has an improperly weakened field. While this interlocking or equivalent mechanism is preferably arranged directly between the speed-controlling device and the motor starter, it is evident that it may be applied between any device controlling the speed controller and any device which controls the current passing through the motor armature, such as a switch in series with the motor armature and starter."

The first patent, No. 1,077,613, contains forty-three claims. The invention seems to be indicated fairly well by Claim 37, which reads as follows:

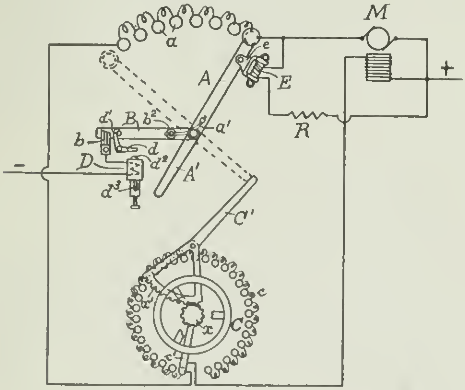


FIG. 1—COMPOUND MOTOR STARTER WITH FIELD RESISTANCE AUTOMATICALLY CUT IN WHEN "NO VOLTAGE" OCCURS

"The combination of a constant electromotive force supply circuit, a motor connected therewith and having a field winding energized independently of its armature current, controlling means for said motor comprising two operatively, protectively mutually related resistance-controlling movable members, one of said members being adapted to control the circuit of the motor armature, and the other of said members being adapted to control the said motor field winding, and protective means comprising a 'no voltage' winding energized independently of the currents in said armature and said field winding, insuring that the field-controlling resistance will be sufficiently low in value when the starting current is passed through the motor armature."

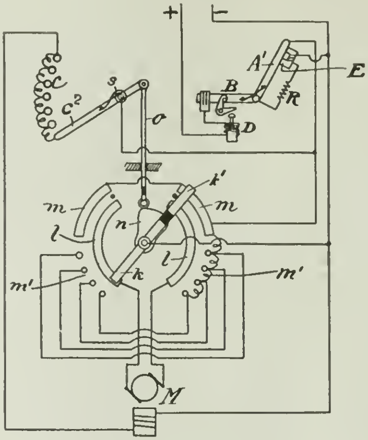


FIG. 2—COMPOUND REVERSING MOTOR STARTER

The second patent, No. 1,077,614, relates especially to controllers for reversible motors, and a typical claim (Claim 29) reads as follows:

"The combination of an electric motor, means for varying and reversing the current through one element of said motor and for varying the current in the other element of the motor, and an automatic controlling switch the closure of which is controlled by said means."

The third patent, No. 1,077,615, relates to the forms of compound motor starters in which the entire manipulation in practice is done by a single handle. Claim 27 of this patent reads as follows:

"A controlling device for an electric motor comprising starting and speed-regulating mechanism, a 'no voltage' magnet, and a common operating means arranged to start the motor, regulate its speed and bring the starting mechanism under the influence of the 'no voltage' magnet."

Mr. Leonard's applications were filed on July 11, 1903, or more than ten years before the final issue. A long interference took place between Leonard and Horton, the latter associated with the Cutler-Hammer Manufacturing Company, over Claims 19, 21, 22, 26 and 27 of patent No. 1,077,613, which the office had inadvertently granted to the latter, although his date of conception was subsequent to Leonard's filing date.

The final decision in the matter of this patent was handed down by the United States Circuit Court of appeals. Claim No. 26 will serve to illustrate the five claims that were the subject of litigation. It is as follows:

"Claim 26. In combination, a movable member, a resistance controlled thereby, a second movable member, a resistance controlled thereby, means for connecting said members to cause the same to move in one direction together but permitting said first movable member to move in an opposite direction independently of the second member, and means for automatically returning both members to their initial position upon the release of said second member."

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Central-Station Float on Electric Truck, Menominee, Mich.

A pageant in which the merchants of the twin cities of Marinette (Wis.) and Menominee (Mich.) some time ago participated happened to be held at an opportune moment for the Menominee & Marinette Light & Traction Company to enter its new electric truck in the procession and advantage was also taken of the event to display appliances from the company's electric shop. A motor-driven washing machine and a general-utility motor shared the center of the truck with a gas-range, while the sides of the vehicle were decorated with electric irons and the front and rear carried electric-fan displays. The float was easily one of the most attractive in the parade, and with the public-spirited proclamations on the banners at the sides there can be little doubt of the favorable impression it created in the minds of the citizens.

CENTRAL-STATION FLOAT

Low Wiring Prices Boost Electric Service at Lima, Ohio

During the fall season an average of 165 houses a month at Lima, Ohio, were equipped for electric service. Mr. J. C. Sweeney, superintendent of the lighting department of the Ohio Electric Company, which operates electric railways and supplies energy for lighting and motor service in western Ohio, attributes this extraordinary increase in business to the reduced wiring prices being offered by local contractors. Although Lima has a population of but 30,000, between twenty-five and thirty wiremen are at work on house-wiring jobs at all times. Keen competition between the contractors has forced wiring prices down until in some cases work is done at prices ranging from 40 cents to 50 cents an outlet.

General realization of the advantages of electricity over gas by the inhabitants of this former natural-gas belt has also been a possible factor in the record-breaking wiring business being done at Lima.

Stimulating Electric-Vehicle Interest in New England

To increase interest in the electric vehicle among prospective users in the outer Boston district a meeting of the New England Section of the Electric Vehicle Association of America will be held at Salem, Mass., on Jan. 15. The program includes a parade of electric trucks and pleasure cars at 3 p. m. through Salem, Beverly and Peabody, a dinner at 6 p. m. at the Salem Club, an illuminated vehicle parade through the Salem business district at 7:30 p. m., and a meeting in Board of Trade Hall at 8 p. m.

The speakers will be Mr. H. F. Thomson, of the research department of the Massachusetts Institute of Technology; Mr. Frank J. Stone, of the Electric Storage Battery Company; Mr. George W. Holden, of the Edison Storage Battery Company, and representative electric-vehicle dealers. The Salem Electric Lighting Company is inviting visitors to its plant on this date and is offering free energy and garaging to all out-of-town cars associated with the gathering. Mr. J. A. Hunnewell, of Lowell, Mass., is chairman of the New England Section, and the business secretary is Mr. O. G. Draper, 39 Boylston Street, Boston.

Acquiring Ice-Making Load at Reading, Pa.

Officials of the Merchants' Ice Company, of Reading, Pa., after spending a number of months investigating different methods of plant drive and visiting some of the most modern electrically operated ice factories in the country, have contracted with the Metropolitan Electric Company, of Reading, Pa., to buy central-station energy.

At the present time the ice company has two 40-ton York steam-driven ice machines installed, but since during the past summer its business outgrew its product a new 100-ton machine has been decided upon. The local central station decided to go after this business and arranged to have representatives of the ice company make several trips to different ice plants using electric drive, among them the Knickerbocker Ice Company, Chicago, Ill.; the Webster City Ice Company, Buffalo, N. Y., and others. The result is that not only will the new equipment be driven electrically, but the two steam machines will in the near future be changed to electric drive also.

One 300-hp motor will drive the 100-ton machine and two 125-hp motors will operate the 40-ton ammonia compressors. A 20-hp motor will drive the air compressor for pumping condensing water. Several smaller motors are to be used on the brine agitators and other accessories. Other apparatus which will be installed with the new equipment includes a twelve-effect distiller, built by the York Manufacturing Company, and a We-Fu-Go & Scale Company water purifier. The latter machine is to be used to soften and purify the condensing water before it goes to the distiller. The condensing water continues uniformly throughout the year at 54 deg. Fahr., and the ice company expects to manufacture a ton of ice for 42 kw-hr.

Reaching the Small Towns in Central Illinois

Size, or the lack of it, is apparently no bar to the small community's receiving service from the Illinois Northern Utilities Company, whose cross-country transmission lines now extend over a large section of the northwestern part of the State.

Among the towns which have recently contracted for service with the company is Kingston, Ill., with a population of 300. The initial order placed with Mr. C. B. Yonts, general contract agent, called for the installation of twenty-two street lamps, or one for every street corner in the village. Contracts have also been closed for the operation of an electric motor to pump the village water supply. The local citizens are greatly pleased at the step forward thus taken, and they declare that the electricity for street lighting will cost less than even the kerosene formerly consumed, while the motor-driven water-works will show a yearly saving over the gasoline fuel formerly required for the pumping engine. The street-lighting contract represents an annual income of $2 per capita of population, while the pumping service will add another dollar per capita to the central-station income.

The commercial department of the company is on an average wiring one house to every eight inhabitants of the communities it reaches, these customers' contracts being practically all signed before the transmission lines are complete. After service is available in the towns it is expected that the number of customers per capita will be even further increased.

Instilling Courtesy Into Company Subordinates

It can be set down as a truism that a satisfied customer is the best advertisement for any company, said Mr. E. R. Kelsey, advertising manager of the Toledo (Ohio) Railways & Light Company, before a meeting of the Association of Ohio Properties operated by Henry L. Doherty & Company, held recently at Toledo.

Of what use is a high-salaried advertising man if the company has a $5-a-week boy at its application desk?

One short, ill-tempered reply from a telephone operator or from a boy selling lamps can quickly break down all the selling arguments of the company's best salesmen.

The new-business manager may be known personally to comparatively few customers; the president himself cannot hope to meet as many as he would like; but the clerks, meter readers and lamp boys are all meeting customers every day. The company will be judged by the treatment given to its patrons by each employee.

Many companies hold regular meetings of heads of departments to talk over public policy plans—how best to meet and please patrons. Excellent indeed are the results accomplished, and yet how few meetings there are with the telephone operators, the meter readers, the clerks behind the application desk and other subordinate employees, who have it in their power either to make or break the company's friendships.

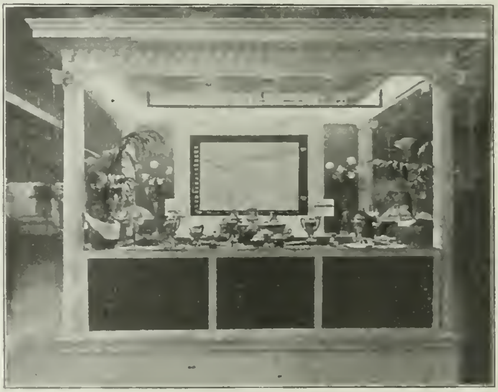
In each office, advised Mr. Kelsey, there should be some one man, skilled in diplomacy and in the knowledge that "a soft answer turneth away wrath," to handle the complaints. It is not the treatment their complaints receive that counts half so much with some people as the treatment given their pride. A battle is always lost when an adversary loses his temper. Every consumer has the right to courteous treatment, and the right man handling complaints can easily turn into friendship for the company the spirit that formerly represented antagonism.

"Is it easy to get to your complaint department?" asked Mr. Kelsey of the managers present, "and is the person complaining made to feel that he is doing the company a favor? And after a complaint of a new installation is made does someone telephone or make a personal visit to see if the company's service is satisfactory? A little thing, you may say, but to the consumer it is an evidence that the company is taking a personal interest in him.

"Never neglect to investigate a complaint. You may receive a valuable suggestion. You may find a defect that needs remedying. With so many consumers you cannot hope for satisfactory service unless you make it plain to your customer that he must co-operate with you. In that way he feels that he has a real interest in the company and the company has a real interest in him beyond the mere payment of a bill."

A Central-Station Display Booth at Kansas City

From the standpoint of the Kansas City Electric Light Company, the manufacturers' exposition held in that city in December was a conspicuous success. This exhibit of "Made in Kansas City" goods was held under the direction of the local commercial club, and various manufacturers installed practical machines and turned out their products just as in their own shops or factories.



COVE LIGHTING IN CENTRAL-STATION BOOTH

From a lighting standpoint the central-station company's booth differed radically from others in the hall. A cove system was employed in which the new 12-in. tubular tungsten lamps were utilized with gratifying results. Used in this way, forty-two 40-watt lamps, representing an expenditure of about 5.1 watts per sq. ft., produced a soft, glareless illumination of comparatively high intensity, which aroused considerable interest and drew forth much favorable comment. The accompanying photograph, which was made with a two-minute exposure on an ordinary plate, shows the even distribution of light afforded, and there is a wealth of detail in the picture which would probably have been impossible of attainment without the aid of a flashlight under any other system of electric lighting. One of the new high-efficiency tungsten lamps was also exhibited and attracted considerable attention.

The curve showing "Cost of Living Compared with Electric Lighting," which occupies the central position in the picture, was painted on a piece of curtain cloth 4 ft. 6 in. by 6 ft. 6 in., which was placed in a box and illuminated from the back in such a manner as to eliminate all spots or shadows. It served to furnish food for thought for any disgruntled individual customers who might think that electric light is unduly expensive.

A complete line of electrically heated devices and cooking appliances was shown and demonstrated. The public evidenced its appreciation by consuming 125 lb. of toasted marshmallows prepared on an electric grill. Although the actual sales at the show were comparatively small, the interest aroused resulted in bringing a steady stream of customers to the display rooms and in the sale of a considerable number of energy-consuming devices.

Emergency Assembly Test on Boston Edison System

Responding at top speed to the emergency call "Serious trouble at L Street," more than 100 officials of the Boston Edison company assembled at the system's main generating plant in the small hours of a recent December morning to find awaiting them a sandwich and coffee luncheon instead of realizing the visions of burning coal fields, exploded boilers and wrecked turbines which sprang into being with the telephone summons sent forth to each man's home on the stroke of twelve.

The test was planned by General Superintendent W. H. Atkins without giving the slightest inkling of it in advance. At the call, the men on the emergency list from all over the system pressed every possible agency into service to reach the station. Automobiles, taxicabs, hacks, carry-alls, night cars on the Boston Elevated system and in some cases pairs of stout legs were called upon, and even the members of employees' families co-operated in making the "get-away" a success.

Records of the time of calling each man and the time of his arrival at L Street were kept, and many valuable points were ascertained which will be of use if a genuine emergency arises in the future. Within thirty-seven minutes each one of the forty-five men whose names are on the regular emergency list had been called up. The test was not only a call to the L Street station, but for many subordinate employees it was a call to report at their headquarters for unknown duties. Emergency men presented themselves at the company's garage, stockrooms and district offices, and in many cases it was necessary to use toll lines and messenger service in reaching the men wanted. District foremen in charge of lines, chauffeurs, construction crews and other employees made record time to their quarters. The heads of departments in many cases utilized the time while waiting for the arrival of automobiles in telephoning to subordinates and concentrating their forces at headquarters, pending further instructions.

The table gives the relation between arrival time and distances from the L Street plant.

Individual times of response varied from four minutes, in the case of an electrical engineer living about 100 yd. from the station, to one hour and nineteen minutes for an official whose home was 16 miles away and who made the trip in a local taxicab.

Among the points brought out which indicated possible improvements in handling emergency calls were the desirability of turning on porch lamps or front-room lamps when waiting for chauffeurs at residences, in order to save time in picking up officials; the maintenance of correct address lists and index cards giving shortest routes at company automobile service stations; superiority of long rings on the telephone compared with short calls when waking persons wanted in emergencies, and the need of more complete arrangements with local contractors for handling emergency night service. The installation of a telephone in the home of one member of the main stockroom crew was also suggested as a means of more quickly getting the force together.

DATA ON EMERGENCY TEST, BOSTON EDISON COMPANY

Time of Arrival	Average Distance, Miles	Average Time, Minutes
12:11–12:30 A.M.	3.00	17
12:30–1 A.M.	3.75	34
1–1:30 A.M.	4.50	45
1:30–1:52 A.M.	9.00	67

In appreciation of the loyalty and reliability of the staff in responding to this unexpected demand upon its "readiness-to-serve," Mr. Atkins contributed a letter to the current issue of *Edison Life*, in which a detailed account of the emergency drill is printed, with cartoons of prominent employees and extracts from their personal diaries.

Boosting Heating Appliances Through Women's Literary Clubs

The business management of the Union City (Ind.) Electric Company recently furthered the popularity of electric heating devices in Union City by getting one of the ladies of a prominent local women's club to read a paper entitled "Electrical Conveniences for the Home" at one of the club's regular afternoon meetings.

A day was set aside in advance and the paper duly presented before the club members, about thirty in number. It gave a clear and interesting description of the practical uses to which various appliances might be put, particular emphasis being laid on the great saving in labor for the housewife. The subject was rendered still more impressive to all present through the co-operation given by the hostess of the club in serving an afternoon luncheon to the ladies which had been prepared wholly by electrical appliances on the dining-room table.

A percolator, a toaster, a chafing dish and a grill were operated simultaneously. The electric company also helped by sending to the home a supply of all kinds of appliances. These were arranged attractively in the rooms where they would come to the attention of the club members.

Orders for several appliances to be used as Christmas presents were secured directly in this manner. Indirectly, also, the event came to the attention of many persons of the town not members of the club, and the propaganda of electrical appliances was thus spread wide. This publicity proved particularly valuable since it was of the mouth-to-mouth kind and came through neighbors and friends, rather than directly from the electric company.

The Union City Electric Company was recently acquired by the Albert Emmanuel syndicate, of Dayton, Ohio. Mr. D. O. Vaughn is local manager.

The Committee Idea in the Sales Division

A committee system has been inaugurated in the sales department of the Rochester Railway & Light Company for the purpose of conserving and tabulating the knowledge and experience gained by each salesman and disseminating this information among his fellow-workmen. Committees are assigned to each of the following topics: Data book, new applications of electrical energy, steam distribution and sales, illumination and lamps, refrigeration, private plants, motor installations and mechanical drives, consumers' transformers, protective and meter installations, electric heating, contractors' equipment, electric vehicles and garages, rates and the use of electricity on the farm.

Meetings are held once a week at which one or two of the committees report. The reports are discussed and if approved are placed on file. The file is indexed so that all the information obtained is immediately available. A committee is assigned the task of editing and condensing these reports, which are then ready to be incorporated into a data book. This book, when completed, will also contain references to interesting installations, statistical data pertaining to the company, and copies of complimentary letters. One of these books will be given to each member of the staff, who will then have evidence in hand to verify his arguments.

Harvesting Ice with Central-Station Energy

The Central Massachusetts Electric Company, of Palmer, Mass., is making effective use of electricity in harvesting ice by the methods shown in the accompanying illustrations. Last winter the outfit seen in Fig. 1 was employed by a local ice company, the installation having been made under the conditions that the consumer should pay the regular rate of 8 cents per kw-hr., without discount, and in addition should meet the cost of running service wires into the premises and of dismantling the wires and truck rigging. The net cost of the rigging on the truck to the ice company was $20, the central station having made the installation of a temporary character so that a good deal of the equipment could be used in other ways later. The ice equipment was collected and installed on the truck over night. It consists of a three-phase, 220-volt induction motor, countershaft, two transformers, meter and switching device. At two of the company's ice houses this equipment superseded the service of a portable engine and boiler which operated a drum hoist. In making the application the connecting rod of the engine was unbolted from the crank shaft and the flywheel was belted directly to the motor-driven countershaft on the truck. The rest of the hoisting mechanism remained unchanged.

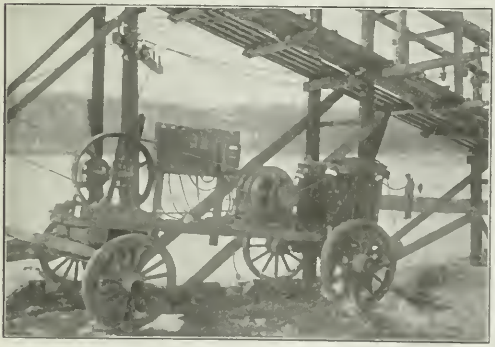


FIG. 1—ELECTRICAL EQUIPMENT FOR HARVESTING ICE

The success of this apparatus last year led to its purchase by the ice company, and this winter it will be maintained as a part of the regular ice-cutting equipment. The Blackstone (Mass.) Electric Company, also one of the Parker properties, has just obtained a contract from the Miller Ice Company, in East Blackstone, for the installation of a 20-hp motor, for which service the consumer will pay the regular rate of 10 cents per kw-hr. and purchase the entire equipment. For the service at Palmer a 20-hp motor was used last year, but this was found to be too large, as shown by the accompanying tests and cost data.

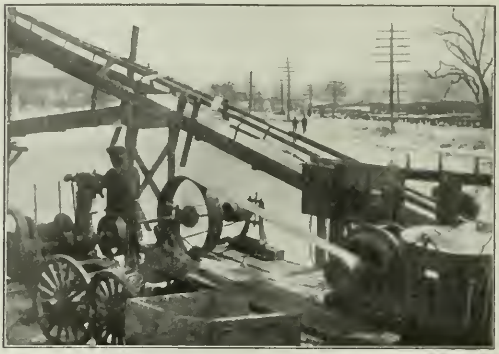


FIG. 2—INCLINE FOR CONVEYING ICE

DATA ON ICE HARVESTING BY ELECTRICITY, PALMER, MASS.

Speed of ice travel, feet per minute	85
Shaft load, hp	3.7
Load and 1400 lb. ice, hp	6.1
Net per 200-lb. cake, hp	0.33
Maximum cakes on ice way, number	14
Maximum power, fourteen cakes on way, hp	8.5
Total ice harvested, tons	1031
Total kilowatt-hours used in harvesting	95
Total cost of harvesting, energy	$7.60
Cost of energy for harvesting, per ton	0.0076

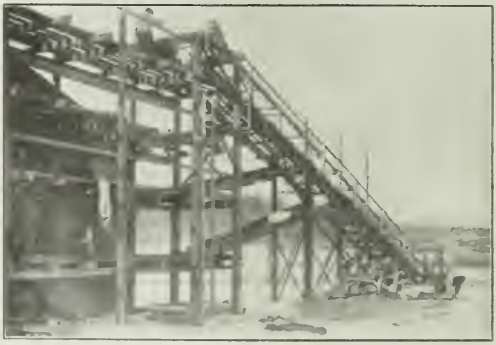


FIG. 3—HARVESTING ICE BY DRIVE FROM BELOW

Although the total revenue was small for this service, the use of electricity in harvesting ice proved to be a great advertisement for the company throughout its entire territory and aroused great interest.

Illumination and Wiring

A Giant Single-Word Electric Sign at Milwaukee

An electric sign declared to be the largest single-word electric roof display in the world is in operation on the Majestic Building, Milwaukee, where it advertises Gimbel Brothers' department store. The sign formerly erected in this position was destroyed by a severe storm, and to guard against a similar accident twenty concrete piers measuring 2 ft. by 2 ft. have been laid in the roof as sleepers for the 8-in. by 14-in. double angle irons used as the vertical and horizontal supports. The figures of the men in the accompanying illustration give some idea of the size of the display.

The sign is lighted by 1500 10-watt tungsten lamps supplied from the circuits of the Commonwealth Power Company. The letters are 32 ft. high, and the entire sign measures 159 ft. long and 52 ft. high. The size of the individual letters makes it possible for the sign to be read at a distance of 15 miles on a clear night.

GIANT ELECTRIC SIGN

Educating the Public in Good Lighting Practice

At the International Exposition of Safety and Sanitation held recently in New York the Illuminating Engineering Society had an interesting educational exhibit which consisted of a series of small booths illustrating correct and incorrect methods of lighting interiors. After the exposition closed the exhibit was removed to the American Museum of Safety, 29 West Thirty-ninth Street, New York, where it is now on display. A general view of the booths as they appeared in the safety exhibit is shown in Fig. 1.

One booth, designated as No. 3, contained a placard made up half with a glazed surface and half with a matte surface like that of blotting paper. The card was oscillated automatically, and at certain angles a letter printed on the glazed surface became invisible owing to specular reflection, although the letter on the matte surface could always be seen. The purpose of this booth was to show the effect of glare from shiny or glazed paper on the eye's ability to see, and to suggest how the eyesight can be preserved by having books and magazines printed on unglazed paper.

Booth No. 4 consisted of a miniature schoolroom equipped with glossy-surfaced and dull-surfaced blackboards. Several kinds of natural and artificial lighting were shown, which were made to change periodically. For reading it was shown that light should come from the side or rear in such a direction as to avoid glare in the eyes and shadows on the book. The effects with the glossy-surfaced blackboard were similar to those obtained with the glazed paper. Viewed at certain angles, the letters were entirely invisible. The dull-surfaced boards were more comfortable for the eyes, and the chalk inscriptions on them could be read with ease.

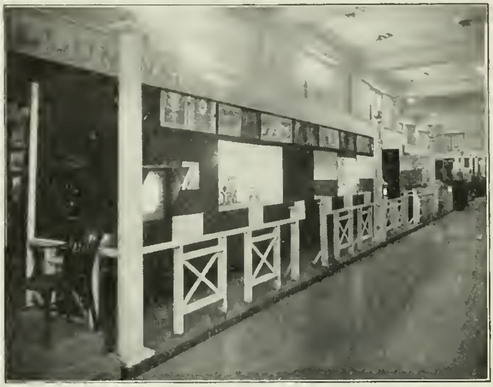


FIG. 1—BOOTHS SHOWING CORRECT AND INCORRECT LIGHTING SYSTEMS

The next booth illustrated correct and incorrect methods of lighting show windows. In the former the light sources were hidden by a reflector, which directed the light from in front and downward over the display, thus illuminating the goods at a high intensity and at the same time protecting the eyes of the observer. With the incorrect method, exposed light sources were used to line the windows, partially "blinding" the observer and preventing him from seeing the goods advantageously.

Booths Nos. 6 and 7, shown in Fig. 2, illustrated correct and incorrect methods of machine-shop lighting, suggesting also how proper illumination will prevent accident. Both localized and general lighting were successively applied in booth No. 6 and the lamps were equipped with reflectors. These reflectors distributed their light economically in the useful direction, at the same time keeping the rays away from the workman's eyes. The units were so located as to give the highest

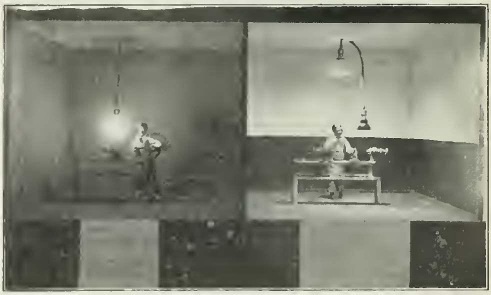


FIG. 2—INCORRECT AND CORRECT METHODS OF MACHINE LIGHTING

intensity on the more important parts of the machines and to eliminate objectionable shadows. The room was finished in a light color, adding to the economy of illumination. The lamp in booth No. 7, as shown in the illustration, had no reflector. A bright light shining before the eyes of the workman would naturally be a hindrance to efficient production and would increase the liability to accidents. The lamp was also placed improperly, the important parts of the machine being in shadow. The dark surfaces tended to reduce the quality of illumination.

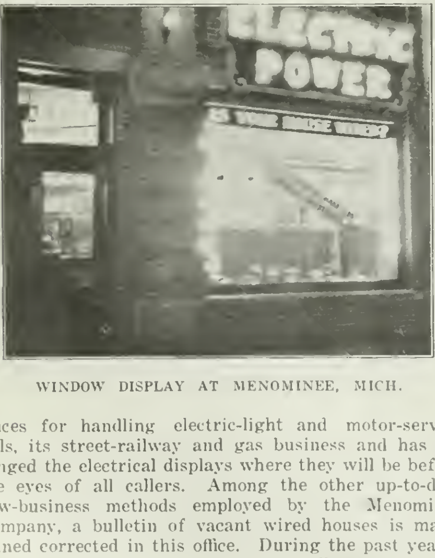
Booth No. 8 showed the four following methods of lighting rooms: (a) bare lamps giving glare; (b) lamp with opal reflector, an example of direct lighting; (c) lamp with semi-indirect inverted reflector projecting the major portion of its light onto the ceiling for redistribution; (d) lamp inclosed in opaque indirect reflector, all light being thrown on the ceiling and upper wall for redistribution.

In booth No. 9 light was thrown on a statue in succession from above, from the right, from below and from the left, and finally a more diffused illumination was thrown on the model from above. This exhibit showed how the appearance of statuary and architectural forms can be affected by the position of the light sources.

Modern New-Business Methods, Menominee, Mich.

The Menominee & Marinette Light & Traction Company, operating electric-service, street railway and gas properties in the northern peninsula of Michigan, finds time to keep its window displays up to date, even though Menominee is not a large city. The illustration herewith shows the lighted window a few weeks before Christmas, percolators, samovars, irons, water heaters, luminous radiators, general-utility motors and the like occupying prominent places under the conspicuous sign advising the purchase of electric ware for Christmas gifts.

Taking advantage of its opportunity, the electric-service company has established in one building its offices for handling electric-light and motor-service bills, its street-railway and gas business and has arranged the electrical displays where they will be before the eyes of all callers. Among the other up-to-date new-business methods employed by the Menominee Company, a bulletin of vacant wired houses is maintained corrected in this office. During the past year a remarkable record for connecting small customers has been made, for within the two towns of Menominee and Marinette, totaling 25,000 in population, an average of more than one service per working day has been added to the company's circuits.



WINDOW DISPLAY AT MENOMINEE, MICH.

Nitrogen-Filled Tungsten Lamps in Seattle's Ornamental System

The first nitrogen-filled tungsten lamps to be used for ornamental street lighting are now in operation in Seattle, Wash., and have attracted much attention locally by reason of their great brilliancy and pure-white color. These new nitrogen-filled lamps are of the 80-cp, 6.6-amp type, the first to be made commercially available, and the lot shipped to Seattle constituted the initial assignment sent out from the factories of the National Quality Division of the General Electric Company.

NITROGEN-FILLED TUNGSTEN LAMPS IN SEATTLE STREET LIGHTING

The poles equipped with the new units are standard five-lamp posts having their lamps fed from individual 250-watt transformers in each pole base. These transformers take energy from the 120-volt mains and deliver it at 8 volts to the lamps. Mr. J. D. Ross, superintendent of Seattle's municipal lighting department, equipped these poles with the 8-volt transformers in 1909 when the multiple-type low-voltage tungsten lamp was still in the laboratory, believing that the sturdy filament possible with the low-voltage lamp would give it a length of life well warranting the extra transformation. Proof of the soundness of that early view is at hand in the shape of two of the original tungsten lamps placed in service on the cluster-lamp poles in 1910 and just removed after burning over 12,000 hours. These old lamps were taken down to make room for the new nitrogen-filled units, but the veteran lamps are still unblackened and apparently as good as new. The average life of the low-voltage tungsten units in service on Seattle's municipal street-lighting system—some 11,700 lamps in all—has for the last two years been well over 4000 hours.

When tungsten lamps first became available they were used to replace all the carbon street lamps in Seattle as rapidly as possible. Now it is expected to replace all the old-type tungsten lamps with the new nitrogen-filled units, thus securing even greater economy and better light, and maintaining the citizens' assertion that Seattle is "America's best-lighted city."

Letter to the Editors

Electric Service, Energy and Charges

To the Editors of the Electrical World:

SIRS:—Articles appear from time to time with some such title as "Rates for Electricity." If electricity were something tangible like potatoes or bricks, our natural thought then would be that the cost or price of electricity would be the natural subject rather than "rate." A rate is a measure of movement or motion. We speak of the rate of flow of a river or the rate of doing work, and the term in itself implies differentiation. Why, then, do we use the word "rate"? It is because we properly recognize the continuity of the electrical service. A far better general title would be "rates and prices for service and electricity."

Community development is the measure of civilization. Money is the universal medium of barter. In the effort to establish the common law for barter the intellect of man has during many centuries gradually evolved two quite different general classifications of exchange in which this common medium is used.

First—The sale and purchase of something the vender has in excess of his own needs in which the price paid is always less than the value to the purchaser. One who has an excess of a thing beyond his needs will sell such a thing at the best price he can get without regard to its cost to him.

Second—The second class of exchange represents that development of the community idea which, as I have said before, is a measure of the progress of civilization and by which an individual contributes his proportion to the expenses of the community. Inasmuch as this payment is involuntary, being dictated by the community and being measured not by the value to the payee as an individual as may be determined by himself but as determined by the community, this second class of demand has received a definite name and is called taxes. The theory of taxation is in a state of development and doubtless is still a long way from being exactly equitable.

Electric central-station service is a distinctly modern development. Its charges have much in common with the charges made by other public utility companies, such as transportation and water companies, etc. The charges by these quasi-public corporations lie somewhere between the first and the second classes. Inasmuch as electric service is in a measure competitive and inasmuch as it is in competition with an inferior but somewhat approximate service which can be rendered by the customer to himself, it is obvious that no central-station service can be rendered at a greater price than the recipient is willing to pay. For the same reason the community has no right to demand that charges for this service shall be based entirely upon the cost to the public utility company unless the community also properly controls such competition, thereby placing the question of charges for electrical service clearly in the second classification, that of taxes.

Inasmuch as the community in this democratic country of ours is, in the final analysis, supreme, when the time comes for the community to use electric central-station service exclusively, carrying to its logical conclusion the universal decision of commissions and courts to the effect that central-station service is a natural monopoly, then the basic equity of charges from the standpoint of taxes will receive consideration. The water companies have for a very long time been in this class.

It is generally conceded that the commonwealth has the right to demand that public service corporations to which exclusive franchises have been granted shall not derive more than a reasonable return upon the capital used and useful in performing their public services. We should not confuse this qualification, applying to the business as a whole, with the question of rate schedules, which apply to classes of consumers. Moreover, courts and commissions have allowed public service corporations, provided that there is no discrimination between customers demanding service under equivalent conditions, fairly wide latitude in establishing charges for their services in order that they may best utilize their capital.

The gas rates are usually much less equitable than the electric rates. Of course, this has resulted from the fact that the gas industry is older and that it was born at a time when rate theories were far from being as developed as they are to-day. The subject is further complicated by the fact that the gas can be transmitted in closed vessels and has the form of a commodity. Instantaneous service of any sort was not a recognized condition of any industry previous to the days of the water and gas companies, and as water and gas can be stored the fact that these can be delivered to the premises of the consumers did not in the public mind seem equivalent to delivery, nor were the expenses incident to such delivery fully appreciated by the consumers for many years.

The telephone and electric-light companies, which must give instantaneous service and which do not deal in anything recognizable as a commodity, by which I mean something that can be stored in vessels or carried in bulk from place to place, are the first general cases of their class.

It was not until the advent of these two companies that the theories of charges for service began to be developed or used. Were the gas and water companies to start over again, their forms of rates would be quite different from what they now are.

The fact that two electric companies have not really the same schedule is a mark of progress and evolution from the condition of the gas-company rates into a more scientific rate of charging, and the time is coming when the gas companies themselves will be forced to an abandonment of their elementary system of charges.

The divergence between the system of charges used by the more progressive central stations which are free from demagogical interference on the part of purely local public authorities appears greater than it actually is. A scrutiny of the 1911 report of the rate research committee of the N. E. L. A., particularly that portion referring to the three-dimensioned rate models, makes this particularly clear.

One recent writer stated that the difference between the highest and lowest rates is almost incredible, quite ignoring the fact that the rates per kilowatt-hour appearing in the usual rate schedule are merely the charges for service plus the charges for energy, divided by the number of kilowatt-hours supplied. They are not charges for electrical energy alone, but include also not only the cost of delivery of the energy supplied but also the cost incurred in anticipation of instantaneously meeting the customer's maximum demand for energy. The inherent unfairness of such a statement is so evident that there should be no discussion. It is only because of a concession on the part of the central stations that their rates are shown by the kilowatt-hour for the benefit of that part of the public which does not realize the fact that the central stations are rendering primarily a service rather than selling a commodity.

If one wished to be captious, he might instance in practically every charge for service inequalities just as glaring. Take, for instance, street railway fares. The advocates of the zone system show the glaring inequalities of one man riding 10 miles for 5 cents where another man rides only 1 mile, thereby showing that the rates vary as ten to one for a passenger. They might assume the extreme case of the weight of the individual and consider the charge for a ton mile, for it is evident that a 200-lb. man carried 10 miles and a 50-lb. child carried 1 mile show a disparity not of ten to one but of forty to one! If they would consider the case of "off-peak" and "on-peak" fares, it would become even more obvious that this 200-lb. man carried 10 miles on the peak load is getting his fare at an extremely cheap rate, whereas the 50-lb. child carried 1 mile during "off-peak" raises the disparity in charges from a forty-to-one to perhaps a two hundred-to-one ratio.

That these illustrations are not unfair will be quite evident in the study of foreign street railway fares with their classification of service into first, second and third classes, with their zone systems and with their preponderance of third-class service during certain hours of the day and of high-class service during other hours of the day.

Mr. Percival Robert Moses, in a very recent article in the *Electrical World*, says that the cost to the large central station of a small customer for practically all items comes about the same in terms of the units sold, yet one does not have to go far to show how absolutely impossible such a conclusion is. If he would take the individual cases of the isolated plant demanding breakdown service, he would see that the cost to the central station is almost purely a demand cost. The kilowatt-hours sold would be few, whereas a consumer such as a street railway or a large hotel may spread its use over so large a part of the day that a very considerable part of this cost will be the kilowatt-hour cost. If, on the other hand, we go to the smallest cost of the smallest customer that is handled in many American cities—and a much larger number in European cities—on a very small connected load, it will be found that such customers occasion almost entirely a customer's or consumer's cost, and that the cost for demand or kilowatt-hours is very small.

In Mr. Moses' article Mr. Brandeis is quoted. No one can find any fault with Mr. Brandeis' opinion, as, with the logic of a clear mind, he first states his premises and then his deductions therefrom. Mr. Brandeis says: "Assuming that the cost of producing and delivering electric energy is the same per unit." Such an assumption is without basis in fact, and hence his deductions, though sound, fall as did the Venetian Campanile, not because they are unsound, but because the foundation is faulty.

Mr. Brandeis, as quoted by Mr. Moses, states positively that the central-station charges fall into the second class of charges. This must be recorded as an opinion, since court decisions, commission decisions and present practice differ in this respect in different cases.

A fundamental error is frequently made in assuming that it is discrimination to base the charge in accordance with the use to which energy is put. The real point at issue is that the time of duration of and relative amount of demand for certain classes of trade are so characteristic and differ so much from other characteristic trade requirements that the central stations have chosen to designate the rates therefor by naming the use to which the energy is applied, avoiding thereby a longer and more involved description, which would be generic. These rates consequently are not made for the use, but rather for the time duration and other characteristics of such use.

On the basis of barter, in my first classification of charges, the value of service and its character are both recognized as proper bases for discrimination.

In some of the older professions, such as the medical and the legal, where charges are purely for service and in which nothing approaching a commodity plays any part, those bases are almost universally recognized to-day.

In the second class of charges—or, as they are called, taxes—this point of view also holds to a very considerable extent to-day. Take, for instance, the single illustration of the cost of policing a city, which is a community charge and which is paid out of the general tax fund. No one will hold that the police department spends more time and goes to greater expense to protect one building than another. In fact, money in bank vaults probably demands the least time of protection on the part of the police or fire departments, and yet no special tax allowance is made therefor. We appreciate that the value of this protection is a measure of the proper charges. Without the police department such property would be in danger, but the mere fact of the existence of the police and the community protection the police organization affords protects property in just the same sense that the break-down switch on the premises of an isolated plant protects that plant against loss from a shut-down even though such a shut-down may never occur.

If we might assume Mr. Brandeis to be a single taxer, his point of view would be more easily understood, although even in this case single-tax advocates recognize the value proper in distributing taxation for the protection or service and not alone the cost of such protection or service. No tax expert goes so far as to suggest distributing charges for police or fire service against the man actually robbed or against the property actually on fire.

It must be assumed that as time passes the quasi-public corporations will more nearly adjust their charges from the viewpoint of the taxation expert, probably by classes. This seems to be the trend of commission and court decisions, and the consequent state of apparent chaos is merely an evidence of a change in progress.

The extent of central-station service, as has been stated, is merely a measure of our electrical civilization. We will probably live to see central-station service so universally supplied where isolated plants now are in operation that it will be considered quite as improper for any customer to manufacture his own electricity as it is to manufacture his own gas or to pump his own water. There are many cases in the Middle West where a man could obtain all the gas he needs by driving a well in his own yard, and yet he takes service from the natural-gas companies. The reason is not far to seek. It is based purely on fundamental economics, which in the end will govern.

The cost of central-station service and of electrical energy is extremely difficult to classify, but on general principles we must agree that two adjoining isolated plants can be served from a plant common to them both more cheaply than they can be served separately. What is true of two would be true of more than two. A general statement of this fact is a statement of central-station service. If this be granted, it is quite apparent that the central station should serve isolated plants at a rate somewhat less than they could possibly serve themselves.

It is to be regretted that it is not possible briefly to express the whole rate question. The subject is too involved. Our states have wisely appointed commissions to make the subject a life's study, and to these commissions the central station and the public can wisely submit their differences.

C. E. Wendell.

Chicago, Ill.

Field of the Operating Engineer

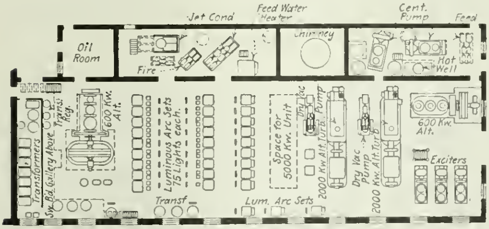
A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

A Winter Warning Concerning Electromagnets

To its electric cranemen handling material with electromagnets during winter weather the safety department of the Inland Steel Company, Indiana Harbor, Ind., has issued instructions to exercise great care in carrying loads over the heads of men on the ground. When the trolley rails are wet or icy contact cannot be depended on to furnish steady power and the load may be accidentally dropped owing to interruption of the circuit.

Utilizing Engine-Room Space to Best Advantage

The municipal street-lighting plant at Detroit, Mich., serves as an excellent example of a station which has been re-equipped without extending the building, to serve a considerably larger system than it was originally intended for. As equipped in the beginning with Western Electric direct-current series-arc machines, the plant soon became limited in the amount of energy it could supply. The old apparatus has therefore been gradually replaced by modern alternating-current generators and mercury-arc rectifiers. Each addition of apparatus was made without extending the original building, until now the engine room is literally "packed," although everything is accessible.



ENGINE ROOM IN DETROIT MUNICIPAL PLANT, SHOWING COMPACT ARRANGEMENT

This room measures about 75 ft. by 259 ft. and among the apparatus installed in it are the following: Two 600-kw, 2300-volt triple-expansion reciprocating units; two 2000-kw, 2300-volt turbo-generators; three exciters with a total rating of 160 kw, thirty-two mercury-arc rectifiers and regulators (all seventy-five-lamp type except one which is fifty-lamp) and thirty transformers ranging in size from 33 kw to 500 kw, with an aggregate rating of 6000 kw. The method of arranging this apparatus to economize space to the best advantage is shown in the accompanying diagram.

Next spring still another generator is to be installed in this engine room, raising the total generating rating of the station to 10,200 kw. The additional unit will be a 5000-kw, two-phase horizontal-type, double-flow Westinghouse turbo-generator. For use in conjunction with it there will be installed a surface condenser having 8000 sq. ft. of cooling area. Condensing water will be drawn directly from the Detroit River, which flows parallel to the rear of the plant. Records show that the temperature of the river has never exceeded 72 deg. Fahr., so it is expected that a 29-in. vacuum can be maintained continuously on the new turbo-unit. No difficulties will be encountered in conveying the water from the river to the condenser as the maximum variation in the river level is 6 ft. and the normal variation is only 2 ft. The four prime movers which are now installed in the engine room may be connected to either jet or barometric condensers, thereby providing flexible operation.

To make room for additional generating equipment, which may be required in the future, the building will have to be extended toward the river front, unless the reciprocating sets now in use are replaced by turbo-units of higher rating. The present boiler equipment will provide sufficient steam for all apparatus including the new 5000-kw unit, but the commission contemplates also extending and improving the boiler plant in the spring. Mr. Frank R. Mistersky is general superintendent of the Detroit street-lighting system.

Safety Hints for Accident Prevention in Power Plants

To spread practical advice bearing on "the safety idea," the United Gas Improvement Company, Philadelphia, Pa., has just issued a suggestive illustrated booklet on accident prevention, the subject matter of which is an amplified revision of the address of Mr. James B. Douglas, claim agent for the company, before the public-policy meeting at the 1913 Chicago convention of the National Electric Light Association. The following safety hints are reproduced from its pages, together with several of the excellent photographs with which the book is liberally illustrated. These illustrations are copyrighted by the United Gas Improvement Company, Philadelphia, Pa.

Fig. 1 shows a guard rail arranged on a frequency-changer set. This rail prevents employees being caught in moving parts or slipping through the bedplate opening while adjusting brushes, wiping collector rings or feeling bearings. It will also be observed that the step on which the attendant stands furnishes a firm place for his feet, which would otherwise rest on the curved surface of the frame.

Ledges to Prevent Falling Tools

Fig. 2 shows a station operating floor in which the openings around the turbines, stairways and edge of the gallery have been guarded by angle-iron ledges. This comparatively inexpensive precaution has doubtless saved many employees working on the floor below from being injured by falling tools, pipes, bars, etc.

An improved method of carrying ladders on company wagons is shown in Fig. 3, the extension of the ladder being here made to overhang in front of the body instead of at the rear, where it might cause accidents to pedestrians when the truck is turning sharp corners. The safety department recommends that pipes, bars and all other long objects be carried thus overhanging at the front instead of at the rear.

Fig. 4 shows the use of a wire guard for protecting an exhaust fan. It was feared that an employee standing on the ladder might lose his balance and in attempting to save himself thrust his arm into the fan blades.

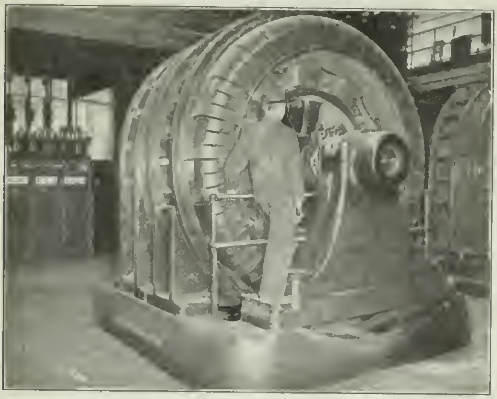


FIG. 1—FREQUENCY CHANGER WITH GUARD RAIL AND FOOT PLATE

The switchboard at the right was boxed later to protect employees against possible short-circuits.

Racks for Furnace Tools

Furnace tools left lying on boiler-room floors, it is pointed out, may cause employees to trip and suffer serious injuries. A blacksmith can make a practical rack for such tools at small expense, and all tools should be kept on this rack when not in use.

Another tripping hazard is presented by the stringing of testing lead wires across passageways and the use of lamp-cord runs in offices.

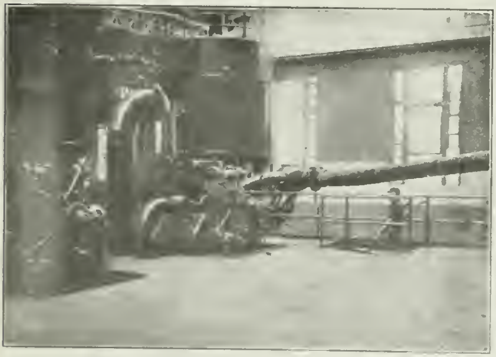


FIG. 2—OPERATING FLOOR WITH ANGLE-IRON LEDGES TO PREVENT TOOLS FROM FALLING

A dangerous practice common among engine-room attendants is that of wiping pulley faces carrying belts running at high speed. A slip of the hand or the catching of a strand of waste in the running belt might result in the loss of the employee's arm or his life. Guards should be placed around such belts and instructions issued not to touch belts or pulleys while in motion.

Protection for Men on High-Tension Lines

As long as men are working on switchboards or lines in "U. G. I." plants, cards are hung on the controlling switches reading, "Danger.—Do not throw switch; men working on circuit." Use of rubber gloves and safety shields is also required of all linemen working among live conductors. For electricians' use, insulated screw drivers are recommended. The shanks of these tools are insulated within a fraction of an inch of the working end. Their use will prevent burns due to short-circuits caused by tools slipping and making contact with charged conductors.

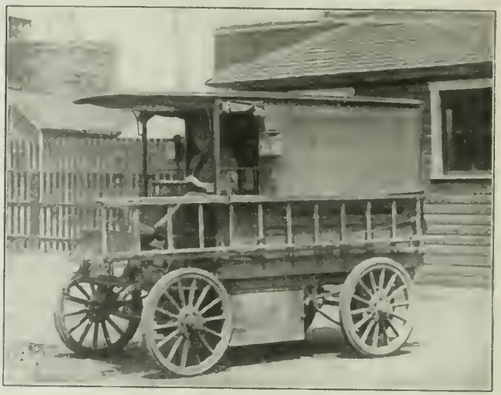


FIG. 3—APPROVED METHOD USED FOR CARRYING LADDER ON WAGON

Glassware should not be stored on shelving without ledges or strips to keep it from falling and breaking. While there is little danger of employees being injured by falling glassware, serious injuries have resulted from their stepping on broken glass.

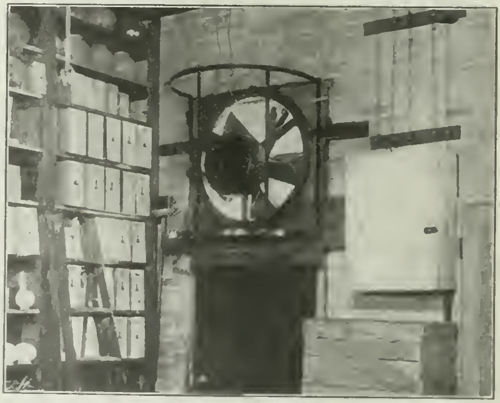


FIG. 4—WIRE GUARD PLACED AROUND EXHAUST FAN FOR PROTECTION

Hazards in Overhead Construction

In running guy wires, outside-construction men should take care that the lines are high enough at street corners to clear drivers of passing wagons. Serious accidents have resulted from neglect of this point.

Lines may be set correctly in the first place, but the leaning of the poles after a few years' service sometimes causes the wires to drop into positions where they may shock drivers or pull them off their wagons.

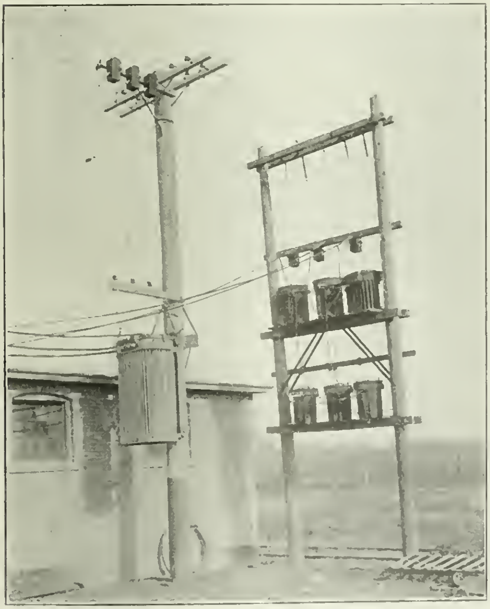
To protect adventurous youths against the penalties of their own curiosity, permanent steps or spikes should not be used on poles at a height below 8 ft. from the ground. Sockets, into which spikes or bolts may be inserted by linemen when needed, are recommended for the first 8 ft., while above this height permanent steps may be used.

While the desire of the United Gas Improvement Company to prevent accidents has, of course, been actuated by humanitarian motives, the results obtained from its safety campaign have proved of marked economic value as well; for, as pointed out by Mr. Douglas, an accident avoided means "money saved, efficiency undisturbed and protection uninterrupted."

Use of 150-kw Pole-Type, Three-Phase Transformers at Milwaukee

A feature of the advanced line-construction methods employed by the Milwaukee Electric Railway & Light Company has been the use of very large three-phase transformers for serving customers' motor installations.

The accompanying illustration shows how the mounting of transformer equipment is simplified, the space requirements are reduced and the appearance of the work is improved by replacing several single-phase transformers by a single three-phase unit. On the right is shown the old equipment which until recently supplied energy to one of the largest foundries in Milwaukee. The initial installation here comprised a bank of three single-phase transformers supported on a platform between the two poles. As the demand for service grew another platform was erected on the same poles, accommodating a second bank of transformers.



150-KW, THREE-PHASE POLE-TYPE TRANSFORMER REPLACING THE SMALLER SINGLE-PHASE UNITS

Recently the increased demand for energy in this foundry brought about another change, which consisted in replacing the half-dozen small units by the 150-kw, three-phase, sixty-cycle transformer shown mounted on the pole at the left. The method of hanging the transformer on the pole and of leading the primary wires to it represent the standard practice of the Milwaukee company. Way clamp-type insulator pins and Matthews fuse-type switches are used. The installation illustrated is declared to be one of the largest three-phase transformers ever erected on a pole. Mr. G. G. Post is electrical engineer for the company.

Etching Numbers on Glass Meter Cases

Please tell me how to etch numbers, letters and figures on glass meter cases as is the practice of some central-station companies. We have experimented with various methods of attaching company numbers and name-plates to meters, but have found none satisfactory and would like to try the plan of etching.

F. K. N.

Figures can be etched on glass with a solution of hydrofluoric acid, which attacks the glass surface, roughening it to a "sand-blast" finish. The etching fluid may be applied with an ordinary rubber-type stamp, using changeable letters in case it is desired to print consecutive numbers. Several brands of these acid etching "inks" are marketed by manufacturers of writing fluids and are well adapted for this purpose.

Work of Artillery Electrician-Sergeants

Please furnish me with information concerning the position of electrician-sergeant in the United States Coast Artillery, the requirements necessary for appointment, character of duties and amount of pay and allowances.

A. Z.

Electrician-sergeants of the second class are appointed from graduates of the electrical course of the Department of Enlisted Specialists, United States Coast Artillery School, Fort Monroe, Va. In order to be eligible for the school the candidate must have had at least one and one-half years' service in the Coast Artillery Corps. The curriculum of the school course includes instruction in the fundamental principles of electricity, use of instruments, operation of generators and motors, testing of cables and apparatus, care of telephones, storage batteries and search-lamps, interior and exterior wiring, cable splicing, construction and operation of fire-control installations and wireless telegraph and telephone systems, machine-shop practice and principles of power-plant operation. Electrician-sergeants who have served in the second class are eligible through competitive examinations to positions as electrician-sergeants of the first class and to the still higher rank of "master electrician." Electrician-sergeants, first class, are charged with the supervision, care and operation of electrical installations, including search-lamps and power plants when necessary. Electrician-sergeants of the second class have similar duties, including the care of lines and means of communication and smaller power plants. The monthly pay of an electrician-sergeant, second class, is $36; that of an electrician-sergeant, first class, is $45, with an increase of $4 per month for each additional enlistment. The men are furnished their quarters (with excellent bathing facilities) heat, light, rations and clothing.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Rheostats for Direct-Current Motors.—L. Cachot.—A long and profusely illustrated article on the calculation of starting resistances and regulating rheostats for direct-current motors.—*La Revue Elec.*, Nov. 21 and Dec. 5, 1913.

Heating of Dynamo-Electric Machines.—Oskar Szilas.—The first part of an illustrated article on a graphical method for investigating the heating of electric machines and transformers.—*Elek. u. Masch.* (Vienna), Dec. 14, 1913.

Induction Machines.—Johann Lissner.—A long paper of a highly mathematical nature on the theory of induction motors and induction machines, or in general alternating-current machines without commutators, with applications to special problems.—*Elek. u. Masch.* (Vienna), Nov. 23, 30; Dec. 7 and 14, 1913.

Lamps and Lighting

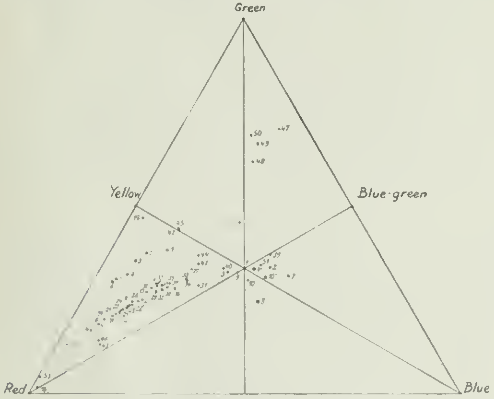


FIG. 1—COLOR TRIANGLE

Graphic Representation of the Color of Lamps.—Erich Jasse.—An article with reference to the recent article by Bloch on a method of determining the color of the light of lamps. The present author recommends the use of Maxwell's color triangle. (Fig. 1.) In any equilateral triangle the sum of the distances of any point within the triangle measured to its three sides is always the same wherever the point may be, the sum in question being equal to the distance of any angle of the triangle from the opposite side. The center point is at equal distances from all three sides, so that if it be assumed that the three fundamental colors, red, green and blue, when mixed in equal proportions, give white, the center of the triangle may be used to represent white. The three angles represent the fundamental colors in saturated condition, as indicated by "red," "blue" and "green" in Fig. 1. Any point on the line connecting the red corner with the center point thus represents a pure red more or less mixed with white. Similarly, any point in the interior of the triangle represents a definite color, and the ratio of the distances of this point from the three sides of the triangle shows the proportion of red, green and blue present in the color designated. Mixtures of two colors are shown as points on the side of the triangle connecting the angles representing those two colors. When the line connecting an angle with the center is prolonged beyond the center point, the complementary color is obtained. For instance, the prolongation of the "blue" line which connects the "blue" corner with the center point represents yellow. The results obtained by Bloch for the color values of different lamps are represented in the diagram by simple points and figures. For example, 1 (the center point) is daylight; 14 is the light of the Bunsen burner with sodium (almost saturated yellow); 15 is the thallium Bunsen burner (light green); 16 is the lithium Bunsen burner (almost saturated red). Points 18, 19 and 20 represent carbon incandescent lamps consuming 4, 3.5 and 3 watts per candle-power respectively; 21 and 22 are for graphitized-carbon lamp consuming 2.5 watts and 2 watts per candle-power respectively; 25 shows the tantalum lamp taking 1.7 watts per candle-power, and 26, 27, 28, 29, 30 and 31 represent tungsten units consuming 1.2, 1, 0.8, 0.6, 0.5 and 0.4 watt per candle-power respectively. Point 34 shows the light of a pure-carbon arc lamp without a globe; 40 the magnetite-arc lamp, and 41, 42 and 43 intensive flame-arc lamps for white, yellow and red light respectively. Point 47 shows the glass-tube mercury-vapor lamp, and 49 the quartz-tube mercury-vapor lamp without a globe. Points 51, 52 and 53 show Moore tube using carbon dioxide, nitrogen and neon respectively. Some results of H. E. Ives are also entered in the diagram as dots surrounded with a little circle. Point 2 refers to a Welsbach mantle with 0.75 cerium, 4 to the tungsten lamp taking 1.25 watt per cp, 5 to the tantalum lamp taking 2 watts per cp, 6 to the carbon lamp at 3.1 watts per cp, and 7 to the mercury-vapor lamp at 0.55 watt per cp. Considerable differences exist between the results of Bloch and Ives and other observers. The author recommends that Bloch's method be investigated further, especially to compare the results thus obtained with those secured by the spectrophotometric method, in order to determine the exactness of the former. Another source of error pointed out is the standardization of the comparison lamp.—*Elek. Zeit.*, Dec. 18, 1913.

German Lamp Tax.—F. Fasolt.—The conclusion of his statistical article on the manufacture and taxation of electric lamps in Germany and the consumption of lamps in Germany and their export to other countries. The financial results of the tax are criticised and their effect on German manufacturers is discussed, especially with respect to the method of figuring the tax on the cost of the lamps according to the tariff laws of Canada and the United States. The author urges that the lamp taxation law should be abolished.—*Elek. Zeit.*, Dec. 18, 1913.

Electric Automobile Lighting.—Emil Dick.—An illustrated description of a system for lighting automobiles by means of an axle-driven dynamo in combination with a storage battery. The system is an execution in miniature of the author's railway-car lighting system.—*Elek. u. Masch.* (Vienna), Dec. 14, 1913.

Generation, Transmission and Distribution

Tractive Force of Electromagnets.—Paul Kalisch.—A long mathematical article, illustrated by diagrams, on the calculation of the tractive force of lifting electromagnets. Maxwell's formula for the tractive force is not altogether correct, but a generally accurate formula has not yet been found. It is recommended that Maxwell's formula be used with a correction factor.—*Elek. Kraftbet. u. Bahnen*, Dec. 4, 1913.

Surges in High-Tension Transmission Lines.—Felix Finckh.—An article on real and imaginary surges in high-tension transmission lines. The author points out that in the case of many accidents it is not possible to decide whether they were due to surge phenomena causing a high voltage or to other causes. Especially in the case of short-circuits between windings in machines and transformers a great many different causes may be assigned. Before steps are taken to prevent the recurrence of such accidents it is important to find out the exact reason, and to do this an accurate knowledge of the peculiarity of the design of the machines, etc., is necessary. The manufacturers who first built the machines are best able to do this.—*Elek. Zeit.*, December, 1913.

Gas Engines.—E. G. Coker and W. A. Scoble.—An abstract of a paper read before the (British) Institution of Civil Engineers on cyclic changes of temperature in gas-engine cylinders.—London *Electrician*, Dec. 19, 1913.

Traction

Energy Supply to Railways by Central Stations.—Thierbach.—The author emphasizes the fact that the cost of generating energy in a central station can be very much reduced if the plant also supplies power for traction. This is especially true when a rate schedule is employed according to which the customer pays a fixed flat rate for the maximum kw demanded and also a small unit charge per killowatt-hour for the energy consumed during the year. For those hours during the evenings in the winter in which the lighting load curve has its maximum, it is recommended that the traction energy be obtained from a large storage battery which could be charged during the remainder of the day. The author investigates in detail the economy of this arrangement.—*Elek. Kraftbet. u. Bahnen*, Dec. 14, 1913.

British Railway Statistics.—The annual tables of statistics of British electric railways obtaining energy from combined lighting and traction power houses. These systems number 141. In another set of tables a list is given of British railways with power houses supplying traction energy only, their number being 43. A list is also given of fifteen British electric railways now in operation. The information presented includes a description of the routes followed, names of officials and details of track, overhead equipment, rolling stock, etc. —Supplement London *Electrician*, Dec. 19, 1913.

Lötschberg Single-Phase Railway.—The conclusion of the long illustrated article on the single-phase railway from Spiez to Brig (Lötschberg tunnel railway). In the present instalment L. Thormann gives details of the power plants and transmission lines.—*Elek. Zeit.*, Dec. 18, 1913.

High-Tension Direct-Current Railways.—A list of forty-nine high-tension direct-current railways in Europe. Forty-six of these employ two conductors. The trolley potential varies from 800 volts to 2000 volts, the motor pressure from 500 volts to 1200 volts. Three roads employ three conductors, the pressure being 2×600 volts, 2×700 volts, and 2×1200 volts, respectively.—*La Lumière Elec.*, December, 1913.

Prevention of Accidents on Railways.—Von Knapitsch.—An illustrated article on the means employed to prevent accidents on the Vienna street railways. One of the principal methods is the use of moving pictures illustrating correct and improper ways of entering and leaving street cars.—*Elek. Kraftbet. u. Bahnen*, Dec. 14, 1913.

Electric Locomotives.—F. Lydall.—A paper giving diagrams and design data of twenty-seven different electric locomotives—London *Electrician*, Dec. 19, 1913.

Electrical Equipment for Automobiles.—A. Armagnat.—An illustrated account of recent progress in lighting dynamos, electric starters and combined lighting and starting equipments for automobiles.—*La Revue Elec.*, Dec. 5, 1913.

Installations, Systems and Appliances

German Central-Station Statistics.—Georg Dettmar.—A summary of the status of German central stations on April 1, 1913. While these statistics were formerly issued every year, the report now appears only every two years. The present statistics show the excellent condition and the very rapid growth of German central stations. In 1907 there were 1530 municipal plants in Germany, in 1909 there were 1978, in 1911 there were 2526, and in 1913 there were 4040, so that the increase by two-year periods was 448 from 1907 to 1909, 548 from 1909 to 1911, and 1,514 from 1911 to 1913. The rapid increase in the last few years is also illustrated in Fig. 2, which shows the development of German central stations from 1895 to 1913. Different curves give the number of stations, the total connected load in millions of kilowatts, lighting load, stationary-motor load, railway load and load due to heating and cooking apparatus. Since many of the central stations transmit energy to other cities, there are at least 17,500 cities in Germany now supplied with electricity, which represents an increase of 6500 cities, or 60 per cent in the last two years. The number of connected lamps and their equivalent in kilowatts is shown in the accompanying table. This shows the rapid increase in incandescent lamps, while for the first time that statistics are

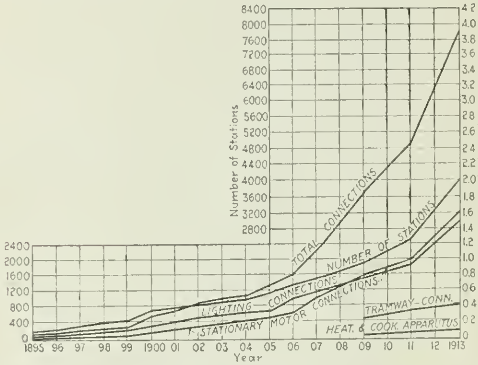


FIG. 2—CURVES SHOWING DEVELOPMENT OF GERMAN CENTRAL STATIONS

DATA ON LAMPS, GERMAN CENTRAL STATION

Year	Number of Incandescent Lamps Connected	Kw of Incandescent Lamps Connected	Number of Arc Lamps Connected	Kw of Arc Lamps Connected
1909	12,808,351	640,418	234,566	117,283
1911	16,209,233	810,462	245,772	122,886
1913	24,554,381	1,227,719	230,190	116,095

available there has during the last two years been a reduction of arc lamps, owing to the introduction of high-candle-power incandescent lamps. The number and capacity of stationary motors has also been greatly increased. The total connected load of German central stations has been doubled during the last four years. Fig. 3 gives curves for the different distribution systems used. While the direct-current systems have decreased in rating during the last two years the mixed direct-current and alternating-current systems, and especially the pure alternating-current systems, show a very large increase. While the average increase of capacity of machines installed in stations within two years was formerly 250,000 kw, the increase during the last two years has been more than 600,000 kw. Particularly do the stations with ratings from 2000 kw to 5000 kw show large growths. Of the 1880 direct-current stations 1015 use the two-wire system, 862 the three-wire system, and three the five-wire system. Of the 278 mixed systems thirteen use direct current and single-phase alternating current, while 265 supply direct current and three-phase energy. In answer to the question whether the communities with electric service contain also gas plants no information is available from 1936 cities, while in other cities 1576 have no gas plants, and 528 have a gas supply. In 1913 2833 stations were owned by private individuals or companies and 1012 by municipalities or the State. In all, 198 stations supply energy for traction. Out of 2953 stations which furnished information on the subject of distributing networks, 122 stations have cable systems, 2221 stations have overhead wires and 610 stations both cables and overhead wires. As to meters in use, 707,359 meters are used for lighting only, 152,821 for motor service, and 792,852 for both lighting and motors. Some 15,000 prepayment meters are in use. The number of consumers who have flat-rate schedules, as far as this can be ascertained, is 146,730. Fig. 4 gives the curves for the motive power in use in the stations. The number of steam stations is still the highest, and although it has slightly increased during the last two years, the number of water-power stations has grown rapidly. From 733 stations reports were received giving information on the energy sold. From 1909 to 1911 it totaled 1,254,253,000 kw-hr., and from 1911 to 1913 it was 1,949,092,000 kw-hr., which shows an increase of 55.4 per cent in two years, or 28 per cent in one year. The annual increase was formerly only 15.9 per cent. There are now 103 stations in Germany having a rating of more than 5000 kw each. Their aggregate rating is 1,560,752 kw. Eleven stations have a capacity of more than 25,000 kw. These are the Berlin Electricity Works (192,732 kw), the Düsseldorf-Reisholz system (65,000 kw), the Upper Silesian Electricity Works in Gleiwitz (59,000 kw), the municipal station in Hamburg (44,325 kw), Essen (39,400 kw), Hagen (38,500 kw), Frankfort-on-the-Main (36,734 kw), Saarbrücken mining department (33,000 kw), the municipal station at Munich (32,968 kw), Berlin-Schoeneberg (26,630 kw), and Mülhausen (25,052 kw). —*Elek. Zeit.*, Dec. 18, 1913.

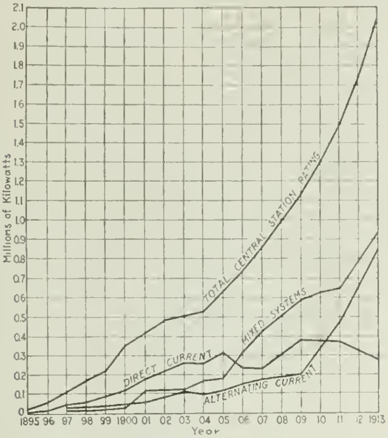


FIG. 3—VARIATIONS OF DIFFERENT DISTRIBUTION SYSTEMS

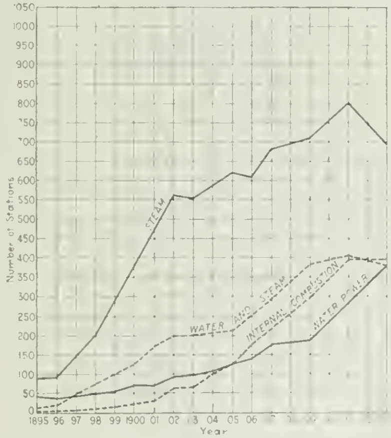


FIG. 4—VARIATIONS OF MOTIVE POWER USED IN STATIONS

Co-operative Control of Central-Station Properties.—R. A. Chattock.—The author refers to a development which has been going on in Germany during the last few years. Privately owned central stations were the rule at first, but these apparently used their monopolies to the detriment of the consumer. A reaction in favor of municipal control followed, but this has also proved not entirely satisfactory since the machinery available for the management of these undertakings was found too cumbersome and inelastic. The outcome has thus been a condition of dual control under which the company manages the property and the municipalities concerned assist in financing it and are represented on the supervising board. The advantages claimed for this arrangement are that company control appears to be more flexible; it is not subject to boundary restrictions and can include in its operations large areas comprising many municipalities; full advantage can be taken of centralization and its beneficial effect upon cheapening the cost of production; special rates can be better negotiated; the property can be extended more quickly and readily to meet industrial requirements; municipal finance can provide the capital required at a cheap rate of interest, and small as well as large municipalities can become interested in and can join in the same central-station system without allowing mutual jealousies to interfere. The procedure as regards opening streets for laying mains and dealing with other municipal departments, such as water, gas, railways, etc., is also declared to be made much easier. While this development in Germany is believed to be a step in the right direction, the author thinks it does not go nearly far enough as the supply of electric energy is still exploited with the sole ultimate object of earning profits. His ideal is nationalization of electricity supply, that is, control of the whole of the supply by a government department in a way similar to the control of the post office.—London *Elec. Review*, Dec. 19, 1913.

Starting Internal-Combustion Motors.—O. H. WILDT.—A long article, illustrated by diagrams, on the various methods used for starting internal-combustion motors.—*Revue de Mécanique*, July 31, 1913; an abstract with illustrations in *La Revue Elec.*, Nov. 21, 1913

Wires, Wiring and Conduits

Conductivity of Aluminum and Heat Treatment.—H. GEWECKE.—When sheet aluminum is heated for two hours at 215 deg. C., or for one hour at 230 deg. C., its conductivity is found to be improved by 6 per cent without seriously affecting the mechanical properties of the metal. Aluminum wire can be handled in the same way, but the loss of mechanical strength is very serious in this case.—From *Zeit. d. Ver. Deutscher Ing.*, translated in London *Electrician*, Dec. 19, 1913.

Electrophysics and Magnetism

Photo-electric Effect.—R. POHL AND P. PRINGSHEIN.—A paper on the long-wave limits of the normal photo-electric effect. The authors conclude that from the experimental data at present known it may be regarded as pretty firmly established that the long-wave limit of the normal photo-electric effect furnishes a measure of the binding force between the electrons and the illuminated molecule. On the other hand, any attempt to formulate this relation quantitatively is met with the difficulty that the values for the long-wave limits of the normal photo-electric effect in the case of many metals and alloys are subject to variations as great as an octave and more. This difficulty is all the more real in that as yet we are not in a position to determine what influences on and in the extremely thin bounding surface of the metal in which light absorption takes place are the determining factors in this displacement.—*Philos. Mag.*, December, 1913.

Mechanical Effect of Magnetism.—S. R. WILLIAMS.—A continuation of his comparative studies of magnetic phenomena. In the present instalment the author deals with the twist in steel and nickel rods due to longitudinal magnetic fields. His results show that for some specimens of ferro-magnetic substances two mechanical effects may occur when a longitudinal magnetic field is imposed upon them, namely, a change in length and a twist. These effects and also other magnetostrictive effects are larger in nickel than in iron and steel. The fact that a mechanical effect due to magnetization can occur in a rod because somewhere in its history it has suffered some change in its structure proves emphatically that one must be very sure how the specimens were prepared, else there can be no way of comparing one observer's results with another, and hopeless confusion arises.—*Amer. Jour. of Science*, November, 1913.

Electrochemistry and Batteries

Electrolytic Production of Perforated Copper Tubing for Radiators.—An illustrated description of the Feldkamp process. In this a flat lead strip, say 0.125 in. in thickness and perforated at intervals with 0.25-in. holes staggered with reference to each other, is electroplated with copper, after which the strip is cut into suitable lengths. These are heated above the melting point of leads, thus melting out the lead core. What remains is the copper plating in the form of a light copper tubing having an internal contour corresponding to the original perforated lead strip. This is used for automobile radiators, for radiators for house heating systems, etc. The electroplating process is continuous, the lead passing in the form of a long strip through the bath, in each side of which are anodes in the form of wires. There is no anode scrap, and the thinner wire passing out of the bath has a higher value per pound than the thicker wire which passes in.—*Metall. and Chem. Eng'ing*, January, 1914.

Nitrates by Electrolysis.—G. DARY.—An illustrated article on the Nodon scheme of producing nitrates by direct electrolysis of peat deposits.—London *Elec. Review*, Dec. 19, 1913.

Units, Measurements and Instruments

Single-Phase Power-Factor Indicators for Variable Frequency.—LEONARD MURPHY.—The author thinks that the comparative lack of popularity of power-factor indicators for testing-room and laboratory work is mainly due to the non-adaptability of the single-phase type to measurements at various frequencies. The voltage element of a single-phase instrument usually consists of two fine-wire coils, mechanically at right angles and rigidly fixed together. One of these is excited with energy tapped off across the line potential through a high non-inductive resistance, while the other coil is excited in a similar manner, except that the resistance is replaced by a choking coil or a condenser. The readings of such instruments depend on the frequency of the current. A simple method of overcoming this difficulty to some extent is shown in Fig. 5. It involves the use of both a choke coil and a condenser. The cross coil is divided into two parts, one of which, *B*, carries the choke-coil current, and the other, *B'*, that from the condenser. These two parts are wound one over the other and are so connected that the leading current from the condenser produces a magnetic field in the same direction at any instant as the lagging current from the choke coil. Thus the ampere-turns on the two parts of the coil are added together, although the currents are 180 deg. out of phase, the result being that the totol cross ampere-turns tend to become constant, even though the frequency is varied considerably. Thus, for example, an instrument may be arranged to work over a frequency range of thirty-two cycles to seventy-eight cycles per second, with only a 10 per cent variation in the total cross ampere-turns.—London *Electrician*, Dec. 19, 1913.

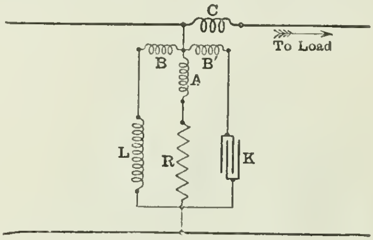


FIG. 5—SINGLE-PHASE POWER-FACTOR INDICATOR

Exhibition of Instruments.—An account of a recent exhibition of the Physical Society in London. Besides the exhibition experimental lectures were given. The exhibits included the electrostatic oscillograph of Ho and Koto, recently described in the Digest; Duddell standard coils, the Coblentz linear bismuth-silver thermopile, etc. The article is to be continued.—London *Electrician*, Dec. 19, 1913.

Telegraphy, Telephony and Signals

Telephone Relays.—The British and German telephone departments are engaged in making experiments with telephone relays on lines from London to Cologne and Berlin, using the Anglo-Belgium submarine cable. The line from London to Brussels is equivalent to 22 miles of standard cable; Brussels to Cologne, 8 miles, and Cologne to Berlin, 20 miles. By inserting a telephone relay at Brussels the speech between London and Cologne was equal to that through only 20 miles of standard cable so that even between London and Berlin speech could be heard. Two types of relay were employed, namely, the Brown relay and the Lieben-Reisz relay. The latter has been described in detail recently in the Digest. The older form of the Brown relay has also been formerly described in the Digest, but in the recent experiments a new form is used. In this the secondary contact is a microphone chamber containing carbon granules instead of the minute "condition space" between a platinum point and disk employed in the earliest pattern, although subsequently replaced by an iridium point and hard-carbon plate in the relays for wireless telegraphy. A diagram of the instrument is seen in Fig. 6. In the latter *N* is the permanent magnet, on the pole-pieces *H* of which are wound two coils carrying the current received from the line. A steel reed *P* can be adjusted by the screw *W*, and has the front of the microphone chamber *M* fixed to its upper end, which faces the pole pieces of the permanent magnet, making an almost complete magnetic circuit with a very small air gap. The microphone chamber contains two carbon-faced electrodes and is nearly filled with fine carbon granules. The tension of the reed is adjusted by the screw *W* until the reed is on the point of dropping against the pole pieces, so that its elasticity is nearly balanced by the magnet pull. *S* is a stop screw to prevent the reed from falling against the magnet faces. *K* is a regulating winding in series with the microphone; it prevents any considerable drop in the steady current when the relay is strongly operated, and also, by its telephonic action, intensifies the magnifying power of the instrument. The relay is used with a condenser in series on its primary side; while the circuit of the secondary side is made up of a battery, the primary of an induction coil and the microphone chamber. According to Brown, the relay will magnify the current about twenty times, and its use corresponds to a saving equivalent to the loss in 30 miles of standard cable. If inserted in the middle of an ordinary simplex line, a relay has, of course, the disadvantage that it can work in only one direction, and in early experiments the line was duplexed. There is, however, difficulty in maintaining good balance on such a duplexed telephone line owing to variations in insulation resistance and varying terminal conditions. Duplexing also, of course, halves the transmitted and received currents. Brown, therefore, now uses a highly sensitive simplex automatic switch to reverse the relay connections according to the direction of the received speaking currents.—London *Elec. Eng'ing*, Dec. 18, 1913.

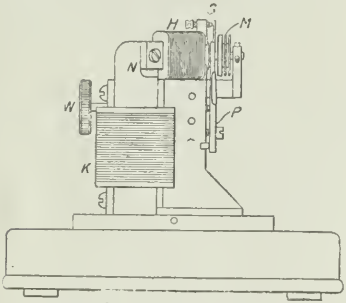


FIG. 6—TELEPHONE RELAY

Huertley Magnifier.—An editorial note on the Huertley magnifier which was shown at the recent exhibition of the Physical Society in London and which depends upon the variation of resistance of two platinum wires forming two sides of a Wheatstone bridge. Each of these wires is mounted over a slit in a tube through which air is blown. The movement of the receiving coil, such as is used in a siphon recorder, is transmitted to these wires by silk fibers and the resultant movement causes one wire to be drawn further out of the stream of air, while the other is drawn further into it. The wires are maintained hot by passing a current through them, and thus each movement causes a considerable variation of resistance. In actual operation the movement is barely visible. The instrument is capable of receiving seventy-five words per minute with 0.7 microamp.—London *Electrician*, Dec. 19, 1913.

Book Review

Electrical Engineering. By Clarence V. Christie. New York, N. Y.: McGraw-Hill Book Company, Inc. 417 pages, illus. Price, $4 net.

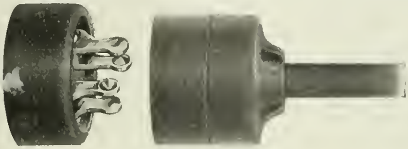
A single volume cannot cover the whole field of electrical engineering, even if practical details are entirely omitted. For this reason, the title of Professor Christie's book fails to give an accurate indication of its contents. The book deals with the principles of electrical engineering, with special reference to dynamo-electric machinery and transformers. The brief preface is, however, a correct guide to the subject treated and to the method of treatment. To quote the author: "This book has been compiled as a foundation for lecture courses for junior and senior students in electrical engineering," and the further statement is made that the general groundwork may be extended to suit the requirements of particular classes. It may be said without hesitation that the task the author set himself to do he has executed in an admirable manner. The book is entirely without superfluous matter, a most desirable feature if the principle of condensation is not carried too far; the fundamentals are clearly stated, and the necessary proofs are given in well-worded and accurate language. In the opinion of the reviewer, this is essentially a teacher's book, forming an excellent groundwork capable of expansion and further illustration as the case demands. Chapter I is devoted to electrostatics, a subject usually neglected or treated inadequately in textbooks on electrical engineering subjects. Chapter II deals with the principles of the magnetic circuit, and Chapter III with electric circuits. The remaining seven chapters treat mainly of the elements and theories underlying the design and operation of transformers and both direct-current and alternating-current machinery. In the last chapter the principal formulas for transmission line calculations are developed. The author's method of determining the inductance of parallel wires might be challenged. He integrates between the limits R and $(D - R)$, thus departing from the usual method, which takes into account the flux from the surface of the outgoing wire to the *center* of the (cylindrical) return conductor. The difference in practical work will usually be negligible, but the formula in general use is simpler in appearance and more accurate. The commendable tendency to condense and avoid verboseness or the introduction of unnecessary material is occasionally the cause of too little being said; thus, on page 174, the saving of a few words leads to possible confusion in the minds of readers, who can be imagined as attempting to picture, with varying degrees of success, the existence in the armature windings of a current due to no apparent cause. Such criticisms are, however, of minor importance. They do not detract from the value of the book, which should appeal to a large number of teachers and students.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed
Manufactured Products of Interest to Electrical Readers

Motor Attachment Plug

The attachment plug illustrated herewith has been designed by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., for small portable motor-driven devices such as vacuum cleaners, grinders, floor polishers, compressors, etc. The base of the plug can be permanently secured to the motor frame, which is provided with rugged double lugs. The contacts are dead when the device is not in use, the live contacts of the part attached to the flexible cord being sunk below the surface.

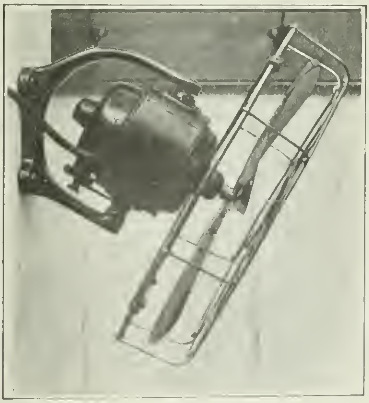


ATTACHMENT PLUG

A heat-resisting material called "Thermoplax" is used in the construction of this plug, which is rated at 10 amp and 250 volts. The heavy double lugs and contacts are so designed that the plug can be separated by a pull at any angle.

Ball-Bearing Bracket Oscillating Fan

The oscillating fan illustrated herewith is supported by a cast-iron bracket inclined at a fixed angle of 25 deg. The fan is equipped with ball bearings which permit the body to oscillate with a minimum amount of friction. All of the oscillating mechanism is entirely concealed within the rear-end cover, leaving visible only the revolving disk and lever. By twisting a knurled head in the disk the arc of oscillation may be varied in three steps from 90 deg. to zero, at which latter point the fan stops oscillating. The fore part of the shaft is supported by a ball bearing to take up the forward thrust. The body casing and end covers are made of pressed metal, and the motor frame is laminated. A speed regulator giving three running speeds has been designed for use with this fan, which is made by the Diehl Manufacturing Company, Elizabeth, N. J.



OSCILLATING FAN ATTACHED TO WALL BRACKET

Electric Starting and Lighting Equipment for Automobiles

The United States Light & Heating Company, Niagara Falls, N. Y., is manufacturing a combined motor and generator for starting automobile engines and for charging the batteries and providing energy for the lighting equipment. The armature is of flywheel size and weight and is bolted to the flange of the engine crank-shaft in place of the usual cast-iron flywheel. In the 1914 model all external regulating devices, such as carbon piles and other resistances have been eliminated, the regulation being accomplished by a new disposition of the copper-wire coils of the machine.

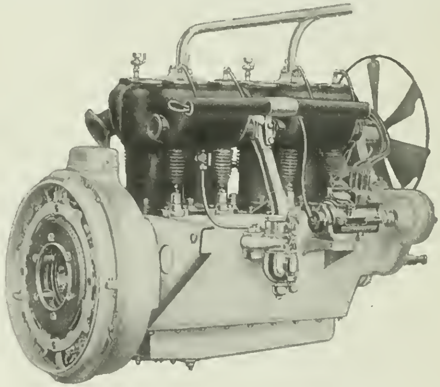


FIG. 1—MOTOR-GENERATOR MOUNTED ON ENGINE

When the starting button is pressed down the armature and the field coils become energized, causing the armature to revolve at a speed varying from 200 r.p.m. to 400 r.p.m. The motor-generator not only acts as a starter and as a generator but also as a flywheel. After the foot-button has been pressed down the engine commences to fire; the button is then released and the machine is automatically changed from a starting motor to a charging and lighting generator driven by the engine. At a definite engine speed the automatic switch closes and the energy passes from the generator to the battery.

The starting switch is installed beneath the floorboard with the push-button protruding within easy reach of the driver's foot. The device is of the revolving-drum type and has contacts similar to those used in street-car controllers. The contacts break in a bath of oil. The switch has two positions, one for starting and the other for charging. When the foot-button is pressed down as far as it will go starting connections are made; when the foot-button is released charging connections are made.

The automatic switch is simply a small magnetically operated carbon-break switch which closes the charging circuit when the generator voltage is sufficient for charging and opens when the generator voltage falls below that of the battery.

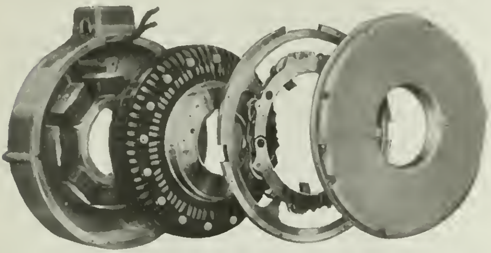
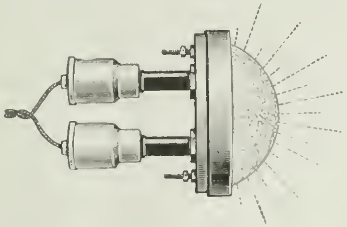


FIG. 2—DISASSEMBLED PARTS OF MOTOR GENERATOR

The machine is designed in a range of sizes from a 60-ft.-lb. starter for a small four-cylinder engine to a 400-ft.-lb. starter for an eight-cylinder fire-pump engine. Fig. 1 shows the motor-generator attached to a Moyer engine, and in Fig. 2 the different parts are shown disassembled.

Radiant Electric Heater

The electric "fire" heater illustrated herewith has been put on the market by Messrs. Redglo, Ltd., Liverpool, England. The heating element is entirely inclosed in a quartz dome, which is made in an electric furnace. The area of this dome is 23 sq. in. Red rays radiate from the globular face of the dome. The heating element is made of an alloy particularly adapted to withstand high temperatures for long periods. Substantial leading-in pillars, which are housed in porcelain, are carried away from the heating center and screwed into the terminals. The latter are designed for a pressure of 100 volts, but at the same time they are insulated for pressures as high as 500 volts. The heating elements are wound for any predetermined pressure between 100 volts and 250 volts, and either direct current or alternating current can be used.



ELECTRIC HEATER

Each unit consumes 600 watts and measures 7 in. over all from the tip of the quartz dome to the end of the terminals. The dome is 5.125 in. in diameter, and the complete weight of the device is only 2 lb.

Electric Versus Gasoline-Truck Operating Costs

If the local conditions are known, it is a simple process to compute the comparative costs of operating gasoline and electric trucks, as pointed out by Mr. E. J. Bartlett, of the Baker Motor Vehicle Company, Cleveland, Ohio. In general terms a comparison of the operating costs of an electric and a gasoline truck of the same load capacity, traveling the same number of miles per day, is given below:

Driver.—Saving of $156 per year over electric truck since a mechanic is not required to operate and care for the electric truck, making a difference in wages of $3 per week.

TABLE I—DAILY OPERATING COSTS, ELECTRIC AND GASOLINE TRUCKS

Size of Truck	Battery Wear and Charging Energy	Fuel and Engine Lubricating Costs
1000-lb truck	$1.03	$0.65
2000-lb. truck.	1.25	0.85
4000-lb. truck. . .	1.47	1.00
7000-lb. truck. . . .	1.93	1.40

Tire Wear.—About the same as with the gasoline cars. Electric-truck tires wear longer owing to the slower speed, but they also cost more owing to the more resilient qualities necessary to propel the truck with the least power.

Battery Wear.—The items of battery wear and charging energy should be considered as fuel cost and will vary with the cost of energy and size and type of battery. If an energy cost of 3 cents per kw-hr. is assumed, using figures computed for the "Exide Ironclad" battery as an average equipment, the daily costs will be approximately as in Table I, compared with gasoline operation at 17 cents per gallon.

TABLE II—REPAIR AND DEPRECIATION PER YEAR

Size of Truck	Electric	Gasoline
1000-lb . .	$260	$600
2000-lb.	300	700
4000-lb.	390	900
7000-lb.	495	1130

These figures show that the gasoline-truck fuel and lubricating oil alone cost over one-half as much as the combined cost of battery wear and charging current for the electric truck.

Repair Parts, Labor and Depreciation.—As the above item already provides for battery wear, there is left in the case of the electric truck a simple, sturdy mechanism which requires very little in the way of repair parts and labor to keep it in excellent operating condition.

In addition to these simple parts, such as axles, springs, frame, etc., which are similar in construction in both electric and gasoline trucks, the latter includes a complicated reciprocating gas engine, a train of clash gears or transmission, clutch, gear-shifting devices, etc. The repairs, of course, are very much higher for the gasoline truck, and its efficient life is about one-half that of the electric truck, or five years against ten. Assuming the initial cost to be the same for the two types, we have in Table II a comparison for the different sizes.

Assuming interest on the investment, insurance, storage, painting, etc., to be the same for either type, a summary of these figures on a basis of 300 working days per year shows the results given in Table III.

TABLE III—COST OF OPERATING VARIOUS TRUCKS PER YEAR OF 300 DAYS

Size of Truck	Electric	Gasoline	Difference in Favor of Electric
1000-lb............	$1349	$1731	$382
2000-lb............	1455	1891	436
4000-lb............	1611	2136	525
7000-lb............	1854	2486	632

In addition to this saving in operating cost more continuous service is afforded by the electric truck. It has no valves to grind, carbon deposits to be removed, ignition and carburetor parts to be repaired, nor similar minor attentions which keep the truck out of commission several days a year. The electric vehicle is simple in construction, simple to operate and always on the job with a minimum expense. It is adapted to the trucking requirements of at least 85 per cent of all lines of business, and in these cases it will operate at an economy to the owner as compared with other means used for haulage.

Automatic Voltage Regulator

The Thompson-McArthur Company, Buffalo, N. Y., is putting on the market an automatic voltage regulator which is illustrated herewith. The device is designed to keep the voltage of a generator at any desired value, regardless of variations in the engine speed or changes in the load on the generator, by automatically varying the field strength, an operation usually done by hand. Two types of regulators are made, one designed for operation with direct current and the other for alternating current.

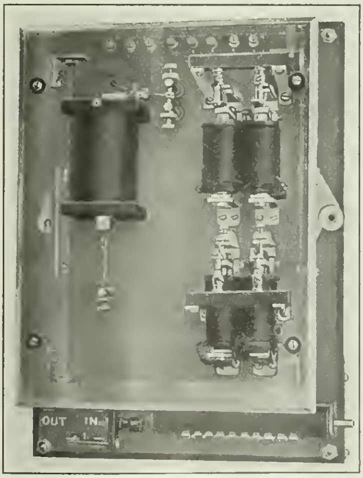


FIG. 1—AUTOMATIC VOLTAGE REGULATOR

Referring to the diagram shown in Fig. 2, when the switch is placed in the "out" position the regulator is not in service and circuit No. 1 is in operation, the field current passing through the rheostat, which permits the usual hand control. When the switch is thrown in, circuit No. 3 is used, and if the voltage is normal the tension of the adjusting spring on the core of the control solenoid just balances the pull exerted by the solenoid field. The pivoted lever is then held in a neutral position, touching neither of the relay-control contacts. If the voltage tends to rise, however, the solenoid exerts a greater torque and pulls the core up until the pivoted lever touches the lower relay contact, causing the relay for lowering the voltage to be energized. The field-control contacts ordinarily held closed by a spring are opened, and the field current has to pass through an additional resistance, thus lowering the voltage of the generator. If the voltage has a tendency to drop, the core of the control solenoid goes down and causes the pivoted lever to touch the upper relay-control contact. This action closes circuit No. 2 by energizing the relay for raising the voltage. The field rheostat is short-circuited, and the field current "builds up," therefore raising the voltage of the generator.

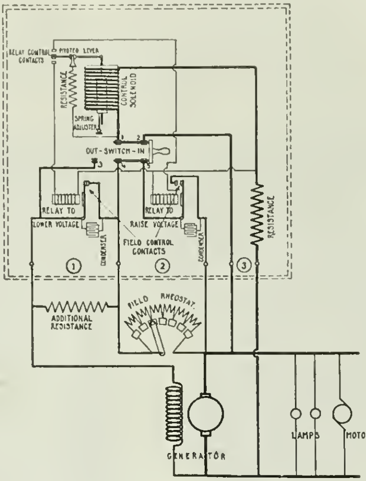


FIG. 2—WIRING DIAGRAM OF AUTOMATIC VOLTAGE REGULATOR

An alternating-current regulator has an added alternating-current solenoid to control the torque of the direct-current control solenoid and give the proper voltage to the exciter. A current transformer is also necessary to assist in controlling the exciter voltage. This current transformer can be used for line-drop compensation if so desired. A voltage transformer is necessary when the voltage of the alternator is over 500 volts. The alternating-current regulator is applied to the exciter.

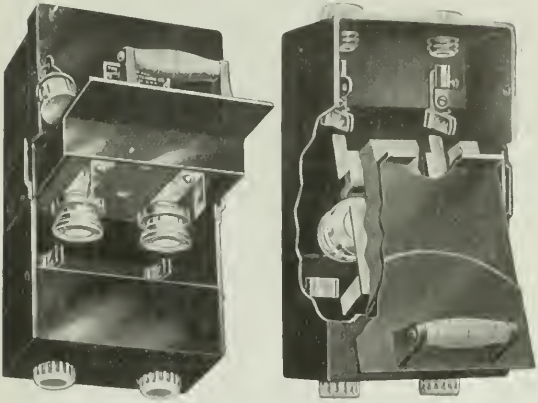
When two or more direct-current generators are operated in parallel one regulator is sufficient. It should be used with the largest unit. One regulator may also be used with more than one alternating-current generator where the exciters are operated in parallel and the exciter rheostats have a fairly wide control of voltage (30 per cent below normal).

This regulator may be used to compensate changes in line drop for either direct-current or alternating-current installations covering large areas by adding an extra winding to the control solenoid. In the direct-current regulator the compensating coil is connected to a shunt in the main line or in the busbar, while in the alternating-current device it is connected to a transformer in the line or the busbar.

Inclosed Service Switches

The service switches shown herewith are designed to meet conditions where it is desirable not to hamper the switch and fuses with seals and, at the same time, to prevent improper access to current-carrying parts of the switch and cut-out.

Fig. 1 shows one of these service switches open with the fuses exposed for inspection or replacement. The circuit is protected by ordinary Edison fuse plugs. The upper part of the box in which the service wires enter is sealed. Fig. 2 shows the same box with the cover of the service terminal chamber removed and the side of the box cut away to show the relation of the fuses and the moving switch parts. The switch and fuses are mounted on a pivoted cover and are so arranged that in opening the box the switch is disconnected from both the line and load terminals. A projecting flange upon the inner side of the cover closes that part of the box in which are the switch and fuses before the moving switch contacts engage the fixed contacts. The upper part of the base on which the switch is mounted swings downwardly into the box when opening the switch, thus forming a barrier between the open end of the box and its sealed or service end.



FIGS. 1 AND 2—SWITCHBOX UNCOVERED AND SWITCHBOX WITH COVER OF TERMINAL CHAMBER REMOVED

Small boxes are usually arranged so that the cable or conduit may enter the box directly. Fig. 3 shows how the terminals may be secured inside the box, making it impossible to remove them without breaking the seal of the terminal chamber. The terminals are designed to slip back over the pipes or cables, thus permitting the wires to be fanned out, lugs soldered on and connections made to the switch and cut-out before the terminals are drawn into place. Open-link fuses are used with this type of box. The cut-out designed for these open-link fuses is built up from single-pole units for two-pole, three-pole, four-pole or five-pole switches, the units being fastened together by the screws at *H*. The covers controlling the action of the switching members are secured to one another by the screws at *A* which engage the cross-bar *K*. In cases of emergency, therefore, an outer leg of the switch can be opened separately.

Open-fuse detectors are provided on the outer poles as indicated at *B*, so that in case one of the outer leg fuses of a three-wire circuit is opened it can be found and repaired without disturbing the operating part of the system. Since the flange of the switch cover *I* closes the opening in the box before the fuses become alive, open-link fuses can be used in this type of box, as the fuses can be blown only when the cover of the box is securely closed. The fuses and all accessible energy-carrying parts are dead when exposed, and danger of shock or accident is therefore eliminated while installing the service fuses.

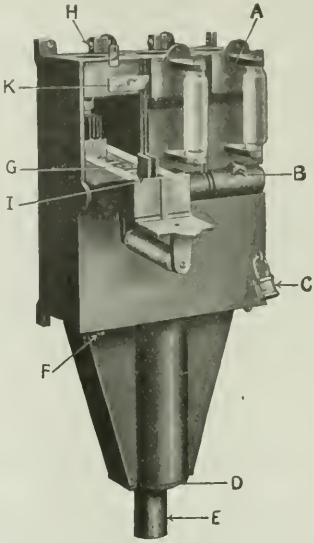


FIG. 3—SERVICE BOX SHOWING HOW CABLES ENTER BOX

These service switches are manufactured by the Palmer Electric & Manufacturing Company, Franklin and Congress Streets, Boston, Mass.

Electrical Equipment of Foreign Gasoline Cars

Judging from the equipment of foreign gasoline automobiles exhibited at the Automobile Salon held in New York Jan. 2 to 10, the manufacturers are trying to meet the demands of customers by adding every possible electrical convenience and perfecting those which have already been put in use. Several special-order cars were exhibited which were even more elaborately equipped electrically than the stock cars.

Side-lamp fixtures with the lenses cut prismatically to give the appearance of several lamps within were used on a few of the vehicles built by an Italian company. In contrast to the ugly head-lamp and side-lamp fixtures used several years ago manufacturers are now equipping their cars with lamps shaped to conform with the lines of the vehicle to which they are attached. To some cars the appearance of submarine boats has been given by inclosing the side lamps in lugs projecting from and integral with the cowl. Bullet-shaped head-lamp and side-lamp fixtures are also being used. One of the German-make cars is equipped with lighting fixtures which in addition to having the usual flat glass lenses are provided with removable bullet-shaped covers having small lenses for use where a bright, dazzling light is prohibited. These covers when not in use may be attached to the rear end of the fixture by snap clips.

In addition to the usual electric dome lamps employed in the inclosed cars, angle-bracket lighting fixtures are being used so that the occupants of the car may have suitable illumination for reading. One of the French cars shown was equipped with a three-lamp-cluster dome fixture without the diffusing glass.

Considerable attention has been directed toward assembling all of the electrical instruments and switches (made necessary by electrical accessories) on a single panel on the footboard where they are accessible and within the view of the chauffeur. Meters and other indicating instruments on the dashboard are illuminated either by dial lamps, by ordinary bracket fixtures or by slotted cylindrical reflectors which can be rotated about a horizontal axis to reflect the light in several directions.

To another French car has been added a gang switch controlling head, side, tail and instrument lamps, with an auxiliary foot switch for simultaneously extinguishing the head lamp and lighting the side lamps or vice versa. This additional switch is convenient when automobile trips are made frequently between cities and suburbs as the chauffeur may easily extinguish the side lamps used in the city and light the brighter head lamps for country roads.

Electric lighting and starting equipment was shown on most of the cars exhibited, but is furnished only on request and not on stock cars. Westinghouse, Rushmore and the U. S. L. starting and lighting equipments are among those employed on foreign cars. More attention, it appears, is being paid to the location of these units, so as not to interfere with the operation with other apparatus, than to the design, as each of these types has given satisfaction.

A French car designed to order was exhibited with elaborate exterior and interior lighting fixtures. Electric flambeau torches supported on antique-finish copper brackets were employed as side lamps. The head lamps and tail lamps were inclosed in hand-beaten copper fixtures representing lion heads. The interior of the limousine was illuminated by electric lamps supported on Louis XV bracket fixtures and dome lamps.

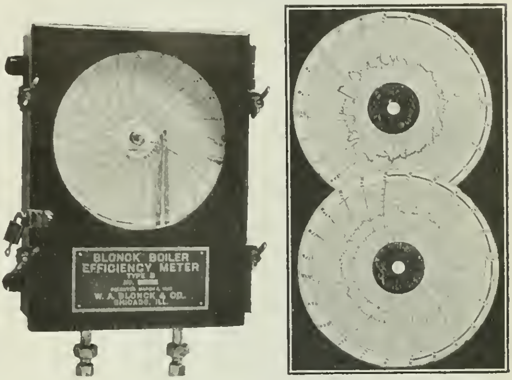
In addition to the foreign cars exhibited there were several American cars. The cars made by one American company were all equipped with Vulcan electric gear shift and the U. S. L. starting and lighting system. Another American car, in addition to being equipped with electric lighting and starting apparatus, was provided with a two-rate battery-charging switch.

Boiler-Efficiency Recording Meters

The boiler-efficiency recording meter illustrated herewith is manufactured by W. A. Blonck & Company, Fisher Building, Chicago, Ill. An indicating meter made by the same company was described in the *Electrical World* of Feb. 8, 1913. As in the indicating meter, this recording meter shows the draft resistance of the fuel bed and the drop in draft between the furnace and the damper. The two records are made on the same chart, and for clearness one is registered in red and the other in blue ink. The recorder is designed for use in conjunction with the indicating meter and should be installed where the chief engineer or superintendent may have ready access to it, while the indicating instrument may be mounted on the boiler front for the guidance of the fireman.

The charts in Fig. 2 show an example of conditions before and after the meter was applied and its use explained to the fireman. The boiler affected is a 500-hp horizontal water-tube unit fitted with a traveling chain grate. The total available draft is somewhat more than 0.8 in., water gage, and investigation showed that for the highest efficiency under normal conditions of load the draft through the fuel bed should be 0.3 in. and that through the boiler 0.5 in.

On the upper chart, taken before the fireman was instructed, the draft distribution was irregular, extreme variations occurring within short periods. The draft through the fuel bed varied from the maximum of 0.5 in. near 2 a. m. to the minimum of 0.18 in. at 2 p. m. With the damper position unchanged a decrease in the draft through the fuel bed resulted in the admission of excess air and a resultant waste. Excess air means a greater volume of gases flowing through the boiler per unit of time and hence an increase in the draft between the furnace and the damper. These facts account for the behavior of the two record lines of the charts at the points where they are converging and diverging.



FIGS. 1 AND 2—BOILER-EFFICIENCY METER AND CARDS

When the record shows a decrease in both the draft through the fuel bed and that through the boiler, the indications are for decrease in the rate of combustion (hence decrease in steam output also) and no change in efficiency. Similarly, when increase in both furnaces and boiler draft is shown, the indications are increase in rate of steaming and no change in efficiency. Other things remaining the same, the rate of steaming or boiler capacity developed and the efficiency of the boiler depend solely upon the available draft and the distribution of that draft. This being true, it is possible to study a given set of boiler conditions quite thoroughly with the meter, so that practically all changes that occur to affect the two factors of capacity and efficiency can be instantly detected. Even falling baffles and soot or slag accumulations on the tubes may be discovered through their effect on draft distribution.

Electric Cigar Lighters for Automobiles

Although electric cigar lighters are not new, their use on automobiles is novel. Many of the large foreign and American cars exhibited at the New York automobile shows were equipped with this new convenience. Illustrated herewith are several forms of electric light-

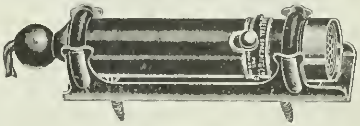


FIG. 1—CYLINDRICAL CIGAR LIGHTER

ers manufactured by Asch & Company, New York, for use on automobiles. The cylindrical-shaped lighter is provided with a clip-holder, and the watchcase type may be similarly supported or hung on a hook. The combination electric cigar lighter and portable lamp fills an important requirement on automobiles and launches.

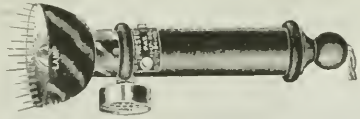


FIG. 2—COMBINATION CIGAR LIGHTER AND PORTABLE LAMP

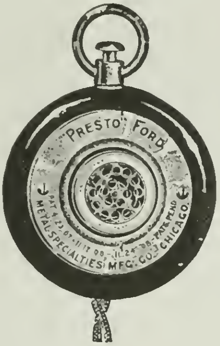

PRESTO FORD
PAT 4.23.07-11.17.08-11.24.08-PAT PEND
METAL SPECIALTIES MFG. CO. CHICAGO.

FIG. 3—WATCHCASE-TYPE CIGAR LIGHTER

These devices operate on 6 volts and are provided with contact buttons and flexible silk cord.

Peak-Voltage Meter

As was pointed out by Mr. H. A. Morss in the *Electrical World* of July 19, 1913, it has often been observed that the ordinary voltmeter does not measure accurately the stresses to which the dielectric is subjected in the testing of insulated wires and cables. The need of an instrument which can measure any peak in the voltage-wave curve has long been recognized in connection with high-voltage testing, since it is well known that in such tests the peak of the wave is coincident with the breaking down of the insulation. The large charging current due to the electrostatic capacity of the cable tends to distort the wave-form in cable tests and makes the reading of the ordinary voltmeter unreliable.

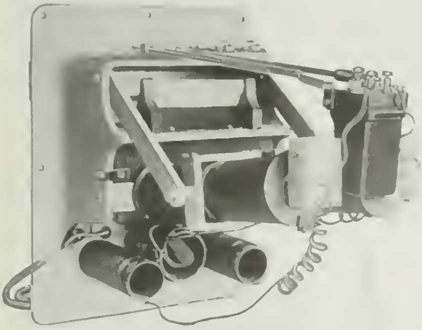


FIG. 1—REAR VIEW OF PEAK-VOLTAGE METER

The Simplex Wire & Cable Company, Boston, Mass., of which Mr. Morss is vice-president, has developed a device based upon the principle of the oscillograph but having its movement confined to a straight line. By means of this instrument the peak of the voltage wave is indicated at the limit of oscillation along the line to which its movement is limited. The instrument does not show the character of the wave or the form of its peak, but it is said to give a good record of the voltage for that peak, whatever the shape of the wave may be.

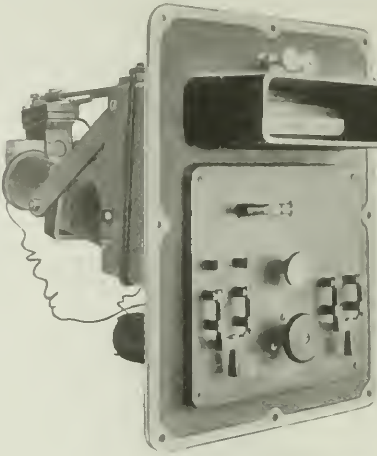


FIG. 2—FRONT VIEW OF PEAK-VOLTAGE METER

The instrument, which is illustrated herewith, is of the switchboard type of voltmeter and is about 10 in. wide by 12 in. long by 14 in. deep. It consists of a heavy electromagnet, between the poles of which is placed the vibrator. By a suitable arrangement of lamp, mirror and lenses, a beam of light is thrown on a ground-glass scale in front, graduated to read volts. The instrument is connected through a potential transformer directly to the high-voltage circuit, the current being so small that the apparatus can be left in the circuit all the time. It can be quickly calibrated at any time by applying direct current of known voltage.

Electrically Heated Foot-Warmer Rugs

The foot-warmer rug illustrated herewith is the product of the Simplex Electric Heating Company, Cambridge, Mass. The heating element is covered with a neatly bound Wilton carpet. It can be connected to any convenient lamp socket or, if used in electric vehicles, to a suitable receptacle attached to the seat riser. The rug is 15 in. wide by 27 in. long. Its power consumption is 100 watts.

ELECTRICALLY HEATED RUG

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Brisk Sale of Electrical Holiday Gifts in Kansas City, Mo.—During the holiday season almost the complete stock of appliances and other electrical gifts which the Kansas City Electric Light Company had on hand was sold to an eager public. To the application of department-store methods of advertising and selling during the Christmas campaign is credited the popularity of electrical appliances. All customer purchasers were given the privilege of paying one-third cash and the balance within ninety days.

Railway Electrical Supply Manufacturer Sees Good Year Ahead.—While the present volume of business might be better the Ackley Brake & Supply Company, of 50 Church Street, New York, sees nothing acute in the present situation, and it looks forward to a good business when construction activities begin in the next quarter. Mr. Ackley is at present enjoying an extended trip through Europe, devoted mainly to pleasure, but with the idea also of looking over the situation there as a preliminary to increased sales activity abroad.

Receiver for George W. Jackson, Inc.—On petition in bankruptcy of James B. Clow & Sons, Judge Carpenter, of the United States District Court, Chicago, appointed Fred A. Busse receiver for George W. Jackson, Inc., Chicago, on Jan. 5. The receiver's bond was fixed at $5,000. Mr. Busse is a former Mayor of Chicago. The bankrupt confessed its inability to pay its debts and consented to the appointment of a receiver. It has done a large contracting business in Chicago in former years. Mr. Jackson, either as an individual contractor or as head of the corporation bearing his name, built the tunnels underlying the central part of Chicago, now operated by the Chicago Tunnel Company principally for the transportation of freight on narrow-gage railways, but also for the cables of the automatic telephone system competing with the Chicago Telephone Company. No schedule of assets and liabilities was filed at the time the application for a receiver was made.

Sub-Committees of Chicago Association of Commerce.—Sub-committees of the large and active ways and means committee of the Chicago Association of Commerce have been appointed for 1914. Subdivision No. 31, relating to "electrical goods, lighting, gas fixtures and wire," has as its chairman R. C. Fenner, of the Cutler-Hammer Manufacturing Company, the other members being H. L. Grant, vice-chairman, Western Electric Company; John A. Bennen, Thordarson Electric Manufacturing Company; Charles H. Roth, Roth Brothers & Company, and S. F. Dibble, General Electric Company. Subdivision No. 62, representing "city transportation and public utilities," is made up as follows: George B. Foster, chairman, Commonwealth Edison Company; B. S. Garvey, vice-chairman, Chicago Telephone Company; Clifford Arrick, Chicago Telephone Company; L. J. Mink, Western Union Telegraph Company; B. I. Budd, Metropolitan West Side Elevated Railway Company.

Western Electric Company's Pension Plan Gives Satisfaction.—President H. B. Thayer of the Western Electric Company issued a statement recently to the employees of the company which contained, among other things, an expression of satisfaction with the results for the past year of the operation of the employee's pension and insurance plan. He said in part: "The benefit plan has been in full operation during the year. Sickness benefits have been paid to over 500 employees and accident benefits to over 450. Fortunately, the accidents have as a rule been not of a serious nature and have involved only temporary disability. There have been twelve cases of death of those coming within the provisions of the plan, and there are fifty-three pensioners. The disbursements under the plan for the first ten months of the year were over $80,000. In many cases these payments have come in times of great necessity and have been of great relief. In all cases they have given the help in time of trouble which the company, through the benefit plan, has wanted to give."

Importers' Association Formed.—The Importers' Association of America is the official title of an organization recently incorporated in New York for the purpose of inducing co-operation between importers in every line on matters of mutual interest. Judge T. S. Sharretts has been retained by the promoters of the association as legal adviser and will have charge of its preliminary developments until a permanent executive staff and directorate have been chosen. His office at 165 Broadway, New York, is the temporary headquarters of the association. The scope of the body will be nation-wide and will include importers in every field. One of the main duties of the association will be to assist in the determination of correct market values in foreign markets in order to assist importers in the proper valuation of imports and thus reduce friction with the customs authorities. Judge Sharretts stated to an *Electrical World* representative that the association will carefully avoid affiliating itself with any political party or creed and will devote itself entirely to furthering the legitimate interests of importers, aiming toward greater uniformity and efficiency in methods.

Buckeye Engine Company Develops a New Selling Plan.—Announcement has just been made of a very novel selling plan which the Buckeye Engine Company, of Salem, Ohio, has inaugurated in connection with the merchandising of its "Buckeye-mobile." The novelty consists in embodying in the contract of sale on each engine—at the purchaser's option—a bond guaranteeing the fuel consumption of the unit. As a result of more than a year's continuous test under various conditions with various grades of fuel the company is convinced that it is safe to make a guarantee of a normal specified amount of fuel per brake-horse-power-hour, per indicated horse-power-hour, or per kilowatt-hour. The guarantee is embodied in connection with the analysis of the fuel in the contract and there is a forfeiture and bonus clause. The company agrees that upon completion of a witness test it will deduct from the purchase price as a forfeiture $1,000 for every 0.1 lb. of coal required per indicated horse-power per hour in excess of the guarantee, provided that in no case shall the amount of the forfeiture exceed the purchase price. This is on condition that the purchaser shall pay to the company, in addition to the purchase price, $100 for every 0.1 lb. of coal per indicated horse-power per hour required less than that called for by the guarantee. In event of there being a forfeiture or bonus allowance in this contract as a result of the witness test, as above provided for, then such sums shall be deducted or added, as the case may be, to the original purchase price.

J. G. White on General Conditions, Domestic and Foreign.—On Mr. White's return from abroad, about a month ago, an *Electrical World* representative called on him for some personal impressions concerning conditions in the financial and engineering fields in England and on the Continent. The following abstract is made from a statement prepared by Mr. White covering his observations along the above lines. He says in part: "On arriving in London last July general conditions there were found to be about as unfavorable as they had been in New York during the few preceding weeks. The same general conditions prevailed throughout the summer. Before sailing from England on Dec. 3 there was just beginning to be a slight hope of improvement, not so much as to immediate change as regarding probable improvement early in the year. Financial people generally agreed that a decided trade reaction had already set in, both in Great Britain and on the Continent. Financial conditions in Berlin had apparently improved more than in any other of the large financial centers. Regarding J. G. White & Company, Ltd., I am pleased to state that it has on hand probably as large an amount of construction work at the present time as ever before. Perhaps the largest single contract the company is now carrying out is that for the construction of a complete system of electric railways for the city of Pernambuco, Brazil, together with improvements to the gas works and telephone system and the building of a complete electric-lighting plant and distributing system for that city. Other work on hand or recently completed includes electric railway and steam railway construction in and near Buenos Aires, Argentina; a complete electric railway system for Santa Fé, Argentina; sanitation works at Para, Brazil, and other similar work. The company has recently developed a special operating or management department, and this department is now directing the general operation of a number of utility properties located all the way from Yucatan to Argentina."

Sales of Hydroelectric Equipment in Alaska.—During the past year the Westinghouse Electric & Manufacturing Company has undertaken a number of contracts for hydroelectric development in Alaska that will greatly improve mining conditions in that territory. The most important of these is the new generating unit for the Alaska Treadwell Gold Mining Company to be installed in the Hugget Creek development. This unit will consist of a 2350-kva waterwheel generator driven by a Pelton waterwheel running at 300 r.p.m. This unit will give the mining company about 3000 hp additional rating. A 50-kw motor-generator exciter set, with special shaft, so that the unit may be waterwheel-driven when desired, is also included. During the past summer the Kennecott Mines Company, operating one of the highest grade copper mines in the world, located in the Copper River district, purchased a 200-kva waterwheel generator, together with all the necessary switchboards and accessories. This water-power plant will supplement a steam-driven power plant now being operated by the mining company and containing one 400-kva generator and another generator of 50-kw rating. A considerable number of electric motors for mining and milling operations were purchased along with the other equipment. A contract has also been recently closed for a 300-kva waterwheel generator to be installed by the Chicagoff Mining Company, one of the Guggenheim interests operating near Sitka. This generator will be used to supplement the mining company's present installation rated at 127½ kw. With the generator in question there were also ordered the necessary step-up and step-down transformers for transmitting the energy at high voltage from the power plant to the mines. In addition to the above, the Alaska Juneau Gold Mining Company, of Juneau, Alaska, recently purchased from the Westinghouse company a 1012-kva waterwheel generator, to be driven by a Pelton wheel, the energy from which will be used to supplement that of a 937-kva steam turbine.

Electrical Outlook from the Underwriters' Laboratories.—A little different angle of the electrical outlook was presented to an *Electrical World* representative last week in a short talk with Dana Pierce, of the Underwriters' Laboratories, 135 William Street, New York. Mr. Pierce touched upon a number of interesting points. Concerning the business handled by the laboratories during the past year, he said that for the first six months it was about normal in both quantity and variety. During the latter part of the year there has been a decrease in quantity and a tendency toward the more standard lines, little new in the line of apparatus or supplies being handled. The label service is in good demand. One of the very favorable tendencies of the past year, according to Mr. Pierce, is the great improvement in the quality of the wire manufactured under the new code specifications. Agitation to the end of an improvement in the quality of wire for electrical uses was begun some time ago, and the actual manufacture of a better grade of wire was only started on a large scale during the past year. The improvement which has been made in the short space of one year was characterized by Mr. Pierce as nothing short of marvelous, and, with the present standard in view, he said that it was hard to believe that the old specifications could have been tolerated. The same tendency toward standardization has been in evidence to less degree in other electrical materials and equipment during 1913. An interesting question was recently put up to the Laboratories by British manufacturers, and the step taken to solve it is full of significance, as indicating how political border lines are destined to break down with the progress of business expansion. The National Electrical Code is standard in a large part of Canada. It differs radically from the specifications to which British electrical manufacturers work; in fact, in England there is no universal standard in these matters. The result has been that the products of such manufacturers have often been imported into Canada and then found to fall short of the specifications there recognized. To correct this difficulty the Laboratories were asked to establish a branch in London and extend their service to all who wish to take advantage of it, and this has been done. Similar, though less insistent, demands have been made for branches in other European countries. Perhaps the outcome might be international standardization, along the same lines that have been found so effective in the United States. Mr. Pierce spoke specially of the 1913 electrical code for New York City, just issued, and gave it as his opinion that the revision of that code to very nearly approximate the National Electrical Code is a decided step toward general efficiency and sets a precedent that might well be followed by other cities large and small.

Where American Electrical Exports Go.—The following table, summarizing the geographical distribution of American electrical exports for the year July 1, 1912, to June 30, 1913, inclusive, was obtained from the New York office of the Bureau of Foreign and Domestic Commerce:

Item	Distribution					
	Europe	N. Amer.	S. Amer.	Asia	Oceanica	Africa
Generators:						
Value ...	$459,668	1,022,847	272,615	873,781	135,456	9,040
Fans:						
Number .	2,068	14,129	6,864	5,821	1,089	286
Value ..	$25,627	148,141	82,101	85,338	14,529	3,048
Arc Lamps:						
Number .	339	5,940	3,426	176	134	2
Value ...	$8,141	107,613	63,546	3,660	2,970	89
Carbon-filament Lamps:						
Number .	151,684	972,527	327,116	32,111	37,965	6,017
Value ...	$17,040	148,073	48,144	7,061	6,922	1,048
Metallic-filament Lamps:						
Number .	36,599	513,244	519,895	10,408	190,650	92,697
Value ...	$12,547	175,616	134,833	3,336	48,176	20,184
Motors:						
Value ...	$367,276	1,898,971	590,320	540,193	319,401	81,756
Telegraph Instruments:						
Value ...	$6,024	131,999	54,264	5,197	17,563	58
Telephone Instruments:						
Value	237,970	918,135	144,436	41,940	28,539	626
Miscellaneous:						
Value .	$1,861,701	9,152,807	3,374,118	1,546,092	1,218,696	293,647
Total:						
Value .	$2,995,994	13,704,202	4,764,377	3,106,598	1,792,252	409,496

NEW YORK METAL MARKET PRICES

	Dec. 29		Jan. 6	
Copper:	Bid	Asked	Bid	Asked
Standard, spot*	14.37¼	to 14.87½	.....	.....
	Selling prices		Selling prices	
	£ s. d.		£ s. d.	
London, standard, spot*..	66 6 3		64 3 9	
Prime Lake	15.25	to 15.50	15.00	.....
Electrolytic	14.75	to 15.00	14.25	to 14.62½
Casting	14.50	to 14.62½	14.25	to 14.50
Copper wire base	16.00	.....	15.75	....
Lead	4.15		4.15	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter..	7.25		7.50	
Spelter, spot	5.30	to 5.35	5.25	to 5.35
Tin, spot	37.62½	to 37.87½	36.77½	to 37.12½
Aluminum:				
Prompt delivery	18.50	to 19.00	18.50	to 19.00
Future	18.50	to 19.00	18.25	to 18.75

*COPPER EXPORTS

Heavy copper and wire	13.50	13.50
Brass, heavy	8.75	8.75
Brass, light	7.75	7.75
Lead, heavy	4.05	4.05
Zinc, scrap	4.37½	4.25

*OLD METALS

Total tons to Jan. 6......................... . .3,592

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Merger of Virginia Utilities Planned.—Meetings of the stockholders of the Citizens' Railway, Light & Power Company, the Newport News & Old Point Railway & Electric Company and the Hampton Roads Traction Company were called for Jan. 9 to approve a plan for merging the companies under the name of the Newport News & Hampton Railway Gas & Electric Company.

Ohio Utility Changes Dividend Plan.—The directors of the Northern Ohio Traction & Light Company have given notice of a change in their policy concerning the declaring of dividends. Hereafter, instead of making the declaration for the entire year payable quarterly, the dividends will be declared quarterly. The February dividend of 1¼ per cent will be paid the same as last year.

Chicago Subway Fails to Get Bids.—On Jan. 5, the day on which bids for the construction of the proposed new Chicago subways were to be opened, it was found that no bids had been received. The city plans to give a twenty-year franchise to the builder, who will be paid for the construction out of earnings in that portion of the twenty-year period remaining after the lines are completed. Evidently this proposition did not look attractive to prospective contractors.

Service Pension Plan Adopted on Insull Property.—The Public Service Company of Northern Illinois, one of the Insull properties, has just decided upon a service pension plan for the payment of annuities to employees who have served a certain number of years with that company or any of its subsidiaries. The plan goes into effect in March, 1917. The annuities will be paid according to three classifications, taking into consideration the age of the applicant and the length of time in the company's service, and a minimum annual pension of $300 is proposed. The plan is modeled after that of the Commonwealth Edison Company of Chicago.

Standard Underground Cable Declares Extra Dividend.—The Standard Underground Cable Company, of Pittsburgh, Pa., has declared an extra dividend of 3 per cent in addition to the regular quarterly 3 per cent dividend on its $3,500,000 outstanding capital stock. The dividend record of this company is interesting. Organized in 1889, its first dividend in 1890 was 3 per cent. The rates paid in the succeeding years were: 1891, 6½ per cent; 1893 and 1894, 6 per cent each; 1895, 7 per cent; 1896, 8 per cent; 1897, 6½ per cent; 1898 and 1899, 8 per cent each; 1900, 1901 and 1902, 10 per cent each; 1903, 1904 and 1905, 12 per cent each; 1906, 17 per cent; 1907, 15 per cent; 1908, 22 per cent; 1909, 29 per cent; 1910, 20 per cent, including an extra dividend out of earnings for 1910 and a special 5 per cent dividend out of earnings of previous years; 1911, 15 per cent; 1912, 15 per cent, including 3 per cent extra in January. Last January the extra 3 per cent dividend was declared also. The date of the present payment is Jan. 10.

Industrial Board Recommended for "Unscrambling" Big Business.—In an address before the Illinois Manufacturers' Association at Chicago on Jan. 5 Samuel Untermyer advocated an industrial commission to act in the breaking up of trusts and the regulating of corporations. He stated that the machinery of the courts is not adapted to the disintegration of outlaw corporations, which must be not only unscrambled but kept unscrambled. Among the changes advocated by Mr. Untermyer were the prohibition of interlocking staffs and directorates, the abolition of the usual form of holding company, the prohibition of stock watering, the disclosure of profits from the sale of securities, the requirement of cumulative voting in order to secure minority representation on directorates, the abolition of voting trusts, the prevention of fiscal agency contracts, the prohibition of deposits of interstate corporations in private banks, the incorporation of the stock exchanges and clearing houses, and the prevention of the migration of corporations into states offering illegitimate inducements in the form of lax corporation laws.

Morgan Firm Withdraws from Many Directorates.—The financial world was surprised last week by the announcement of the withdrawal of the members of the firm of J. P. Morgan & Company from directorships in many large industrial, financial and public utility concerns. In all, about thirty large companies are affected by the action of the Morgan company, and the three largest are the New York Central System, the New York, New Haven & Hartford Railroad Company and the American Telephone & Telegraph Company. The Western Union Telegraph Company and the Westinghouse Electric & Manufacturing Company are also on the list of the companies affected by this action. A statement issued by J. P. Morgan, explaining the motives of himself and his associates in resigning from these directorates, seems to imply that the move has been under consideration for some time and is the result of an apparent growing public sentiment against the interlocking directorate system and its abuses. G. F. Baker, chairman of the board of directors of the First National Bank of New York City, when interviewed concerning the action of the Morgan interests, stated that he had desired to do the same thing for some time and would resign from a number of directorates as soon as it became possible. It will be a matter of interest to see what plan of control will be substituted for the one abandoned and to what extent other financial interests will follow the example set.

Alleged Manipulation of Central Union Telephone Company.—Certain minority stockholders in the Central Union Telephone Company have brought suit against the American Telephone & Telegraph Company, Theodore N. Vail, B. E. Sunny, Union N. Bethell, L. G. Richardson and other officers of the parent Bell company or subsidiary companies. The plaintiffs allege that the defendants have been "milking" the Central Union company and urge the naming of a receiver to protect their interests. The case was brought in Chicago before Judge W. E. Dever, of the Superior Court of Cook County, with an opposing array of counsel. It is said that the capital stock of the Central Union Company is $5,450,927, of which the American Telephone & Telegraph Company owns $5,204,977.50. The dissatisfied stockholders are said to own about $100,000 worth of the stock of the company. It is charged that three years ago the company had no deficit, but that although its gross annual income is about $7,000,000, a deficit is now rolling up at the rate of $300,000 a month. The parent Bell company says that it loaned the Central Union about $35,000,000, and the interest charges on this sum, together with the money borrowed, have placed the Central Union company in its present plight, according to the complainants. The Central Union operates in parts of Illinois, Indiana and Ohio. Many letters have been read into the record of the case. They are alleged to have passed between Mr. Sunny (president of the Chicago Telephone Company, and also of the Central Union and other operating companies), Mr. F. P. Fish, former president of the American Telephone & Telegraph Company; Mr. Vail, the present president; Mr. F. A. Pickernell, Mr. L. G. Richardson, former president of the Central Union, and others. The lawyers for the petitioning stockholders tried to prove that the officers of the Central Union company conducted a continuous campaign to force down the price of the stock by refusing to declare dividends and thereby to enable the American Telephone & Telegraph Company to buy up the outstanding shares at a low figure. Some of the letters are of considerable interest. One, alleged to be written by Mr. B. E. Sunny to Mr. Theodore N. Vail, under date of July 23, 1913, is said by the newspapers to contain the following: "It is not so much a question of trying to conduct the business in a progressive way and without offending the Sherman act as it is meeting the demands from every quarter for a single telephone system and first-class service. The public demand is first and the Sherman act is second, for the reason that what is asked for now is the last expression of the people." Attorneys for the defendants have presented a number of affidavits tending to refute the charges of the minority stockholders that business was systematically diverted from the lines of the Central Union to those of the American Telephone & Telegraph. These affidavits gave a detailed explanation of the diversion of business from one company to the other. It is contended that the letters read into the record on the part of the complainants make only a partial showing of the case and fail to incorporate answers or replies that would have dissipated the idea of unfairness.

Business Notes

Alfred F. Moore, of Philadelphia, Pa., manufacturer of insulated wire, is now represented in Chicago territory by E. P. Bartlett, 1368 Grand Avenue, where a complete stock is carried for the convenience of customers.

The Steel City Electric Company, of Pittsburgh, Pa., has announced the appointment of the G. A. Schardt Company, of the same place, as its sales representative in West Virginia and in the section of Pennsylvania west of Altoona.

The "Exide" Battey Depots, Inc., of Atlanta, Ga., has been forced by its increase of business to seek larger quarters, and after Jan. 1 it will occupy the warehouse of the Georgia Railway & Power Company, at 20 Piedmont Avenue.

The Barber-Dwinnell Electric & Manufacturing Company, of Kansas City, Mo., announces that it has been granted a charter under the laws of that State and has augmented its working capital, retaining, however, the personnel and policies of the old organization.

The Doubleday-Hill Electric Company, of Pittsburgh, Pa., has just purchased a building at 727 Twelfth Street, Washington, D. C., where it proposes to open shortly a large Eastern branch, affording it greater facilities for rendering quick service to its customers in that territory.

The International Engineering Corporation, Ltd., of 49 Exchange Place, New York City, has been formed for the purpose of carrying on engineering work in the United States, Canada, Central America and South America. Its officers are J. W. Burke, president, T. C. Gillespie, vice-president; H. P. Du Boise, secretary; H. M. Lloyd, treasurer.

The Monitor Controller Company, of Baltimore, Md., has moved its Philadelphia office to Suite 823, Drexel Building. After Jan. 1, 1914, the Boston office of the same concern will be under the supervision of the Tompkins-Stoddard Company, of 77 Franklin Street. Mr. Stoddard, of that firm, was formerly Boston representative of the Monitor company.

The K & B Company, formerly at Eighth and Chestnut Streets, Philadelphia, Pa., has moved to 25 North Seventh Street, where it has increased facilities and will handle special electrical supplies and mechanical devices. It has recently been appointed Philadelphia agent for the Union Metal Manufacturing Company on that concern's line of street-lighting standards.

The Robbins & Myers Company, of Springfield, Ohio, has made a number of organization changes recently. The St. Louis (Mo.) office of the company is now located at 1515 Chemical Building, and is in charge of I. Elkas. A. S. Chamberlain has lately assumed the direction of the company's New York office. A branch office has been opened in Cleveland, Ohio, under the management of A. J. Reed. The Cincinnati (Ohio) office is now at 9 East Third Street, and G. H. Liebel is in charge.

New Industrial Companies

Maysmith & Lowe, of Victoria, B. C., Can., have been incorporated with a capital stock of $10,000 to do a general electrical and mechanical engineering and contracting business.

The Klingelsmith Electric Truck Company, of Chicago, Ill., has been incorporated by Joseph M. Klingelsmith, Michael M. Cure and Earle F. Tilley. The company is capitalized at $350,000 to manufacture electric vehicles.

The Electric Construction Company, of Chicago, Ill., has been incorporated with a capital stock of $10,000 to do a general electrical contracting and manufacturing business. The incorporators are Christopher C. Buckels, George Homer Hightower and Ernest Cooley.

The Held Company has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $150,000 and purposes to manufacture and sell scientific, electrical and medicinal instruments. The incorporators are H. E. Latter, W. J. Maloney and O. J. Reichard, of Wilmington, Del.

Trade Publications

Guy Anchors.—A folder has recently been issued by W. N. Matthews & Brother, St. Louis, Mo., which briefly describes and illustrates how 20 per cent of the cost of storm anchors can be saved by the use of Matthews guy anchors.

Electricity in Iron Foundries.—Bulletin A4167 of the General Electric Company is devoted to the subject of electricity in iron foundries. The bulletin is fully illustrated with some typical applications of motors in iron foundries and contains a chapter on foundry lighting.

Electric Furnaces.—Bulletin No. 8 of the Hoskins Manufacturing Company, 453 Lawton Avenue, Detroit, Mich., refers to electric furnaces. Made in muffle, tube and crucible chamber designs and in a number of sizes, adapted to a wide variety of uses. The bulletin contains twenty pages and is fully illustrated.

Regulator for Street Lighting.—The Electric Appliance Company, Chicago, in Bulletin No. 202, refers to the "A-W" regulator for street lighting, a device designed to maintain a constant current on a series tungsten lamp circuit. Illustrations are given showing the constructive features of the device and diagrams of connections. A description of the device is presented and the method of installing it outlined. The bulletin contains also two full-page illustrations showing series lamps controlled by "A-W" regulators in two cities.

Heating Appliances.—Electric household appliances for cooking and miscellaneous purposes are illustrated and described in Catalog No. 18 issued by the Simplex Electric Heating Company, Cambridge, Mass. The index to the contents of this catalog indicates a surprisingly large variety of these devices, and the illustrations show many artistic designs. A separate leaflet is addressed to dealers urging them to take advantage of the increased demand for electrical Christmas gifts and illustrating some of the advertisements in the leading magazines advertising Simplex specialties.

Electric Furnaces.—Bulletin 1026 of the Metallurgic Engineering Company, 53 West Jackson Boulevard, Chicago, Ill., relates to the Snyder system electric furnace. This furnace is designed for convenience of operation under American foundry conditions. A description of the furnace, its characteristics and quality, together with a reference to tilting and control, is given. A table is included giving approximate costs of melting steel in a Snyder system electric furnace in the Middle West for the usual range of tonnage for twenty-four hour and twelve-hour operation. The system is available for either alternating current or direct current, single-phase or three-phase operation at 60 cycles or 25 cycles.

Fire Extinguishers.—The Pyrene Manufacturing Company, 1358 Broadway, New York, has issued a trade circular containing the announcement of an advertising campaign of Pyrene extinguishers which has been directed to 15,000,000 readers. Fac-similes in colors of the covers of the leading popular and technical magazines in which Pyrene advertisements appear afford an effective suggestion of the wide newspaper publicity given to these fire extinguishers. Across the top and across the bottom of pages showing sample advertisements of this device are pertinent paragraphs addressed to dealers, to whom this opportunity to handle the Pyrene fire extinguisher and benefit by the national advertising is offered.

Illumination Computer.—The Engineering Department of the National Lamp Works of the General Electric Company, Cleveland, Ohio, has prepared an ingenious "illumination calculator" in the form of a circular celluloid slide rule for computing the spacing of lamps to give any desired intensity. To use the computer the intensity required is first determined from a table on the back of the card, the "utilization factor" being meanwhile read from a second set of data. Setting these values opposite each other, one reads, just below the size of lamp, figures showing the required spacing and height above the floor for the reflector selected. The scale is graduated in terms of lumens per lamp and is correct for "Mazda" lamp efficiencies now standard.

Personal Mention

Mr. Roy Baldridge, of Macomb, Ill., has been made manager for the Central Illinois Public Service Company at Plymouth, Ill.

Mr. W. E. McFadden, for some time manager of the Salina (Kan.) Light, Power & Gas Company, has resigned and removed to Nebraska.

Mr. Harry J. Frith has resigned his position as district manager for the Central Illinois Utilities Company, with headquarters at Watseka, Ill.

Mr. T. P. Alston has resigned as general manager of the St. John's Light & Power Company, of St. Augustine, Fla., and the office of general manager has been abolished.

Mr. F. Kumpf, manager of the light and water utilities of Waterloo, Ont., has been appointed by the Hydro-Electric Power Commission of Ontario to a position in Ottawa.

Mr. B. F. Wood, formerly assistant engineer of the Pennsylvania Railroad, has been appointed chief engineer of the United Gas & Electric Engineering Corporation, of New York City.

Mr. George H. Caffery, former manager of the United Electric Light & Water Company, of Norwalk, Conn., has accepted a position as superintendent of an electric-light plant in Texas.

Mr. J. Sanger, formerly superintendent of distribution for the Winnipeg municipal electric-light plant, has accepted a position with the Winnipeg branch of the Siemens Company of Canada, Ltd.

Mr. Henry Heick, vice-president of the electrical supply and contracting concern of Albrecht & Heick, Louisville, Ky., has retired after a connection with the business extending over twenty-seven years.

Mr. W. H. Timm, formerly connected with the Wisconsin Railroad Commission at Madison, Wis., has been appointed assistant secretary of the Public Service Commission of New Hampshire as successor to Mr. F. E. Webster.

Mr. Frederick E. Webster has resigned as assistant secretary of the Public Service Commission of New Hampshire and accepted the position of treasurer and auditor of the Rockingham County Light & Power Company, Portsmouth, N. H.

Mr. Frank W. Harvey, Jr., Chicago, business manager of *Popular Electricity and the World's Advance*, has been appointed alternate statesman of the Jovian Order for Illinois, succeeding Mr. E. H. Waddington, resigned owing to removal from Chicago.

Mr. Gaylord Buck, who has been connected with the new-business department of the Citizens' Gas, Electric & Heating Company, of Mount Vernon, Ill., for the past eighteen months, has been appointed commercial manager, succeeding Mr. W. P. Guinau.

Mr. T. H. Aldrich, supervising engineer for the National X-Ray Reflector Company, gave an illustrated address on "Present-Day Practice in Interior Lighting" before the Chicago Jovian League on Jan. 5. He dwelt on the necessity of concealing light sources.

Mr. J. S. Kennedy, for many years secretary of the Public Service Commission, Second District, New York, has been appointed secretary to the employees' benefit fund committee having in charge the welfare of 45,000 telephone employees of the Bell system in the East.

Mr. W. P. Guinau, who has been commercial manager of the Citizens' Gas, Electric & Heating Company, of Mount Vernon, Ill., for the past two years, has been transferred to be commercial manager of the Danbury (Conn.) Gas & Electric Company, which is controlled by the same company.

Mr. John F. Wessel, general manager of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, a subsidiary of the Republic Railway & Light Company, has returned to New York to take up duties with the latter corporation. The office of general manager has been abolished.

Mr. J. B. Sunderland has severed his connection with the British Columbia Electric Railway Company, Ltd., of Vancouver, B. C., with which he has been connected for the past five years. He has taken charge of the agency department of Messrs. McDonald, Marpole & Company, of Vancouver, B. C.

Mr. A. D. Mackie, who has been sales manager in Detroit for Hodenpyl, Hardy & Company, bankers, of New York, has been appointed general manager of the Union Railway, Gas & Electric Company, Springfield, Ill., as successor to Mr. A. D. Furlong, who has been transferred to Saginaw and Bay City, Mich.

Mr. Thomas J. Lyons, who severed his connection with the Blackstone Valley Gas & Electric Company of Woonsocket, R. I., was presented by the employees of the company with a gold chain and charm set with diamonds on Dec. 27. Mr. Lyons has accepted a position with the Michigan Stove Company, with headquarters at Binghamton, N. Y.

Mr. Frank G. Baum was guest of honor at a dinner given by the Pacific Gas & Electric Company, Dec. 19, in celebration of the completion of the Lake Spaulding dam and Beaver River power plant, both of which were constructed under his supervision. The dinner was given at the St. Francis Hotel, San Francisco, and was attended by 200 persons.

Mr. Ernest Gonzenbach has resigned as president and general manager of the Sheboygan (Wis.) Railway & Electric Company, following the sale of the controlling interest in the company to local interests in Sheboygan. Mr. Gonzenbach intends for the present to devote himself to the further development of a fruit and dairy farm on which he has lived for several years.

Mr. Roger W. Babson, Wellesley Hills, Mass., was the principal speaker at a dinner given by the Jovian Club of Minneapolis at the Hotel Radisson on Dec. 30. Mr. Babson had been attending the convention of the American Economic Association, and the electrical men took advantage of the occasion to get him to talk to them on finance, labor and international peace.

Obituary

David G. Mouat, purchasing agent for the Lindstrom-Smith Company, of Chicago, manufacturer of electrical specialties, died suddenly on Jan. 3.

Bernard Corrigan, who was president of the Kansas City (Mo.) Railway & Light Company from 1902 to 1911, died of heart disease in that city on Jan. 6, after a few hours' illness.

Zero Marx, founder of the Zero Marx Sign Works, and a pioneer in the manufacture of electric signs in Chicago, died in St. Mary's Hospital, Rochester, Minn., on Dec. 31. The cause of death was uremic poisoning.

W. E. Davidson, secretary of the Pearson Mexican corporations, having offices in Toronto, Ont., and which include the Mexican Light & Power Company, the Mexican Tramways Company and the Mexican Northwestern Railway Company, died on a steamer in the Gulf of Mexico on Christmas Day.

William D. Marks, well known as a consulting engineer, died at Plattsburg, N. Y., on Jan. 7. Professor Marks was born in St. Louis Feb. 26, 1849, and was graduated from Yale in 1870 with the degree of Ph.B. He specialized in civil and mechanical engineering and later received his C. E. degree from the same college. After leaving Yale he engaged in practical engineering work in connection with railways and gas and iron works. In 1876 he became instructor in mechanical engineering at the Lehigh University and the following year became associated with the University of Pennsylvania as Whitney professor in engineering. He was superintendent, in 1884, of the International Electrical Exhibition of the Franklin Institute, and later became engineer and president of the then Edison Electric Light Company of Philadelphia. Professor Marks was an honorary life member of the Franklin Institute, a full member of the American Institute of Electrical Engineers and a member of the American Philosophical Society. He was the author of several books and of many scientific papers and reports.

Construction

New England

CHERRYFIELD, MAINE.—The Cherryfield El. Lt. Co. may purchase within the next 12 months a new waterwheel. E. S. Nash is superintendent.

HIRAM, MAINE.—Development of the water-power on the Saco River at Highland Rips, between Limington and Baldwin, or at Allens Falls on the Little Ossipee, between Cornish and Hiram, or both, is under consideration by the Baldwin & Hiram Lt. & Pwr. Co. The company is securing options and purchasing land on both sides of these rivers. J. Merrill Lord, of Parsonsfield, is interested in the company.

BOSTON, MASS.—A bill has been filed by Representative Beck, of Chelsea, in the State Legislature asking that authority be given to the Metropolitan Park Commissioners to expend $500,000 for the construction of an electric-light plant for the purpose of furnishing electricity to maintain lamps on parkways under their direction.

BOXFORD, MASS.—The Lawrence Gas Co., of Lawrence, has applied to the State Board of Gas and Electric Light Commissioners for permission to supply electricity for lamps, heaters and motors in Boxford.

NORTH ATTLEBORO, MASS.—Within the next three months the Electric Light and Water Department expects to erect a fireproof storage warehouse (concrete and steel construction) to replace the one destroyed by fire three months ago: also within the next six months to reconstruct boiler room (fireproof) and install a new 150-hp boiler.

PITTSFIELD, MASS.—The committee appointed by the Board of Alderman to investigate the advisability of purchasing the plant of the Pittsfield El. Co., to be owned and operated by the municipality, submitted its report on Dec. 15 to the board. The committee does not advise the purchase of the plant by the city at the present time or any time in the near future.

WORCESTER, MASS.—Locations for 389 lamps that are to be installed on the streets of Worcester under the proposed new street-lighting system have been designated by Henry A. Knight, superintendent of light and wires. The original estimate called for 307 6.6-amp luminous-arc lamps, but the revised list to be considered by the Council calls for 389 lamps. The City Council has accepted the report of the committee on lighting streets, recommending the relocation of 77 arc lamps in the outskirts of the city. The Worcester El. Lt. Co. has the contract for street lighting.

VALLEY FALLS, R. I.—The town of Cumberland has entered into a contract with the Blackstone Valley Gas & El. Lt. Co. for a period of ten years which provides for an all-night lighting service and the installation of new lamps. The company is planning to install 160-cp lamps on Board Street as soon as possible.

BRIDGEPORT, CONN.—The lamps committee of the Board of Aldermen will ask the Board of Apportionment for an appropriation of $89,538 and for $16,000, the latter to be used for the installation and maintenance of the proposed ornamental street-lighting system. The plans provide for 118 additional arc lamps.

TORRINGTON, CONN.—The Torrington El. Lt. Co. has awarded the contract for the construction of a new substation and power plant (34 ft. by 57 ft.); brick and concrete construction.

Middle Atlantic

ALBANY, N. Y.—Bids will be received by the Trustees of Public Building, Capitol, Albany, N. Y., until Jan. 20, for electric wiring of the west wing of the State Capitol Building, Albany. Drawings and specifications may be consulted and blank forms of proposals obtained at the office of Lewis F. Pilcher, state architect, Capitol, Albany.

ALBANY, N. Y.—Bids will be received at the office of the clerk of Board of Supervisors, City Hall, Albany, until Feb. 4 for furnishing and installing complete as follows: (1) Electric wiring for lamps and motors, conduits for telephones, watchman's clock system, fire-alarm system, wiring for time-clocks and miscellaneous bell work (2) time-clock system; (3) electric passenger elevators, all for the new court house for the county of Albany, to be built on Columbia Street between Lodge and Eagle Streets. Plans and specifications may be seen at the office of the clerk of the board, City Hall, Albany, or at the office of Hoppin & Koen, architects, 244 Fifth Avenue, New York; also at the office of V. C. Wynne, consulting electrical engineer, 86 State Street, Albany. Copies of plans and specifications may be obtained upon application to the architects.

BROOKLYN, N. Y.—Bids will be received by R. A. C. Smith, commissioner of docks, Department of Docks and Ferries, Pier A, foot of Battery Place, North River, New York, until Jan. 15, for furnishing under contract (No. 1399) all labor and material required for installing electric-lighting fixtures at the Thirty-ninth Street Ferry terminal, borough of Brooklyn. Blank forms and further information may be seen at the office of the department.

SYRACUSE, N. Y.—The ordinance providing for the ornamental-lighting district passed by the City Council has been signed by Mayor Schoeneck. By the terms of the new ordinance the number of lamps will be increased to 593, making an addition of 378 lamps.

SYRACUSE, N. Y.—Bids will be received by the trustees of the New York State College of Forestry, Syracuse University, Syracuse, until Jan. 27, for construction, heating and ventilating, plumbing and gas-fitting and electric work for the New York State College of Forestry, Syracuse University, Syracuse. Bids will be for each division of the work separately and no combination of bids will be considered. Drawings and specifications may be consulted and blank forms of proposals obtained at the office of the dean of the New York State College of Forestry at Syracuse University, Syracuse, and at the office of Lewis F. Pilcher, state architect, Capitol, Albany, where complete sets of plans and specifications may be obtained.

WARSAW, N. Y.—Arrangements have been made by the Warsaw Gas & El. Co. with the village to remove all overhead wires on Main Street in the business section and place them in underground conduits for the purpose of furnishing electricity to maintain the lamps on the new standards. The company is to remove the poles and place the wires in conduits at its own expense, the village furnishing the lamps and standards.

BANGOR, PA.—The Industrial El. Lt. Co., to which a franchise to furnish electrical service in Bangor was recently granted, will secure electricity from the Lehigh Coal & Navigation Co. Wires will be strung on the poles of the Blue Mountain Tel. Co. A transformer station will be erected in Bangor. As yet definite arrangements for installing the system have not been made. D. M. Hambright, of Bangor, is engineer in charge and E. G. Markley is secretary.

LEBANON, PA.—The Lebanon Valley El. Lt. Co. has been granted a franchise to furnish electricity in the city of Lebanon for a period of 50 years. The franchise provides for a minimum bid for street lighting at $65 per lamp per year.

MAUCH CHUNK, PA.—The power house of the Mauch Chunk Ht., Pwr. & El. Lt. Co. was destroyed by fire on Dec. 27, causing a loss of about $80,000. The Mauch Chunk company has entered into contract with the Lehigh Coal & Navigation Co., of Philadelphia, to furnish electricity for one year. For the present the service will be supplied from Harwood, via Hauto and Nesquehoning. A new wire will be erected between Nesquehoning and Mauch Chunk.

MONTROSE, PA.—The property of the Montrose El. Lt., Ht. & Pwr. Co. has been purchased by the Susquehanna & Lanesboro Ht. & Lt. Co., of New Milford. The new company, it is understood, proposes to make extensions to the system. The local plant will be used to supply electricity between Susquehanna and New Milford.

PHILADELPHIA, PA.—C. E. Schermerhorn has completed plans and has invited bids on the electrical installations for the church and Sunday school building for the First Baptist Church.

PHILADELPHIA, PA.—The contract for the installation of the entire electrical equipment, including the wiring for lamps and motors, in the new building of the Ford Motor Car Co. at Broad Street and Lehigh Avenue, Philadelphia, has been awarded to the United El. Construction Co., 1727 Sansom Street, Philadelphia. The building is 231 ft. by 312 ft. and is ten stories high. The cost of the electrical work is estimated at about $200,000.

PITTSBURGH, PA.—The Duquesne Lt. Co., of Pittsburgh, is planning to erect a new substation on Warrenton Avenue, near the Mount Washington tunnel. The building will be 114 ft. by 46 ft., one story and basement and of brick and concrete construction.

PITTSBURGH, PA.—Twenty-six companies chartered for the Ohio and Beaver Valleys have been merged into the Harmon El. Co. with a capital stock of $130,000. The directors are: William McBride, of Sewickley; D. C. Wiseman, of Bellevue; T. L. Bedell, of McKeesport, and C. H. Walsh, of Pittsburgh.

PITTSBURGH, PA.—One hundred and sixty-two electric companies chartered for southwestern Pennsylvania companies within the last 18 months have filed notices of merger into four corporations, each headed by W. S. Kuhn, of J. S. & W. S. Kuhn, Inc., of Pittsburgh. Of the above companies, 100 have been merged into the West Penn Ltg. Co., capitalized at $547,000, 39 into the West Penn Lt. & Pwr. Co., with a capital stock of $244,000; 16 into the West Penn El. Co., capitalized at $901,000, and seven into the Kittanning El. Co., with a capital stock of $51,000. The first three companies will have offices in Pittsburgh and the latter in Kittanning. The directors of all four companies are as follows: W. S. Kuhn, J. B. Van Wagener, Byron Trimble and J. A. Lynch, of Pittsburgh, and C. W. Scheieck, of Mount Lebanon.

SCRANTON, PA.—The Scranton El. Co. will erect a substation in Moosic to furnish electricity to the Scranton Ry. Co. to operate its cars in that section. At present the electric company is using two substation cars of the Scranton, Dunmore & Moosic Lake R. R. Co., pending the construction of the station. Frank Caum is general manager of the Scranton Railway Co.

WASHINGTON, PA.—Burgess W. W. Hoyt has vetoed the ordinance passed by the Council granting a franchise to the Relief El. Lt., Ht. & Pwr. Co.

BOONTON, N. J.—The Board of Utility Commissioners has approved the ordinance granting the Boonton, El. Co. permission to erect distribution lines in the streets of Boonton Township.

FREEHOLD, N. J.—The Board of Public Utility Commissioners has granted the Monmouth Lt. Co., of Freehold, permission to issue securities to the amount of $6,400, the proceeds to be used for extensions in its system in Marlboro, Englishtown and vicinity.

HADDONFIELD, N. J.—Allen Clymer, borough clerk, writes that no proceedings are yet under way for a municipal electric-light plant in Haddonfield.

JERSEY CITY, N. J.—The Board of Freeholders is considering the installation of ornamental iron poles in connection with the street-lighting system along the county boulevard.

LODI, N. J.—Bids will be received by the Board of Education until Jan. 14 for the construction of a 13-room school building, including electrical work, heating and ventilating. Anton L. Vegliante, of Garfield, is architect.

MORRISTOWN, N. J.—The Morris County Trac. Co. is contemplating the construction of a power plant in Morristown, to cost about $250,000. O. G. Schultze, of Morristown, is secretary and treasurer.

NEWARK, N. J.—The Public Utility Commissioners of New Jersey have granted the Pub. Ser. El. Co., subject to certain conditions, permission to issue $3,000,000 in capital stock, the proceeds to be used for improvements and extensions to its system.

HARPERS FERRY, W. VA.—The Harpers Ferry El. Lt. & Pwr. Co. is contemplating enlarging its power plant with a view of extending its service. George R. Bready is secretary and manager.

MARTINSBURG, W. VA.—The Martinsburg Pwr. Co. has filed a mortgage with the Safe Deposit & Trust Co. of Baltimore, as trustee, to secure an issue of $5,000,000 in bonds. The securities, it is said, will be issued as needs require. The company has plans under way for enlarging its central power plant in order to supply electricity to operate the new electric railway in Martinsburg.

BOYCE, VA.—Arrangements are being made by the town of Boyce to install a municipal electric-light plant. It is proposed to build a hydroelectric plant, for which surveys have been made by F. L. Robeson, of Virginia Polytechnic Institute, Blacksburg. The town has already purchased a 90-kw alternator and will purchase an engine to operate the generator until the water-power is developed.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 20 for furnishing at the various navy yards and naval stations the following supplies: Portsmouth, N. H., Schedule 6223—one 25-kw turbo-driven generator. Brooklyn, N. Y., Schedule 6212—255 miscellaneous opal, heat-resisting inner globes; Schedule 6222—eight electric air heaters for ships; 1600 ft. single-conductor, armored wire, Navy standard. Schedule

6221—miscellaneous spares for electric ranges and ovens; Schedule 6214—15,000 lb. calcium carbide in 100-lb. metal drums. Boston, Mass., Schedule 6204—renewing storage batteries for motor trucks; Schedule 6211—14,000 lb. galvanized, cast-steel crucible wire, 3000 lb. galvanized soft steel wire; Schedule 6217—3800 lb. of chloride of calcium. Newport, R. I., Schedule 6220—1350 lb. miscellaneous hard-drawn copper tubing. Bids will also be received at the same place until Jan. 27 for furnishing at the navy yard, Mare Island, Cal., the following: Schedule 6201—600 lb. electrolyte acid in carboys and 5000 lb. of carbide calcium in 100-lb. drums. Bids will also be received until Feb. 10 for furnishing at the navy yard, Brooklyn, two 5-kw radio sets for ship installation as per schedule 6196. Applications for schedule should designate the schedule desired by number. T. J. Cowie is paymaster general, U. S. N.

North Central

BATTLE CREEK, MICH.—The city commission has decided to expend $4,500 on electric-lighting fixtures for the new city hall, bids for which will be received until Jan. 19. Bids will also be received on an electric elevator.

DETROIT, MICH.—The Ford Motor Co., of Detroit, is planning extensive additions to its power plant during the coming year, involving an expenditure of about $1,000,000. A new building will be erected in the rear of the present power plant, at a cost of $150,000; the equipment will include four engines, one steam and three gas, and four generators, with a rating of 3750 kw each. Orders have been placed for the generators, which will be built by the Crocker-Wheeler Co., of Ampere, N. J.

GRAND RAPIDS, MICH.—The Board of Public Works is contemplating asking the City Council for an appropriation of $10,000 for extensions and improvements to the municipal electric-light plant.

HILLSDALE, MICH.—The Council is considering the installation of a cluster-lamp system for lighting the streets.

IRONTON, MICH.—The Village Council is considering the question of establishing a municipal electric-light plant in Ironton.

PETOSKEY, MICH.—The Council has authorized a special commission to secure bids for the installation of an electrically driven pump for the water-works system.

WAYNE, MICH.—Bids will be received by the water-works committee until Jan. 28 for motors and electrical equipment to be used in connection with a new water-works system. Bids are also asked on installing the motors and electrical equipment and the necessary wiring, etc., inside of the pump house. P. J. Snyder is clerk of the committee.

CLEVELAND, OHIO.—The Otis Steel Co., 3441 Jennings Road, Cleveland, has secured a permit to construct a power house in connection with a group of buildings. New equipment, it is understood, will soon be purchased.

CLEVELAND, OHIO.—The Vedder El. Co., of Cleveland, has been awarded the contract for wiring and installing electrical apparatus in a new four-story addition to the Taylor Arcade. The company has also secured the contract for wiring and installing electrical apparatus in three new shop buildings for the Cleveland Ry. Co., now under construction.

BLOOMFIELD, KY.—Harry M. Logan, proprietor of the Bloomfield light and power system, expects to purchase some wiring supplies.

CARROLLTON, KY.—Within the next four months the managers of the municipal electric-light plant expect to purchase a new boiler, a new alternating-current generator, to take the place of the present direct-current machine, new switchboard, 500 30-ft. (6-in.-top) poles and other line material. R. L. Bartlett is superintendent.

CYNTHIANA, KY.—The Cynthiana El. Lt. Co. expects to purchase some flatirons and fans (133 cycles, 110 volts). C. C. Addams is superintendent.

DAWSON SPRINGS, KY.—The Dawson Lt. & Pwr. Co., of Dawson Springs, has been organized to take over the electric department of the Dawson Milling Co. The present plant has an output of 60 kw, direct current, and it is proposed to change the system to alternating current with an output of 100 kw in about 12 months. The cost of changing the plant is estimated at from $12,000 to $15,000. The company at present has 60 meters and is preparing to install 75 more. It also has a contract for street-lighting pending. No new equipment will be purchased at present. K. Kevil, of Sikeston, Mo., is engineer in charge.

MOUNT OLIVET, KY.—The installation of a municipal electric-light plant in Mount Olivet, to cost $5,000, is reported to be under consideration.

KENDALLVILLE, IND.—The City Council has passed an ordinance appropriating $4,000 for posts, equipment and installation of a boulevard lighting system on Mitchell and Rush Streets.

MULBERRY, IND.—The Mulberry Lt. & Pwr. Co. is contemplating some extensions in the early spring and may purchase some transformers. Nothing definite yet decided upon. Albert I. Yundt is treasurer.

ROYAL CENTER, IND.—The Royal El. Lt. Co., Ltd., of Royal Center, expects to purchase a few arc lamps and incandescent lamps. W. H. Bingham is secretary.

BATH, ILL.—Within the next few months the managers of the municipal electric-light plant expect to purchase a 100-amp generator. L. F. Roloff is manager.

CHICAGO, ILL.—Bids will be received by John McGillen, clerk of the Sanitary District of Chicago, room 600, 900 South Michigan Avenue, Chicago, Ill., until Jan. 15, for series, alternating-current, inclosed flame-arc lamps. Specifications may be obtained upon application to the above office. For details see proposal columns. Thomas A. Smyth is president of board of trustees.

CHICAGO, ILL.—Bids will be received by the clerk of the Sanitary District of Chicago, Room 700, 900 South Michigan Avenue, Chicago, Ill., until Jan. 29 for construction of the superstructure of a trunnion bascule bridge across the south branch of Chicago River at Jackson Street, in the city of Chicago, as follows: (a) Bridge superstructure; (b) operating houses, machinery, inclosures, etc. (alternative one), or (b) operating houses, machinery inclosures, etc. (alternative two); (c) lamp standards; (4) 20,000 lb. of reinforcing metal furnished and placed ;(e) 25 cu. yd. of extra concrete; (f) 10,000 ft., board measure, of extra untreated timber and lumber; (g) extra creosoted timber and lumber; (h) extra structural steel; (i) extra machinery steel; (j) extra steel castings; (k) extra machinery iron castings; (l) extra iron castings; (m) extra bronze and babbitt. All proposals must be made upon blank forms of proposal furnished by the Sanitary District. Specifications, contract, form of proposal and plans may be obtained upon application at the office of the Sanitary District. A deposit of $15 will be required for each set of plans taken out, which will be refunded upon return of same. Thomas A. Smyth is president of board of trustees.

GENEVA, ILL.—Within the next six months the managers of the municipal electric-light plant and water-works system expect to erect a new boiler house and install two boilers; also to purchase two 300-hp boilers, air compressors and feed-water heaters. Olof Peterson is superintendent.

JOLIET, ILL.—The City Council has decided to contract with the Pub. Ser. Co. of Northern Illinois, of Chicago, for electricity to operate the city pumping station for a period of five years.

MELVIN, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has been granted a franchise to operate an electric-light system in Melvin. The company will probably be given a contract for lighting the streets of the village.

MONMOUTH, ILL.—The Monmouth Pub. Ser. Co. has increased its capital stock from $600,000 to $1,000,000. The stockholders of the company have ratified plans for improvements to the plant, to cost about $100,000.

MOUNT CARMEL, ILL.—The Mount Carmel Public Utility & Service Co., which recently purchased the light, heat and water plants at a public sale, will make improvements to the properties. Phillip Barnhard, of Mount Carmel, is secretary and treasurer.

MOUNT VERNON, ILL.—The Citizens' Gas & El. Co., of Mount Vernon, is contemplating making extensions to its plant and system. The company was recently granted a 35-year franchise by the City Council.

NEPONSET, ILL.—The Village Board has granted the Kewanee Lt. & Pwr. Co., of Kewanee, a 20-year franchise to supply electricity for lamps and motors in Neponset. The service will be furnished by the transmission line of the company extending from Kewanee to Sheffield.

ROCK FALLS, ILL.—Bonds to the amount of $8,000 have been voted for improvements to the municipal electric-light plant.

SHAWNEETOWN, ILL.—The managers of the municipal electric-light plant expect to replace the street arc lamps with tungsten lamps within the next six months. George E. Porter is superintendent.

STEWARD, ILL.—Within the next six months the Steward El. Lt. & Wtr. Co expects to erect one storage tank of 8000-gal. capacity for fuel oil. C. T. Beitel is proprietor.

STONINGTON, ILL.—The village of Stonington expects to purchase within the next five months a generating unit for the municipal electric-light plant; also within the next three months some washing machines. O. W. Culbertson is manager and purchasing agent.

WEST FRANKFORT, ILL.—Steps have been taken toward the organization of a utility company in West Frankfort to be capitalized at $250,000. The promoters have in view three franchises covering street railway, water and gas privileges. The survey for the proposed electric railway runs from the new Orient mine, west of West Frankfort, to Old Frankfort, 1 mile east, and includes a spur to each of the large coal mines there. C. E. McClintock, of Johnston City, Ill., and others are interested.

WINCHESTER, ILL.—The City Council has granted a 25-year franchise to a company recently formed to operate an electric-light plant. Under the terms of the franchise work must begin on the plant within three months. R. W. Frost, E. J. Frost, E. D. Smith, C. W. Banes, R. M. Riggs and others are interested in the project.

DOUSMAN, WIS.—The local electric-light plant, owned by R. L. Adams, has been purchased by L. J. Bischel, who will remove it to his mill. Work will begin at once on the erection of the transmission line from the mill to the village.

KENOSHA, WIS.—Work will begin at once on rebuilding the lines of the Kenosha Home Tel. Co. The cost of the work is estimated at from $60,000 to $80,000.

CLARA CITY, MINN.—The Village Council is negotiating with Maynard Council and the Montevideo El. Lt. & Pwr. Co., of Montevideo, with a view of securing electrical service for the town. Bonds to the amount of $5,000 were recently voted to install an electric-light system. If the service is secured from the Maynard plant, the village will erect the transmission line from the plant to Clara City.

DE GRAFF, MINN.—The proposal to issue bonds for the installation of a municipal electric-light plant in De Graff will soon be submitted to the voters.

INTERNATIONAL FALLS, MINN.—The Minnesota & Ontario Pwr. Co. is planning to install an additional generating unit and auxiliary equipment at its plant in International Falls to generate electricity for the paper mills and other industrial plants here.

MINNEAPOLIS, MINN.—The contract for furnishing electricity for 2800 lamps for lighting the streets of the city has been awarded to the Minneapolis General El. Co. at $60 per lamp per year. The company was also awarded the contract for supplying energy for the Corinthian standard lamps at $45 per standard per year.

WINONA, MINN.—Bids will be received by the State Board of Control, St. Paul, Minn., until Jan. 15, for the construction of model school building at the State Normal School, Winona, Minn., including general contract work, heating and ventilating, plumbing and electrical work, in accordance with plans and specifications prepared by C. H. Johnston, architect, Capital Bank Building, St. Paul. Bids will be received collectively or separately. Copies of plans may be seen at the Builders' Exchange in St. Paul and Minneapolis, at the office of the president of the State Normal School, Winona, and at the office of the State Board of Control, St. Paul.

FARNHAMVILLE, IA.—Bids will be received by the Town Council until Jan. 19 for furnishing material and constructing an electric light and power system in Farnhamville. Work must begin on the plant on or before March 1 and be completed by June 1, 1914. Plans are on file in the office of J. W. Hartinger, clerk.

FONTANELLE, IA.—The Electric Light Commissioners expect to purchase within the next two months one carload of 25-ft. and 30-ft. poles, heating and cooking apparatus, etc. The town has just installed an electric-light and water plant. Electricity for operating the system is purchased from the municipal electric plant in Greenfield and is transmitted over a 6600-volt line, 7 miles long, erected by the town of Fontanelle. L. F. Troxel is manager.

LEON, IA.—Within the next six months the Leon El. Co. expects to erect 6 miles of 2300-volt, single-phase transmission line; also to purchase one 150-hp tubular boiler, a 150-lamp series street-lighting system, one carload of poles and 12 electroliers. J. F. Smith is president.

MANNING, IA.—Within the next three months the Manning El. Lt. Co. expects to purchase one triplex pump (7 in. by 8 in.)

and aand points and pipes; also 25 steel electroliers for five-lamp clusters. H. Ohrt is president.

MOULTON, IA.—J. G. Belton, owner of the local electric-light plant, expects to purchase during the summer of 1914 a coal-handling system; may also purchase some electrical appliances and supplies, etc. A day service is now furnished by the plant.

NEWTON, IA.—The Electric Light Commission expects to purchase within the next three months one 150-hp boiler for the municipal electric-light plant. C. O'Leary is superintendent.

ROCK VALLEY, IA.—The Rock Valley El. Co. expects to erect a new power house or about 11 miles of transmission lines within the next six months; also to purchase one 100-hp Corliss engine, one 35-hp engine, one 75-kw generator and switchboard and two 80-hp boilers; also to purchase within the next 12 months about $500 worth of wiring supplies and 40 hp in motors. S. Thayer is manager.

SUMNER, IA.—Within the next six months the Sumner Lt. & Pwr. Co. expects to erect 12 miles of transmission lines; also to purchase one 50-kva transformer and a supply of electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc.; also within the next three months to purchase five car loads of 25-ft. (6-in.-top) poles. Charles Kurmence is manager.

VOLGA, IA.—Oscar Weisner has been granted a franchise to construct and operate an electric-light and power plant for a period of 25 years.

JOPLIN, MO.—The Empire District El. Co., of Joplin, is installing a 2500-kva low-pressure exhaust turbine to be operated in conjunction with the reciprocating engine plant at Riverton, Kan.

PIEDMONT, MO.—The Piedmont El. Lt. & Pwr. Co. is planning to install an electric-light plant to be operated by oil engines. The present plans provide for a 20-kw, 2300-volt plant, with 3 miles of transmission lines. W. E. Bunyard, of Bonne Terre, Mo., is manager.

CASSELTON, N. D.—Hallett & Lynch have been granted a franchise to install an electric-light plant in Casselton; also a contract for street lighting.

DICKEY, N. D.—A proposal has been submitted to the Town Council by J. L. Tucker, representing a St. Paul electric company, offering to install an electric-light plant in Dickey.

McCLUSKY, N. D.—Phillip Kiefer, of Moorhead, Minn., has submitted a proposal to the Council offering to install an electric-light plant in McClusky, provided he is given a franchise and a site for plant.

WYNDMERE, N. D.—The installation of an electric-light plant in Wyndmere is under consideration. One or two propositions for the establishment of a private plant have been submitted, but general sentiment is favorable to municipal ownership.

DELL RAPIDS, S. D.—A franchise has been granted to N. C. Draper to install an electric light and power system in Dell Rapids.

GREAT BEND, KAN.—Within the next three months the Great Bend Wtr. & El. Co. expect to purchase coal and ash handling systems and some electric heating ranges. The company has recently purchased a carload of poles to improve its distributing system. J. R. Murphy is manager.

HAVEN, KAN.—The Haven El. & Ice Co. expects to purchase within the next two months one 35-hp or 45-hp center-crank, high-speed steam engine (second-hand preferred).

LE ROY, KAN.—At an election held recently bonds to the amount of $13,000 were voted for the installation of a municipal electric-light plant.

LIBERAL, KAN.—Within the next four months the Liberal Lt., Ice & Pwr. Co. expects to purchase 500 lb. No. 6 weather-proof wire and a carload of 25-ft. and 30-ft (6-in.-top) treated cedar poles. H. W Magruder is president and manager.

LINDSBORG, KAN.—The town of Lindsborg expects to purchase within the next 12 months one or two 200-hp boilers and street lamps. M. H. Blaine is superintendent.

RUSSELL, KAN.—The city of Russell expects to install within the next three months an auxiliary generating unit in the municipal electric-light plant, consisting of a 60-hp to 100-hp engine, a 50-kw to 75-kw generator, and switchboard. M. C. Fox is city manager.

SPEARVILLE, KAN.—The Diamond El Lt. & Pwr. Co., of Spearville, expects to purchase 25 meters within the next 12 months. Thomas J. Stinson is manager.

Southern States

DANBURY, N. C.—We are informed that the installation of an electric-light plant in Danbury is not contemplated, as reported in the issue of Dec. 13. M. T. Chilton is clerk.

WILMINGTON, N. C.—We are informed that the city of Wilmington has taken no definite action in regard to establishing a municipal electric-lighting plant. F. F. Pillet is city engineer.

COLUMBUS, GA.—The Southern Ferro Concrete Co., engineers and contractors, Georgia Building, Atlanta, Ga., has been awarded the general contract for the construction of the Columbus Hotel, Columbus, Ga., including the reinforced-concrete skeleton frame, elevators, plumbing, heating, electrical work, fixtures, refrigeration plant, kitchen equipment, etc. The building will be ten stories high and will cost about $200,000. Parties interested in furnishing bids should address the company at its Atlanta office.

GLENVILLE, GA.—The Council has engaged the J. B. McCrary Co., of Atlanta, Ga., as engineers and contractors for the proposed municipal electric-light plant. Dr. L. A. DeLoach is Mayor

VALDOSTA, GA.—Plans are being considered for the construction of a power plant on the Willacoochee River, about 3 miles from Valdosta, for which preliminary surveys are now being made by A. B. Langford, of Valdesta, civil engineer.

ZEPHYRHILLS, FLA.—The Zephyrhills El. Lt. & Pwr. Co. has changed its name to the Zephyrhills El. Co. The company expects to purchase some wire and a few motors. Waldo M. Francisco is president.

JACKSON, TENN.—At an election to be held Jan. 19 the proposal to issue $25,000 in bonds, the proceeds to be used for enlarging power plant and extensions to lighting system, will be submitted to the voters.

BIRMINGHAM, ALA.—The Tidewater Co. will soon submit to the city commission a request for a franchise for the entire system which it proposes to build in Birmingham. The present plans provide for a street-railway system making connections with the present main line to all of the principal suburbs of Birmingham, including Norwood, Avondale, the Southside, West End, Powderly and Bessemer. George Brown is vice-president and chief engineer.

CLAYTON, ALA.—Bonds to the amount of $5,000, it is reported, have been voted for improvements to the municipal electric-light system.

OPELIKA, ALA.—The managers of the municipal electric light and power plant have recently purchased a 150-kw generator and a 225-hp engine. Charles Schafer is superintendent.

VICKSBURG, MISS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 30 for the installation of an electric passenger elevator in the extension of the United States post office and court house in Vicksburg, Miss. For details see proposal columns. O. Wenderoth is supervising architect.

MURFREESBORO, ARK.—The Murfreesboro Lt. & Pwr. Co. is planning to install an electric light and power plant. The equipment will consist of one 125-hp tubular boiler, one 100-hp engine, one 75-kw alternating-current, 60-cycle, 2300-volt generator, one marble switchboard, oil switches, ammeters, voltmeter and possibly five transformers, 150 poles and 8 miles of wire (approximately), single-phase recording meters and tungsten street-lighting system. No contracts for equipment will be let at present. W. E. Rafferty, of Murfreesboro, is engineer in charge of the work.

OZARK, ARK.—George F. Brockman, owner of the local electric-light plant, has recently installed a 75-kw, single-phase, 60-cycle Fort Wayne generator, a Hoppe open heater and new switchboard, and has also rebuilt the distributing systems in Ozark, Altus and Deming.

RUSSELLVILLE, ARK.—A group of St. Louis financiers has organized a company to furnish electricity for lamps and motors in seven Arkansas towns in Yell and Conway Counties between Fort Smith and Little Rock. The company, which will be known as the Seven Cities Co., has taken over the Russellville hydroelectric plant and expects to close options on plants in neighboring towns soon. It is proposed to consolidate the light and power plants in most of these towns into one central plant, with branches. The towns are within a radius of 40 miles of Russellville. The chief towns to be served are Russellville, Dardanelle, Morrilltown, Dover and Cabin Creek. The plant at Russellville is located at the Junction of the Illinois and Arkansas Rivers. The company is capitalized at $500,000. R. D. Smith is president of the new company.

DE RIDDER, LA.—The De Ridder Lt. & Pwr. Co., it is reported, is contemplating the construction of a power plant, to cost about $30,000.

SUPPLY, OKLA.—Bids will be received by the Board of Trustees of Supply until Jan. 13 for the construction of an electric-light plant and water-works system, to cost $18,500.

ARANSAS PASS, TEX.—Work will probably begin some time in January or February on the proposed municipal electric-light plant in Aransas Pass, for which $8,000 in bonds were recently voted. Bonds to the amount of $22,000 were also voted for a water-works system. As yet an engineer has not been engaged. Charles H. Gile is city clerk.

NAVASOTA, TEX.—The Navasota Lt. & Pwr. Co. has increased its capital stock from $20,000 to $200,000 and has changed its name to the Navasota Ice, Lt., Pwr. & Wtr. Co. Extensive improvements and additions will be made to its light and power plants and water-works system.

Pacific States

BREMERTON, WASH.—The City Council has rejected the proposal submitted by Gustav F. Rust, of Colby, representing a group of promoters, offering to build an electric plant on the Hama Hama River, near Eden Ferry, and to transmit energy to Bremerton; construct a street and interurban railway system, and turn the entire system over to the city at the end of three years for $350,000. The Council has decided to call a special election to vote on the question of establishing a municipal electric-light plant.

CONCONULLY, WASH.—The Big Bend Lt. & Pwr. Co., controlled by the Okanogan Valley Pwr. & Lt. Co., of Spokane, has applied to the County Commissioners of Okanogan County for a franchise to extend its transmission lines over all roads in Okanogan County. The company proposes to extend its transmission lines from Brewster to Omak and Okanogan.

OKANOGAN, WASH.—In order to increase the water supply for the Okanogan irrigation project in the State of Washington, the Secretary of the Interior has approved the recommendation of the Board of Reclamation Commissioners that plans be made immediately for the development of power to pump water for about 1050 acres. Power will be developed at two drops in the main canal. The sum of $82,000 has been allotted from the reclamation fund for the work.

OMAK, WASH.—The City Council has granted the Okanogan Lt. & Pwr. Co., of Okanogan, a franchise to furnish electricity for lamps and motors here. Arrangements are being made to erect a transmission line to Omak.

PUYALLUP, WASH.—The Puget Sound Trac., Lt. & Pwr. Co., of Seattle was recently granted the contract for furnishing electricity for lighting the city for a period of four years. A large number of arc lamps will be erected in the business district and tungsten lamps in the residential district. About $5,000 will be expended for improvements to the local system.

SEATTLE, WASH.—The City Council has authorized the Light Department to expend $20,000 for making necessary alterations in the municipal substation at Seventh Avenue and Yesler Way.

SPOKANE, WASH.—The Trustee Company has applied for a franchise to install underground conduits for furnishing electricity for heating and lighting service throughout the city. The company proposes to install a plant to cost eventually from $300,000 to $400,000. Harry A. Flood is president of the company.

EUGENE, ORE.—The Booth Kelly Lumber Co., of Eugene, has engaged the West Coast Engineering Co., of Portland, to prepare plans and take charge of the installation of an electric-lighting and power system in the large sawmill being erected by the lumber company in Springville, Ore. Motors ranging from 200 hp to 300 hp (aggregating 2500 hp) will be installed. Three-unit monorail systems will be installed in the yards for handling lumber.

KLAMATH FALLS, ORE.—The Department of the Interior, Washington, D. C., has acted favorably on the petition of the city of Klamath Falls for the establishment of a power plant in connection with the Klamath reclamation project. The government is to construct the plant and the city to finance the same.

NEWBERG, ORE.—The Yamhill El. Co. expects to install a 500-kva step-down transformer to furnish electricity in Newberg. The company has entered into a contract with the Portland Ry., Lt. & Pwr. Co., of Portland, for energy to operate its system. C. J. Edwards is manager.

BURNEY FALLS, CAL.—The Board of Supervisors of Shasta County has granted the Pitt River Pwr. Co. a franchise to furnish electricity in Fall River and Burney Valleys. The company proposes to build a power plant in Burney Falls to have an output of 1000 hp at a cost of about $50,000

CALISTOGA, CAL.—The Calistoga El. Co. is contemplating the purchase of poles, wires, meters and voltmeter (recording). C. W. Couch is secretary and manager.

DURHAM, CAL.—Within the next 12 months the Durham Lt. & Pwr. Co. expects to purchase a few transformers, insulators, meters, etc., and to expend about $200 for incandescent lamps. J. A. Foster is manager.

LAKEPORT, CAL.—The Mount Konocti Lt. & Pwr. Co., of Lakeport, expects to purchase within the next 12 months 1500 incandescent lamps. A. N. Joslin is general manager.

REDLANDS, CAL.—The Holton Pwr. Co., of Redlands, expects to erect within the next six months a substation at El Centro and to connect the high-tension transmission line to be erected by the Coachella Valley Ice & El. Co. from Banning to El Centro with the present lines of the Holton company in the Imperial Valley. W. G. Driver is secretary.

RIVERSIDE, CAL.—The Southern Sierras Pwr. Co., of Riverside, will take over the lines of the Temescal Wtr. Co. and furnish power for operating the pumping plants of the water company in Temescal Canyon. The plant of the Temescal company at Ethanac was closed down Jan. 1, 1914.

SAN FERNANDO, CAL.—The Pacific Lt. & Pwr. Corpn., of Los Angeles, is contemplating rebuilding its distribution system throughout the town of San Fernando.

SAN FRANCISCO, CAL.—The Board of Public Works has authorized the city engineer to prepare plans for a street-lighting system for streets traversed by extensions of the municipal railway and to prepare specifications for the enlargement of the Geary Street carhouse.

SUTTER CREEK, CAL.—The South Eureka Co., is planning to equip its Oneida Mine with electrically operated machinery.

GENESEE, IDAHO.—The Washington Wtr. Pwr. Co., of Moscow, has submitted a new proposal to the City Council for furnishing electricity for lamps and motors in Genesee. Two street-lighting contracts have been offered, one for five years and the other for ten years. The Council is also considering tungsten lamps for street-lighting.

IDAHO FALLS, IDAHO.—The City Council has granted the Idaho Falls El. Co. a franchise to build a power house in Idaho Falls. Under the terms of the franchise the company cannot sell electricity for commercial purposes in Idaho Falls.

PRIEST RIVER, IDAHO.—The Council is considering the question of establishing a municipal electric-light plant in Priest River.

PRIEST RIVER, IDAHO.—Investigations are being made by L. V. Smith and a party of engineers of the power sites on the Priest River, owned by the Pan Handle Ry. Co., with a view of building a power plant to supply electricity to nearby towns as soon as the situation warrants.

ST. ANTHONY, IDAHO.—The Utah Pwr. & Lt. Co., it is reported, is contemplating the construction of a new power house on the site of the present station in the spring. The new plant will have an output of 750 hp.

CLIFTON, ARIZ.—The Arizona Copper Co., Ltd., of Clifton, expects to install 600 kva in transformers in the Clifton substation to furnish electricity to operate the Clifton pumping station. Norman Carmichael is vice-president and general manager.

CROWN KING, ARIZ.—The Nelson Mining Company is planning to build an electric railway from Crown King to its holdings, about 1 mile distant. An electric power plant, it is stated, will be built in Crown King.

BILLINGS, MONT.—Surveys, it is reported, have been completed by the Big Horn Canyon Irrigation & Pwr. Co. for a railroad from Canyon to Custer, a distance of 68 miles. Power for operating the proposed railroad will be developed from a dam in the Big Horn Canyon.

GLASGOW, MONT.—The city of Glasgow will soon award a contract for the installation of a new street-lighting system, including 400 lamp standards and 100 blocks of cement walk. The latter part of January the city will also place an order for an additional electric generating unit for the municipal electric-light plant. E. S. Severance is city engineer.

HELENA, MONT.—An election will be called by the City Council the latter part of January or the first of February to submit the proposal of granting a franchise to the Standard Engineering Co., of Seattle, Wash. Preliminary plans provide for a steam plant at first; later a larger plant will be built.

Canada

LACOMBE, ALTA.—The town of Lacombe is planning to install, in the near future, an engine-driven, 100-kw, three-phase, 60-cycle, 2300-volt generator, complete with field rheostat and pulley from which to belt an exciter. E. J. Tett is manager.

BRANDON, MAN.—A proposition has been submitted to the City Council by C. Chamberlain relative to transmitting electricity from Silver Falls to Brandon.

WINNIPEG, MAN.—Tenders will be received by the Board of Control for furnishing and erecting in the power house at Point du Bois one head-gate-lifting mechanism, including the necessary accessories.

WINNIPEG, MAN.—Tenders will be received until Jan. 29 for furnishing electrically operated switching apparatus and accessories for the King Street substation. Plans and specifications may be obtained at the office of the Light and Power Department, 54 King Street, Winnipeg. M. Peterson is secretary of Board of Control.

WOODSTOCK, N. B.—The Maine & New Brunswick El. Pwr. Co., of Presque Isle, Maine, has applied for a franchise to erect transmission lines in Woodstock to furnish electricity for lamps and motors.

HANTSPORT, N. S.—Several proposals have been submitted to the Town Council recently for lighting the town by electricity.

FORT WILLIAM, ONT.—The Kaministiquia Pwr. Co., of Fort William, proposes to increase its capital stock from $2,000,000 to $2,500,000 and will issue about $200,000 to pay for the cost of an additional installation of 12,000 hp.

ORILLIA, ONT. — The Hydro-Electric Power Commission of Ontario has been asked to submit a proposal to furnish the town of Orillia with a 24-hour service from the Big Chute plant. This would do away with the proposed installation of a new plant by the town of Orillia.

WELLAND, ONT.—Tenders will be received by William H. Lowe, secretary of the High School board of Welland, until Jan. 17, for construction of new high school building complete, including electric wiring. Separate tenders for each part of the work or bids for the entire work will be considered. Plans and specifications may be obtained upon application to D. F. Forbes, architect, 43 Temple Building, Welland.

COTE ST. PAUL, QUE.—In order to secure more power the Department of Railways and Canals of the Canadian government is constructing a new power house at Côte St. Paul, on the Lachine Canal, Quebec. At present there are two power houses on the canal. One will now be abandoned and a new one built near the site of the second. The building will be 70 ft. by 70 ft. New generating equipment will be installed, consisting of four turbine wheels 60 in. in diameter and one turbine wheel 30 in. in diameter, two exciter wheels, five generators and two transformers. Provision is made for an output of a total of 650 hp. Electricity generated at the plant is utilized for lighting the waterway and for opening and closing dock gates.

MONTMORENCY FALLS, QUE. — The Dominion Textile Co. is making extensions to its plant in Montmorency Falls. New machinery installed will be driven by electricity.

QUEBEC, QUE.—The Merchants' Lt., Ht. & Pwr. Co. has submitted to the local Legislature a by-law asking permission to amend its charter by increasing its capital stock from $800,000 to $3,000,000.

WILKIE, SASK.—The Town Council is considering the question of submitting a by-law to ratepayers providing for an appropriation of $30,000 for extensions and improvements to the electric-light system in Wilkie. It is proposed to install an additional engine to increase the output of the plant to meet the increasing demands of electricity for lighting and later to supply power for industrial plants.

Miscellaneous

VALDEZ, ALASKA.—The Valdez El. Pwr. Co., recently organized, is planning to erect a power plant, transmission lines, etc., during the coming year. The officers of the company are: E. E. Ritchie, president; George J. Love, secretary, and W. H. Blackwell, treasurer.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Jan. 21, for signal cable and cable end bells, filling compound for same, and vitrified salt-glazed conduit. Blanks and general information relating to this circular (No. 818) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major Boggs is general purchasing officer.

New Incorporations

AURORA, ILL.—The Dayton & Ottawa Pwr. & Lt. Co. has been chartered with a capital stock of $100,000 to develop and distribute water, electrical and other power. The incorporators are De Witt E. Northam, Sidney E. Blanc and F. W. Simpson.

GLYDON, MINN.—The Glydon Lt. & Pwr. Co. has been incorporated by A. J. Fitzsimmons and others.

KINGS, N. C.—The Dan River Ry. Co. has been incorporated by Harlee Miller, of Clements; B. E. Kapp, of Bethania, and E. C. Butler, of Hamilton, N. Y. The company proposes to construct and operate interurban electric railways between towns in Stokes and adjacent counties; also to develop electrical power for lamps, motors and other purposes.

HARRISBURG, PA.—Charters were issued by the State Department on Dec. 31 for 11 new companies to operate in the eastern part of Bucks County, covering the towns and townships of Bristol, Bensalem, Bridgetown, Durham, Falls, Lower Makefield, Upper Makefield, Nockamixon, Plumstead, Solebury and Tinicum. The incorporators are S. D. Warriner, of Philadelphia; Rollin H. Wilbur, of St. David's, and B. F. Baker, of Germantown, all interested in the Lehigh Coal & Navigation Co., of Philadelphia. The electric plant of the Lehigh company is in the coal regions, about 50 miles distant from the towns it proposes to furnish with electrical service.

EDGEMONT, S. D.—The Edgemont El. Lt. Co. has been incorporated with a capital stock of $25,000 by Thomas Colgan, Albert Herman and G. W. Highley.

BIG STONE, TEX.—The Big Stone Lt. & Pwr. Co. has been granted a charter with a capital stock of $25,000. The incorporators are I. D. Aldrich, A. C. Lutz, George K. Clark and others.

BOWIE, TEX.—The Bowie Lt. & Pwr. Co. has been incorporated with a capital stock of $50,000 by Hiram Grossman, Mose Grossman and W. C. Woodlief. The office of the company will be in Dallas.

BURKBURNETT, TEX.—The Burkburnett Lt. Co. has been incorporated with a capital stock of $5,400 by G. W. Wigham, B. Schwegler and August Lehoefener.

PITTSFORD, VT.—The Pittsford Pwr. Co. has been granted a charter with a capital stock of $500,000 to supply electricity for lamps and motors in Pittsford and Chitterden, Vt. The company proposes to issue $400,000 in capital stock at once, the proceeds to be used to purchase two sites for power houses in Chitterden and Pittsford and also to petition for the right to use the water of the Chitterden reservoir. The incorporators are F. E. Smith, C. C. Davis and H. Nash, Jr., all Massachusetts men.

GLIDDEN, WIS.—The Glidden Lt., Pwr. & Wtr. Co. has been incorporated with a capital stock of $5,000 by Fred Boheim, Conrad Mohr, Frank Deringer, Leopold Gibit and Julius Schroeder.

VANCOUVER, B. C.—The Metropolitan El. Co. has been incorporated with a capital stock of $10,000 to do a general electric-light business. The head office of the company will be in Vancouver.

CAUGHNAWAGA, QUE.—The Caughnawaga Lt., Ht. & Pwr. Co. has been incorporated with a capital stock of $50,000 to generate and distribute electricity.

L'EPIPHANIE, QUE.—The Compagnie Electrique de l'Epiphanie, Ltd., has been incorporated with a capital stock of $49,000 by J. A. Borbeau, J. B. T. Richard and M. Forest.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 30, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,082,511. Alternating-Current Motor; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Feb. 21, 1911. Auxiliary transformer associated with the motor so as to permit relative adjustment between the armature current and field current.

1,082,529. Apparatus for Forming Oxides of Nitrogen; J. S. Island, Toronto, Canada. App. filed Dec. 27, 1911. Supply of oxy-nitrogen gas is passed through an electric arc flame.

1,082,532. Dynamo-Electric Machine; B. G. Lamme, Pittsburgh, Pa. App. filed Feb. 21, 1911. Damper or auxiliary winding for field members of rotary converters and other synchronous machines.

1,082,561. System of Distribution; E. H. Schwarz, New York, N. Y. App. filed Dec. 21, 1910. Polyphase constant alternating-current distribution or lighting system.

1,082,563. Coil for Electrical Apparatus; H. B. Smith, Worcester, Mass. App. filed Jan. 26, 1910. Spiral form of coil for high-voltage transformers, etc.

1,082,571. Commutator Brush; T. W. Varley, New York, N. Y. App. filed Nov. 13, 1908. Strap brushes make sidewise tangential engagement with the commutator cylinder.

1,082,579. Dynamo-Electrical Machine; D. H. Andrews and E. C. Ketchum, Boston, Mass. App. filed Jan. 31, 1912. Prevents displacement of any of the elements of the armature when same is driven direct from high-speed turbine.

1,082,587. Metal-Filament Incandescent Lamp; M. D. Greengard, New York, N. Y. App. filed Jan. 30, 1913. Filament supported on hooked ends of arms carried by two spaced cross-rods

1,082,596. Treating Metal-Carrying Ores; I. Kitsee, Philadelphia, Pa. App. filed Aug. 14, 1908. Accelerates action of cyanide solution on metal-carrying ore by applying currents of electricity to said liquor for comparatively short periods.

1,082,603. Alternating-Current Induction Motor; B. McCollum, Washington, D. C. App. filed March 18, 1912. Nickel resistances in the secondary circuit of an induction motor.

1,082,606. Supervisory Alarm System; J. G. Nolen, New York, N. Y. App. filed Aug. 1, 1912. Electro-pneumatic system.

1,082,615. Electric Switching Device; R. Wikander, Pittsburgh, Pa. App. filed March 23, 1911. Electromagnetic switch for use in unit switch-control systems for motors.

1,082,653. Induction Wattmeter; G. A. Scheeffer, Indianapolis, Ind. App. filed Aug. 31, 1910. Overcomes "singing" by providing a "magnetic cushion" for the upper bearing of the armature shaft.

1,082,654. Electric Meter; G. A. Scheeffer, Indianapolis, Ind. App. filed Jan. 14, 1910. Lifting device for raising the armature from its lower bearing.

1,082,667. Automatic Resetting Alarm Cut-Out for Electric Burglar-Alarm Systems; J. P. Williams and H. Huhn, New York, N. Y. App. filed Dec. 16, 1910. An electric protective circuit is automatically controlled to sound and cut out an alarm and the cut-out is automatically reset after its period of operation.

1,082,683. Automatic Cut-Out and Compensating Socket; G. T. Dunklin, South Bend, Ind. App. filed March 21, 1912. For series lighting circuits.

1,082,694. Electric Switch; E. A. Halbleib, Rochester, N. Y. App. filed Nov. 29, 1912. Switch plugs longitudinally movable through the walls of a casing inclosing contact devices.

1,082,703. Supervisory Alarm System. J. G. Nolen, New York, N. Y. App. filed Aug. 1, 1912. Protective piping connected to fluid-pressure-actuated alarms initiating devices.

1,082,721. Liquid Resistance. A. Aichele, Baden, Switzerland. App. filed Aug. 8, 1913. Electrolyte is movable in respect to the electrodes.

1,082,731. Combination Lock and Circuit-Breaker; G. J. Buckeye, Kansas City, Mo App. filed Aug. 21, 1911 To prevent unauthorized use of automobile

1,082,759. Panelboard Switch; J. A. Obermiller and P Eickenberg, Chicago, Ill. App. filed July 29, 1912. Panelboard switch which may be quickly applied to the branch bars of a panelboard.

1,082,767. Riveted Metal-Work; A. F. Rietzel, Charlestown, R. I. App. filed Sept. 16, 1909. Employs a rivet and uses electric heat and pressure to weld parts together.

1,082,772. Conductor Post for Electrical Distribution; C. Schuster and C. N. Bergmann, Pittsburgh, Pa. App. filed March 3, 1911. For knife switches; large ampere capacity and ample contact area.

1,082,810. Electric Device; A. A. Kent, Philadelphia, Pa. App. filed June 12, 1908. Contact device for internal combustion engines.

1,082,811. Device for Uniting Insulated Conductors of Electricity; A. A. Kent, Philadelphia, Pa. App. filed Jan. 24, 1911. High-potential connecting device.

1,082,825. Automatic Train Stop; H. G. Sedgwick, Mill Valley, Cal. App. filed Dec. 24, 1908. When engineer cuts out brake mechanism operating circuit controlled by the roadbed devices is broken.

1,082,840. Automatic System of Block Signaling for Electric Railways; S. M. Young, New York, N. Y. App. filed May 4, 1908. Alternating-current system with rails conduetively continuous and impedances connected at intervals across rails.

1,082,856. Attachment for Controlling Telephone Switch Hooks; J. Frith, Bridgeport, Conn. App. filed Nov. 8, 1912. Receiver-supporting arm with a manually operable catch for controlling the usual receiver hook.

1,082,869. Storage Battery; A. S. Hubbard, Greenwich, Conn. App. filed Aug. 3, 1912. Vent duct for sealed batteries.

1,082,887. Contact Device for Hand-Lamps; L. Maisel, Madison, Wis. App. filed Sept. 13, 1913. Thumb-piece must first be thrust inward before it can be slid into circuit-closing position.

1,082,920. Damper-Regulating Apparatus; H. B. Weir and J. L. Fyke, Milwaukee, Wis. App. filed Feb. 14, 1912. Thermostat controls magnet, which by pawl and ratchet operates drum connected by cords with dampers.

1,082,933. Tungsten and Method of Making the Same for Use as Filaments of Incandescent Electric Lamps and Other Purposes; W. D. Coolidge, Schenectady, N. Y. App. filed June 19, 1912. Relates to the manufacture of drawn wire for tungsten lamps.

1,082,950. Arc-Light Electrode; J. L. R. Hayden, Schenectady, N. Y. App. filed July 15, 1909. Metallic compounds fused and poured in fluid mass into a metal shell.

1,082,951. Combined Conductor's Valve and Emergency Switch; F. Hedley and J. S. Doyle, Mount Vernon, N. Y. App. filed July 11, 1912 Operated to apply brakes and cut off current supply to motors.

1,082,956. Automatic Control System for Electric Railways; B. F. Hutches, Jr., Allendale, N. J. App. filed Feb. 7, 1912. For single track; current automatically cut off at the switch until the track has been cleared.

1,082,962. System of Distribution; H. A. Laycock, Schenectady, N. Y. App. filed April 8, 1911. Means for varying the energy, inserted in each side or leg of a three-wire system.

1,082,971. Subterranean Heater; A. Pick, New York, N. Y. App. filed Jan. 2, 1913. For heating oil wells, etc ; embodies plurality of rigidly supported removable and replaceable resistance elements.

1,082,978. Arc-Lamp Electrode C. P Steinmetz, Schenectady, N Y. App. filed Dec 10, 1903. Composed of carbon associated with titanium carbide.

1,082,982. Rheostat; R. L. Watkins, New York, N Y. App. filed May 22, 1911 Folding rheostat with plurality of pivoted resistance leaves.

1,083,017. Trolley; P. Johnson, Heaton, N M App. filed May 1, 1913. Spring pressed guard pivoted on spindle of trolley wheel.

1,083,047 Trolley. M Adamski, Stoneboro, Pa App. filed April 25, 1913. Pole with triangular-shaped contact head pressed upward by spring piston.

1,083,049. Convertible Trolley A L. B[illegible]hner and J Scott, Cleveland, O. App. filed May 31. 1912 Pilot wheel cuts away ice in advance of the trolley wheel and may be replaced by a plain contact wheel.

1,083,066. Method of Treating Molds Used in the Art of Electrotyping; G. E. Dunton, New York, N. Y. App. filed May 22, 1911. Stands the electrotyping mold on edge and melts the same from the pan attached to the back thereof.

1,083,070. Compound Metal; B. E. Eldred, New York, N. Y. App. filed Oct. 26, 1911. Wall of glass with wire of high melting metallic material sealed therethrough and held in the glass under compressive strains.

1,083,076. Typewriting Machine; O. Fischer, Berlin, Germany. App. filed April 26, 1910. Includes a type wheel which is rotated and then thrown against the platen by electromagnetic means.

1,083,085. Loose-Coupled Tuning Coil; A. C. Gowing and M. C. Spencer, Worcester, Mass. App. filed June 21, 1912. Primary and secondary, each made up of two independently adjustable sections.

1,083,109. Magnetic Wedge for Dynamo-Electric Machines; B. F. Lee, Schoolfield, Va. App. filed Dec. 14, 1912. Embodies laminated magnetic wedges in the coil slots.

1,083,132. Electrode for Preventing Cathodic Reduction; A. Pietzsch and G. Adolph, Munich, Germany. App. filed Oct. 3, 1912. Cathode body covered by a winding of asbestos string.

1,083,168. Process of Producing a Resinous Compound; D. Whipple, New York, App. filed Nov. 6, 1909. For insulating cables.

1,083,172. Dry Ore Concentrator; W. E. Winnie and J. E. Seeley, Los Angeles, Cal. App. filed Oct. 30, 1911. Valuable metal separated from finely ground rock by mechanical and electrical means.

1,083,187. Electric-Arc Lamp; F. Buchanan, Dayton, Ohio. App. filed Dec. 9, 1909. Has a pawl-and-ratchet-operated feeding clutch.

1,083,191. Thermoelectric Generator; J. J. Cook, Jersey City, N. J. App. filed March 25, 1911. Thermoelectric pile with markedly low internal resistance.

1,083,210. Arc Lamp; C. A. B. Halvorson, Jr., Lynn, Mass. App. filed Aug. 3, 1909. Has large upper positive electrode and two smaller lower negative electrodes.

1,083,218. Adjustable Comsined Shade and Hood Holder; C. G. Rush, Chicago, Ill. App. filed March 28, 1913. Lamp mounted on the face of the fixture or canopy secured to the ceiling or side wall.

1,083,221. Starter for Internal-Comnustion Engines; F. R. Simms, Willesden Lane, London, Eng. App. filed Feb. 23, 1910. Combined trimble coil and operating switch.

1,083,222. Electric Ignition Apparatus. F. R. Simms, Willesden Lane, London, Eng. App. filed Dec. 10, 1910. Auxiliary circuit-breaker for use when external current source is used for ignition.

1,083,232. Process for the Production of Ammonia; R. W. Wallace and E. Wassmer, London, Eng. App. filed Aug. 18, 1913. Passes nitrogen over metal capable of forming a nitride which is capable of being subsequently transformed into a sulphide.

1,083,255. Electric Transmission of Intelligence; I. Kitsee, Philadelphia, Pa. App. filed July 13, 1906. Employs a double condenser.

1,083,256. Telephony; I. Kitsee, Philadelphia, Pa. App. filed April 24, 1907. Especially designed for railroad work.

1,083,257. Telegraph System; I. Kitsee, Philadelphia, Pa. App. filed March 23, 1908. Duplex cable system involving an artificial line.

1,083,258. Electric Transmission of Intelligence; I. Kitsee, Philadelphia, Pa. App. filed April 11, 1908. Effects of induction are utilized for transmission of intelligence.

1,083,259. Casle Telegraphy; I. Kitsee, Philadelphia, Pa. App. filed Feb. 14, 1908. Relates to receiving organism of high-capacity lines, such as submarine cables.

1,083,260. Electric Motor; R. E. Noble, Chicago, Ill. App. filed July 2, 1910. Barrel-wound armature with commutator extending wholly within the cord turns of the armature winding

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Engineers in Regulation

The discussion at the Stevens Institute of Technology reported in our news columns this week had as its subject "The Engineer's Part in the Regulation of Public Utilities." The real question is whether the engineer shall have more of a part in the future than he has had in the past; that is to say, more of an influence in regulative policies. Generally the place of the engineer has been that of a member of the commission staff. He has made investigations on which decisions were based. No doubt, the engineer, though an employee, has exercised as much wholesome influence in some cases as he could have done had he been a commissioner. The circumstances that permit so strong an influence by a subordinate are not found in all of the commissions. As a member of a commission the engineer would have a vote. If outvoted by his associates, he could express his views in a dissenting report. The object of engineer membership on a commission, however, is not to create dissension; it is to make decisions fairer and to make the policy of regulation effective for both the public and the corporation. The reason why engineer membership should do this is that the problems submitted to commissions are largely of an engineering character. There should be a public demand for the appointment or election of engineers on the board. That there has not been such a demand is due in part to public ignorance of engineers and their great works. The correction of this is education of the public.

The Low-Priced Electric Vehicle

The announcement that a six-hundred-dollar electric automobile is to be put on the market by a Detroit manufacturer who now turns out gasoline cars at the rate of a thousand a day has a lesson for the vehicle makers in the field he proposes to enter. Its significance is, however, even larger to the central-station industry, which will be the chief beneficiary of the innovation. For years electric-vehicle manufacturers have been urged to develop an electric car which could be sold at a price within the reach of the average American family. But, in spite of this expressed demand, the price of electric vehicles has been forced up, year by year, and luxuries have been piled on until the idea of a poor man's car has in most cases been quite lost sight of. Statistics show that about 1,000,000 families in the United States have incomes of approximately $3,000 per year. With prudence such an income should make an electric vehicle costing less than $1,000 not only an attainable luxury but a family convenience. Consider what a market this great group offers for the low-priced electric automobile in comparison with the restricted élite class for whom the luxurious vehicles of to-day are largely designed. At last, however, the electric vehicle is to have its chance under the long-denied advantages of a low price and quantity production, and it is not likely, either, that the field of this "everyman's" car will long be limited to any single manufacturer. In keeping with its lighter weight such a car will probably show a reduced consumption in kilowatt-hours, but in the quantity in which the low-priced electric vehicle is likely to be utilized lies such a central-station opportunity as even the most optimistic has not yet dared to predict.

Concealed Pole-Type Transformers

The number of transformers required in the lighting service of the Commonwealth Edison Company, Chicago, is very large and increasing rapidly. Many of the transformers are located in the residence and downtown business districts where civic pride demands attention to appearance. While the standard outdoor transformer has been greatly improved in this respect since the late eighties when alternating-current lighting service on any considerable scale was accompanied by the decoration of a building with a row of conspicuous transformer cases and unsightly wiring, there is still room for improvement. The placing of transformers in ornamental cylindrical cases in streets is not new, handsome construction of this type having been used quite early in the history of alternating-current lighting. These booths, however, were designed merely to conceal the transformer and at the same time render it accessible. The new transformer pole designed by engineers of the Commonwealth Edison Company, described on page 154 of this issue, appears to have most, if not all, of the advantages of the older plan while requiring much less space. The principal advantage of the new scheme is the ease with which a large radiating surface can be provided by using a considerable oil depth. This arrangement permits the use of a lighter transformer for a given output. Whether the reduction in cost thus resulting will offset the increased cost due to the necessary use of a steel pole is a manufacturing problem. The answer will depend partly upon the extent to which the plan takes the fancy of the central-station managers. It is, at any rate, an interesting example of the application of simple and direct methods in solving the live problems of electrical energy distribution.

The Growth of Central Stations in Germany

Some particularly instructive information regarding the development of the central-station business in Germany is contained in a recent statistical report in the *Elektrotechnische Zeitschrift* covering the past sixteen years, in other words, nearly the whole period of modern central-station practice. Looking back over the tables, it is hard to realize how great and rapid has been the progress in the construction of electrical supply stations in a single active country. German statistics have been well kept, so that, while no statistical report is impeccable, the figures before us are probably quite as reliable as any such data can reasonably be expected to be. There are to-day a few more than 4000 stations in the German list, as against 148 in 1895. This growth in numbers is sufficiently startling, but it becomes more so when one realizes that within the last two years there have been put into service more electricity works than the total number in existence half a dozen years previously. The total load at present is approximately 3,750,000 kw, of which about 36 per cent is in arc and incandescent lamps, about 43 per cent in stationary motors, and the rest in a somewhat scant railway supply and miscellaneous appliances.

The total loads are less interesting than the story told by the variations in practice. For example, the great motor load is a growth in comparatively recent times. In the last seven years it has increased almost sixfold, twice as fast as the load of incandescent lamps. In the last four years, however, the incandescent-lamp load, thanks evidently to the introduction of the metallic-filament lamps, has doubled, just about keeping pace with the increase of motor load. The effect of a striking change in the art is in no wise more clearly shown than by this sudden variation. Meanwhile the arc-lamp business has failed to hold its own. It reached its maximum in 1911 and now has fallen off by 5 per cent or 6 per cent, with every probability of further decrease. A very noticeable similar decrease is in the aggregate rating of the stations for direct current and alternating current respectively. The pure direct-current systems reached the top of their rating four years ago and have since fallen off by nearly 20 per cent. In the same period the rating of the alternating-current plants has increased considerably more than fourfold, and that of the mixed systems employing both kinds of current has nearly doubled. As might be expected from this tendency, the use of storage batteries, while not absolutely on the decrease, is relatively waning. Only 24,000 kw is recorded as added in the last four years, while in the four previous years the additions were 65,000 kw. Since 1911, in fact, there are only about 2000 kw recorded as added to the central-station equipment, and by far the greatest proportion of this amount is found in the works with mixed distribution.

With respect to the systems used, the rating of the pure direct-current plants averages only about 150 kw, showing the effect of very local distribution, while the usual city plant is of the mixed direct-current and alternating-current or three-phase type. Many small stations have sprung up in the last few years, and there are now between 1100 and 1200 having a rating of not over 100 kw. The total output of all the plants for which statistics are available for the last year of record was very nearly 2,000,000,000 kw-hr. From the inspection of these various data the general trend of German central-station practice is fairly evident. The increase both in motors and incandescent lamps is very rapid, the arc-lamp business is falling off as might be expected, pure direct-current distribution is being pushed to the wall by the three-phase and mixed distributions, and in the case of the latter the small increase of storage-battery plants shows plainly that the growth is in the alternating-current part of the work. There has been recent rapid increase in the number of hydroelectric transmission systems which has been a powerful factor in the relative increase in three-phase plants, but the absolute decrease in the direct-current equipment cannot be thus explained and must be charged to the working over of inefficient equipment into that better fitted for the requirements of modern energy distribution.

Sources of Energy for Electrochemical Processes

One of the advantages of an electrochemical plant load, from the standpoint of the power-house manager, is that its ratio of average to maximum load may approach unity. That is, the load, under favorable conditions, may be nearly constant day and night. If operated in connection with an electric-lighting system, it may even happen that the electrochemical load will permit of being greatly reduced during the peak hours of the evening lighting, but such a joyful combination of happy conditions rarely falls to the lot of mortal managers.

One of the disadvantages of a large electrochemical load is that it is not easy to build large direct-current generators to be driven by steam turbines. Steam turbines, as is well known, are essentially addicted to high rotary speeds, and heavy-current electrolytic commutating generators do not take kindly to such speeds. In the paper by Mr. F. D. Newbury, read last week before the American Institute of Electrical Engineers and abstracted in this number, the various methods of supplying continuous current for large electrochemical loads are discussed. The conclusions are that with steam turbines as prime movers it is desirable at the present time either to drive large direct-current generators through reducing gearing or to employ synchronous converters, especially when the distance between the electrochemical plant and the power house is considerable.

Since the direct-current strength supplied in electrochemical processes is often very large, the conducting mains are apt to be very heavy, so that it is essential to place the direct-current generators close to the load.

If large reciprocating gas engines should come into extensive commercial use for power-house generator driving, the particular difficulties of connecting large direct-current generators with their prime movers would disappear. It is probable that on account of its simplicity the steam turbine will be able to maintain a strong hold on the field against all types of large reciprocating engines. On the other hand, considerable improvement has been made during recent years in the design of large homopolar commutatorless direct-current generators, driven by steam turbines, although there is still much room for further development in this direction.

Methods of Checking Meter Connections

When a single-phase wattmeter is connected in the ordinary way, between a pair of single-phase supply mains and a single load, it is always possible, theoretically, to trace out the connections of the instrument beforehand, so as to insert it correctly for measuring the power delivered to the load. But the task of tracing out the leads is sometimes troublesome and can be avoided entirely if, as ordinarily happens, the pair of potential leads can be distinguished from the pair of current leads. All that has to be done is to connect these pairs of leads respectively to the proper pairs of binding posts on the instrument, making sure that both the impressed voltage and the current are within the instrument's compass, and see what happens. If the instrument pointer moves over the scale, the connection is right. If, on the contrary, it moves backward, the connection is wrong. In other words, it is not possible to connect the wires up reversed, if the wattmeter is of the ordinary type and gives a reading on the scale. The inherent probability of making the first connections right is equal to that of making them wrong, or the chance of initially establishing a correct connection is 50 per cent. Similar reasoning applies to the connection of a single-phase watt-hour meter, except that as such apparatus is ordinarily constructed and internally connected, there can be no mistake when the directions accompanying the instrument are followed in ordinary low-tension installations.

In the case of the insertion of either a polyphase wattmeter or a pair of single-phase wattmeters to measure the power transmitted along three-phase mains, the conditions are known to be quite different. As before, it is theoretically possible to predetermine the correct wiring by a process of ratiocination. Assuming that the two pairs of potential leads and the two pairs of current leads are correctly labeled, the initial chance of making a correct connection, without thinking the matter out, is only 25 per cent, while actually, with some uncertainty among the leads, the chance is still smaller. Many persons have it in their working philosophy to believe that life is too short to admit of the ratiocination, and that the experimental method of trial and error pays better. This essentially pragmatic philosophy may not, however, be trusted too far. If the power-factor of the load is in the neighborhood of 100 per cent, as in simple incandescent lighting, then all that is necessary is to connect up each of the two wattmeter circuits separately and see that the pointer in each case moves forward over the scale, just as in the single-phase case. The total power is then, of course, the sum of the two readings. If, on the other hand, the power-factor of the load is low, as in the supply of energy to underworked induction motors, it may well happen that one of the two wattmeter readings is negative, although its scale reading is positive, and then the power supplied is the difference of the two meter readings instead of the sum. The error that may thus be made in determining three-phase power or energy is sometimes very serious. It applies to both wattmeters and switchboard watt-hour meters. We present this week two articles on practical means for insuring against such misconnections. One is by Mr. P. Ackerman, in relation to wattmeters, and the other by Mr. Raymond S. Brown, in relation to watt-hour meters. The two methods are easily remembered and easily carried into effect, although they are quite distinct. Of the two methods, the latter depends upon the fact that the ordinary watt-hour meter has a large inductive reactance in its potential circuit.

Evolution of a Transmission System

Those who are interested in the phases of growth displayed in electric service will read with appreciation the story in this issue of the evolution of the Menominee and Marinette system. The work done in this district is absolutely typical of what has frequently built up a considerable industry out of the praiseworthy attempts of former days. More than half a dozen companies of earlier times—electric, railway and gas—finally came together, merging interests and uniting plants as far as might be, and finally the whole work of the district has been transferred to a modern hydroelectric plant of nearly 5000 kw, situated some 20 miles from the center of activity, a distance so great as to have been almost unthinkable in the days when the first of the amalgamated plants made its start in business. It is a plant working at moderate head, very workmanlike, but not necessitating any specially novel equipment. One thing worth noting, however, is the exemplification here of the increasing tendency to acquire private rights-of-way even for comparatively small systems. Such rights-of-way are easier to obtain now than they used to be, on account of the disappearing prejudice against high-tension transmission, and once acquired they give a certain sense of security, particularly in a somewhat wooded country. The danger from tree troubles almost always present along the highway is vastly reduced, and where the right-of-way is fairly accessible it is patrolled without difficulty even when not on a sufficient scale to justify the employment of an aviator as patrolman, an improvement already instituted on one of the great Pacific Coast systems.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Plan for Anti-Trust Legislation

It was authoritatively announced in Washington on Jan. 14 that the forthcoming Presidential message to Congress will outline a plan for an interstate trade commission. According to the announcement the commission will be designed principally to make inquiries and give information and will not have power to fix prices or exercise as much supervision over industrial affairs as does the Interstate Commerce Commission over railroad affairs. Interlocking directorates will be prohibited. Punishment will be sought for individuals responsible for monopolies.

Thomson on Wireless Transmission

Dr. Elihu Thomson will be the chief speaker at a joint meeting of the New York Companies' Section of the National Electric Light Association and the New York Electrical Society to be held in the Edison Auditorium, 44 West Twenty-seventh Street, New York, on Monday, Jan. 19, at 8 p. m. His subject will be "The Wireless Transmission of Energy," the lecture being illustrated with lantern slides.

Engineering Departments of Harvard University and Massachusetts Institute of Technology Merged

The engineering departments of Harvard University and of the Massachusetts Institute of Technology are to be combined as the result of an agreement reached on Jan. 9. By the agreement the combined departments of mechanical engineering, electrical engineering, civil and sanitary engineering, and mining engineering and metallurgy are to be conducted in the new buildings of the Massachusetts Institute of Technology now in process of erection in Cambridge. Harvard University is to discontinue its schools of applied science in these departments. The president of the Massachusetts Institute of Technology is to be the executive head of the co-operative work, and the faculty will comprise the faculty of the Massachusetts Institute of Technology enlarged by the addition of Harvard professors of the departments involved. Provision is made that when in the future the corporation of the Massachusetts Institute of Technology selects a president the president of Harvard University is to sit with the committee on selection. It was announced that both institutions are to remain absolutely unaffected in name, organization and in the title to property.

Massachusetts Institute is to furnish the buildings, laboratories and equipment together with contributions from its special and general funds, while Harvard is to give some equipment and the interest on funds that it holds for education and research in these departments. As soon as the new buildings of the Massachusetts Institute of Technology are finished (about the middle of 1916) Harvard University will send all its engineering and mining faculty, students and plant there, using the present engineering and mining buildings for other Harvard purposes. The advantage of the plan is that it will terminate duplication and rivalry between the two institutions, all the Massachusetts Institute engineering and mining faculty members becoming at once professors of both the Massachusetts Institute of Technology and the Harvard University. The total student enrolment in Harvard University will forthwith be increased by some 600. According to President MacLaurin of the Massachusetts Institute of Technology, it will be possible to maintain under the scheme of co-operation outlined above a much stronger school of applied science than either institution alone can furnish, and it will be possible to keep that school practically unrivaled in America, if not in the world.

Progress of Inspectors' Convention at Cincinnati

At the ninth annual meeting of the Western Association of Electrical Inspectors at the New Hotel Gibson, Cincinnati, on Jan. 27-29, the president's address will be delivered by Mr. Ben W. Clark, and committee reports will be presented as follows: Executive committee, Mr. William S. Boyd, secretary of the association; "National Electrical Code," Mr. F. D. Varnam; "Outside Wiring," Mr. M. E. Cheney; "Theater Wiring," Mr. F. L. Lucas; "Show Window and Display Wiring," Mr. F. P. McGough; "Electric Traction Systems," Mr. Frank R. Daniel; "Installation and Operation of Induction Motors," Mr. K. W. Adkins; "Architects' Specifications," Mr. F. H. Moore; "Signal Systems," Mr. Frank S. Anderson; "Rubber-Covered Wire," Mr. V. H. Tousley. In addition there will be papers on "Practical Car Wiring," by Mr. C. H. Anderson, and "The Incandescent Lamp and Its Circuit," by Mr. R. W. Shenton. There will be a complimentary smoker on the evening of Jan. 27 and a dinner on the evening of Jan. 28. For those attending the convention from Chicago and its vicinity arrangements have been made for a special sleeper on the train of the Pennsylvania Railroad leaving Chicago at 11:45 p. m. on Jan. 26.

Mr. Ford to Build a Light, Low-Priced Electric Automobile

Applying the methods of light construction, large-scale production, and low selling price which have characterized the Ford gasoline automobile, Mr. Henry Ford, Detroit, Mich., will shortly begin the manufacture of a light electric automobile to be sold at about $600, according to statements obtained from reliable sources, including Mr. Ford himself.

The new "Ford electric" will be built in a separate factory under the management of Mr. Ford's son, Edsall, and all manufacturing operations will be carried on entirely distinct from the present organization of the Ford Motor Car Company, Detroit, Mich. It is proposed to produce a runabout type of car weighing 1100 lb., including the 405-lb. storage-battery equipment. Edison nickel-iron cells will be used. A car of the type described has already been built and is now in experimental use on the streets of Detroit. Runs of 100 miles per charge will be possible with the new light-weight vehicle. The methods of unit production on a large scale which have distinguished the Ford factory at Detroit (where 1000 gasoline cars are now turned out daily) are to be applied in the manufacture of the new electric vehicle, and assurance is given that the selling price of the complete battery-driven car to the public will be less than $1,000, perhaps as low as $600.

Mr. Ford spent several days in New York City just prior to putting in effect the plan to divide $10,000,000 with his employees, establishing a minimum wage of $5 per day in the Detroit factory, and he took advantage of his visit in the East to call on Mr. Thomas A. Edison at the latter's laboratory in West Orange, N. J., where plans for a light, low-priced electric car were discussed. Mr. Ford also plans to visit Mr. Edison in Florida during February.

Annual Messages of Governors to Legislatures

The annual messages sent by some of the governors of states to legislatures contain references to public utility regulation and to other matters affecting public service corporations. Following are extracts from the messages of the Governors of Rhode Island and Maryland:

Governor Pothier of Rhode Island

Gov. Aram J. Pothier of Rhode Island called attention to acceptance by 2018 establishments in the State of the workmen's compensation act. He says that an educational campaign based on a careful study of the character and causes of more than 11,000 accidents should be of practical benefit and a material factor in the elimination of a number of the apparently unnecessary accidents occurring almost daily in manufacturing and other industrial establishments.

Amendment of the public utilities commission law is recommended so as to require every public utility to render to the commission uniform accounts of all business transactions in such manner and form as the commission may prescribe.

Governor Goldsborough of Maryland

Gov. Phillips Lee Goldsborough of Maryland said that a workmen's compensation act was passed at the last session of the Legislature, but because it did not seem to suit conditions it proved ineffectual. In order that the matter might be considered, the Governor appointed a commission whose report, with a recommended draft of a new bill, will be made the subject of a special message.

Success of Electric Parcel-Post Delivery at Indianapolis

Rented to the Indianapolis post office authorities to "help them out of a hole" in the delivery of parcel-post packages, two Waverley electric vehicles have been giving such satisfactory service in comparison with a pair of gasoline cars that the latter are now to be discontinued and their places taken by electric trucks. The first two "electrics" have now been in operation about ten months, and on Sept. 1 a third was added.

It was after the gasoline vehicles first used in delivery work at Indianapolis had proved unsatisfactory that the local manufacturer was asked to supply electric trucks for the same purpose. One of the stipulations made was that these trucks should have sufficient mileage for the out-of-town and suburban work required of them. The machines were not sold to the government, but were rented on an hourly basis, the Post Office Department itself furnishing the driver. The batteries were kept up by the owners, who also made all repairs except in case of collision. At the rate at which the cars were rented a satisfactory profit was earned.

Comparing the performance of the electric vehicles with that of the gasoline cars, as noted in our issue of Dec. 27, the cost per parcel-mile was 0.00137 cent for the gasoline cars and 0.0011 cent for the electric trucks, thus showing a saving of almost 25 per cent in favor of the battery-propelled wagons. In an eight-and-one-half-hour day the gasoline cars delivered, for example, 136 packages during 135 stops in a run of 45.6 miles. Meanwhile, in a seven-hour working day the electric wagons had averaged 271.5 parcels in 189 stops over a distance of 18.75 miles. The cost of the day's run in the case of the gasoline cars was $8.50 per truck, not including the wages of the carrier, and for the electric wagons the cost was $5.60. The table compares the unit costs for the two classes of service.

DELIVERY WAGON AT INDIANAPOLIS

OPERATING COSTS OF GASOLINE AND ELECTRIC CARS IN PARCEL-POST SERVICE

	Gasoline	Electric
Stops per mile.	2.94	6.02
Cost per stop, in cents	6.36	3.26
Cost per parcel, in cents. . . .	6.30	2.06

The electric delivery wagons in the service of the Indianapolis post office have proved very reliable and, it is declared, have never failed to perform any service they have been called upon to do. The gasoline cars, on the other hand, as shown by experience, could not be depended upon. In point of speed the travel of the electric cars has been found ample for parcel delivery, for the requirements in this direction are not great. As the result of the satisfactory service rendered by the present fleet of three "electrics," the Indianapolis post office authorities have asked the Waverley company to furnish additional vehicles on the same basis.

Power Problems in the Electrolytic Deposition of Metals

A joint meeting of the American Institute of Electrical Engineers and the New York sections of the American Electrochemical Society and the American Society of Mechanical Engineers was held at the Engineering Societies Building, New York City, Jan. 9, the subject for the symposium being "Power Problems in the Electrolytic Deposition of Metals." President C. O. Mailloux of the American Institute of Electrical Engineers presided as chairman of the session and called first upon Mr. Lawrence Addicks, superintendent of the United States Metals Refining Company, Chrome, N. J., for a discussion of the conditions imposed by commercial practice in the electrolytic refining of copper as a typical process.

Limitations Imposed by Commercial Electrolytic Practice

By far the larger proportion of the world's copper is electrolytically refined, said Mr. Addicks, and this work is almost exclusively an American industry, centered chiefly in big plants on New York Harbor. When using soluble anodes in copper refining, 95 per cent of the emf is absorbed by the ohmic resistance of the circuit and measures in general about 0.3 volt per cell. With peroxidized lead or similar insoluble anodes in sulphate solutions, about 2 volts per tank is required to maintain the same current density. The power limitations specified by the author for copper refining are as follows: (a) direct current; (b) 8000 amp to 15,000 amp; (c) 100 volts to 200 volts per circuit; (d) units of 1000 kw to 1500 kw; (e) circuits electrically independent to avoid cross-leakage; (f) constant current, with 20 per cent variable voltage; (g) continuous operation twenty-four hours a day; (h) steam required for heating the electrolyte; (i) plants of 3000 kw to 9000 kw total rating should be considered.

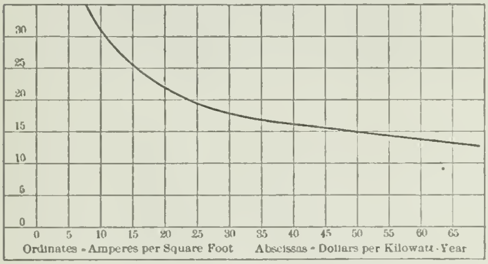


FIG. 1—RELATION OF CURRENT DENSITY AND COST OF ENERGY

The current density to be used is fixed by the balance between the interest on the copper tied up, the cost of energy and the difficulties in practical handling of the rough deposits. The relation for American practice is shown in the accompanying curve, Fig. 1. In the vicinity of New York density values of about 20 amp per square foot of active cathode surface are generally employed, resulting in an average consumption of about 1 kw-hr. for each 8 lb. of copper deposited. As many as thirty pairs of electrodes each 3 ft. square are now used in single tanks, calling for currents of about 10,000 amp. Owing to the desirability of limiting current leakage between sets, Mr. Addicks recommended the use of motor-generators instead of rotary converters in any scheme for distributing power from a large unit over several circuits.

The electrolytes used have high positive temperature coefficients, so that in addition to the heating due to the energy dissipated in the tanks (which would alone maintain a temperature of 90 deg. to 100 deg. Fahr.) it has been found advantageous to add sufficient steam in closed-coil heating tanks to keep the electrolyte at an average temperature of about 130 deg. Fahr.

Fig. 2 shows the results that can be expected from 1200-kw units of the types noted, excluding steam for operating condensers. The installation cost of such plants may be taken roughly at $100 per kw, including the disproportionate boiler apparatus. Among the possible future sources of power for electrolytic plants, as enumerated by Mr. Addicks in closing, are gas-driven units, large capacity turbo-alternators driving smaller motor-generators, compound reciprocating engines exhausting into a main from which exhaust-steam turbines are fed, multiple-expansion reciprocating engines, turbine-driven unipolar generators, or some combination of these.

Prime Movers for Electrolytic Generators

In his paper on "The Mechanical Side of the Problem," Mr. H. E. Longwell, consulting engineer, Westinghouse Machine Company, East Pittsburgh, Pa., pointed out the fact that any engine the exhaust steam of which is fully utilized can be considered as operating at 100 per cent efficiency. Comparing the performance of a steam-turbine plant with a gas-producer installation, each made up of 1500-kw units and operating at high load-factors, the author estimated that, using a good grade of fuel containing 14,500 lb.-Fahr. heat units per lb., the gas-producer plant would probably show a saving of ½ lb. of coal per kw-hr. over the consumption of the steam-turbine station. With coal at $3 per ton, this saving of 2 tons per annum would effect an economy of $6 per kw-year, to gain which an extra investment of about $50 per kw would have to be made over and above the cost of the steam-turbine plant. Making annual allowances of 8 per cent for interest, 1 per cent for taxes, 1 per cent for insurance, 2 per cent for maintenance and 8 per cent for sinking fund, 18 per cent would be required to insure a return on the investment. As 20 per cent would be desirable, Mr. Longwell pointed out that the saving of $6 per kw-year effected by the gas-producer units could not be justified unless the differences in initial cost were $30 or less per kw of installation. Although it is common practice in copper-refining plants to allow 50 per cent of the steam for the main generating units, 25 per cent for the auxiliaries and 25 per cent for heating the electrolyte, the author declared that since the auxiliaries extract but little useful heat from the live steam, their exhaust can be used advantageously for heating, so that the entire amount for auxiliaries and heating need be only about one-half that required for the main prime movers. In the case of one copper-refining plant which he cited as turning out 500 tons per day the waste heat from the flue gases of the reverberatory furnaces alone is capable of furnishing 50,000 lb. of steam per hour. This steam represents about 40 per cent of that required to run the entire plant and is sufficient for all the requirements of the auxiliaries and the heating of the electrolyte.

Commenting on the theoretical advantages of arranging reciprocating compound engines to exhaust into low-pressure turbines, Mr. Longwell pointed out that the low-pressure turbine costs about 75 per cent more per kw than the complete-expansion unit. Few triple-compound engines, he thought, are enough better than two-cylinder units to make the addition of the intermediate cylinder worth while.

The development of a highly efficient transmission gear for turbines has now made possible the efficient turbo operation of direct-current generators. Several of these geared sets have already been in continuous service for several years, the best known examples being those at San Diego, Cal., Cleveland, Ohio, and Louisville, Ky. While a turbine-driven direct-current unit is more expensive than an equivalent direct-current alternator, it is nevertheless cheaper, said Mr. Longwell, than the combination of turbo-alternator and rotary converter advocated by another speaker.

With careful supervision a plant of 6000 kw to 9000 kw should be built for about $75 per kw, said Mr. Longwell. Burning coal at $3 per ton and allowing 10.5 per cent for investment charges, it should be possible at 100 per cent power-factor to produce energy at the switchboard for 4.3 mills per kw-hr., "more or less."

Electric Equipment for Electrochemical Processes

The paper on "Sources of Direct Current for Electrochemical Processes" prepared by Mr. F. D. Newbury, New York, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., outlined various methods of producing energy required for electrochemical processes and pointed out the problems involved in each method of generation, including a comparison of the efficiency, first cost and reliability of the systems.

Because of the high speeds of preferred prime movers and the continuous full-load and large-current requirements of the electrolytic industry, it is difficult to design suitable direct-current commutating machines. Since the current output of such generators is proportional to the number of armature circuits in parallel, the rating is limited only by the peripheral speed and length of the commutator and by the number of current-collecting brushes which can be used.

Three methods of clamping commutator segments were enumerated; these comprise the V-ring and shrink-ring constructions and combinations of the two. The plain V-ring method has the advantage of simplifying commutator-repair work while the shrink-ring type can be used only on relatively small-diameter commutators.

Where large currents are to be delivered to a point 1000 ft. or more away from the generator, it is better to transmit with alternating current at high voltage and use synchronous converters at the delivery end. For the adjustment of pressure to maintain constant current direct-current generators have the advantage of simple field-current control. If not more than 5 per cent regulation is required, the voltage of synchronous converters can be similarly controlled, provided the alternating-current circuit has sufficiently high reactance. Alternating-current boosters can also be used to vary the direct-current voltage of synchronous converters. As direct-current generators carrying an electrochemical load are usually required to operate continuously at full load, they should be designed particularly for commutation.

For generating energy at high current ratings four methods involving the use of steam-turbine prime movers have given satisfaction. Because of the inherently high speed required for economical turbine operation and the relatively low speed of commutator generators, gear-connected generators have given more satisfactory results than direct-connected units. The ordinary simple process of current collection in unipolar machines becomes more difficult with increased speed and large-current requirements and therefore unsuits this type of generator to very large installations. The alternating-current generator combined with a synchronous converter gives the best all-round method, especially in large plants where energy has to be transmitted any distance or where water-driven prime movers are used. Tank circuits can then be segregated by employing separate transformers and converters on each group.

Discussion

Among those who took part in the discussion were President C. O. Mailloux and Messrs. H. B. Coho, C. A. Roush, F. A. Lidbury, F. L. Antisell, J. B. F. Herreshoff, J. B. Herreshoff and C. H. Vom Baur.

Mr. Lidbury declared that some of the power-plant examples given by the authors, rated as high as 120,000 hp, are far larger than the practical requirements of any existing electrolytic plant. Most such electrolytic plants, except in the aluminum industry, have power demands ranging from 1000 hp to 10,000 hp. He also commented on the selection of voltages for water-wheel-driven generators and advocated direct-current generation and transmission, even for considerable distances, pointing out difficulties in the way of alternating-current generation with rotary-converter transformation. Economically, added Mr. Lidbury, it is obvious that operating costs will be practically doubled by maintaining two stations containing moving machinery, while maintenance charges will also be considerably increased. Moreover, the electrochemical engineer, he said, is apt "to have an absurd prejudice in favor of simplicity." Generally, the electrochemist has enough operating problems of his own without desiring to assume in addition the troubles of a central-station superintendent which are likely to result by multiplying the electrical links in his chain of power machinery.

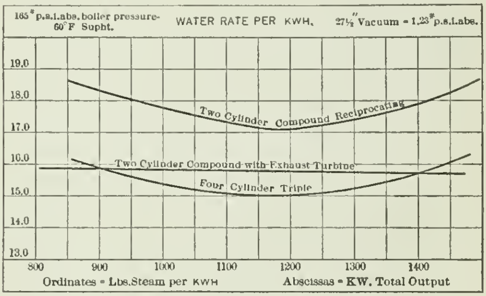


FIG. 2—WATER RATES OF VARIOUS PRIME MOVERS

Mr. Antisell called attention to the high operating efficiency of reciprocating engines at partial loads as compared with turbine units.

Mr. J. B. F. Herreshoff told of the varied experiences of his company in using several types of prime-mover sets, including a couple of 2000-kw turbine-driven homopolar machines. These units gave much trouble at the collector rings and brushes and exhibited heat losses amounting to 30 per cent of the input. His nephew, Mr. J. B. Herreshoff, about this time conceived the idea of employing a low-voltage alternating-current generator, the output of which was rectified, without voltage transformation, by a properly designed rotary converter. The idea did not at first meet with favor among the engineers of the large manufacturers, but was finally accepted and is now in general use for electrolytic work.

Mr. J. B. Herreshoff, who followed his uncle on the floor, said that by doubling the density of current flow twice the amount of copper will be deposited in a given time. This requires double the voltage and thus four times the power, but has the advantage that the electrolyte is automatically kept warm without the use of steam. Although the power requirement is quadrupled, the cost per pound of copper is only doubled, but objections are found in the roughness of the deposit, which becomes crystalline and brittle when formed at high densities. Where two rotaries are supplied from one generator differences in voltage can be obtained by weakening the field of one converter slightly, while strengthening the field of the other. An objection to this method is in the unequal heating of the rotary-converter armature, which may become serious if the difference in pressure is run above 30 volts to 40 volts.

President C. O. Mailloux said that it is actually possible to obtain good copper or bad copper deposits at almost any current densities from 10 amp per sq. ft. to 1000 amp per sq. ft. In 1885 he conducted experiments to produce electrotype shells at a rapid rate. These shells had formerly been deposited at the slow rate of 5 amp to 20 amp per sq. ft., taking two or three days. As the result of a series of experiments during which the circulation, strength and temperature of the solution were carefully controlled, it was found possible to deposit copper at the rate of 1000 amp per sq. ft., obtaining beautiful homogeneous products. Later, in connection with the manufacture of copper tubes, deposition rates of from 3000 amp to 6000 amp per sq. ft. were readily obtained. It is theoretically possible, in spite of the apparent paradox, said Mr. Mailloux, to deposit any amount of copper with a given amount of electrolytic power. A preceding speaker mentioned the fact that in order to double the current density the power has to be quadrupled. Proceeding inversely, and decreasing the density, a point will finally be reached where, although very large deposits will be made with the given energy, the area of plant required and the interest costs on the large amount of copper tied up would prevent the economical use of any lower densities.

Mr. Addicks pointed out that the higher the current density the more rapid must be the circulation in order to keep sufficient copper close to the anode, which, he said, is the secret of making good deposits. He added that in one year's time a triple-compound engine consuming 15 lb. of steam per kw-hr. would show savings over a 1500-kw turbine consuming 17 lb. per kw-hr., amounting to $39.42, figuring steam at 15 cents per 1000 lb., or $2.60 per kw. Such a saving would justify the additional expenditure of $15 per kw on the plant. Mr. Addicks questioned whether a turbine, with its alternating-current generator, transformer, rotary-converter and booster, would be, after all, very much simpler than a reciprocating engine driving a direct-current generator.

Mr. Vom Baur spoke of the use of oil engines in the electrochemical industries. Oil from fields recently discovered in Mexico can be sold in New York, he said, for less than 3 cents a gallon, so that such engines can produce a kilowatt-hour for 0.45 cent.

Mr. Addicks in closing the discussion pointed out that the oil engine employs a fuel which, compared with coal, is in the hands of a small selling group, and he also questioned whether such internal-combustion engines have the reliability necessary for electrolytic work.

Mr. Longwell said that the gas engine has a great many uses to which it is eminently suited, but that he doubted whether electrolytic plants were included among these.

Mr. Newbury explained as the reason for selecting very large plants as examples his effort to show that in such sizes the converter apparatus recommended is really simpler, more reliable, more efficient and less costly to maintain than the apparently simpler installations consisting of merely prime mover and generator. In sizes of 1000 kw to 2000 kw, he admitted, the turbo-alternator and rotary-converter cannot make a showing against the direct-current generator provided the electrolytic plant is located near the place of generation.

Automobile Engineers Discuss Electrical Subjects

At the annual meeting of the Society of Automobile Engineers, held at New York City Jan. 4 to 8, standard dimensions and methods of rating lead storage batteries for gasoline cars were adopted, and several papers on electrical subjects were presented. Among the topics discussed were the following: "Storage Batteries," Mr. W. H. Conant, Gould Storage Battery Company, New York; "Development of Electric Tractors for Handling Freight Cars Over Tracks Laid on City Streets," Mr. T. V. Buckwalter, engineer Pennsylvania Railroad; "An Electrically Controlled Dynamometer for Testing Gas Engines," Prof. R. C. Carpenter and Mr. Nathan C. Johnson, Cornell University, Ithaca, N. Y., and "Shifting Gears by Electricity," Mr. Frank N. Nutt, chief engineer Haynes Automobile Company, Kokomo, Ind.

The practices recommended by the electrical equipment division of the organization were accepted as standard by the society. These rulings will affect many electrical manufacturers unless modified by the standards committee. The latter action may follow as the result of objections presented by the United States Lighting & Heating Company, New York, too late to affect the approval given by the society.

The recommended practices read as follows:

Six-volt to 25-volt automobile electrical apparatus after being installed shall be capable of withstanding an insulation test of 500-volt alternating-current applied for one minute.

The over-all dimensions of lead storage batteries for lighting and starting or a combination of the two shall not exceed 7.5 in. in width or 9.5 in. in height. Handles and clamping devices shall be placed only on the ends of the batteries, and terminals shall not extend above the battery handles.

Lighting batteries shall be rated in ampere-hours, figured on the 5-amp rate of discharge which terminates in a final voltage of 1.8 per cell. Combination lighting and starting batteries shall have two ratings—the one for lighting being expressed in ampere-hours figured on the 5-amp discharge rate with a final pressure of 1.8 volts per cell, and the second, for starting, being given as the maximum ampere rate at which the battery can be discharged for twenty minutes with a final pressure of 1.65 volts per cell. The initial temperature in each case shall be 80 deg. Fahr. The dimensions and type of fuses for automobile equipment were also specified.

Mr. Conant's paper on storage batteries described in a semi-elementary and technical manner the theory, construction and characteristics of lead storage batteries. Positive and negative voltage reading by means of a cadmium electrode was discussed by the author. Other subjects taken up in the papers dealt with efficiency, the relation of voltage and rating, and the effect of temperature on battery action.

The paper on electric tractors by Mr. Buckwalter had been previously read before the Chicago meeting of the Association of Railway Electrical Engineers and is briefly mentioned in the Nov. 1 issue of the *Electrical World*.

Mr. Johnson in his paper described an electrically controlled dynamometer used to record the torque of a gasoline engine and at the same time automatically maintain the speed of the engine constant. An abstract of this paper will appear in a later issue.

Equipment for shifting automobile transmission gears by means of solenoids was described in Mr. Nutt's paper. A lively discussion followed in which some of the advantages and disadvantages of the electric gear shifts now manufactured were brought out. The feasibility of further electrifying gasoline cars by installing electrical steering and braking apparatus was also discussed. Among those who expressed their views were Messrs. Findley D. Hubbell, Pope Manufacturing Company, Hartford, Conn.; George W. Dunham, Chalmers Motor Company, Detroit, Mich.; William Guy Wall, National Motor Vehicle Company, Indianapolis, Ind.; W. A. McCarrell, Vulcan Motor Devices Company, Philadelphia, Pa.; Howard Marmon, Nordyke & Marmon, Indianapolis, Ind.; B. B. Bachman, Autocar Company, Ardmore, Pa., and Herbert Chase, New York City.

Questions were raised as to the speed and practicability of changing gears electrically as compared with the manual operation.

Mr. Wall said that for the inexperienced motorist electric gear shifting is simpler than manual operation, while the experienced driver can acquire skill in operation with the modern method which makes it superior to hand control.

Mr. McCarrell pointed out the advantages of electric gear shifting: first, it is better suited to women motorists; second, the hands need never be removed from the steering wheel, and, third, every speed change can be anticipated. Further electrification of cars to cover steering and braking, the speaker declared, will require additional battery rating, which is not warranted.

Specification for Rubber Insulation

The joint rubber insulation committee, the activity of which was noted on page 828 of our issue dated Oct. 25, 1913, has published its report simultaneously in the January issues of the *Proceedings* of the American Institute of Electrical Engineers and the *Journal of Industrial and Engineering Chemistry*, the latter being the monthly publication of the American Chemical Society. The report will also appear in the next issue of the United States Bureau of Standards' circular on rubber. A specification for a high-grade rubber compound and details of an analytical procedure for use with it contained in the report are reproduced herein.

The industry is now provided with a specification prepared by a body of chemists and engineers, all actively engaged in the field of rubber insulation, composed of representatives of manufacturers, consumers and independent consultants in equal numbers. From the manufacturers' point of view this specification is of considerable economic importance as it gives them an opportunity to escape from the necessity of making a number of different 30 per cent Para compounds to meet the various specifications now in use. Manufacturers will now be required to make only three grades of rubber insulation, the Code, the Intermediate and the 30 per cent Hevea, although, of course, certain manufacturers will continue to make proprietary articles which cannot be purchased under specification.

The specification has been adopted by the Association of Railway Electrical Engineers, has been recommended for adoption by the committee on rubber-covered wire of the American Electric Railway Association, and is now in use by the electrical department of the New York Central & Hudson River Railroad Company. It is expected that other users of high-grade rubber insulation will adopt this specification and thereby do away with the host of existing specifications.

It will be noted that this specification must be supplemented by appropriate clauses relating to tensile strength, elasticity, insulation resistance and dielectric strength. The joint rubber insulation committee has made no effort to supply clauses containing these requirements, but other committees have made recommendations on these subjects, so that it is now possible to write a specification for high-grade rubber insulation complete in all respects.

Specification for 30 Per Cent Hevea Rubber Compound

1. A 30 per cent fine Para or smoked first-latex Hevea rubber compound with mineral base shall be furnished. It shall contain only the following ingredients: Rubber, sulphur, inorganic mineral matter and refined solid paraffine or ceresine.

2. It shall not contain either red lead or carbon.

3. The vulcanized compound shall conform to the following requirements when tested by the procedure of the joint rubber insulation committee: (See *Proceedings* A. I. E. E. and *Journal of Industrial and Engineering Chemistry*, January, 1914.)

(a) Results to be expressed as percentages by weight of the whole sample:

	Maximum	Minimum
Rubber	33	30
Waxy hydrocarbons	4	—
Free sulphur	0.7	—

(b) Results to be taken between the limits given in proportion to the percentage by weight of rubber found:

	Maximum	Minimum
Limits allowed for 30 per cent rubber compound:		
Saponifiable acetone extract	1.35	0.55
Unsaponifiable resins	0.45	—
Chloroform extract	0.90	—
Alcoholic potash extract	0.55	—
Total sulphur (see note 2)	2.10	—
Specific gravity	—	1.75
Limits allowed for 33 per cent rubber compound:		
Saponifiable acetone extract	1.50	0.60
Unsaponifiable resins	0.50	—
Chloroform extract	1.00	—
Alcoholic potash extract	0.60	—
Total sulphur (see note 2)	2.30	—
Specific gravity	—	1.67

4. The acetone solution shall not fluoresce.

5. The acetone extract (60 cc) shall be not darker than a light straw color.

6. Hydrocarbon shall be solid, waxy and not darker than a light brown.

7. Chloroform extract (60 cc) shall be not darker than a straw color.

8. Failure to meet any requirements of this specification will be considered sufficient cause for rejection.

9. Contamination of the compound, such as by the use of impregnated tapes, will not excuse the manufacturer from conforming to this specification.

Note 1: This specification shall be supplemented by appropriate clauses relating to tensile strength, elasticity, insulation resistance and dielectric strength.

Note 2: The limit in total sulphur may be omitted at the option of the purchaser. It would be desirable that the sulphur of vulcanization be limited to exclude reclaimed rubber, which contains the sulphur of its previous vulcanization, but the committee has not yet developed a method for determining this quantity. It is, therefore, confronted with the choice of either placing a limit on the total sulphur or giving up the attempt to exclude shoddy by sulphur limitation. Option is therefore given to the purchaser to insert or omit the limit on total sulphur. Such insertion will at times exclude reclaimed rubber, and the committee believes it possible to make a suitable compound with this limitation. The committee thinks that a sulphur limit positively excluding reclaimed rubbers would place too great a hardship in other ways on the manufacturers. Where the specification is used with no total sulphur limit, the use of many kinds of, or much, reclaimed rubber will be guarded against by the limits of the various components of the acetone extract. When the limitation on total sulphur is omitted, sulphur-bearing fillers, which possess certain advantages, may be used.

The Engineer's Part in Regulation

A discussion on "The Engineer's Part in the Regulation of Public Utilities" was held at the Stevens Institute of Technology, Hoboken, N. J., on Jan. 9. Those who took part in the discussion were Dr. Alexander C. Humphreys, president of the institute, and Messrs. John W. Lieb, Jr., James E. Sague, Newcomb Carlton and George Gibbs.

Dr. Humphreys Urges Engineer Commissioners

Dr. Humphreys cited cases where commissions exercised discrimination or rendered unfair decisions excluding testimony or affecting public service corporations. He holds that no commission or any other one government authority should be placed in office to exercise the three functions of government, legislative, executive and judicial. There should be some measure of control of public utilities, particularly if these properties are to be protected in monopoly. The general tendency of the public service commissions is to discourage destructive competition.

Those responsible to the owners must be permitted to manage the properties if efficiency and economy are to be obtained and maintained. Certainly the utilities should not be held to any cast-iron rule as to fair return when what would be a fair return in one case would be wholly inadequate in another case.

Dr. Humphreys pointed out that the state commissions need regulation as much as corporations. Too often the men appointed are not qualified to exercise the great power placed in their hands. The honest men among them recognize this and apply themselves diligently to fit themselves for the responsibilities for which they were not fitted when they assumed office.

Continuing, Dr. Humphreys said that many of the questions which the commissions are called upon to determine require for their solution the highest engineering training and experience, yet it is the exception when an engineer is appointed as a commissioner. The engineering profession is most often represented not by membership on the board but by employment by the board, and so with no vote. On every one of the commissions the engineering profession should be adequately represented in the persons of men educated in engineering and later trained in the hard school of experience.

Whether the commissioner is engineer, lawyer, accountant or business man, he should have had experience in the exercise of administrative functions. In character he should be above reproach. He should be judicial in temperament and particularly he should be free from the temptation of playing to the gallery. The engineers as a class are themselves in part to blame for not taking a more active part in the administrative side of life and for not deliberately and advisedly equipping themselves for administrative responsibilities.

In speaking of the predominance of lawyers on commissions, Dr. Humphreys said that if the membership of the commission must be consigned to a single profession five broadly trained engineers with competent legal assistants on the staff would give far better results than have, on the average, been obtained thus far.

In conclusion, Dr. Humphreys emphasized the point that as a general proposition the great corporations have not won their success by financial legerdemain. The pioneer labors have been for the benefit of the country as a whole, and therefore it ill becomes the representatives of the people to deny to these pioneers and their successors a rightful participation in the fruits of their successes. The legislation and regulation which in the final analysis will stand the test of time and will accord justice to the producer and the consumer must take full account of the inherent physical and financial limitations within which the properties are forced to operate.

Mr. Carlton Favors Engineers as Commissioners

Following the reading of Dr. Humphreys' paper, Mr. Newcomb Carlton, vice-president of the Western Union Telegraph Company, called attention to two points: The personnel of public service commissions in general is far from satisfactory. The commissions would be made more equitable, judicial and competent by the appointment of mechanically trained, experienced engineers as members. Mr. Carlton declared that he could not conceive of an engineer capable of fulfilling all the requirements suggested by Dr. Humphreys. An engineer possessing sound technical knowledge coupled with broad administrative experience is in demand everywhere and is therefore placed beyond the call of commissions as now constituted, unless patriotism is a controlling motive.

Regulation has come to stay and commissions should therefore be organized so as to become attractive to men of the caliber desired. Because of the threefold functions of a commission (legislative, executive and judicial) this body should be advanced to the permanent standard of a court with the corresponding respect, honor and dignity that attaches to a judicial body. By educating the public to hold the opinion that public service control must succeed and can succeed only through its exercise of fairness and broadmindedness, the equitable consideration of all can be obtained.

Mr. Gibbs on Commission Organization

A paper by Mr. George Gibbs, consulting engineer of the Pennsylvania Railroad, was read by Dr. Humphreys.

Mr. Gibbs said that an engineer in the position of business manager or commissioner on a public utility board soon, on account of his multifarious duties, gets out of touch with the details of professional progress, and unless he is willing to delegate the investigation of engineering matters to subordinates who are specialists, his decisions must rest upon general knowledge, which is not always a true guide. The matter of proper commission organization is fundamentally one of selecting faithful men of sound judgment and organizing ability, previous specialized training being a matter of less importance. Another consideration of very great importance in commission organization is that of the proper term of office If the selection of commissioners is of the character mentioned, a long office tenure would be to the great advantage of the community, and it seems a great pity that frequent changes at short intervals, which are now the rule, should deprive the public and the corporations of the benefit of the commissioners' experience acquired while holding office.

In the opinion of Mr. Gibbs, the internal organization should include a permanent engineering staff headed by a chief engineer of eminence in his profession and the retention of outside engineering consultants who are specialists in the various lines of engineering advice needed and who are called in as occasion requires. This organization, of course, presupposes that the engineering staff will be called upon for analysis of the technical problems arising before the commission and that the latter will accept the advice of its staff upon such matters.

Mr. Gibbs believes, from personal experience on both sides of the railway-regulation question, that a good start has been made in working out the complex problem upon these lines. The commissions have very important and useful functions to perform and are becoming increasingly solicitous of performing their duties well. The railroads, on their part, believe in thorough and impartial investigation of matters affecting the public interest and are co-operating with the commissions. The engineer has an important status in connection with the commission work, and, as a matter of fact, this is so well recognized that staff engineers are frequently more highly paid men than the commissioners themselves. The added honor of holding the title of "commissioner" is, of course, attractive, but is not essential to the dignity of the engineering profession, nor will the field opened up by the employment of a few engineer commissioners add materially to the opportunities of men of that profession in securing positions of high honor and remuneration in the community.

Mr. Lieb Sees Need of Lawyers and Engineers

Mr. John W. Lieb, Jr., vice-president New York Edison Company, said that it must be obvious that the presence of a technically educated and scientifically trained member on the commission should be of enormous assistance and value in its work, only second in importance to the presence of a representative of the legal profession. The professional politician is likely to be strongly represented in the make-up of the commissions, but to find a representative of the engineering profession in the commissioner's chair is indeed unusual and exceptional. This cannot be in the public interest and shows a state of things which does not reflect wisdom and foresight in the appointive or elective powers and is hardly creditable to the authority and influence of the engineering profession in the conduct of public affairs.

Surveying the field from the viewpoint of those who have had to represent the interests of the corporations subject to the jurisdiction of the commissions, Mr. Lieb said that it is a matter of surprise that the commissions have done as well as they have in many cases which have come before them involving purely technical or engineering matters.

In the treatment of rate questions—in addition to the commanding questions of company policy and commercial expediency—the factors which enter into the problem are largely engineering questions, Mr. Lieb said, and their determination must depend upon engineering knowledge and experience. These questions involve consideration of such matters as physical valuation, functional depreciation, normal wear and tear, obsolescence, supersession, adequacy of equipment, betterments, etc., all of which are matters that must be approached from the engineer standpoint, and their proper evaluation must devolve upon the engineering staff. On the other hand, such matters as the ultimate property value for rate-making purposes, the rate of return, going-concern value and the building of the rate structure are matters which require something more than engineering judgment, knowledge and experience for their determination.

Continuing, Mr. Lieb said that many of the questions involved in commission regulation are the results of operation of economic laws, the laws of supply and demand, of economic production and distribution, of marginal utility, etc. The consolidation of small plants into large production units to obtain the results of large bulk output, lower investment costs, higher operating efficiencies, improved load-factors and combined diversity factors—this is a question in engineering economics and the efficient conduct of business which has developed new problems in the operation of public service corporations, and with these the commissions must also concern themselves. Public opinion has expressed itself as opposed to that monopoly which aims to crush competition, but it fails to make delicate distinctions as to whether the monopoly ensues naturally and logically upon the combination, as a result of improvements in operating efficiencies incidental to the consolidation of production and distribution facilities, or as a result of a mere conspiracy to "freeze out" a struggling competitor.

Mr. Sague on Experiences in New York

The final discussion was presented by Mr. James E. Sague, member of the Public Service Commission of the Second District of New York. He joined in the expressions of the other speakers preceding him by remarking that it is peculiar that engineers should have taken so little interest heretofore in a state regulation which affects the business success of practically all engineers. Mr. Sague believed that legislation involving details of operation in public utilities should be a matter of last resort. An increased demand for public ownership can be expected unless regulation is made so efficient and just as to satisfy reasonably the public need. At the same time, it is necessary to preserve to public utility managers their right to enthusiastic and successful work and to the stockholders their just return. Commission regulation is still in the "stone age" of its development. There is no precedent to guide the governors in their appointments, or the commissioners in the exercise of their duties. Lawyers can afford to accept commission appointments better than can engineers of equal grade, as the work does not seriously interrupt their legal career and may be a decided help.

In conclusion, Mr. Sague said that it is the right and duty of engineers to take part in the solution of these great problems. They can be settled properly only after the truth has been ascertained, and a fundamental duty of engineering is to ascertain the truth and to work in accordance with it.

Convention of Independent Telephone Association of America

The Independent Telephone Association of America met at the Hotel LaSalle, Chicago, on Jan. 6, 7 and 8 for its first annual convention.

In response to an address of welcome by Mr. L. D. Mathias, of the office of the Corporation Counsel, city of Chicago, Mr. D. M. Neill, Red Wing, Minn., said that the independent telephone men wondered at the passive attitude with which the people of Chicago accepted the telephone monopoly when they had been so progressive in disapproving all other restrictive business combinations. He said that although utilities commissions in many states had the power to regulate the income or dividend earnings of a company, they were powerless to fix expenses of the companies or to adjust salaries of officers. Competition, he stated, was the only real correction.

In his presidential address Mr. E. B. Fisher, Grand Rapids, Mich., declared that the independent telephone men are firm believers in the value of competition for bringing about the most efficient service. He said that telephone companies should not be allowed to violate anti-trust laws any more than should other corporations. Mr. Fisher declared that monopolistic interests had withheld telephone patents from the public which should be used for the betterment of the industry. Quoting from a statement by President Wilson on anti-trust legislation, he stated that certainly in that policy the President of the United States has the hearty support of the convention. He suggested that the association through committees keep the Department of Justice informed as to the views of its members on questions of telephone monopoly in various parts of the country.

At the afternoon session Mr. J. B. Middleton, Portland, Ore., read a letter from Mr. Samuel Hill, president of the Portland company, urging the co-operation of the independent companies and suggesting that they might act with the Postal Telegraph-Cable Company as the Bell companies co-operate with the Western Union Telegraph Company.

Speaking on liability insurance and the workman's compensation act, Mr. W. A. Alexander, Chicago, explained state laws as they affect telephone companies in their relations with the public, showing how employers may insure themselves against loss through injury to employees. To show that telephone companies need such insurance he made the statement that during the last year 25,000 telephone men had been injured and 123 men had lost their lives. During the same period 183 employees of electric-lighting companies were killed in accidents, according to Mr. Alexander. It will be found, said the speaker, that in cases where crossed wires of telephone and electric-lighting companies are the causes of accidents the decisions are about equally divided as to which company is at fault. Judgment is generally rendered against the company owning the defective wire

Alderman C. E. Merriam, Chicago, deplored the Chicago City Council's loss of power with the coming of the State Public Utility Commission of Illinois, stating that corporations might be able to obscure local issues in the excitement of a state or nation-wide election. The present choice of corporations, said the speaker, lies between thorough-going and stringent regulation and government ownership, and the responsibility of managers and operators of utilities to their shareholders is heavy. Only by giving the best service can the issue of government ownership be avoided.

The Independent Telephone Association of America has been formed, said Mr. C. B. Randall, St. Paul, for telephone men who wish to stay in the business and not for promoters. The speaker outlined briefly the qualifications for membership, stating that only telephone companies in which the American Telephone & Telegraph Company does not hold a substantial financial interest are eligible.

For the reason that 80 per cent of the toll calls of this country are conducted within a 30-mile radius and 10 per cent of the calls do not extend over distances of more than 150 miles, Mr. Randall contended that the toll business of the country as well as the local exchanges could be handled without use of the Bell lines, especially at the prices now offered by Bell interests.

Mr. J. C. Crowley, Jr., Superior, Wis., said in discussing the future work of the service committee that the aim would be to print each month in the bulletin of the association accounts of solutions of common problems of benefit to operators of small exchanges. The articles will contain data on erection and maintenance of indoor and outdoor plants.

In a paper entitled "An Accounting System Which is Simple, Flexible, Practical and Meets the Requirements of State and National Commissions," Mr. J. W. Coffey, Indianapolis, Ind., explained how the accounts of companies should be conducted in order to facilitate making out reports for the state commissions.

In the Wednesday afternoon session Mr. J. C. McCabe, Bay City, Mich., who has been a newspaper publisher for many years but is now interested in the telephone company in Bay City and Saginaw, read a paper entitled "Publicity." It was shown that newspaper advertising is desirable for the telephone company making a campaign for new subscribers. Sample advertisements which had been used in Bay City were shown. Mr. McCabe said that managers of companies should cultivate the acquaintance of the newspaper men in their towns, and where the size of the company permitted, it was, in his judgment, good policy to maintain a publicity department.

At the "experience meeting" a resolution was introduced by Mr. Frank Binkley, of the Hamilton (Ohio) Home Telephone Company, proposing that the association aid the Hamilton company in its controversy with the American Telephone & Telegraph Company. The Ohio courts had decided that the subscribers of the Hamilton company are not entitled to the use of the Bell lines between Hamilton and Cincinnati, a distance of about 25 miles. The case is still before the courts and the commission. The resolution was referred to the resolutions committee and was adopted.

Speaking on "The Little Big Things of Transmission," Mr. H. T. Currier, Chicago, urged that standard apparatus be adopted for long-distance transmission. It is in this branch of the business, he pointed out, that individual companies have always been weak.

Mr. J. C. Crowley, Jr., Superior, Wis., in opening the discussion on the "Action of Wisconsin Railroad Commission on Standardization of Operating Rules and Practices," told of the steps taken by the Wisconsin State Telephone Association. Mr. J. N. Canby, of the engineering staff of the commission, read fourteen rules which had been formulated by the commission. A final hearing for revision and acceptance of the rules has been announced by the commission for Feb. 11 and 12, 1914.

Speaking on the financing of an independent telephone company, Mr. W. F. Goodrich, LaCrosse, Wis., outlined his ideas as to the best means of raising capital.

At the Thursday morning session short illustrated talks were given by Mr. Arthur Bessey Smith, Automatic Electric Company, Chicago; Mr. E. C. Lewis, North Electric Company, Galion, Ohio; Mr. H. N. Farris, Kellogg Switchboard & Supply Company, Chicago, and Mr. H. N. Tolles, Sheldon School of Salesmanship, Chicago. Mr. W. N. Matthews, present Jupiter of the Jovian Order, also gave a short talk.

On Thursday afternoon the committee on resolutions, of which Mr. B. G. Hubbell, Buffalo, was chairman, presented a number of resolutions which were accepted as read. The resolutions are briefly as follows: (1) Resolved, that the Bell interests be enjoined from monopolizing interstate telephone business; (2) that the American Telephone & Telegraph lines be declared common carriers; (3) that the acquisition by the Bell interests of properties which still remain physically separate and intact be declared invalid; (4) that aid be given authorities in regulation for securing the above results; (5) that the Western Electric Company be enjoined from further purchase of telephone manufacturing plants. Officers of the society have been instructed to take necessary steps for the carrying out of the resolutions.

On Wednesday evening about 350 members and guests attended a dinner at the Hotel LaSalle. The election of officers resulted as follows: President, Mr. B. G. Hubbell, of the Federal Telephone & Telegraph Company, Buffalo, N. Y.; first vice-president, Mr. E. B. Fisher, Grand Rapids, Mich.; second vice-president, Mr. E. D. Shade, Johnstown, Pa.; treasurer, Mr. Richard Valentine, Janesville, Wis.; secretary, Mr. W. S. Vivian, Chicago.

Meeting of National Independent Telephone Association

The National Independent Telephone Association opened its seventeenth annual convention at the Hotel LaSalle, Chicago, on Jan. 13. At the opening session ex-Congressman J. Adam Bede, of St. Paul, Minn., made an address on "The Solutions of America's Problems."

Mr. Richard Yates, a member of the Illinois Public Utilities Commission, outlined the non-partisan policy of that body and stated that thus far the utilities of the State had evinced no anxiety regarding the adjustments to be made by the commission. Comparing the New York commissions' duties with those of the Illinois body, he said that while New York State outside of New York City had 902 utilities within its jurisdiction, the number in Illinois totaled 2973. Discussing the needed amendments to the income tax law, Mr. William Fortune, of Indianapolis, Ind., stated that, although he in no way opposed the principle of the income tax, he would strongly suggest that deduction at the source be abolished and information at the source be substituted. This amendment, he said, would allay much of the existing confusion.

Public Service Commission News

District of Columbia Commission

The Public Utilities Commission of the District of Columbia has denied the petition of the Chesapeake & Potomac Telephone Company, a New York corporation, for authority to invest $140,000 of its sinking funds in bonds of the Chesapeake & Potomac Telephone Company, a Virginia corporation. The reason for the denial is that the petitioner owns all of the stock of the Virginia corporation, and it is the judgment of the commission that permission to make such an investment under such circumstances should not be granted in view of the design and purpose of the public utility and anti-merger laws of the District of Columbia.

Wisconsin Commission

A new departure in public utility regulation is evidenced by the recent action of the engineering department in assuming temporary management of the Neshonoc Light & Power Company's business for the purpose of demonstrating to the management that the business could be sufficiently developed to warrant the introduction of day service and to make the improvements necessary to render more adequate service. The utility has in the past refused to make the improvements in its service as recommended by the commission on the ground that the amount of business to be gained would not justify the expense necessary. The commission's engineers during their short stay at the plant solicited enough power business to make the service profitable within a short time after its establishment. As a result of this investigation, the utility will be ordered to rehabilitate completely its hydroelectric plant and to add such new equipment as may be specified by the commission.

Massachusets Commission

The Massachusetts Board of Gas and Electric Light Commissioners has filed its annual report with the Legislature, which convened on Jan. 9. The most important recommendation for new legislation is that the decision of the commission be made final in respect to security issues. The board says:

"During the last year the Supreme Court of the Commonwealth rendered an important decision concerning the authority of the board respecting approval of issues of capital stock. This case (Fall River Gas Works Company versus Gas and Electric Light Commissioners) was a petition for a writ of certiorari on account of a decision of the board dismissing an application for approval of new stock, for the purpose of annulling that decision, and the court directed the writ to issue.

"The result of this court decision has been to call in question some of the most important and fundamental principles underlying the policy so long and consistently pursued in this commonwealth for regulating and controlling companies of this character, a policy which has influenced all of the legislation relative to these companies and antedates the creation of this board. The so-called anti-stock watering legislation of 1894 was intended to give this policy a more positive expression and application rather than to alter or restrict it. Its purpose has been to limit the issue of securities of public service companies exercising a virtual monopoly to their actual needs and to prohibit the representation in additional securities of surplus earnings invested in the plant, with the important object of keeping at a reasonable minimum the dividend burden to be borne by the public.

"The entire course of legislation clearly indicates the well-founded conviction that the volume of securities outstanding against any public utility has a potent effect upon both rates and quality of service, since prices are made and maintained to meet expectations of stockholders as to dividends and service may be seriously impaired by a continued endeavor to meet those expectations. The language employed by the court is so broad that, notwithstanding the narrow issue which was actually involved, it has been made the basis for a claim that the only function of the board is to determine whether the amount of money to be raised is necessary for the particular work done or to be done, and from that the amount of securities necessary.

"It is even confidently asserted that all expenditures for new property must, if the company requests, be represented in new securities regardless of the fact that no obligations may be then outstanding on account of such expenditures or of the company's condition at the time when the board's approval is sought. Under these claims no question of legality of the issue proposed or of the existence of other resources ample to meet the cost of proposed work, no general question of public policy or public interest involved, can be considered by the board.

"If such construction be correct, it is in direct conflict with the policy above described, seriously impairs, perhaps wholly destroys, the effectiveness of a long line of legislation and subverts administrative methods pursued by this board without serious challenge for more than twenty years. The board is of the opinion that the construction referred to is an erroneous one and that the court did not intend so far to weaken the effect of existing law.

"It should be possible to express legislative purposes so clearly as to avoid future disputes. This may well be done by somewhat enlarging, or perhaps more clearly defining, the board's discretion respecting approval of stock and bond issues."

Current News Notes

COST OF MOTOR DRIVE.—On page 381 of our issue dated Aug. 23, 1913, appeared an article entitled "Investigation of the Cost of Motor Drive in a Six-Story Factory." Credit should have been given in this article to Messrs. Royal M. Barton and Frank C. Taylor, of the class of 1911, Massachusetts Institute of Technology, who compiled the data therein shown for a graduation thesis, an abstract of which formed the basis of the article published.

* * *

SPECIAL TRAINS TO PHILADELPHIA CONVENTION, N. E. L. A.—At a meeting of the transportation committee of the National Electric Light Association held at Philadelphia, Jan. 8, to discuss transportation plans for the N. E. L. A. convention scheduled for that city in June, Mr. George W. Elliott, New York, chairman of the committee, announced that a rate of 2 cents per mile had been granted by the Trunk Line Association for the use of delegates to the convention, and that the same rate would probably be followed by other traffic associations throughout the country. Because of the short distance and frequent regular train service to Philadelphia, special trains are not planned from New York City or New England points. From Chicago special trains will be run over the Pennsylvania and New York Central railroads, and it is also planned to have specials from St. Louis and the South.

* * *

ENERGY CONSUMPTION AND COST OF VEHICLE OPERATION.—At an educational meeting held in the auditorium of the Public Service Building, Jersey City, N. J., the subject of motor vehicles was discussed by Mr. S. C. Thompson, of the Public Service Company of New Jersey. After showing figures to prove that the electric truck costs less to operate than either horse-drawn or gasoline vehicles, results of an actual test were presented comparing the performance of a gasoline truck and an electric truck over forty-eight months' operation. In this case the cost of maintenance was found to be 18.5 cents per mile for the gasoline truck and only 8.5 cents per mile for the electric truck. Diagrams showing the relative amounts of energy consumed by different types of tires and street surfaces also proved very interesting. It was seen, for example, that a motor vehicle running on asphalt had an energy consumption of 1 kw-hr. per mile while the same car running through soft snow consumed 2.06 kw-hr. per mile.

* * *

SOCIETY MEETINGS

SUPPLY JOBBERS TO MEET.—The Electrical Supply Jobbers' Association will hold its next convention at the Raleigh, Washington, D. C., from Feb. 17 to 19, 1914. Mr. Franklin Overbagh, 411 South Clinton Stret, Chicago, Ill., is the general secretary.

* * *

ANNUAL MEETING OF PITTSBURGH ELECTRIC ASSOCIATION.—At the annual meeting of the Pittsburgh Electric Association held on Jan. 3 the following officers were elected: President, Mr. A. G. Pierce; first vice-president, Mr. J. W. Smythe; second vice-president, Mr. D. P. Lockard; secretary, Mr. J. A. Jaques; treasurer, Mr. O. J. Goettman, and trustees, Messrs. L. J. Kiefer and A. A. Anderson.

* * *

MEETING OF JOVIAN ELECTRICAL LEAGUE OF SOUTHERN CALIFORNIA.—The regular weekly meeting of the Jovian Electrical League of Southern California was held at Christopher's, Los Angeles, Jan. 7. Mr. Lissner delivered a very interesting address illustrated with stereopticon pictures, the subject being "Camera 'Flashes' During a 'Short Circuit' of Europe." Mr. Max Lowenthal presided. A rejuvenation will be held Feb. 6.

* * *

YONKERS DIVISION, N. E. L. A.—At the monthly meeting of the Yonkers (N. Y.) Division, N. E. L. A., Jan. 12, Mr. L. W. Johnson presented a paper entitled "The Inspector in His District," Mr. A. A. Chisholm discussed "Service Connections," and Mr. A. W. Slocomb read a paper on "Ohm's Law," which was illustrated with lantern slides. Mr. Max Cohen, assistant corporation counsel, followed with an address on "City Government."

* * *

CHICAGO JOVIAN LEAGUE.—At the luncheon of the Chicago Jovian League on Jan. 12, Mr. E. N. Lake, of the Stone & Webster Engineering Corporation, gave an illustrated talk showing some recent examples of engineering and construction practice. One interesting statement made was that the concrete-pouring equipment used in the construction of the Keokuk Dam was large enough to pour a structure equivalent to the Bunker Hill Monument in seventen hours.

* * *

ELECTRIC CLUB LUNCHEONS IN KANSAS CITY.—Luncheons of the Electric Club of Kansas City, which are held bi-weekly at the Hotel Baltimore, have been well attended throughout the fall and winter months. At the meeting held on Dec. 23 the seventy-five members present listened to a short and interesting talk on advertising by Mr. Henry Schott, president of the Ferry-Hanly-Schott Advertising Company. Following Mr. Schott's talk, Mr. L. C. Spake, of the *Electrical World*, made a few remarks on the value of advertising as an educational force.

* * *

PHILADELPHIA SECTION, E. V. A.—The Philadelphia Section of the Electric Vehicle Association of America was inaugurated with a meeting at the Franklin Institute, Philadelphia, Jan. 14. President Frank W. Smith, New York, was present and told of the work of the national organization, which now has a total membership of 542 divided as follows: Central stations, 70; manufacturers, 35; auxiliary, 9; associate, 400, and press, 28. Incorporated in 1910 with thirty-one charter members, the association's membership at the times of its annual conventions has increased as follows: First, 120; second, 197; third, 317, and fourth, 439. Within the year it is expected to increase the enrolment to 1000. Of the association's electric vehicle booklets recently issued, 10,000 copies have already been sold, and nearly 1000 inquiries have been referred to members.

* * *

WESTERN SOCIETY OF ENGINEERS.—Officers of the Western Society of Engineers, of Chicago, have been elected for 1914 as follows: President, Mr. E. H. Lee; vice-presidents, Messrs. B. E. Grant, Ernest McCullough and G. F. Gebhardt; treasurer, Mr. C. R. Dart. The trustees consist of Messrs J. G. Giaver, F. E. Davidson and H. S. Baker. The board of direction is made up of the gentlemen named and Messrs. O. P. Chamberlain, W. C. Armstrong and Albert Reichmann, past-presidents. Mr. J. H. Warder is secretary. The annual meeting and dinner of the society was held on Jan. 7. Dr. Edwin H. Lewis was toastmaster, and Dean Mortimer E. Cooley of the University of Michigan read a paper on "The Relation of the Public and the Public Service Corporations." There were addresses by Mr. Reichmann, the retiring president, and Mr. Lee, the new president. At a meeting of the hydraulic, sanitary and municipal section of the society to be held on Jan. 19 Mr. John W. Alvord will present an address on "The Engineering Lessons from the Ohio Floods."

Electric Service in the Upper Peninsula of Michigan

Development of the properties of the Menominee & Marinette Light & Traction Company during the last twenty-five years —Hydroelectric plant, transmission and distribution systems

TRACING the "family tree" of a present-day electric-service organization in the average American city is an interesting occupation. In nearly every case the history of the art is, in a measure, mirrored by the growth, changes, consolidations and commercial history of the central-station companies. In the case of the Menominee (Mich.) and Marinette (Wis.) Light & Traction Company, whose modern physical equipment is described in the main portion of this article, it will be of interest to devote a few prefatory words to this historical development.

Nearly twenty years ago, with the formation of the Menominee Electric Light Company, capitalized at $28,000, a conservative policy in financial matters was adopted, and throughout the history of the organization this stand has been maintained. Since then other public-service companies in Menominee have been organized, operated independently for a while and later reorganized with increased capitalization, until at present all have been consolidated and are being operated as the Menominee & Marinette Light & Traction Company.

Historical Development

Referring to the "family tree" of the present company, it will be seen that originally four companies operated in the Menominee district, namely, the Menominee Electric Light Company, the Menominee Electric Railway & Power Company, the Menominee Gas, Light & Fuel Company and the Marinette Lighting Company. Subsequently, each of these companies was reorganized for reasons stated in the chart, and the number was reduced to three corporations, known as the Menominee Electric Light, Railway & Power Company. In nearly all of these instances it was necessary to have special acts passed by the legislatures of Michigan and Wisconsin permitting the reorganizations. Finally, on July 8, 1903, the three companies then existing were consolidated by agreement under the name which they now bear, the Menominee & Marinette Light & Traction Company.

Tracing the financial history of what is known as the parent organization, the Menominee Electric Light Company, capitalized originally at $28,000, it will be noted that upon the consolidation with the Menominee Electric Railway & Power Company in 1892 $58,000 in bonds was issued, and the amount of capital stock was raised to $110,000. When the final consolidation was effected in 1903 the company was capitalized at $560,000, which was increased to $1,000,000 when the new Rapids power plant was built on the Menominee River. For this project $355,000 in bonds was issued. It will be seen that a careful effort has been taken to

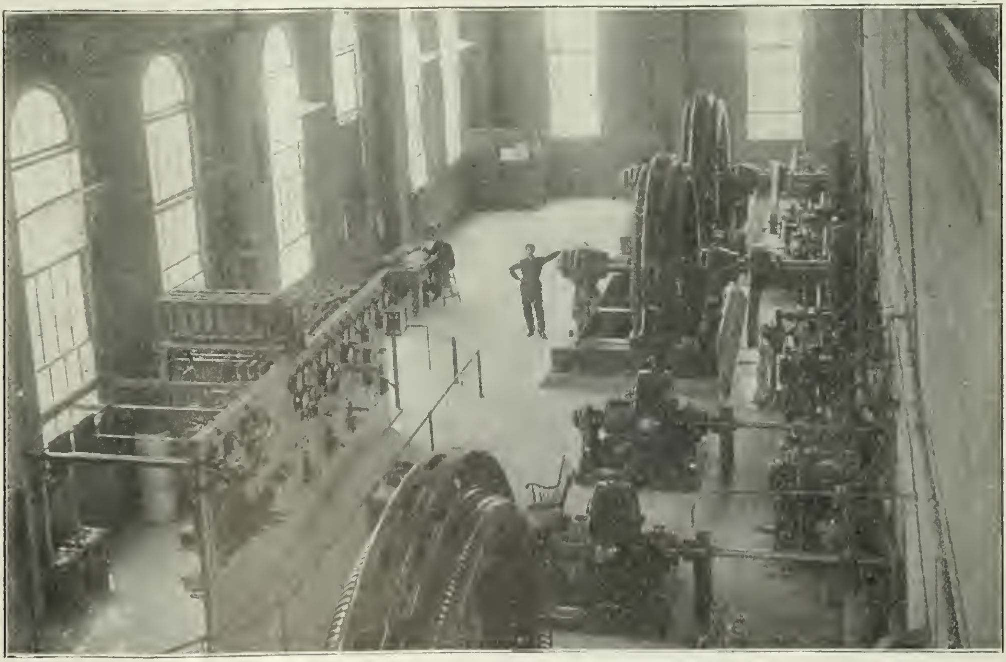


FIG. 1—INTERIOR OF RAPIDS POWER PLANT NEAR MENOMINEE, MICH.

keep down the bonded indebtedness. When $58,000 was needed, as was the case in 1892, the issue was made $58,000, and not $60,000 or $75,000 as a round figure. Again, every dollar received at the treasury of the company from the sale of bonds was always available for expenditure on the project in hand. Every bond of each issue by the parent companies has been sold at par to the companies' shareholders, without incurring the aditional expense of commissions paid to brokerage companies for selling the bonds. It is through such loyalty on the part of shareholders and through similar strokes of good management that the organization finds its stock free from over-capitalization.

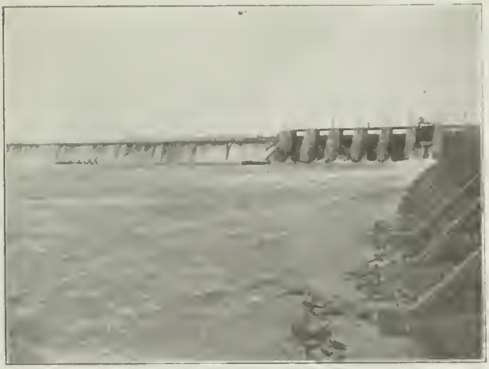


FIG. 2—SPILLWAY, TAINTER GATES AND LOG FLUME

The loyalty of the shareholders has not been without reward, however, for although the gas and street-railway properties have continued to earn about the same amount annually, the receipts from lighting and motor service have grown steadily year after year.

A New Plant and an Old One

The generating equipment of the present company consists of a hydroelectric station, known as the Rapids power plant, 20 miles above Menominee on the Menominee River, and a steam reserve station in the city. As a study in the evolution of generating and switching equipment during the past twenty years, the steam station is of unusual interest, for in it are to be found machines of all types from the early Edison bipolar generators to rather modern three-phase rotating-field alternators. All units are small, however, and the total rating of the plant's three reciprocating engines is but 1100 hp. These engines are all belted to a single-line shaft approximately 125 ft. long, and from this shaft the generating units are driven.

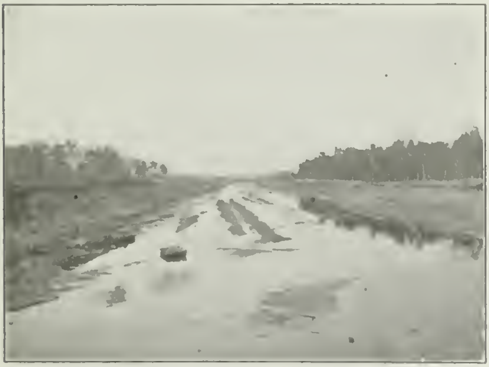


FIG. 3—THE COMPLETED INTAKE CANAL

A portion of the building which houses this steam station constituted the original Menominee power house and still retains a few panels of an early pattern of wooden-front switchboard, representing the first step in removing switching apparatus from the station walls. These boards are now preserved as relics, having long since been discontinued from actual service. Very little switching and metering apparatus is installed in this plant, as its machines deliver energy directly to the Menominee substation near by. Although much of the equipment in the station is now out of date, in times of emergency this plant carries the railway and industrial load until relieved by the hydraulic station.

Hydroelectric Development

The site on which the company's hydroelectric power station now stands lies 20 miles north of the city of Menominee on the Menominee River, the nearest railroad station being Ingalls, 2.5 miles to the northeast. Formerly there were rapids at this point, the river having some 26-ft. fall within a distance of 3400 ft. From the map in Fig. 4, showing the country about the site of the power station, it will be seen that the 3400-ft. canal dredged from a point above the rapids to their lowest extremity makes available this 26-ft. head at the head-works of the station.

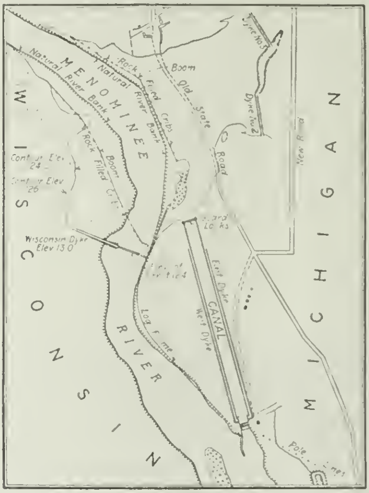


FIG. 4—TOPOGRAPHICAL MAP OF COUNTRY NEAR HYDROELECTRIC PLANT

Inasmuch as all construction had to be carried on at a distance of 2.5 miles from the nearest railroad station, transportation turned out to be an important factor in building the plant. First among the difficulties encountered was the transfer of two steam shovels from their flat cars to the canal over the country roads. By fitting up two small sections of track in which the ties and rails were firmly bound together, the feat, however, was accomplished. As the excavators advanced to the end of one piece of track, the shovel beams, managed by the engineer in charge, reached back, picked up the piece of track in the rear, and set it ahead of the locomotive excavator. Helpers aligned the track, and the locomotive then moved ahead under its own power to the next piece of track and repeated the operation. The scheme was found satisfactory, and, except for an accident at a sharp turn in the road where one crane toppled over and fell down a steep embankment, the trips of both units were uneventful. Very litle damage was done to the shovel which tipped over, and in less than half a day's time the force of men had put it back on its wheels and it had again resumed its travel.

Inasmuch as the canal to be constructed measured 3400 ft. in length and 230 ft. in breadth and was 24 ft. deep at its lower end, the steam shovels played a very important part in the erection of the hydraulic works of the station.

All heavy castings and large electrical units for the plant were hauled by means of horses and double wagons from the railway station at Ingalls. It has been said authoritatively that money would have been saved in the erection of this power station had a spur railroad track been built at the outset for the transportation of machinery and materials.

Characteristics of Water-Power Plant

The erection of the dam across the river at the upper end of the rapids was no small undertaking. The Tainter gates and spillway measure 500 ft. and connect on the Wisconsin side with a 950-ft. earth fill or wing dam which stands about 6 ft. above the spillway. All of the concrete for the dam and Tainter-gate supports was mixed on the Michigan side of the river, and the easterly half of the dam was completed above the water level before work on the second half of the cofferdam was begun. Thus concrete for the second half of the dam was transported over the half which had been already built. The eight Tainter gates shown at the end of the dam adjacent to the Michigan shore have 8-ft. by 12-ft. openings and are raised by means of a motor-driven traveling hoist.

Dikes constructed in the various lowlands shut off the flood of impounded water from the marshes. All these dikes have a top elevation of 6 ft. above the spillway crest. Solid lines in Fig. 4 mark the areas submerged by the impounded water and the dotted lines show the extent of the pondage area when the dam is flashboarded to an additional height of 2 ft. The farm buildings grouped about the junction of the old state road (which has been submerged), with the private roads leading to Ingalls, are on the property of the Menominee & Marinette Traction & Light Company, the buildings having been purchased as part of the 1600-acre farm acquired by the company in securing pondage rights. The company also owns five modern dwellings just east of the central portion of the canal in which the station operators and their families live.

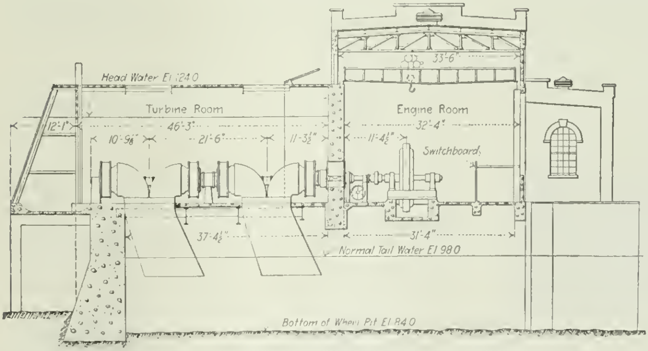


FIG. 5—ELEVATION CROSS-SECTION OF RAPIDS POWER PLANT

Each winter before the erection of the dam at the present site log jams used to form in the rapids on the river, requiring the services of several hundred men and the use of many hundred pounds of dynamite before the jams could be broken.

State laws in Wisconsin forbid water-power companies to impede the passage of logs, and hence a log flume had to be built from the pond to the tailrace below the power house, a distance of 3200 ft. During the logging season several employees at the power house are kept at work sluicing the logs and keeping them clear of the spillway, brooms being used to divert the logs toward the mouth of the flume. In this way the company is able to save a considerable quantity of water, as it is not obliged to release water in large quantities through the Tainter gates to float the logs off the rapids below the dam. Incidentally the logging companies are spared no inconsiderable expense as log jams are avoided. The foundation framework of the log flume may be seen at the right in Fig. 2.

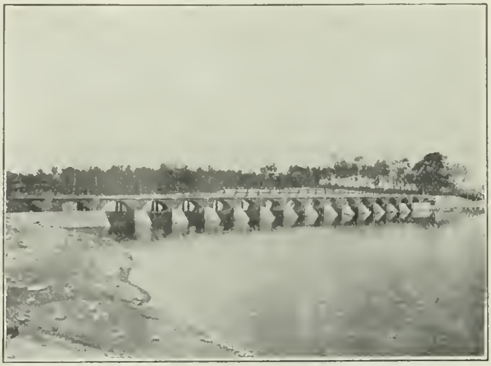


FIG. 6—GUARD LOCKS AT HEAD OF INTAKE CANAL

General Arrangement of Rapids Power Plant

The power house itself is constructed of monolithic concrete pillars and concrete blocks. As will be seen from Fig. 5, which is a cross-sectional drawing of the power house, both the trash rack and the open flumes above the wheels are virtually set in the extended bed of the canal, the tailrace extending under the power house and transformer room. The 3-ft. solid-concrete bulkhead wall on the up-stream side of the generator room withstands the pressure of the 26-ft. head of water in the canal.

The alternating-current generating equipment of the station consists of two 100-kw, three-phase, sixty-cycle Westinghouse alternators driven by four 52-in. Dayton globe waterwheels operating in the open flume under a 26-ft. normal head. The nominal rating of each of these sets of wheels is 1900 hp. A third 1500-kw, three-phase, sixty-cycle alternator was built by the General Electric Company and is driven by waterwheels which are duplicates of the foregoing. All of the machines operate at 150 r.p.m. and are controlled by Lombard governors. Oil pressure for these governors is furnished by pumps belted to the generator shafts.

Duplicate Westinghouse exciters, rated at 100 kw, 125 volts, and 350 r.p.m., are installed in the center of the station. These units are driven by two 22-in. Dayton Globe waterwheels also controlled by Lombard oil-pressure governors. Mechanical governors are generally deemed sufficient for such exciter units, but in this case particularly good regulation was sought and the oil governors were chosen.

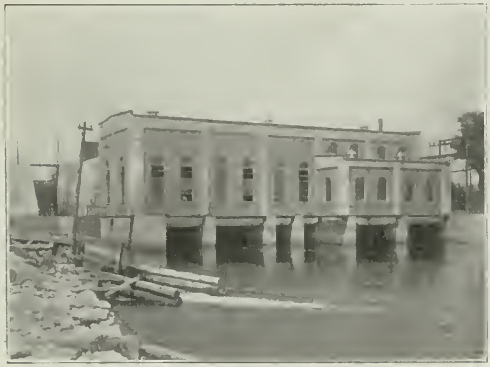
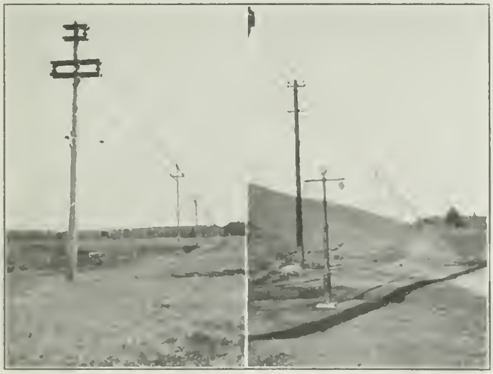


FIG. 7—TAILRACE, RAPIDS POWER PLANT

The switchboard, which may be seen in Fig. 12, consists of eight panels of blue Vermont marble with vacant frame space at the extreme end for an additional panel should it be needed. Enumerating from the farther end of the board, it will be noticed that upon the blank frame space a recording wattmeter and voltmeter have been placed temporarily. Panel No. 1 is a high-tension totalizing panel and carries, besides its oil switch, three 1000-amp ammeters. Since it is expected at some time that another high-tension line will leave the station and extend toward the north, panel No. 2 has been installed as a totalizing panel and at present is connected in series with panel No. 1. In addition, there is a three-phase ground detector and a polyphase integrating wattmeter. Panels 3, 4 and 5 control the alternating-current units and have their equipment installed in duplicate. Each consists of three 600-amp ammeters, one polyphase wattmeter with a 1600-kw scale and one direct-current ammeter for measuring excitation current. In addition to these instruments, the board carries rheostat control, synchronizing push buttons controlling the motors on the Lombard governors, voltmeter plugs and one main oil switch. Contemplating the installation of a fourth generator unit, panel No. 6 has been left blank. Panel No. 7 carries the metering and control equipment for both exciter units, consisting of two 1200-amp ammeters and one 150-volt voltmeter, rheostat control, voltmeter plugs, two 250-volt, 800-amp, double-pole single-throw switches and one single-pole switch used as a bus tie. The frequency meter, power-factor indicator and duplicate Tirrill regulators for the station are located on panel No. 8. Two voltmeters, one for the generators and one for the outgoing line, are mounted on the swinging bracket with the synchroscope.



FIGS. 8 AND 9.—33,000-VOLT AND 2200-VOLT LINES FROM HYDROELECTRIC STATION

The board is spaced 8 ft. from the wall and is supported by an angle-iron framework, which gives ample room at the rear for mounting grid resistors for the various machines. As a means of stopping the large generators, which when running light will continue to revolve under their own momentum for several hours, a galvanized-iron tank has been placed behind the board and connected as a water rheostat. By loading the three phases of a unit with this resistor a machine may be brought to rest in a very few minutes. A direct-current motor-driven air pump, which has completed its tenure of usefulness on the rolling stock of the local street railway, supplies compressed air for cleaning the generators and other electrical equipment.

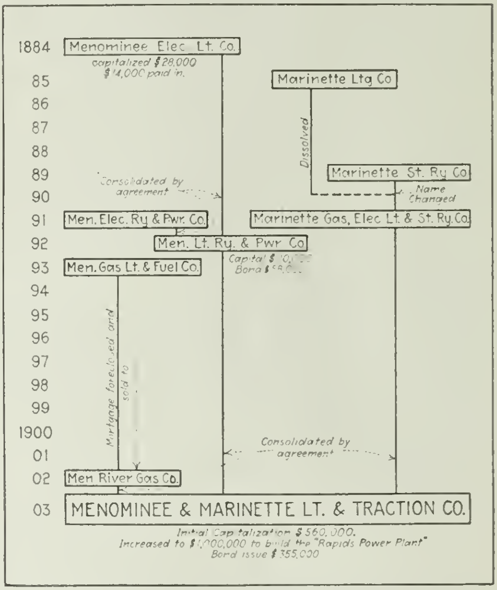


FIG. 10—GENEALOGICAL CHART OF MENOMINEE & MARINETTE LIGHT & TRACTION COMPANY

Transformers and Other Features

In the transformer room from which the high-tension line is shown emerging in Fig. 8 are seven 750-kva, 2200/33,000-volt, Westinghouse single-phase, oil-insulated, water-cooled transformers. The buses connecting the two sets of transformer units with the machine switches and electrolytic lightning arresters are carried on racks of pine timber. As a precaution against fire originating in this compartment a fireproof door may be lowered to separate this room from the main generating station. Disconnect switches are inserted in the low-tension and high-tension leads so that any part of the equipment may be isolated if repairs are needed.

In an easterly wing of the power house a machine shop and boiler room are provided. The machine shop equipment consists of a lathe, drill press, forge, grindstones and emery wheels all driven from a line shaft by a 5-hp, 220-volt General Electric motor operating at 4700 r.p.m. In the boiler room an old stationary steaming unit which was used in construction work about the station has been placed on a concrete foundation and now furnishes steam for heating the power house and the houses of the employees. A 1-hp, 220-volt Fort Wayne motor driving a Paul pump supplies the feed water for this boiler. The action of the pump is controlled automatically through an arrangement of contact-making pressure gages.

Transmission Lines

Practically all of the energy generated by this hydroelectric station is delivered over a 33,000-volt transmission line to the substation in Menominee, 20 miles distant. The three phases of the line are spaced at the corners of an equilateral triangle measuring 52 in. on a side. A single cross-arm and one cast-iron top bracket support the double-petticoat porcelain insulators furnished by the Ohio Brass Company.

The poles are spaced 117 ft. apart in a cleared right-of-way throughout the entire 20 miles. Forest fires, which rage throughout this country in the dry seasons of the year, make it almost imperative that all wooden-pole lines shall be run upon cleared rights-of-way. Thus far, however, no service interruptions have been caused by the forest fires.

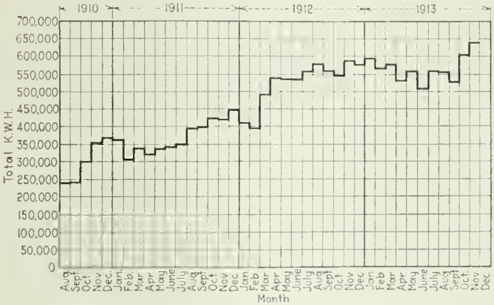


FIG. 11—OUTPUT OF MENOMINEE SUBSTATION

En route to Menominee, the high-tension circuit serves an outdoor substation supplying the community of Wallace, described in the *Electrical World* for Oct. 18, 1913. In passing, it is interesting to note that this tiny village now boasts of two double-faced electric billboard signs measuring 9 ft. by 20 ft. and lighted by twenty 25-watt tungsten lamps.

Menominee Substation

At the substation in Menominee seven 675-kva, 33,000/2200-volt, sixty-cycle Westinghouse transformers of the water-cooled, oil-insulated type step down the voltage for the distribution circuits. The lightning-arrester, high-tension and low-tension switching equipments in this station are duplicates of those at the transformer house of the power station. A portion of the 2200-volt energy is transmitted to the paper mills at Marinette, which are large consumers of electric energy, being stepped up to 6600 volts by a set of 150-kva General Electric transformers. Two motor-generator sets supplying 500-volt direct-current energy for the street-railway system are interesting from the fact that the two 150-kva, 500-volt Westinghouse direct-current generators were taken from the old steam-power plant and are now driven by two 220-hp, 2200-volt, 600-r.p.m., sixty-cycle General Electric synchronous motors.

The switchboard in this substation consists of ten panels of blue Vermont marble, most of which were formerly located in the old steam plant. With the discontinuance of the regular use of this station most of the metering and switching equipment for distribution circuits was transferred to the Menominee substation.

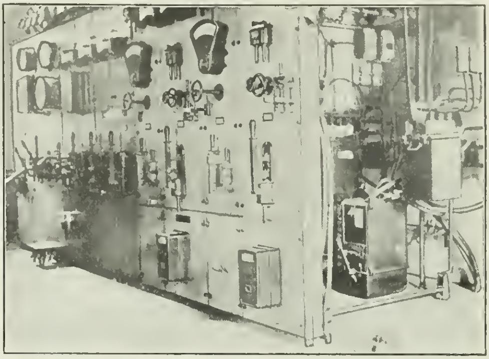


FIG. 12—SWITCHBOARD IN MENOMINEE SUBSTATION

The arc-lighting circuits in the cities of Menominee and Marinette are supplied with energy by fifty-lamp tub-transformer sets, two of which are located in the Menominee substation. A transformer station in Marinette containing three tub transformers receives energy at 2200 volts and distributes it to the series lighting circuits in that city.

Organization and Output

Fig. 11 shows the output for the Menominee substation from the time the hydroelectric plant on the rapids of Menominee River was put in operation in August, 1910, to the end of November, 1913. In that time the output has risen from 240,000 kw-hr. to 640,000 kw-hr. per month. The increase is largely attributed to the growth of the lighting and industrial-motor business, since the street-railway property has not grown materially in that time. Fig. 13 shows a daily load curve for Dec. 5, 1913, which is considered to be typical for the plant.

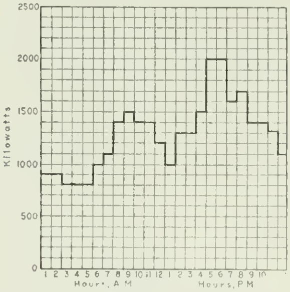


FIG. 13—TYPICAL DAY LOAD CURVE

Mr. Edward Daniell, who has been associated with the parent company since an early date, is secretary and manager of the Menominee & Marinette Light & Traction Company, and in his work he is assisted by Mr. Albert W. Raiche, purchasing agent, and Mr. L. H. Lathrop, superintendent. Mr. J. C. Sprong is chief operating engineer of the hydroelectric station.

Checking Watt-Hour Meter and Wattmeter Connections

Simple methods of verifying connections of single-phase and polyphase meters where power-factor is uncertain. By Raymond S. Brown and P. Ackerman

A Simple Method of Checking Watt-Hour Meter Connections

BY RAYMOND S. BROWN

When making an installation of watt-hour meters to measure the energy delivered to a polyphase load, or when inspecting the connections of such meters already in place, the meterman frequently feels the need of some means, other than a diagram, of checking the correctness of his connections. In many cases it is very difficult to trace out the leads runnning to the meters as they are sometimes inclosed in conduit or run in dangerous proximity to high-tension cables. In order to afford a reliable test which can be made without the annoyance of tracing out the wiring, and which may be applied by anyone not familiar with meters, the following method has been devised and used with good results.

It is assumed that the ordinary two-wattmeter method is used, employing either two single-phase meters or one polyphase meter. Inasmuch as a polyphase meter is electrically equivalent to two single-phase meters, the following discussion will be confined to the method using two meters.

It is a well-known fact that the only time when the two meters will rotate at the same speed is when the power-factor of the load which they are measuring is unity. The direction of rotation of the slow meter will be governed by the power-factor of the load, and, when properly connected, it will rotate forward for power-factors above 50 per cent—that is, for a lag angle of 60 deg.—and backward for power-factors below 50 per cent. This is due to the fact that the current in the meter, under balanced conditions, lags behind the potential across the meter by 30 deg. *more* than the load current lags behind the load voltage. Hence, when the lag angle is 60 deg. for the load, it is 90 deg. for the meter. In the case of the fast meter the angle between current and voltage is just 30 deg. *less* than the corresponding angle of the load; hence, for ordinary commercial loads this meter will always run forward. This makes an incorrect connection on the fast meter very easy to detect, as this meter must always rotate in the direction which the manufacturer has designated as forward. In the case of the slow meter, however, the direction of rotation is not a criterion unless it is known whether the power-factor of the load is above or below 50 per cent. In a great many cases the power-factor of the load is not known. That it is frequently below 50 per cent is evident when we consider that the load may consist largely of the magnetizing current to distributing transformers or to induction motors lightly loaded.

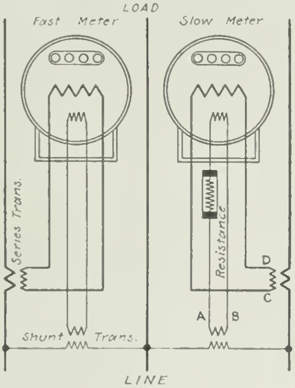


FIG. 1—LOCATION OF RESISTANCE FOR CHECKING CONNECTIONS OF SLOW METER

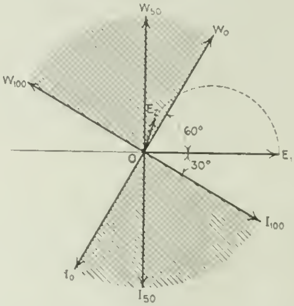


FIG. 2—PHASE RELATIONS IN SLOW METER

Fig. 1 shows the connections for metering a load by the use of series and shunt instrument transformers. It is assumed that each meter is connected to the proper transformers but that the polarity of the leads coming from these transformers is unknown. A reversal of leads *AB* or *CD* may be caused by improper connections on either the primary or the secondary side of the transformers, and will result in this meter running in the wrong direction.

The test for the connection of the slow meter consists in inserting a resistor of high resistance in series with the potential circuit. If the meter is properly connected this will cause it to rotate backward; if it is improperly connected it will rotate forward. The resistance used need not be accurately calibrated. The only conditions necessary are that it be practically non-inductive and of a magnitude sufficient to cause the potential across the meter to drop to less than half its initial value. For 110-volt meters it should be of the order of about 10,000 ohms, hence the internal resistance of a voltmeter may be conveniently used. For general use in making this test, however, it is recommended that the resistor of high resistance be made by compressing in a short fiber tube a mixture of powdered graphite and chalk. Brass plugs should be cemented into the ends of the tube, one plug terminating in a straight rod for inserting into the potential bushing of the meter and the other terminating in a binding screw for attaching a lead. Such a resistor may be carried about in the vest pocket.

The theory of the test is very simple, as may be seen by referring to the diagram of vector relations shown in Fig. 2. The lower shaded quadrant represents all possible locations of the meter current I with respect to the meter voltage E_1 when the meter is properly connected. The upper shaded quadrant represents all possible locations of the current vector W when the meter is wrongly connected, owing to one pair of leads being reversed. The current subscripts refer to load power-factors. E_2 represents the voltage obtained across the potential coil when the high resistance is inserted. The potential coil being almost pure reactance, the effect of inserting the resistance is to rotate the current in this coil forward approximately 90 deg. In like manner the reactance drop is rotated forward 90 deg., its locus being the arc of a circle. The meter will run forward when the angle between current and voltage is acute and backward when this angle is obtuse. Since the angle made by E_2 with any current in the lower quadrant is obtuse and with any current in the upper quadrant is acute, the rule quoted above follows. Of course the speed is much less with the resistance in the circuit, but all that is needed for the purpose of the test is sufficient torque to cause the disk to move.

For polyphase meters the same procedure is followed except that the fast half of the meter is disconnected.

Incidentally the use of this high resistance may be made to serve another useful purpose to the meter tester. It is the custom with most electric-service companies to calibrate their meters in place at more or less regular intervals. The test is usually conducted at 50 per cent and 100 per cent power-factor and loads ranging all the way from light to full. The 50 per cent power-factor for the test is obtained by the use of a phantom load containing a combination of reactances and resistances. It is possible to eliminate the use of reactance entirely and thus somewhat simplify the testing outfit, if power for the phantom load be taken, not from the same phase as the potential circuit, but from the phase supplying current to the potential circuit of the other meter, which has a 60 deg. relationship with that of the first meter. This will probably give 50 per cent power-factor; but it cannot be predicted whether the current will be lagging or leading 60 deg. owing to the fact that the direction of phase rotation is unknown. If, however, the high resistance be momentarily inserted, the question will be answered. If the current is lagging, as it should be, the meter will run backward. If the meter runs forward the current is leading, and the desired result will be obtained by interchanging the phases used for potential and load respectively.

Method of Checking Polyphase Wattmeter Connections Where Power-Factor Is Uncertain

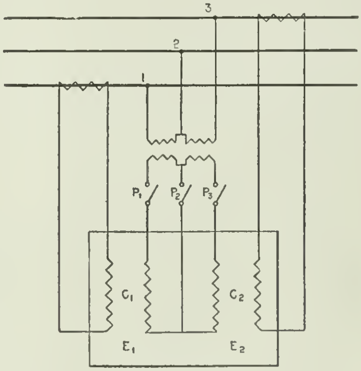
BY P. ACKERMAN

The checking of polyphase wattmeter connections often causes considerable trouble, particularly in cases where the checking has to be made without interfering with the operation of a plant, or where the power-factor is not known, or where intermittent service causes a continuous fluctuation of the power-factor near 50 per cent. For such cases the simple method developed below is very advantageous. It allows one to check with a single reading the correct connections of the meter without knowledge of the power-factor, provided the proper current and potential circuits are connected to their respective single-phase meter elements.

The usual feed connections of a polyphase wattmeter are as shown in the sketch. The meter consists of two single-phase elements, each comprising a current coil and a potential coil. The two potential instrument transformers are normally tied together on open delta, such as is usually the case with the two potential coils in the meter, so that only three instrument leads extend from the transformers to three potential binding posts on the meter.

If now potential lead P_3 is opened, the only meter element E_1 acts, since on meter element E_2 the potential is interrupted, or if P_1 is opened, then only meter element E_2 will act. The two individual single-phase meter elements are known to act with proper connections in the same direction with a power-factor above 50 per cent and in opposite directions with a power-factor below 50 per cent, and it is, therefore, common practice, wherever the power-factor is known, to check the proper connections by checking the proper direction of action of the two single-phase meter elements. However, the power-factor not always being known, the principle cannot be applied in all cases. For such cases the following method is applicable.

If the common potential lead P_2 is disconnected, then the potentials of both meter elements will be in phase with the potential P_1-P_3 since both potential coils are in series connection between the two potential leads P_1 and P_3, and the voltage absorbed by the potential coil of each meter element will be half of the voltage, P_1P_3. Estimating the size and direction of the three individual readings—that is, with open potential lead P_1, then P_3, and finally P_2, with proper connections—the values shown are obtained for different power-factors, the reading being given in percentage of the total meter reading.



POLYPHASE WATTMETER CONNECTIONS

TABLE I—READINGS WITH CORRECT METER CONNECTIONS

Power-Factor, per Cent	E_1 with P_3 Open	E_2 with P_1 Open	E_1+E_2 with P_2 Open
100	+50	+50	+50
86	+33	+67	+50
50	0	+100	+50
26	−62	+162	+50

From Table I it is seen that with proper connections the reading with open common potential lead P_2 will always be half of the total wattmeter reading and positive in its direction, while as shown by Table II the direction would become negative if the low single-phase reading should be reversed.

Therefore the following simple rule can be deduced for checking wattmeter connections of uncertain power-factor:

First—Check first carefully the connections of shunt and series transformers and make sure that the proper current and potential circuits are combined in the same single-phase meter element.

TABLE II—READINGS WITH CURRENT OF LOW-READING ELEMENT REVERSED

Power-Factor, per Cent	E_1 with P_3 Open	E_2 with P_1 Open	E_1+E_2 with P_2 Open
98	−285	+385	−50
86	−92	+192	−50
50	0	+100	−50
26	+28	+72	−50

Second—So connect the current leads to their respective meter coil as to obtain a positive total reading.

Third—Open the potential circuit P_2 and note the direction of the reading; if positive, then the meter connections are correct; if negative, the current leads of the low-reading meter element have to be reversed. After obtaining a positive reading with P_2 open, the direction of the low-reading meter element will tell whether the power-factor of the load is above or below 50 per cent, negative reading indicating a power-factor below 50 per cent and positive reading a power-factor above 50 per cent.

Therefore the method can be used just as well as a rough check on the power-factor.

The meter-man will appreciate such a simple rule since it will help him to solve many difficult problems where the power-factor of a system is not known or in cases where methods based on the two single-phase meter element readings cannot be safely applied, as, for instance, in very intermittent service or where the power-factor varies around 50 per cent.

It must be borne in mind that the check is correct only after the potential and current leads belonging to the same meter element have been located.

The method was developed by the writer when he found it necessary to check wattmeters of a large pulp and paper mill without interfering with the operation. The checking was complicated by the fact that many of the circuits showed a power-factor close to 50 per cent, one single-phase meter element indicating almost zero, while other circuits had very intermittent load and others, again, showed very low load so that any other methods known to the writer could not be applied under the particular circumstances.

The writer does not know whether the method is partly known or not, but, not having been able to find it in any literature, he thinks the publication of the method might be of general interest.

Farming a Transmission-Line Right-of-Way

The new transmission circuit of the Pennsylvania Water & Power Company from Holtwood into Baltimore occupies a purchased right-of-way strip 100 ft. in length. This 500-acre "shoestring" plot is not, however, allowed to remain unproductive, for with the real spirit of conservation the company has permitted nearby farmers to rent its land at a nominal figure, so that every inch of soil is being worked, even the ground beneath the towers being planted.

Loop Transmission System for Eastern Michigan

Changes and extensions to be made next spring will convert the existing transmission lines of the Eastern Michigan Edison Company into a loop system. Most of the energy distributed by this company is generated in hydroelectric plants situated on the Huron River between Ann Arbor and Ypsilanti, Mich., while some is purchased from the Detroit Edison Company.

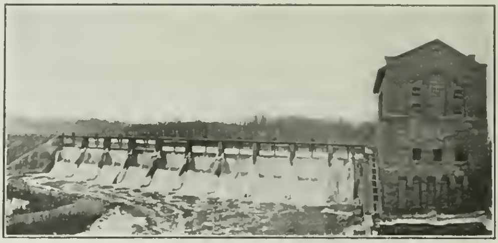


FIG. 1—NEW PLANT AT ANN ARBOR, MICH.

At present there radiate from Detroit three 23,000-volt transmission circuits. One extends northwesterly to South Lyons, while the other two run west, separated by a distance of several miles but finally joining near Ypsilanti. Continuing in the same general direction, the resulting line connects with the Superior, Gettes, Argo and Barton generating plants on the Huron River. Since the completion of the latter plant at Ann Arbor last spring, stub-end lines have been extended to the north and west, feeding the towns of Whitmore Lake and Dexter respectively.

The plan now adopted contemplates extending the line from Whitmore Lake to South Lyons, which is only a few miles distant, in this way connecting all of the hydroelectric plants on the Huron River with Detroit by the northern circuit. The two southern lines previously mentioned will be disconnected at their present junction point near Ypsilanti and continued to the Superior plant as two distinct points. The Superior plant is now connected with the main generating station at Gettes by a single line, but a duplicate circuit will be provided eventually. When these changes are made three circuits traversing as many different territories, and subject to different disturbances, will be provided between the group of hydroelectric stations and Detroit.

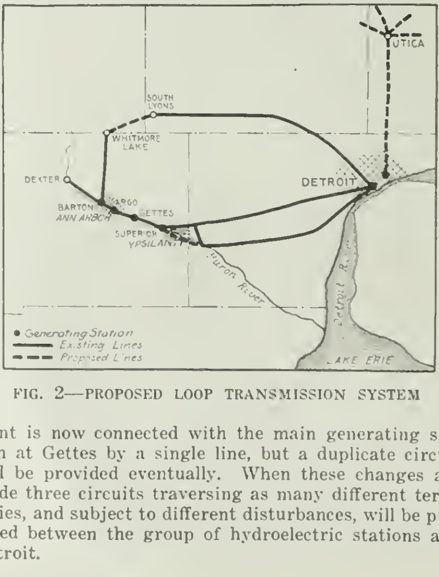


FIG. 2—PROPOSED LOOP TRANSMISSION SYSTEM

Reinforced-Concrete Poles as Cheap as Wood

How 25,000 poles were manufactured and installed by the Toronto Hydro-Electric System—Advantages of concrete poles—Tests and costs. By J. G. Jackson

ALTHOUGH reinforced-concrete poles have been the subject of experiment from time to time for a great many years, it is comparatively recently, so far as the writer is aware, that they have been employed or even seriously considered. The high and increasing cost of wooden poles, their comparatively short life, with consequent prospective renewal at greater expense, as well as the public demand for the beautification of city streets, render the consideration of concrete-pole construction desirable for modern overhead systems.

Quite a number of successful installations of concrete poles have been made during the past five or six years on this continent and in Europe. Perhaps the largest single installation at present is that of 25,000 poles designed by the writer and installed in connection with the municipal street-lighting and general light and power distribution system of the Toronto Hydro-Electric System in Toronto, Canada, during 1910, 1911 and 1912.

The adoption of concrete poles for this installation was due to the necessity of supplying energy to the entire city, comprising over 400 miles of streets, from overhead lines, underground construction being in general too expensive except for the business districts, and a realization that more wooden poles and overhead construction of the usual type, added to streets already occupied by at least two such systems, would be decidedly objectionable.

It was felt that the appearance of an overhead installation could be greatly improved by employing a pole of neat and uniform construction such as could be obtained by the use of concrete. With a suitable lighting system and arrangement of overhead wiring, a pleasing, and, in fact, ornamental, effect can be secured at a cost substantially the same as when wooden poles are employed and with a prospective saving in maintenance expense. This would appear to be of especial interest to the smaller cities and residence districts of large cities, where the demand for underground construction is based mainly on esthetic considerations but where such construction is not justified by the revenue to be obtained.

In this connection it might be noted that in the recent installation of a street-lighting system with which the writer was concerned, for a city of approximately 10,000 inhabitants, the usual practice of installing a "white way" with underground wiring in the business section and gooseneck fixtures on wooden poles in the residential district was abandoned in favor of the installation of concrete poles throughout. This arrangement resulted in a smaller cost for the entire installation, a decorative system in the residence districts and a "white way" with tungsten clusters carried by heavy cast-iron brackets of ornamental design mounted on the faces of the concrete poles. This, in the writer's opinion, was not lessened in effectiveness by the small number of wires overhead. The concrete poles also served to carry the trolley span wires where necessary, so that, as in the case of steel trolley poles similarly employed, a minimum of street obstruction resulted.

Design and Construction of Poles

In the design and construction of the poles employed in the installations referred to an effort was made to eliminate unnecessary details and to render the manufacture as simple as possible in order that poles might be turned out rapidly and at low cost. A pole of solid square cross-section with beveled edges was adopted. The square section not only made possible a simple form of mold, but, as the strains to which a pole is subjected are ordinarily either normal to or in the direction of the line, this is obviously the most efficient arrangement of the material, especially with the longitudinal reinforcement grouped at the four corners, as 50 per cent of these members are then equally effective in tension in any direction normal to a face of the pole. As the majority of the Toronto poles were intended to

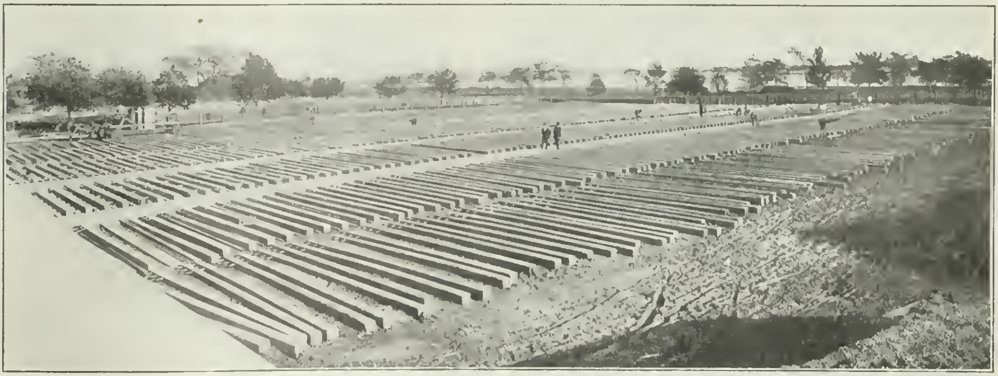


FIG. 1—A TWO-WEEKS' RUN IN POLE YARD, 112 POLES PER DAY BEING TURNED OUT

carry an ornamental lighting bracket and tungsten lamp, they were provided with a ½-in. iron pipe cast in the pole with lower outlet at the lamp and upper outlet under the line wires.

The earlier poles of the Toronto installation were provided with three galvanized-steel cross-arms cast in the pole and having a hole at each end for a steel core pin. This arrangement of cross-arms was not found sufficiently flexible in obtaining clearances of the lines and was later discarded. Holes were provided through the pole with a slot on either face so that brackets of any desired length could be bolted to the pole.

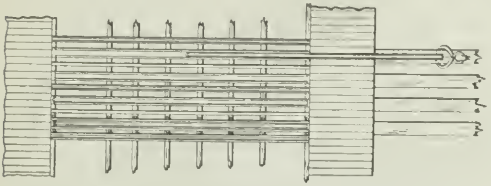


FIG. 2—METHOD OF HANDLING AND SUPPORTING POLES

The concrete poles employed in this installation ranged from 24 ft. to 35 ft. in length, the majority being 24 ft. long. Standard poles were made with 8-in. by 8-in. base and 5-in. by 5-in. top for 24-ft. poles, with 9-in. by 9-in. base and 6-in. by 6-in. top for 30-ft. poles, and with 10-in. by 10-in. base and 6-in. by 6½-in. top for 35-ft. poles. The longitudinal reinforcement consisted of four deformed or square twisted steel bars of high elastic limit set at the corners of the pole and ½ in. from the surface. Three-eighth-inch bars were used in the 24-ft. poles and ½-in. bars in the longer poles.

Extra reinforcement consisting of additional bars extending part way up the pole was provided where poles were expected to be subjected to considerable strain. The cross-sections of the poles were determined with regard to the resulting appearance as well as from considerations of strength and cost. As all of these poles were intended for use on city streets, wind stresses could be considered to be a minimum owing to the sheltered location. With the exception of poles on curved streets, the lateral stresses result mainly from service lines to buildings. It is probable that the greatest strain that the majority of these poles would be sujected to was that due to handling in transportation and erection. The reinforcement provided, giving an ultimate strength as measured by the horizontal pull applied at a point 2 ft. from the top ranging from approximately 500 lb. in the 24-ft. poles to 800 lb. in the larger sizes, with extra reinforcement as stated, has been found to be sufficient for the conditions obtaining in Toronto.

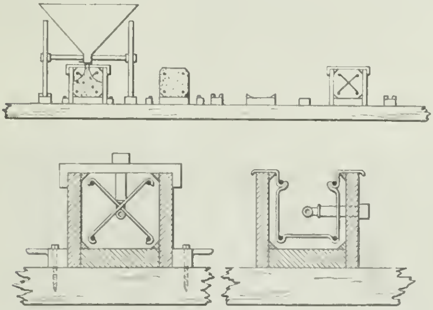


FIG. 3—METHOD OF POURING CONCRETE AND REINFORCING

Poles at ends of lines or at corners were ordinarily well guyed. Insufficient guying at occasional points, however, resulted in considerable deflections of the poles concerned, with consequent easing up of strains; but in comparatively few cases did breakage of poles result.

A number of poles 24 ft. long with 7-in. by 7-in. base and 4-in. by 4-in. top provided with four ¼-in. plain square reinforcing bars were experimented with when determining the sizes of the poles to be employed. These poles were found, at thirty days or thereabouts, to be incapable of withstanding the handling and transportation. It is of interest to note that in tests made on poles thirty days old with plain square-bar reinforcement failure resulted from slipping of the reinforcement in the case of ⅜-in. and ½-in. bars. One-quarter-inch square bars broke without appreciable slipping.

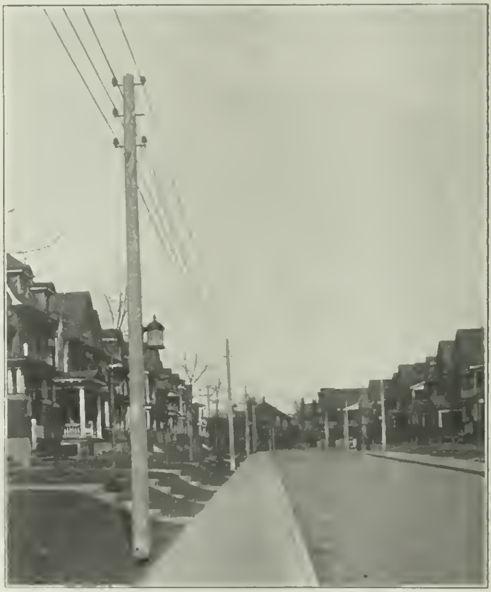


FIG. 4—CONCRETE POLE LINE IN RESIDENTIAL SECTION OF TORONTO, CAN.

Manufacture of Poles

The plant employed in the manufacture of these poles consisted in the main of parallel horizontal forms arranged in rows with a runway at one end of the forms for the delivery of concrete, together with concrete mixer and special wagons for placing the concrete in the poles. All forms were constructed of finished Southern pine as more satisfactory results were obtained with this wood than with the less dense and resinous Northern variety. Bases of forms were spaced 2 ft. apart with wooden rails between, one pair of sides being provided for each three bases. A very wet mixture of concrete in the proportions of one part cement to two parts of sharp sand and four parts of crushed limestone of less than ½-in. size was used. The quality of sand used was found to have an appreciable effect on the characteristics of the pole, a sharp sand, as would be expected, tending to produce the more elastic concrete. Gravel instead of crushed stone was found to give satisfactory results.

A number of mixtures less rich in cement were tried but were found to give a pole somewhat inferior in strength at ages up to thirty days covered by the period of test. The surface, also, was not so good as with the richer mixture. The 1:2:4 mixture employed gave an excess of cement and sand beyond that required to fill the voids in the stone. The method of placing the liquid concrete by pouring from a spout in the bottom of the concrete wagon resulted in the almost complete elimination of air bubbles without special spading or working of the concrete for this purpose after placing in the forms. A small amount of troweling was necessary for the finishing of the upper surface, however. The poles made in this way, when set, presented smooth white cement surfaces showing the grain of the wood on three faces. The hand-finished upper surface was dressed by means of carborundum bricks after removal from the form.

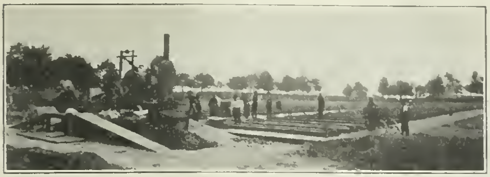


FIG. 5—POLE YARD, SHOWING MIXER AND POURING WAGON

Method of Casting

In casting the poles sides were set up and forms poured on every third base during the first day. On the following day the side walls were removed from the first poles and advanced to the second base, and the operation was repeated. On the fourth day the first poles cast were removed from the forms and the cycle of operations was started again. The removal of poles from the forms was accomplished by sliding the pole endwise from the form in stages a distance slightly greater than its length every third day, until sufficiently set for handling.

In the first stage, in order to prevent overstraining of the green poles, an extension of the base consisting of a 2-in. plank slightly wider than and equal in length to the pole was provided. The withdrawal was accomplished by gripping the base of the pole by means of a particularly robust pair of ice tongs made for the purpose, the tractive effort being supplied by a horse attached to a rope on the tongs. Poles were commonly loaded on the outgoing wagons, or piled for storage after the third stage, at approximately ten days after casting.

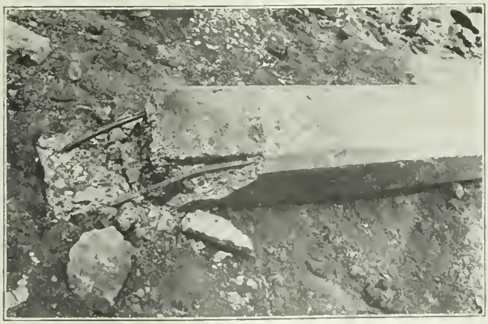


FIG. 6—FAILURE BY SLIPPING OF BARS

Process of Reinforcement

Vertical reinforcement was placed by laying it in the form on wire hangers suitably spaced and with open hooked portions to carry the reinforcing bars. The lateral reinforcement intended to take up the vertical shear and to prevent failure by buckling consisted of a series of short bars with hooked ends dropped diagonally across the longitudinal members at intervals and for a distance above and below the ground line proportioned to the strain to be provided for. No effort was made to bind the longitudinal reinforcement in a cage by means of the suspension wires or together by means of the cross-reinforcing bars except by hooking together as noted and depending on the setting of the concrete to complete the bond and lock the reinforcement in place.

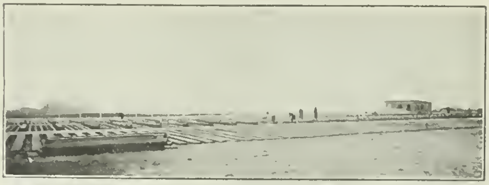


FIG. 7—INITIAL CAST WITH POLES ON EVERY THIRD BASE

This method of reinforcement resulted in a minimum cost both for labor and for material. Repeated inspection of poles cast in this way and afterward broken on test or otherwise proved the method of setting the reinforcement to be sufficiently accurate and the lateral reinforcement to be capable of developing the full strength of the longitudinal steel. It is ordinarily desirable, however, that the lateral reinforcement be such that the pole will fail by crushing of the concrete rather than by breaking of the bars in tension, as in the former case a very considerable force will yet be required to bring the pole to the ground, which would seem to be an advantage in view of the weight of the pole, although the wiring carried would ordinarily prevent the falling of an overstrained pole.

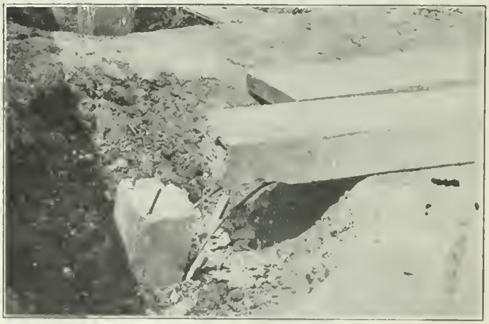


FIG. 8—FAILURE BY BREAKING BARS IN TENSION

In the manufacture of the Toronto poles three yards were employed during a part of the time, turning out approximately 250 poles per day. Two of these yards were adjacent and employed the same men and equipment, giving an output of 150 poles per day practically at one point. The third ward was located several miles distant in order to shorten the haul for the finished poles to the points of erection. One of the yards with forms for more than 100 poles per day was operated for three successive years and was still in fairly serviceable condition at the end of that time, notwithstanding the exposure of a part of the forms to the weather during two winters.

While the majority of these poles were cast out of doors, about 2000 were made in a large building during the winter of 1910-11. The labor cost under these conditions was approximately double that found necessary with unrestricted space.

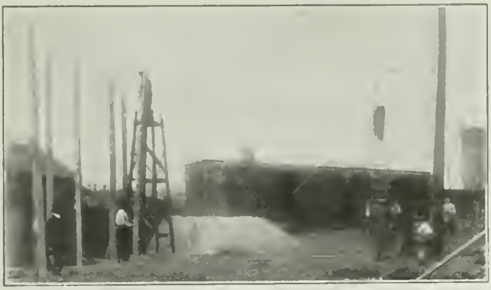


FIG. 9—TESTING CONCRETE POLES

Erection of Poles

Delivery of poles to erection gangs was carried out by means of ordinary wagons upon which oak frames were set to provide several points of support for the poles—a load consisting of six 24-ft. poles weighing 1100 lb. and four 30-ft. poles weighing approximately 1600 lb. Poles were lifted onto the wagons by a loading gang without special equipment and were lowered to the ground on skids.

Ordinary labor was employed in the erection under the direction of line foremen. While three poles erected per day per man was accomplished under favorable circumstances, the average was slightly less than this. Raising pikes with a forked end were used, and poles were lifted and dropped into the holes in the same manner and with the same care as in the case of wooden poles. Twenty-four-foot poles were set 4 ft. in the ground and 30-ft. poles 5 ft. The holes were refilled with the excavated earth, no concrete bases being employed. The small sizes of the bases as compared with wooden poles resulted in a smaller cost for digging holes as a minimum diameter was excavated. While the cartage of concrete poles was comparatively expensive as a result of the weight, the cost of handling and erection was approximately the same as for wooden poles, with a possible advantage in this instance for the concrete pole as a result of the larger number erected and the fact that ordinary labor was employed for this purpose.

Results in Practice

Notwithstanding the fact that no special precautions other than ordinary care were taken in handling the poles, the total breakage on approximately 25,000 over a period of about three years covering manufacture, erection and operation was less than 2 per cent. Failure while in service during this period was a small fraction of 1 per cent per year and resulted mainly from collisions with heavy vehicles and obvious overstraining. While several thousand of these poles have been in service during three winters, carrying from three to six lines ranging from No. 6 to No. 2 and larger, in addition to frequent services to buildings, they appear, except in a number of cases where overstraining is apparent, to be in as good condition as when erected, and inspection of the concrete indicates the improvement which would be expected with age. With the exception of a number of poles which were frozen before the setting of the concrete, no deterioration of the concrete appears to have developed, and examination of the reinforcement of poles broken gives evidence of the preservation of the steel.

COST OF STREET-LIGHTING POLES DESIGNED TO CARRY SIX WIRES AND ORNAMENTAL TUNGSTEN-LAMP BRACKET WITH CONDUIT CONNECTION

24-ft. Pole, 8-in. by 8-in. Base, 5-in. by 5-in. Top; Volume of Concrete, 7 cu. ft.		30-ft. Pole, 9-in. by 9-in. Base, 5-in. by 5-in. Top; Volume of Concrete, 12 cu. ft.	
Cement, at 40 cents per bag	$0.700	Cement	$1.200
Stone, at $1.33 per ton	0.400	Stone	0.710
Sand, at $1.15 per yd	0.145	Sand	0.255
⅜-in. steel reinforcing bars, at $1.95	0.889	½-in. steel bars, at $1.85	1.893
Suspensions for reinforcing bars	0.056	Suspensions	0.072
Lateral reinforcing bars	0.100	Lateral reinforcing bars	0.140
½-in. pipe and fittings	0.268	½-in. pipe and fittings	0.430
Three galvanized-steel cross-arms	0.262	Galvanized cross-arms	0.262
Miscellaneous material	0.050	Miscellaneous	0.060
Depreciation of forms	0.400	Forms	0.500
Mixer and other plant	0.120	Mixer and other plant	0.120
Preparing yard	0.080	Yard	0.080
Total	$3.47	Total	$5.72
Labor	1.05	Labor	1.31
Total labor and material etc.	$4.52	Total labor and material	$7.03
Adding for engineering supervision, office expenses, 10 per cent	0.45	Plus 10 per cent	0.70
Total	$4.97*	Total cost	$7.70

*This, of course, includes the iron conduit pipe and galvanized steel cross-arms, so that the cost of a plain 24-ft. pole would be $4.39 and that of a plain 30-ft. pole would be $6.97.

Cost of Poles

The costs of the concrete poles under the several conditions described were variable, but for a considerable part of the work approximated the figures given in the accompanying table.

It is apparent, of course, that in a comparison of costs of wooden and concrete poles the labor required in preparing the wooden poles and also the painting should be considered as a part of the cost, as the concrete pole is produced as a finished article. While concrete poles can compete, even in first cost, with wooden poles in many cases, and present decided advantages where appearance is a factor, as in the case of street-lighting systems, it is not, in the writer's opinion, probable that satisfactory or economical results will be had from the occasional manufacture of poles by inexperienced persons.

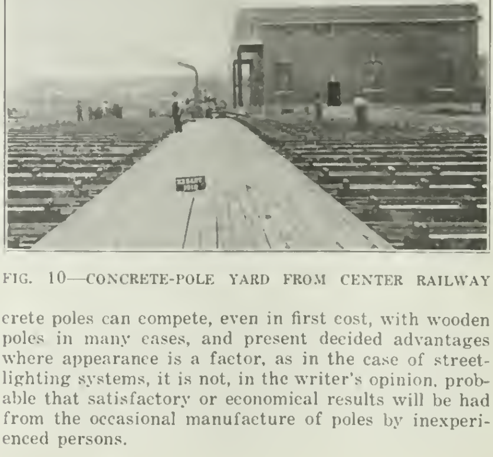


FIG. 10—CONCRETE-POLE YARD FROM CENTER RAILWAY

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Christmas-Tree Outfits Loaned Without Charge

Wherever its electricity was available on the premises, the Minneapolis General Electric Company offered to lend Christmas-tree electric-lighting equipment to churches or charitable organizations without charge. This generous offer was accepted by about ninety applicants during the holiday season. Not all of the requests were for the same night, so that many of the outfits did double or triple duty. The electric-service company delivered the festoons of lamps and called for them after they had been used. Many letters expressing grateful thanks were received by the company.

Furthering Electric-Vehicle Development at Chicago

Addressing the Chicago Section of the Electric Vehicle Association on Jan. 6, Mr. John F. Gilchrist, vice-president of the parent association and also assistant to the president of the Commonwealth Edison Company, expressed a lively sense of the importance of the electric vehicle to central-station interests. After mentioning the fact that one manufacturer of electric commercial vehicles has announced a reduction in price, with the declaration that there will be in future no "trades" for second-hand machines, Mr. Gilchrist said that the association has amply demonstrated its usefulness already. One very important feature of its work is bringing together those who manufacture and deal in electric vehicles and those who produce and sell the energy by which the vehicles are operated. The speaker voiced in an unequivocal manner his conviction that the central-station men should co-operate with the vehicle men. It is no doubt true that the manufacturers and dealers in the electric-vehicle field are doing more than their share in the co-operative undertaking. The important men in the electric-service industry should be made to understand what the possibilities of electric-vehicle development mean to them. This may be a rather slow process of education, but it should be persisted in patiently and tactfully.

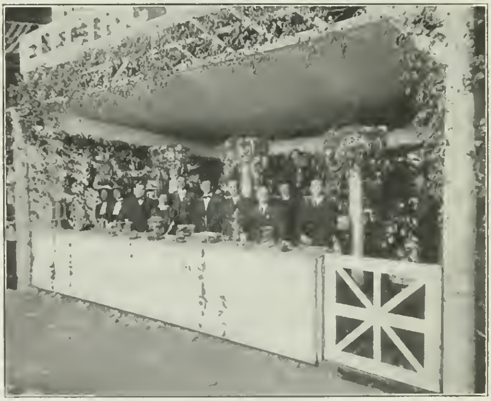
Mr. Gilchrist said that the Commonwealth Edison Company appreciates the electric vehicle and is trying to do some things to help it along. He spoke of the recent reduction in rates by which a tertiary rate of 4 cents (to be reduced to 3 cents on March 1) has been created for small lighting consumers. This new tertiary rate gives the private owner of, say, one electric passenger automobile a chance to put the charging of his batteries on the same maximum meter with the lighting circuits of his house. By using a little care so as not to charge during the time of peak demand, the individual owner of an electric car in Chicago should thus be able to get nearly all his energy for 3 cents per kw-hr. after March 1.

Another interesting statement made by Mr. Gilchrist was that the Commonwealth Edison Company is making a serious study of the Hartford plan of supplying charged batteries to owners of electric vehicles. By this plan the owner has nothing to do with the ownership, maintenance or charging of the batteries he rents for use on his car. When the driver finds that the battery needs recharging he proceeds to the nearest supply station and the entire battery is taken out, a freshly charged one being substituted in its place, the interruption to service of the electric vehicle being but slight. This plan may mean the possible standardization of batteries and battery housings on cars, but it would eradicate the annoyances of owners of small vehicle installations in maintaining batteries. The scheme may not be feasible in a large city like Chicago, but the company is giving the subject careful attention. The speaker concluded by reminding his hearers that Chicago is an ideal city for the electric vehicle, with its absence of grades and the great improvement in the quality of street paving which has been made in the last few years.

Mr. George Harvey Jones, of the Commonwealth Edison Company, mentioned the fact that the maximum rate for electrical energy to public garages as charged by the Commonwealth Edison Company, has been reduced from 5 cents to 4 cents.

Indirect Lighting in a Hurriedly Constructed Booth

At a show in which the Kansas City (Mo.) Electric Light Company participated only a short time was available for building, decorating and lighting the company's booth. In place of a ceiling white canvas was stretched over the top of the exhibit, giving a surface upon which the indirect lighting units in the display might project their rays. Since the ceiling was of canvas, the three heavy lighting units were supported on posts in the floor. These units are not visible in the illustration on account of the floral decorations wreathed about their exteriors. The Kansas City company is a firm believer in the advertising value of such displays.



BOOTH WITH INDIRECT LIGHTING

Contract Agents Display Lighting Chart

When Mr. G. E. Bernecker, contract agent for the Commonwealth Power Company, Milwaukee, Wis., was taking up the matter of flat-rate display lighting with local merchants charts similar to that reproduced in the accompanying illustration were found of valuable assistance. The sketch herewith shows a block in the business district of the city where window and other display lighting was turned on and extinguished by the customers themselves and indicates the irregularity with which the lamps were operated. Horizontal lines mark off the hours from 6 p. m. till midnight, and the unshaded portions indicate the periods of window-lamp operation. The offer made by the company contemplated a special display-lighting circuit controlled from the generating station or substations. The lamps were to be lighted at dusk and extinguished at midnight.

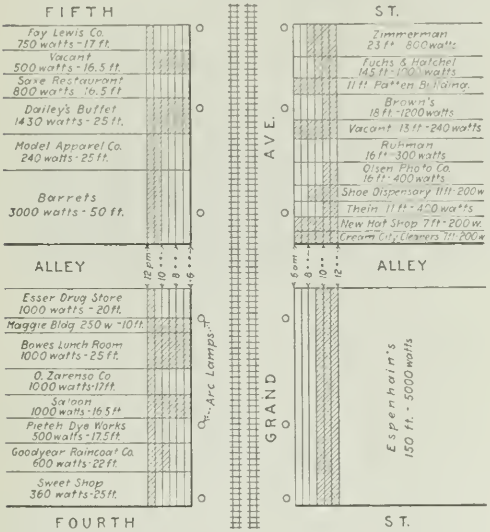


CHART SHOWING POWER USED FOR DISPLAY LIGHTING

When the merchant was confronted with such a diagram showing the frontage of his own property and its connected lighting load, contrasted with that of his neighbors and competitors, very little argument was needed in favor of the well-lighted show window as a silent yet effective salesman to gain his support for the plan.

Advantages of Electric Drive in Woodworking Plant

The Union Electric Light & Power Company, of St. Louis, is doing a good work by publishing in the daily newspapers advertisements giving the reasons of industrial customers for using central-station service. The case of the H. Pauk & Sons Manufacturing Company, 1309-1327 North Fifteenth Street, St. Louis, is cited as a recent example. This company manufactures store fixtures, barber chairs, showcases, etc. It replaced its steam plant with the electric service of the Union company in August, 1910, and since that time has relied upon the central-station service exclusively, having over 170 hp in motors in its establishment. In speaking of purchased electrical energy Mr. Pauk says: "As a result of installing motors on our woodworking machines we have increased our plant output. For the same cost of operation we very much prefer purchased energy to that of our own generation. It has cost us less to operate with central-station service than with a steam plant which we used for years."

New Year's Pledge in Minneapolis

The present management of the Minneapolis General Electric Company appears to be winning the hearty approval of press and public. In times gone by there have been some misunderstandings and disputes between the company and its patrons, but under the "new deal" everything appears to be adjusted satisfactorily. Mr. R. F. Pack, the general manager of the company, takes newspaper space to say that the advent of the year 1914 means to the company renewed efforts to please. In extending New Year's greetings the company gives its thanks to the many citizens who have given the company encouragement in its efforts to do its work better. The company concludes its New Year's announcement with this promise: "Every individual with this company will start the year 1914 inspired by renewed determination to render satisfactory service in the most pleasant and most efficient way."

Easy Riding for the Meters

To reduce the jars of transportation as much as feasible, the United Electric Light Company, of Springfield, Mass., equips its meter automobiles, which indidentally are of the electric type, with a thick velours pad placed on the floor as shown in the accompanying illustration. The cost is nominal and the improvement in riding conditions is marked. The company's officials felt that, in justice to the consumer and the central station alike, nothing should be allowed to interfere with the accuracy of its meters between the test board in its office building and the consumer's installation. Old and new lamps are carried conveniently in these cars in boxes attached to their inside walls.

VELOURS PADS FOR TRANSPORTING METERS

Edison Service for New England's Largest Furniture House

The new ten-story building of the Paine Furniture Company, Boston, Mass., will be equipped with an elaborate installation of lighting and motor apparatus supplied with energy by the Boston Edison Company. The signing of the electric-service contract was extensively advertised in the Boston press, and during the construction period an electric sign, shown in the accompanying photograph, has called the attention of hundreds of thousands of people to the prospective use of electricity in the establishment. The sign is about 20 ft. long, the letters being 18 in. and 24 in. high, and it contains 297 10-watt lamps.

ELECTRIC SIGN DURING BUILDING CONSTRUCTION

The new store will be equipped with 297 hp in motors and a connected lighting installation of 508 kw. Five 30-hp elevators and one 10-hp elevator will be in service. A 7.5-hp motor-driven dust fan, a 5-hp picker fan. two 5-hp sewage ejectors, a 2-hp air compressor and other fans will also be in use. A noteworthy feature of the establishment will be a large furniture manufacturing and repair shop equipped with 85.5 hp in motors ranging from 0.5 hp to 10 hp in rating. The shop tools will include a 7.5-hp ticking machine, 10-hp planer, 5-hp jointer, 1-hp rip saw, 10-hp circular saw. 5-hp cutting saw and other tools aggregating 36 hp

Saving with Battery-Driven Fire Truck

According to figures prepared by the New York Fire Department, the battery-driven fire engine in its service has shown a saving of 40 per cent during the last year over the equivalent operating cost of a horse-drawn truck.

The total expense of operating the electric truck, which is of the couple-gear type equipped with U. S. L. thin-plate batteries, is estimated at $388.74 for the year, the following items being included:

Depreciation	$200.00
Energy, at 6 cents per kw-hr	117.90
Distilled water, sulphuric acid, brushes for motor, and other minor repairs	70.84
Total	$388.74

A comparison of this outlay with the cost of operating a horse-drawn engine shows a saving of $266.52 in favor of the battery-driven truck:

Horse-drawn truck	$655.26
Battery-driven truck	388.74
Saving	$266.52

During the year covered by the above figures the battery-driven truck responded to 319 alarms. One run of 6 miles was made through crowded city streets in twenty-three minutes, the truck at times exceeding a speed of 20 miles an hour.

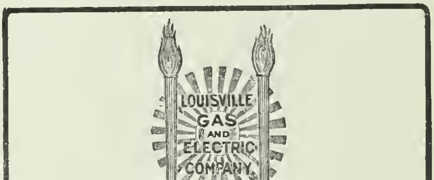
"Your Partner," the Louisville Slogan

The Louisville (Ky.) Gas & Electric Company has adopted a new trade-mark. "Your partner" is the slogan which it bears, while a flaming sun and a flambeau at the sides suggest the service which the company renders. In an announcement to the public regarding the trade-mark, the company said:

"The new trade-mark of the Louisville Gas & Electric Company will stand for a service rendered in the spirit not of exploitation but of partnership. Not only shall this trade-mark stand for service of the highest grade at prices far lower than those prevailing throughout the country, but it also represents service pleasantly and courteously rendered. It shall represent a service for all the people, recognizing no lines of party, race, class or religion—the same grade of service for the humble cottage as for the mansion, charged for, without discrimination, according to the same low-rate schedule.

"Time and experience are necessary to put vitality into this trade-mark. Our best efforts and your friendly co-operation will be needed.

"The people and the company are partners."


LOUISVILLE GAS AND ELECTRIC COMPANY
"YOUR PARTNER"

GOOD WILL

At this time when the subject of Good Will is emphasized in the mind of the world, it seems proper to discuss the good will which should and can prevail between the people and utility corporations.

Good will can not be bought or had for the mere asking It must be deserved and must come as a reward for patient, devoted effort.

We want the good will of every person in this city, and vicinity—man, woman and child.

We can not expect to win active good will in a few weeks or a few months. Within a reasonable time we shall demonstrate our right to the confidence which begets good will.

The people and the Louisville Gas and Electric Company are partners.

Among the tasks to be done in every city those of the public utility organizations are among the most difficult—if not the hardest of all. We transact business every day in the year with the great majority of inhabitants.

Our attitude is that of service in a spirit of partnership; that of wishing every person who pays us a dollar for service, more than a dollar's worth of value in return.

If we succeed in adding to Louisville's growth and prosperity by adequate and low-priced gas and electric service, we shall be glad of the increased individual property values and the increased welfare of individuals.

We realize that we have obligations to the people which can not be ignored. We propose to discharge these responsibilities creditably and always in good faith and good will.

Louisville Gas and Electric Co.
INCORPORATED

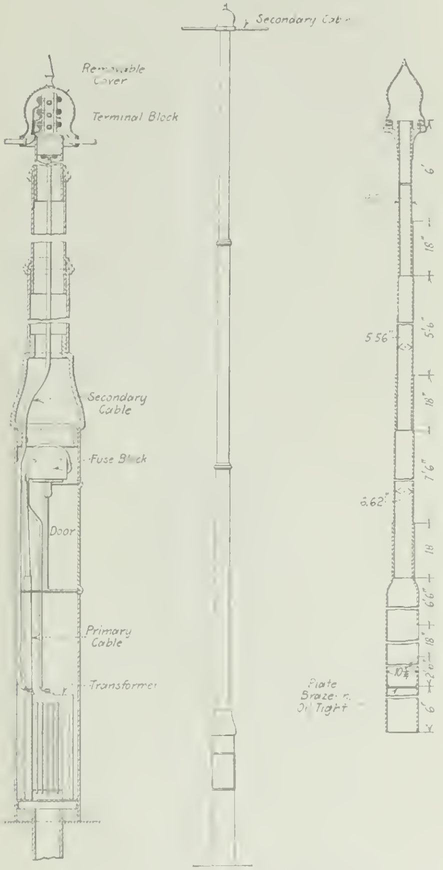
GEO. H. HARRIES, President

ADVERTISEMENT SHOWING GOOD-WILL SLOGAN

Illumination and Wiring

Distributing Pole with Self-Contained Transformer

The Commonwealth Edison Company, Chicago, is preparing to make practical trial of a novel distributing pole with self-contained transformer, which is the invention of Mr. E. O. Schweitzer, chief testing engineer for the company. The feature of the design consists in placing a transformer of somewhat cylindrical form in the lowest section of a tubular steel pole, the high-tension leads to the transformer being brought in through the pole, either from below or from above, while a convenient distributing head is provided for the low-tension conductors.



FIGS. 1, 2 AND 3—CROSS-SECTION AND ELEVATION OF STANDARD POLE, AND CROSS-SECTION OF SPECIAL POLE

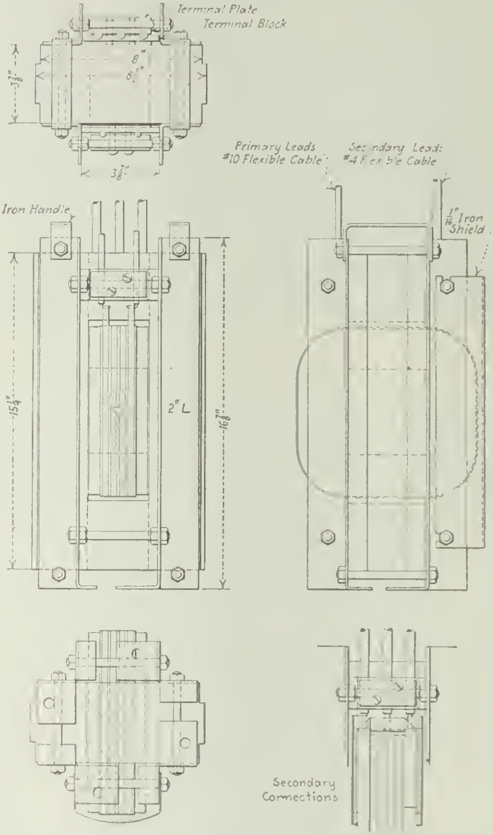


FIG. 4—DIAGRAM OF CIRCULAR TYPE OF TRANSFORMER DESIGNED FOR USE IN POLE

The general principles of the arrangement are shown in Figs. 1 and 2. Beginning at the lower portion of the figure, it will be noted first that the steel pole is supported in the ground by means of a downwardly projecting pipe which also serves as the inlet for the cables from an underground conduit, if such be employed. The pipe is made an integral part of the pole by means of a metal connecting collar. On this collar rests a low metal table which forms the bottom of an oil-tight container for the transformer.

The transformer is of the shell type and of special cylindrical design. It fits loosely in the pole and is furnished with protecting shields to prevent injury to the coils in handling. Provision is made for submerging the transformer in the oil to a considerable depth to insulate the terminals and to provide ample circulation for cooling purposes. Projecting upward through the oil alongside the transformer is a pipe which makes an oil-tight joint with the table below and which conducts the underground cable above the oil surface where a pot-head is used to fan out the conductors. A loosely fitting horizontal partition located well above the oil surface prevents dirt and small articles from falling into the oil. The lowest pole section contains a door which gives access to the transformer below and to the primary fuse-blocks which are mounted immediately above.

The uppermost section of the pole supports a distributing head consisting of a secondary terminal block of insulating material and a metal distributing ring which supports the radiating secondary conductors. The distributing head is covered with an ornamental cap which furnishes protection from the weather.

The Tubular-Steel Pole

The pole employed is made up of standard steel tubing and differs from the usual type only in having a somewhat larger lowest section. In a recently designed form, as shown in Fig. 3, the lowest section has a 10.75-in. inside diameter and is made of 0.375-in. steel. This particular pole is intended for all-overhead connections. For simplicity it is set directly in the ground and the bottom plate of the transformer tank is brazed in. The pole-section joints will ordinarily be provided with ornamental rings. It is likely that an insulating lining will be used in at least a part of the pole, to prevent possible grounding through the blowing of fuses.

The opening provided to give access to transformer and fuses is closed by means of a door which is fitted top and bottom with a flange. By means of this the door may be screwed to the pole if desired and with the aid of gaskets the joint may be made moisture-tight.

The Distributing Head

In the pole arranged for overhead distribution the low-tension cables terminate in a hard-maple block as illustrated in Fig. 6. This consists of a cylindrical lower portion which fits snugly into the top section of the pole and a square upper portion upon which the connecting posts are mounted. As shown, the block is provided with three secondary leads for use in the Edison three-wire system.

In Fig. 1 the distributing wires are shown supported in a simple manner by a metal ring. A more elaborate method is illustrated in Fig. 5, where a metal ring is carried on four straps preferably riveted to the top section of the pole. The cables are clamped to the ring by hook clamps. Either type of head described can be readily covered for protection against weather.

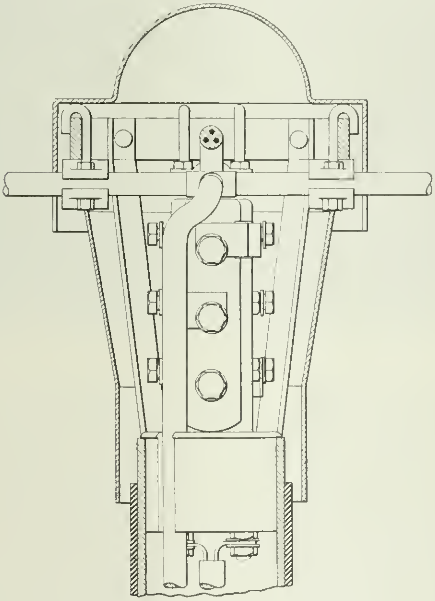


FIG. 5—POLE TOP, SHOWING PROVISION FOR HIGH-TENSION CABLE

The Transformer

The special design features of the transformer for this pole lay in securing a compact, cylindrical form and in the provision of protecting shields and conveniences for handling in the restricted space. A 5-kw transformer is shown in Fig. 4. It is of the shell type with the laminations in the vertical plane. The sheets of the core are clamped together by means of bolts and angle-irons, the latter serving also to form projecting feet to support the core. The two pairs of clamping irons are cross-connected with spacing bolts, the upper pair of which serve to support insulating clamps for the primary and secondary leads. Iron handles are made by bolting arched straps from angle-iron to angle-iron over the top of the core. The coils are protected from injury by sheet-iron shields.

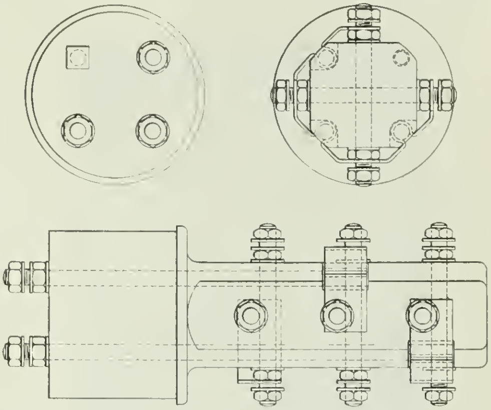


FIG. 6—HARD-MAPLE TERMINAL BLOCK

One of the most interesting features of the design of this transformer is its large output for the given quantity of material. On account of the liberal surface provided by a much greater depth of oil than is usual, the capacity of the transformer is probably 33 per cent greater than it would be were the oil surface but slightly above the top of the core. Not only is the cooling surface large, but the oil circulates well and conveys heat rapidly to the pole shell.

Wiring and Cut-Outs

The primary leads, entering either from below or above, pass directly through the cut-outs which are conveniently reached from the door. When the fuses are removed all apparatus in and on the pole can be handled with impunity. The cables connecting the cut-outs and the transformer can be bent out of the way through the doorway when the transformer is to be removed from the pole, as can also the secondary cable which is secured by a clamp at the top of the transformer pole section.

As compared with the ordinary method of mounting outdoor transformers on poles and walls, the transformer pole described is much more attractive in appearance. It is expected also that the handling of transformers and fuses from the ground will prove more convenient. Such handling is facilitated by the form of the transformer and by its light weight for a given output. For repairs only the core and windings need be removed, whereas with the usual type it is necessary to take down the complete outfit to repair a defective unit. The use of the distribution head is expected to simplify the making of low-tension connections particularly, by rendering it unnecessary for the linemen to climb among the overhead wires for this purpose.

Not the least important among the anticipated savings with the new design is the protection of the transformer from lightning disturbances. The pole forms a grounded protecting shell and will undoubtedly divert most of the lightning discharge to the ground.

Elaborate Temporary Sign and Flasher Installation

To install an elaborate electric sign and outline display on a building for only three weeks' use is rather unusual, but this was done during the holiday season by the Houghton & Dutton Company, Boston, to attract Christmas shoppers to its store. The sign, which represented Santa Claus shooting rockets, measured 24 ft. high and had a spread of 70 ft. It was made of sheet steel in sections convenient for assembling and, knocked down, was brought to the building on three large four-horse trucks. Two weeks were required to erect the display.

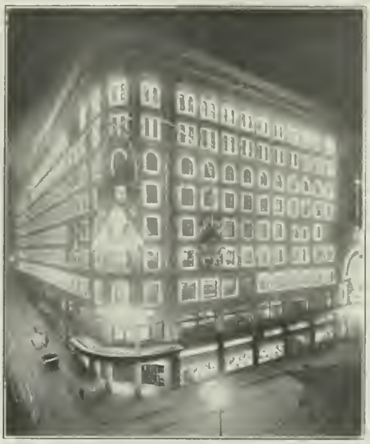


FIG. 1—SIGN FOR CHRISTMAS DISPLAY

The figure of Santa Claus was placed at the corner of the building, and the strings of lamps representing the streams from the rockets extended along two intersecting walls. When operated, the figure appeared to raise its arms, holding in each hand a rocket, the streams from which shot in opposite directions, each finally bursting into a shower of stars. Below the stars figures of toys flashed into view. On one side appeared a hilarious jumping-jack, while on the other was a rocking-horse. The sign proper contained 1700 30-watt lamps, and its operation was made more effective by the flasher shutting off about one-third of the building outline lamps, of which there were 10,300 30-watt units.

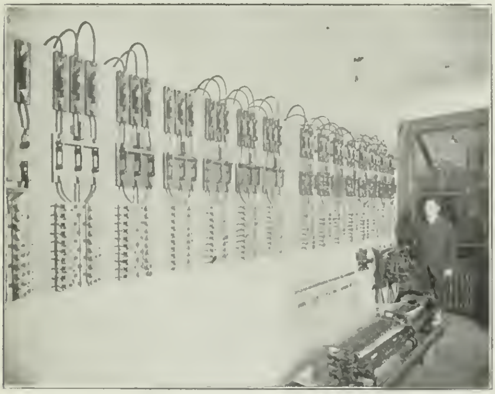


FIG. 2—SPECIAL ASBESTOS-BOARD SWITCHBOARD AND FLASHER

The flashing mechanism, which was unique and necessarily rather complicated, was combined with a specially designed asbestos switchboard on which were mounted sixteen knife switches and 160 fuse plugs. These switches controlled the window outline lamps and a small flasher which, after running one minute, caused a current of 3 amp to close a relay on the large contactor switch. This in turn operated the sign and simultaneously extinguished one-third of the building outline lamps. The total load, which was carried by the Edison Electric Illuminating Company of Boston, amounted to 360 kw. The sign was removed after the Christmas season closed.

Indirect Lighting in the Home

About five years ago Mr. Augustus D. Curtis, president of the National X-Ray Reflector Company, Chicago, read a paper and gave a demonstration of indirect lighting at his home in that city, before the local branch of the Illuminating Engineering Society. The system of shades and reflectors used was somewhat crude, but the subject immediately awakened great interest, and since that time there has been a remarkable development in indirect lighting. This development has, however, been shown to the greatest extent in churches, theaters, club houses, assembly rooms, counting rooms and business offices. Indirect lighting has made comparatively little progress in the home, where the modern movement was begun.

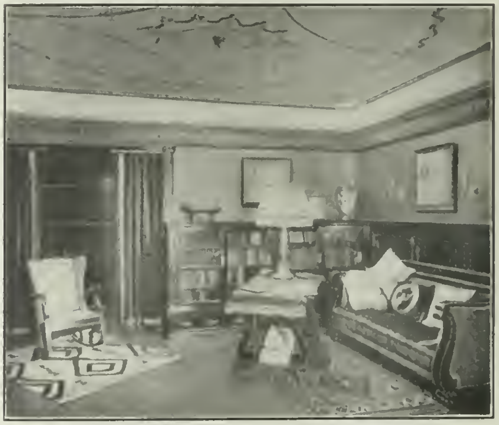


FIG. 1—LIBRARY, SHOWING PORTABLE TABLE LAMP FOR INDIRECT LIGHTING

Recognizing this fact, and desiring to show that progress has been made in this method of illumination for residence lighting, Mr. Curtis threw open his home at 5528 East End Avenue, Chicago, on the evening of Dec. 10 and read a paper before the Chicago Section of the Illuminating Engineering Society on "Five Years' Progress in the Indirect Lighting of the Home." Ladies were invited and a considerable number were present, the total attendance being about sixty-five.

In his paper Mr. Curtis commented on the remarkable development that has been made in methods of indirect lighting during the five years that have elapsed since his original paper. He dwelt on the importance of reflectors and explained the principle of the so-called "luminous reflectors." He criticised much of the so-called "semi-indirect" lighting and said that the principle of indirect lighting should be preserved and not more than 10 per cent or 15 per cent of the light should be used for ornamental or decorative purposes, which is about the proportion in the case of the luminous reflectors. In some of the semi-indirect lighting fixtures there is a failure to direct the light rays to the best advantage and the bowls are too brightly illuminated.

The earlier meeting at Mr. Curtis' house in 1908 was perhaps the inception of the great movement of the present day for eye comfort and the conservation of vision by concealing light sources. Mr. Curtis added that nearly thirty appliances for indirect lighting have recently made their appearance, and he said that about 100 fixture manufacturers are now putting out indirect-lighting apparatus. He predicted that in many public rooms and elsewhere the use of indirect lighting without ceiling fixtures will be greatly extended. This will be accomplished by the use of pedestals, brackets and cornices, while the backs of settees, tops of bookcases, newel-posts and other interior features of the house can be utilized to conceal light sources.

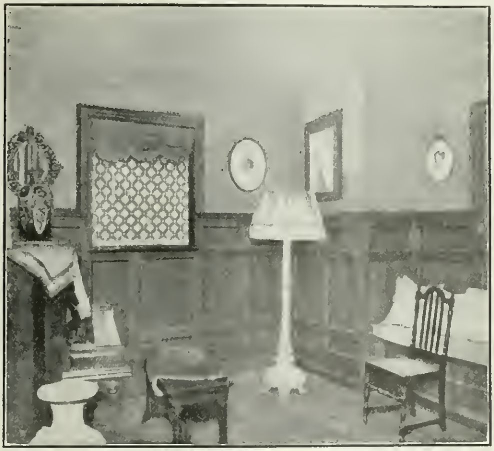
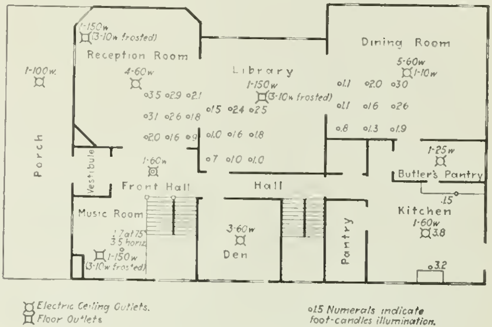


FIG. 2—FLOOR-LAMP ILLUMINATION IN MUSIC ROOM

Mr. Curtis then proceeded to describe the varied and beautiful indirect-lighting fixtures installed in his own home. These are indicated diagrammatically on the accompanying floor plans. Different types of fixtures are used in different rooms, pedestals and portable lamps being employed in the reception room, music room and library, ceiling fixtures in the dining room, bedrooms and bathrooms, bracket fixtures in the halls, etc. The kitchen is the one room where direct lighting is used. An interesting feature is the selection of an indirect-lighting fixture for lighting the porch. Referring to the plan of the second floor, it will be noted that the light intensity in the rear bathroom is much greater than in the front bathroom, although the type of fixture used and the consumption of energy are practically the same in the two rooms. The difference is due to the color of the ceilings and side walls. In the rear bathroom, where white is the color used, the intensity is 2.9 ft.-candles, as indicated on the plan, while in the front bathroom, where the corresponding color is yellow, the intensity is but 1.9 ft.-candles. One pleasing bedroom fixture in Mr. Curtis' house was illustrated in the *Electrical World* of Nov. 1, 1913, page 906.

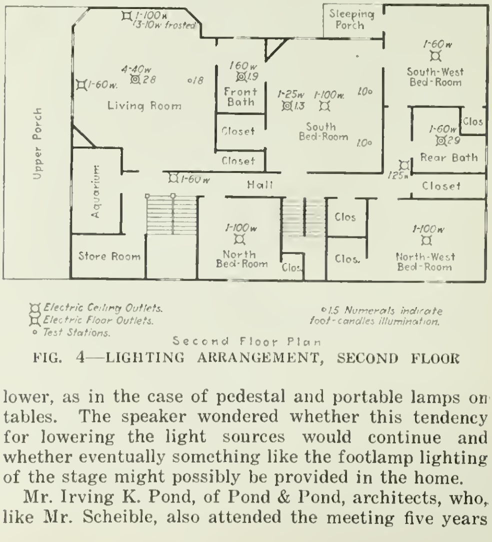
Dr. M. G. Lloyd, chairman of the Chicago Section, presided at the meeting and in a few introductory remarks pointed out the great progress that has been made in the last five years in all forms of lighting and not in indirect lighting alone. He also referred to the injurious effect of highly calendered paper in causing reflection from artificial light sources and told the women present that parents should realize the harm that may be done to their children by the use of glossy paper in schoolbooks.



First Floor Plan

FIG. 3—LIGHTING ARRANGEMENT, FIRST FLOOR

Mr. Albert Scheible, Chicago, said that the opposition which indirect lighting had encountered has been a good thing, as it exposed the defects of the system and caused it to stand on its own merits. He praised the work of Mr. J. R. Cravath, Chicago, as well as that of Messrs. Morgan and Curtis in indirect lighting. In relation to Mr. Curtis' house, he commented on the fact that the interior architectural effects, as in the rounded corners between sidewalls and ceilings, the tinting and the like, are all favorable to indirect lighting. The beautiful effects that the guests saw before them were the results of skilful combination of the work of the architect and the illuminating engineer. Mr. Scheible commented on the absence of much of the "eyebrow shadows" caused by the early indirect lighting. This probably is partly due to getting the fixtures down lower, as in the case of pedestal and portable lamps on tables. The speaker wondered whether this tendency for lowering the light sources would continue and whether eventually something like the footlamp lighting of the stage might possibly be provided in the home.



Second Floor Plan

FIG. 4—LIGHTING ARRANGEMENT, SECOND FLOOR

Mr. Irving K. Pond, of Pond & Pond, architects, who, like Mr. Scheible, also attended the meeting five years before, commented on the development in indirect lighting from floor and portable lamps. As to stage lighting, Mr. Pond remarked that footlamps are being done away with in some of the newer theaters, the lighting effects being obtained largely with side lamps and border lamps. Mr. Pond commended the advancement in the artistic side of artificial lighting. He thinks that indirect lighting has a great future in the home. However, in a drafting room, while indirect lighting is excellent for general illumination, it should be supplemented to some extent by direct lighting over the drawing boards. The general advancement in five years has been in both the efficiency and the charm of indirect lighting.

Mr. James R. Cravath spoke of the importance of the color of the walls and ceilings from which the light is reflected. Great advancement has also been made in so controlling and directing the light from indirect fixtures as to avoid unpleasant shadows.

Several ophthalmologists were present. Dr. Nelson M. Black, of Milwaukee, spoke briefly and was followed by Mr. W. H. Wilder, of Chicago, who said that the movement for indirect lighting is a very important one. Certain eyes are peculiarly sensitive to rays given out by incandescent electric lamps. Perhaps other than light rays may be given off from such lamps. At any rate, the action of strong direct light from incandescent electric lamps seems to injure the eyes of some people who are particularly susceptible. Possibly a chemical change is made in the visual purple of the eye by some radiation from incandescent electric lamps. The concealment of light sources is obviously of great importance in protecting such eyes. However, the speaker agreed with Mr. Pond that in many cases, as possibly in reading rooms, there should be some method of detail or individual direct lighting to supplement general illumination by indirect lighting. Dr. E. V. L. Brown, secretary of the Illinois Association for the Conservation of Vision and Prevention of Blindness, spoke briefly. Opportunity was given to all present to make an inspection of the lighting features on the two floors of the house.

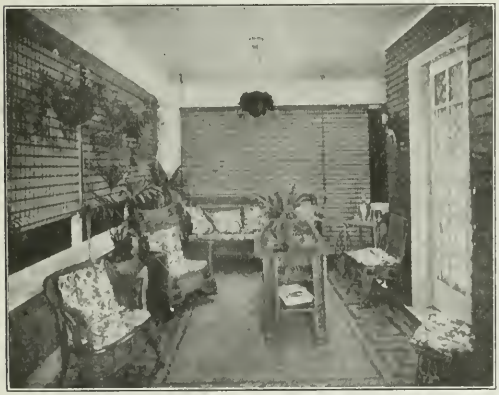


FIG. 5—INDIRECT LIGHTING ON PORCH—BOWL DRAPED WITH FERNS

Recent Telephone Patent

A call-registering system has been invented by Mr. S. D. Williams, of Newport, Wales, in which registration is made both at the exchange and at the subscriber station. At the origination of a call the apparatus is set, but the call can be registered only by the operator. If a call fails, no record is made and subsequent incoming calls may be held without being counted. The counting is so safeguarded that only one registration is possible for each call.

Letters to the Editors

High-Frequency Alternator

To the Editors of the Electrical World:

Sirs:—In an article in *La Lumière Electrique*, Paris, for Sept. 13, as pointed out in your Digest of Current Electrical Literature, *Electrical World*, Nov. 8, 1913, there was given an account of a high-frequency alternator devised by M. Bouthillon, in which he superposes in a conductor a certain number of periodic emfs of equal frequency but with proper phase differences between them, and predicts that the frequency of the resulting emf will be a certain multiple of the original frequency.

I beg to point out that the same principle is described in my British patent, No. 8853, 1911. There the principle is introduced of obtaining either a threefold or ninefold (or any other multiple of three) frequency by starting with a supply emf of either three phases or nine phases (or any other multiple of three), magnifying a certain harmonic in each phase, and finally combining all the effects in a single secondary circuit.

Avondale, Kingsheath, England. A. M. Taylor.

The Edison Battery

To the Editors of the Electrical World:

Sirs:—Will you kindly allow me to protest against the statements made by Mr. Lamar Lyndon in his article published in your issue of Jan. 3? Without further comment the reader is likely to infer that the Edison battery is laboring under serious "handicaps" as to first cost and efficiency. Mr. Lyndon's reference to "the excessive current required for their charge" is particularly misleading to the prospective purchaser of an electric vehicle, although it might possibly appeal to the central station selling the energy. As a matter of fact, the actual increase in operating cost resulting from the "excessive" current demand amounts to 1 or 2 per cent—a quantity less than nothing when placed next to any one of plenty of well-known advantages of the alkaline cell in service.

When quality and value demand and warrant it, high first cost is never a "handicap" but rather an advantage. The customer of a high-priced article naturally examines its relative merits with extreme thoroughness and every sale reflects credit on both the buyer and seller. The *Electrical World's* subscription price is three times that of many of its contemporaries, but we doubt if Mr. Lyndon or the *Electrical World* considers this a "handicap." Furthermore, we are quite sure Mr. Lyndon would not recommend to his clients any battery costing one-third the price of the Edison.

Your paper has probably been one of the most potent influences in the development of the electric-vehicle industry. Its consistent and efficient work deserves more support than it often gets. At this time, when the prospects for an immense growth are so bright, commercial innuendoes that tend to befog the enthusiast and prevent the conversion of those who have not yet grasped the opportunities offered by electric traction should be eliminated from its columns. Let 1914 be a year of boosting. Let those who wish use a battery bought for one-third the price of the Edison if expert attention makes it satisfactory and publish the record of the results as to life, efficiency, maintenance, etc. But for the good of the cause no one should intimate that a battery selling for two or three times as much is not two or three times as good.

ROBERT A. BACHMAN,
Vice-president and General Manager
Edison Storage Battery Company.

Orange, N. J.

The Electrification of Trunk Lines

To the Editors of the Electrical World:

SIRS:—Your editorial of Dec. 27, 1913, entitled "The Electrification of Trunk Lines" I have read with great interest, and I most heartily indorse the sentiment therein expressed, not only in my individual capacity but as an official representative of the Westinghouse Electric & Manufacturing Company.

I should hesitate to address you officially on this subject but for the fact that you state in your editorial that you believe that the art cannot make progress "by the mutual abuse of competitors." As there are only two firms in America which compete for this class of work, of which the Westinghouse Electric & Manufacturing Company is one, it is quite obvious that that company is one of those at which your censure is directed.

I desire to point out that, in common with many others, you hold an erroneous opinion of the position and policy of my company, and to challenge you or any one else to show that my company has ever "abused" a competitor, either directly or indirectly, in an endeavor to establish its position on the question of the proper system to adopt in the electrification of trunk lines or on any other matter.

My company, in developing and exploiting the single-phase system of electric traction, admittedly made a contribution of great value to the electric art. Coincident with the announcement of the development of the system, and especially when it became known that the Westinghouse company had entered into a contract for the electrification of the New Haven road, there began a campaign of misrepresentation and criticism which still continues and which has only one parallel in my experience. By innuendo, by distorted statement and by improper methods every effort has been made to discredit the single-phase development as exploited by my company. About twenty years ago, and by identical methods, the utmost efforts were made to discredit and even to prevent the introduction of the system of distribution by alternating currents which had been brought out and was being advocated by the Westinghouse Electric & Manufacturing Company.

On the occasions when we felt called upon to defend our engineering judgment, especially in the matter of the use of single-phase apparatus on the New Haven road, we were put in the position of apparently advocating the single-phase system as opposed to every other system of electric traction, and for every possible condition of service, notwithstanding the perfectly plain record of my company, which is pre-eminent in railway work, not only in single-phase installations but also in direct-current, 600-volt direct-current, 1200-volt and 1500-volt, and in three-phase applications.

The Westinghouse Electric & Manufacturing Company has electrified more miles of railway under each of the recognized systems than any other company in the world.

While the so-called "battle of the systems" has been raging, with the time-honored method of creating an enemy of straw and then dispatching him with great noise and confusion—wherein my company has been featured as the valiant champion of the straw man and as opposing to the last ditch the development or adoption of high-voltage direct current or any other system than single-phase—we have quietly been filling orders, so that to-day I believe there are more 1500-volt direct-current equipments in operation of Westinghouse manufacture than of any other make.

So with three-phase traction. While our engineering judgment has led us to advise against its use in certain situations, we have strongly advocated it where we believed it was suited, and in the Italian State Railways there exists the greatest three-phase traction installation in the world, and of Westinghouse manufacture.

The truth can never catch up with the lie it seeks to refute, so that some otherwise well-informed engineers are still firmly convinced that the New Haven installation is a complete failure and of small consequence anyway, whereas the facts show that while it constitutes the greatest and most difficult main-line electrification in the world, it is, much to the chagrin of the prophets of evil, a complete success in every particular.

In an editorial, over my signature, in the *Electric Journal* in the issue of October, 1913, I made the following statement:

"For a number of years there has been carried on, in the public press and elsewhere, a controversy which would lead a layman to believe that there was a much wider difference of opinion as to the efficiency of certain systems of electric traction than has actually been the case. As a matter of fact, competent authorities have all along been in substantial agreement and have recognized that most of the problems of steam-railway electrification may be solved satisfactorily in more than one way, while at the same time recognizing that any system which fulfils the requirements of successful operation must of necessity embody certain fundamental characteristics which are well known and appreciated. It could scarcely be expected that railway managers would be unaffected by this controversy on the part of the misguided persons who have been fighting the imaginary 'battle of the systems,' and it would have been natural for them to draw improper conclusions as to the real attitude of those engineers and manufacturers who were and are actually creating and producing apparatus for such service."

This statement is in substantial agreement with your editorial. It is the official opinion of the Westinghouse Electric & Manufacturing Company. The company has taken no part in any "battle of the systems." Its best engineering judgment is at the disposal of its clients and customers. That this is valued and appreciated is best evidenced by the size and quality of the contracts intrusted to it for execution.

The Westinghouse Electric & Manufacturing Company does not need to seek trade by misrepresenting or abusing its competitors. One of the fundamental and cardinal principles of its business is never to run down a competitor's goods. This principle is instilled into every apprentice, every salesman and every employee who has any possible contact with the public, and this has been its policy for twenty-five years.

We object to being included in the category of those who feel it necessary to belittle and misrepresent the accomplishments of others in order to further their own interests.

L. A. OSBORNE,
Vice-president Westinghouse Electric &
Manufacturing Company.

East Pittsburgh, Pa.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Changing Lighting Distribution in Detroit from Two to Three-Phase

On account of the increasing demand for motor service in Detroit's municipal buildings, the Public Lighting Commission of that city is changing the municipal electric distribution system from two-phase to three-phase.

At present all of the energy for street and municipal building lighting is being generated at one station by four two-phase, sixty-cycle, 2300-volt alternators having a total rating of 5200 kw. From this station electricity is transmitted at 5500 volts and 6600 volts to five distributing substations. One of these has just recently been completed and is equipped to supply 2000 alternating-current arc lamps, although only 457 are connected now. The rest of the substations distribute energy to 1644 luminous-arc lamps and 2084 alternating-current arc lamps. The transformer equipment of each substation comprises several sets of transformers so that a defective lamp circuit may be isolated from the substation bus.

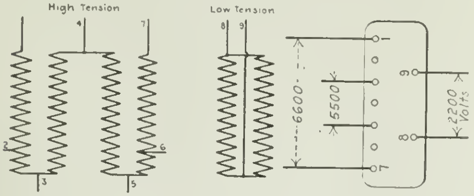


FIG. 1—CONNECTION OF TRANSFORMER WINDINGS

Thirty-two seventy-five-lamp and one fifty-lamp mercury-arc rectifiers and regulators are installed in the main station for supplying energy to the direct-current lamps in the immediate vicinity of the station.

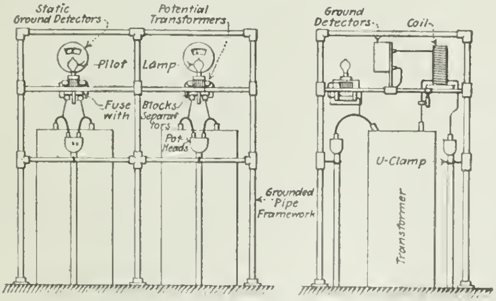


FIG. 2—SPECIAL RACK INCLOSING SCOTT TRANSFORMERS

To effect the change to three-phase distribution for motor service, Scott-connected transformers will be installed in the substations and energy transmitted to them from the main station at 6600 volts. One substation has already been thus converted and is receiving energy over an underground circuit.

Three-phase energy for motor service in the business district will be furnished direct from the main station by a special Scott-connected General Electric transformer set consisting of two 500-kw units. The accompanying diagrams show the transformer taps used for single-phase and for three-phase distribution, the former being used until the distribution is changed.

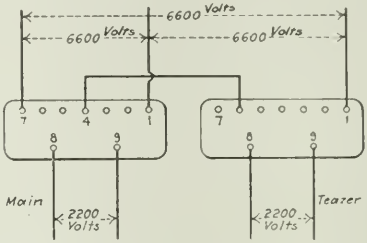


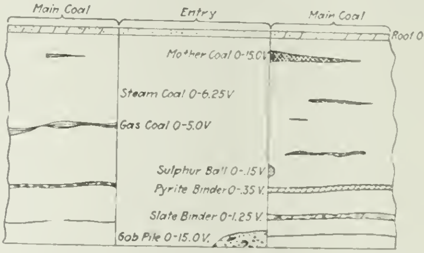
FIG. 3—SCOTT TRANSFORMERS AT DETROIT PLANT

The special transformer set is on the engine floor alongside of one of the 2000-kw turbo-generators. Both primary and secondary leads are carried through lead conduits which emerge from the floor directly in front of and back of each unit as shown in Fig. 2. The conduits rising from the floor, the pilot lamps and the ground detectors are all supported on a grounded-pipe framework built around the set.

Mr. Frank R. Mistersky is general superintendent of the plant.

Ground Currents as Causes of Premature Blasts

In setting blasts in mines the charges sometimes go off prematurely, causing serious injuries to the men who have not had time to withdraw from the workings. A variety of explanations have been given for these accidental explosions, but in an address before the Coal Mining Institute, Pittsburgh, Pa., Dec. 5, Mr. W. F. Edward, Greensburg, Pa., reported his investigations of underground electric currents in the strata and seams of several mines, and suggested that these stray currents may be short-circuited by the ignition wires setting off the blasts. With a voltmeter Mr. Edward found

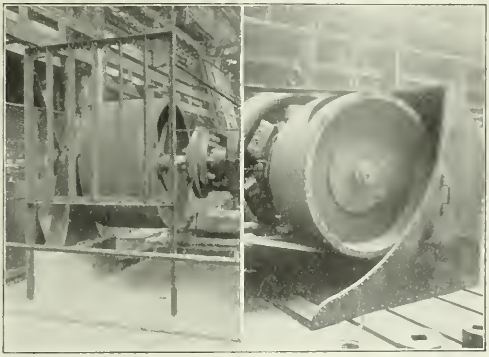


RANGE OF VOLTAGE IN DIFFERENT STRATA

emfs of 15 volts and higher, although these pressures were transient in character, appearing and disappearing with no apparent regularity. To avoid crosses with ground currents when employing metallic firing needles he urged the use of fibrous or wooden points boiled in paraffine. When using the electric method of firing he suggested that both wires be incased in a common metallic spiral tubing which should extend within a few inches of the coal.

Protection of Moving Belts and Gears

Forms of stationary and portable belt guards in use in the shops of the Westinghouse company at East Pittsburgh, Pa., are shown in the accompanying illustrations. The stationary guard is constructed of pieces of angle iron bolted together, the whole device being fastened in place by means of stay rods attached to the frame of the machine and to the outboard bearing. Supports at the base of the guard are cemented into the floor. By constructing the guard with the intermediate bars arranged vertically a breaking belt will strike at least three of the angle irons, while if the bars were fixed horizontally a condition might arise in which only one bar would be required to take the entire strain. One angle iron of the size here used would hardly be sufficient to stop a large belt, but three should afford ample protection.



FIGS. 1 AND 2—STATIONARY AND PORTABLE BELT GUARDS

On the test floors the portable belt guard has been found to be a valuable appliance, for in this work all installations are temporary and the men do not always spend the time on belt lacing that they would if the job was to be permanent. Here also the machines are subjected to overloads seldom met in practice, and the belt strains at times reach enormous values. As shown in the illustration, the portable guard is made of heavy-gage sheet steel riveted to an angle-iron frame. Two men at the handles can carry the device easily from one test to another, as occasion arises for changes.

Nearly all of the switches controlling motors and lighting in the plant are now inclosed, one of the most common types of box being shown in Fig. 3. This protector is made of red fiber and is left open at the top so that the handle of the switch can be reached quickly by the machine operator. Instructions are printed on the white card shown on the box. Another style of switch protector in common use is a box made of the same wire-mesh construction as that used in the gear and chain guards in Figs. 3 and 4.

Wherever gears or flexible chain belts are in use on the exterior of machines, protectors made of medium-weight sheet steel or of wire mesh are used.

In connection with the geared machines the inspectors of the safety department often find exasperating conditions prevailing. Recently a large geared lathe was fitted with a complete set of guards at a cost of $340. Soon afterward the entire protective equipment was found on the floor beside the machine with the exposed gears revolving at their customary speed. Investigation showed that after a gear change the operator had considered it unnecessary to replace the protectors.

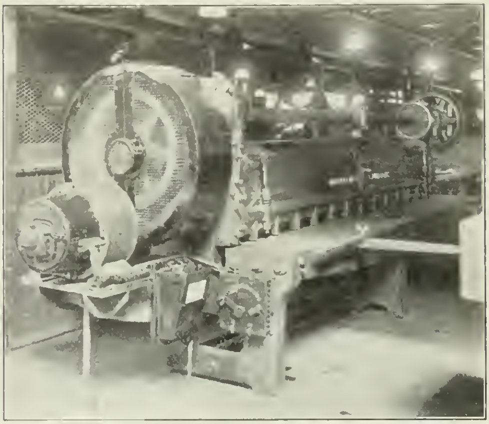


FIG. 3—SAFETY SWITCHBOX AND GEAR CASING

In another instance sanitary drinking fountains were installed plentifully in the coil-winding room, where a large percentage of the employees are girls. However, the well-meaning sanitary department had reckoned without taking into consideration the feminine viewpoint, and it was soon found that the drinking fountains were not used by the girls for whom they were intended, for the reasons that shirtwaists were splashed (and some complexions injured) on coming in contact with water.

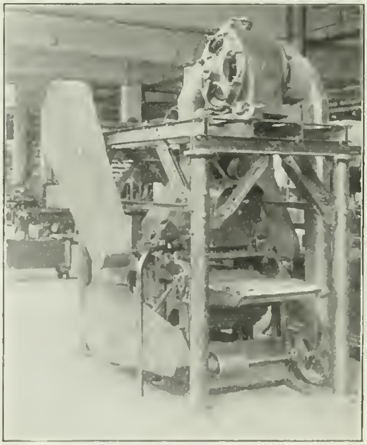


FIG. 4—MESH INCLOSURE OF CHAIN DRIVE

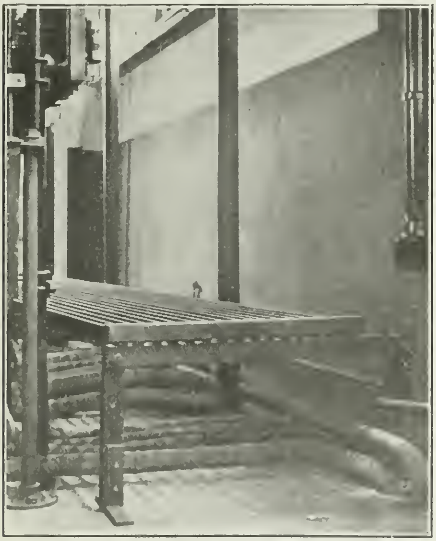
Thus, although good work has been done and is being steadily continued, constant and persistent effort is necessary to guard the average workman from the consequences of his own carelessness and indifference.

Electric Crane Aids in Tearing Up Concrete Floor

A concrete floor in the factory of a large industrial plant recently became so irregular after long use that it was deemed wise to replace it with a new surface. Tearing up the existing concrete loomed as a good deal of a problem until one of the company's employees conceived the idea of using the electric crane to raise and drop a heavy piece of iron for breaking up the floor. This skull-cracker arrangement, which proved to be similar to the scheme used for breaking up scrap castings in steel mills, operated admirably, breaking up the concrete and later removing the large pieces much more quickly and easily than it could have been otherwise accomplished.

Safeguarding the Rear of a Switchboard

In an industrial substation originally designed for overhead cable runs at the rear of the switchboard it became necessary to abandon the plan and run the local distribution circuits across the floor to conduit leaving the building at the rear wall. To facilitate safe working behind the board the grating shown in the accompanying photograph was installed. The grating consists of seventeen ¼-in. by 1½-in. wrought-iron bars laid 1½ in. apart on centers and carried at the ends upon a frame built of 2-in. by 2-in. by ¼-in. angles bolted into the wall and floor as shown. The horizontal bars are supported at five points in the switchboard length of 21.5 ft., and intermediate braces of ¼-in. pipe are provided at intervals of 30 in. The grating affords a walkway 24 in. wide carried 16 in. above the floor, leaving ample space below for the cables and permitting the full use of compressed-air cleaner service, protecting both the operators and the outgoing lines.



SAFEGUARDED PASSAGEWAY BEHIND SWITCHBOARD

Self-Extinguishing Lamps for Stairways

I am equipping a new apartment house with electricity, and a friend who recently returned from Europe has suggested that I install automatic stairway lamps such as are generally used abroad, instead of burning the hall lamps all night long. What kind of switches can I use for this purpose? L. M. N.

In Europe many of the apartment houses are provided with automatic stair lamps which can be lighted by the touch of a button at the bottom or top of the stairs. The lamps burn for two or three minutes, automatically extinguishing themselves at the end of this period. This arrangement gives the late-comer ample time to ascend the stairway (lighting each flight successively if there are several) and it has the advantage of saving the all-night use of the lamps. Such a scheme would, however, be less adaptable to American practice because most cities here have ordinances requiring landlords to operate hall lamps all night long. On the scale of other costs, also, electrical energy is cheaper in this country than abroad, so that less need exists for economizing in kilowatt-hours. The automatic switches used in Germany are based on one of the dash-pot, hot-wire or clock-work principles, the last-named being the one most generally employed. They extinguish the lamps at the end of two or three minutes, after the tenant has had time to reach his apartment if entering, or to pass through the street door if leaving the building. The controlling push-buttons are conveniently placed at each door, where the incoming tenant can unerringly put his finger on them, however dark it may happen to be.

Specific Consumption of Light Sources

State the approximate number of watts per candle-power consumed by the following types of lamps: (a) carbon-filament; (b) graphitized-carbon-filament; (c) tantalum; (d) osmium; (e) tungsten; (f) Nernst; (g) mercury-vapor; (h) Moore tube; (i) open-arc; (j) inclosed-arc, and (k) flaming-arc. P. E. B.

Figures of this nature vary considerably on account of the many different conditions encountered. Incandescent lamps are commonly rated on a mean horizontal candle-power basis and show spherical reduction factors of 0.78 to 0.85. Arc lamps are best rated directly in mean spherical candle-power. The following watts per mean candle-power, as specified, give the approximate ranges of specific consumption for the various types of lamps enumerated:

	Mean Horizontal Cp
Carbon-filament (low voltages)	3.00 to 3.50
Carbon-filament (high voltages)	3.50 to 4.00
Graphitized-carbon-filament	2.50 to 3.00
Tantalum	1.75 to 2.25
Osmium	1.00 to 1.50
Tungsten	0.90 to 1.20
Tungsten (large units, nitrogen-filled)	0.50 to 0.80
Mercury-vapor (glass tube)	0.50 to 0.70
Mercury-vapor (quartz tube)	0.25 to 0.40
Moore tube	1.50 to 2.50

	Mean Spherical Cp
Nernst	1.75 to 2.50
Open-arc (direct-current, clear globes, below 1 watt only with heavy currents)	0.60 to 1.25
Open-arc (alternating-current, clear globes)	0.80 to 1.60
Inclosed-arc (direct-current, multiple, opal inner and clear outer globes)	2.50 to 3.50
Inclosed-arc (direct-current, multiple, opal inner and outer globes)	2.50 to 4.00
Inclosed-arc (alternating-current, multiple, opal inner and clear outer globes)	2.50 to 3.00
Inclosed-arc (alternating-current, multiple, opal inner and outer globes)	2.75 to 5.00
Inclosed-arc (direct-current, series, with clear globes)	2.00 to 2.50
Flaming-arc (series, clear globe)	0.30 to 0.60
Flaming-arc (multiple, clear globe)	0.30 to 0.60

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Mercury-Vapor Rectifier.—K. Norden.—An illustrated account of the development of the large-capacity mercury-vapor rectifier of the General Electric Company, of this country, and of the Allgemeine Elektricitäts Gesellschaft. The special feature of the latest design of the latter company is the arrangement of the anodes in such a way that no mercury can be deposited on them (which would interrupt the valve action and produce a short-circuit between the electrodes). For this purpose the anodes are mounted in special side arms outside of the rectifier proper, and the side arms are curved so as to get the anode entirely out of the path of the cathode flame. This construction also permits easy cooling of the anodes. Some data are given on a 100-kw, 300-amp, 350-volt mercury-vapor rectifier. A test at 100-kw load extending over four hours showed a practically constant efficiency of 90 per cent. —*Elek. Zeit.*, Dec. 25, 1913.

The "Cogging" Effect in Induction Motors.—H. L. Smith.—A note on a paper read before the Rugby Engineering Society. The "cogging" of squirrel-cage motors is due to zigzag leakage and may therefore be expected to be greatest in motors with short pole pitches and small numbers of slots per pole—i. e., slow-speed motors—and least in high-speed motors. Without deleterious results, therefore, the rotor slots for machines with a small number of poles can be larger and fewer in number than for machines with a large number of poles. The practice of making the number of rotor slots incommensurable with that of the stator slots is effective so long as the rotor is central. But when the bearings wear the bulk of the zigzag flux is on one side and the stator develops a "governing" tooth and slot. As every rotor tooth passes the governing slot it is made alternately easier and more difficult for the zigzag leakage to pass, and the rotor tends to stick in the position of minimum reluctance. But the flux in the governing tooth is zero twice in a cycle, and at each of these two instants the rotor is free to move forward one rotor-slot pitch. If the zigzag leakage is bad enough, the machine will continue to run at this peripheral speed of two rotor-slot pitches per cycle. A three-phase, squirrel-cage, four-pole, 220-volt, 0.25-hp motor having twelve slots on the stator—i. e., one slot per pole per phase—and twenty-three on the rotor, with a dispersion coefficient about 17 per cent, exhibited this tendency well. The peripheral speed at synchronism of this machine is eleven and one-half rotor slot-pitches per cycle, and the speed of zero cogging was two rotor slot-pitches per cycle, or 4.23 times that of synchronism, i. e., 260 r.p.m. Owing to the short-circuit current being smaller relative to the normal current than is the case with any ordinary motor, the rotor may be held stationary with full voltage on the stator for quite a length of time without the machine getting unduly hot, or the applied voltage may even be transformed up, when all these cogging effects may be exaggerated.—London *Elec. Eng'ing*, Dec. 25, 1913.

Magnetic Fields.—L. Barbillon.—The first part of a mathematical paper, illustrated by diagrams, on magnetic fields of various forms and the electromotive forces induced by them. The author first takes up a field varying only in space and not varying in time, and gives the formulas for fields produced by salient poles and for fields produced by uniformly distributed windings. He then takes up the discussion of fields varying both in time and space.—*La Lumière Elec.*, Dec. 20, 1913.

Phase Compensator.—F. Niethammer and E. Siegel.—An article on the phase compensator of Brown, Boveri & Company. The authors first discuss the phase compensator alone by giving a theory of the behavior of a direct-current armature with commutator and brushes, on which a polyphase alternating-current voltage is impressed. The author then discusses the combination of an induction motor with a compensator, the dimensions of the compensator, sparking at the brushes, and the driving and regulation of compensators.—*Elek. u. Masch.* (Vienna), Dec. 21, 1913.

Zigzag Winding Diagrams.—Humphry MacCallum. —The author thinks that while a very large number of "series" or "wave" wound direct-current armatures are in use nowadays, this type of winding is not always thoroughly understood. He discusses the subject with the aid of simplified "zigzag" diagrams.—London *Elec. Review*, Dec. 26, 1913.

Heating Dynamo-Electric Machinery. — Oskar Szilas.—The conclusion of his illustrated mathematical article on graphical methods for determining the heating of electric machines and transformers. The present instalment deals with transformers.—*Elek. u. Masch.* (Vienna), Dec. 21, 1913.

Lamps and Lighting

Mercury-Vapor Lamp.—Billon-Daguerre.—A note on a water-cooled mercury-vapor quartz-tube lamp with projecting mirrors. The lamp consumes 18 amp at 70 volts, or about 1250 watts, and gives about 3000 cp. The principal feature of the lamp lies in its production of practically "cold" light. For example, this light may fall for any length of time on celluloid, etc., without producing a heating effect on or deformation of the illuminated portion. This feature is especially advantageous for microscopy and photography.—*La Revue Elec.*, Dec. 19, 1913.

Generation, Transmission and Distribution

Combined Mercury-Vapor and Steam Turbine Units. W. L. R. Emmett.—An article on "power from mercury vapor," the object being to get a much higher efficiency from a turbine plant, operating on both mercury vapor and steam than from a turbine using steam alone. In the present instalment the author gives such data concerning mercury vapor as are required for a thermodynamic investigation of the problem. The process proposed is briefly as follows: Mercury is vaporized in a boiler heated by a furnace of the ordinary type. From this boiler it passes at a pressure near or not much above the atmosphere to the nozzles of a turbine which drives a generator or other load. From this turbine the exhaust is led to a condensing boiler where it is condensed on the outer surface of the tubes, which contain water; this water is vaporized by the heat delivered, and the steam produced is used to drive other turbines or for any other purpose. This condensing boiler is preferably placed at a level above the mercury boiler so that the condensed liquid will run back into the mercury boiler by gravity without the aid of a pump. Since the mercury vapor is much hotter than the steam, the gases will normally leave the mercury boiler at higher temperatures than those at which they leave a steam boiler. To utilize this excess heat it is proposed to convey the gases after leaving the mercury first through a heater which raises the returning liquid to a temperature near the boiling point; second, through a superheater which superheats the steam delivered by the condensing boiler, and, third, through an economizer which heats the feed water for the condensing boiler and so reduces the gases to the lowest practicable flue temperature.—*Gen. Elec. Review*, January, 1914.

British Power Companies.—The annual statistical tables of British electric power companies with data on equipment, distribution systems and maps.—Supplement to London *Electrician*, Dec. 26, 1913. In an editorial analysis of this table it is pointed out that the tables present the record of a great experiment and of a failure almost as complete. As the results of British legislation, except in a few cases where the local conditions have been particularly favorable, the electric companies have not developed at the rate which their promoters had every right to expect. Many of them are able to operate only small stations, and others are practically moribund. "Altogether this table forms a good example of Dr. Ferranti's recent dictum that when legislation tries to benefit the public the public is nowhere except when it comes to paying." The connections even in such industrial districts as those supplied by the Clyde Valley and Cleveland and Durham companies do not exceed 50,000 kw. This is due to the fact that the pick of the load is in other hands. A striking fact is the number of substations of some of the companies. The Clyde Valley Company possesses 113 substations, with five more under construction, for connections amounting to 43,500 kw, while the Scottish Power Company, with connections amounting to 5000 hp, has no less than forty-two substations under its control.—London *Electrician*, Dec. 26, 1913.

Electric Power for Forging and Stamping Plant.—A note on a paper by W. Spencer before the Rugby Engineering Society in which it is stated that motors driving stamps should be capable of giving the maximum power required at a half-hour rating. For any good motor the output on the half-hour rating will be from 33 per cent to 55 per cent larger than that on the continuous rating. Compound-wound motors are recommended for driving stamps or hammers, since they run at a lower speed as the load increases and are able to stand sudden fluctuations of load. They should be arranged to speed up 20 per cent between the maximum load, calculated from the lifting powers given in a table, and one-sixth of this load. Shunt motors may also be used, but they should be 15 per cent more powerful, as they do not stand fluctuations of load so well. Alternating-current motors may be used, of either the short-circuited rotor or wound rotor types. To obtain the power required for a battery of stamps, the rule is to add together the power required by each stamp separately and to multiply by a factor. These factors are: For two stamps, 0.84; for three, 0.7; for four, 0.58, and for five, 0.47.—London *Electrician*, Dec. 26, 1913.

Panama Canal.—Articles by J. W. Upp on co-operation in the Panama Canal switchboard equipment, by W. Schildhauer on control of the lock machinery, by E. M. Hewlett on centralized control system and power-station switchboards for the Panama Canal, by C. H. Hill and C. T. Hentschel on lock boards and interlocking system, by E. H. Jacobs and H. M. Stevens on the position-indicator system and machines for the locks and on switching, disconnecting and bus arrangement for alternating-current power circuits, by S. M. Mauger and E. Bern on the generation and distribution of power for operating and lighting the Panama Canal, and by W. B. Connolly on the materials used in the Panama Canal switchboards.—*Gen. Elec. Review*, January, 1914.

Electric Power in Sugar Factories.—A. I. M. WINETRAUB.—An article showing the economy of the electrification of cane-sugar factories. From the value of the saved fuel alone and without considering the other advantages, the change-over from steam to electricity in an old mill should pay for itself in three or four years.—*Gen. Elec. Review*, January, 1914.

Steam Turbines.—An article, illustrated by diagrams, on the engineering and commercial development of the Parsons steam turbine during the last twenty-five years.—London *Electrician*, Dec. 26, 1913.

Traction

Electric Versus Steam Traction.—L. CALISCH.—A paper on the economic aspects of electric traction and its advantages over steam. The advantages for suburban service are stated to be high acceleration and retardation and consequently a high schedule speed, more frequent service, increased terminal accommodation, increased earning capacity, greater flexibility in making up trains, and economies due to a cheap supply of electrical energy. These advantages are discussed with the aid of statistical data from British suburban railway practice. As to electric traction on main roads, the chief advantages of handling freight trains with electric locomotives are said to be, first, the hauling of longer and heavier freight trains at higher speeds, and, second, a great reduction in locomotive stand-by losses, which are very high in freight-train service. In England the North-Eastern Railway has decided to electrify its line between Middlesbrough and Shildon, which carries a very heavy ore traffic.—London *Electrician*, Dec. 26, 1913.

Investment Ratio and Operating Ratio.—RENZO NORSA.—Operating ratio is the ratio of operating expenses to operating revenue, but the term "operating expenses" should be clearly defined. Investment ratio is the ratio of operating revenue to investment, and in this case the term "investment" must be strictly defined. The investment ratio and the operating ratio must be considered together in their relation to returns. The author gives two simple diagrams which show how the returns vary with different investment ratios and operating ratios and describes how to apply these diagrams.—London *Electrician*, Dec. 26, 1913.

Single-Phase Traction.—L. GRATZMULLER.—His complete paper with diagrams presented before the joint meeting of British and French electrical engineers on single-phase traction.—*La Revue Elec.*, Dec. 19, 1913.

Installations, Systems and Appliances

German Central Stations.—G. SIEGEL.—A translation of his German article on the economics of German central stations giving statistical data on investment, equipment and development.—London *Electrician*, Dec. 26, 1913.

Regulator for Electric Hot Plate.—In a continuation of the account of the exhibits at the recent instrument exhibition of the London Physical Society, an electric hot plate with automatic temperature regulation is described. It is made of aluminum and the heating elements are of nichrome foil. The method of insuring that a certain maximum temperature (about 250 deg.

C.) on the heated surface shall not be exceeded employs the regulator shown in Fig. 1, the operation of which is as follows: The temperature of the plate may be set at any desired point by turning a contact screw and setting it in the same manner as a micrometer screw. The head of the screw *a* is divided into five parts, each corresponding to 10 deg. C., while the brass tube *b* is divided into five parts, each corresponding to 50 deg. C. In this way, it is claimed, one can always reproduce exactly the most favorable surface temperature (above that of the atmosphere) for any particular operation. The principle of the regulator depends on the difference in expansion between the hot plate itself and a nickel-steel rod. The free end of this rod *h* rests in a socket in a disk *e* which is pivoted about two short pins *g* mounted on the hot plate. To the disk *e* is fixed a brass strip *d* which carries a platinum contact opposite the platinum-pointed end of the regulating contact *c*. When a contact is made between *c* and *d* a circuit carrying a very small current is closed, with the result that a relay actuates a small mercury switch, thus cutting out the heating circuit. When the surface of the hot plate has dropped below the required temperature the contact between *c* and *d* is broken and the heating circuit is again closed.—London *Electrician*, Dec. 26, 1913.

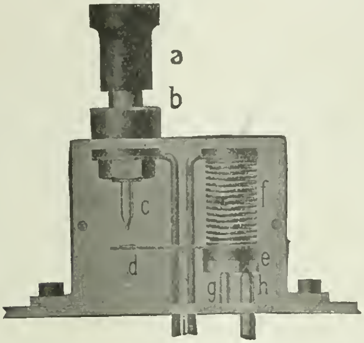


FIG. 1—SECTION OF REGULATOR USED WITH HOT PLATE

Wires, Wiring and Conduits

Shackle Insulators.—W. Weicker.—An illustrated article discussing the advantages of shackle insulators. —*Elek. Zeit.*, Dec. 25, 1913.

Electrophysics and Magnetism

Transmission of Electromagnetic Waves Through and Around the Earth.—G. W. O. Howe.—In the first part of this article it is shown that a wave in the earth itself cannot persist for any great distance unless it travels through the crust and is continuously supplied with energy from the main wave in the atmosphere above. Long-distance transmission cannot, therefore, be due to waves through the earth. In the second part the received current at great distances, as calculated on the assumption of a perfectly conducting earth and an unionized atmosphere, is shown to be much smaller than that actually found by Austin. This strongly supports the theory of reflection or refraction due to ionization of the upper atmosphere.—London *Electrician*, Dec. 26, 1913.

Geissler Tubes.—Millochau.—A French Physical Society paper on the laws governing the form of electric discharges in Geissler tubes and the effects produced by these discharges.—*La Revue Elec.*, Dec. 19, 1913.

Electrochemistry and Batteries

Why the Electric Current Passes Through the Interior of a Wire.—J. Fischer-Hinnen.—Static electricity accumulates on the outside of a conductor. Dynamic electricity in the form of a current passes through the interior of a conductor. The author discusses mathematically why this is so from the standpoint of the theory of static electricity and with reference to the electronic theory.—*Schweiz. Tech. Zeit.*, Aug. 28, 1913; *La Revue Elec.*, Dec. 19, 1913.

Telegraphy, Telephony and Signals

Telegraph Relay and Sensitive Telephone.—With reference to Brown's telephone relay, recently described in the Digest, the present article states that the relay has also been employed to a considerable extent in wireless telegraphy to reinforce the currents at the receiving end. The relay for this purpose differs in some respects in design from the one employed for telephony, but the main principle is the same, the secondary contacts being made by a reed, the tension of which is balanced by a magnet. Mr. Brown has also given considerable attention to the design of a sensitive telephone, particularly for receiving wireless-telegraph signals. Instead of the usual diaphragm, he employs one of conical shape, made of very thin aluminum sheets about 0.002 in. thick, the center of which is fixed to the end of an adjustable reed which is acted on by the receiver magnet. The diaphragm is held in position by a paper or collodion edge. This has the advantage over the ordinary diaphragm that the diaphragm itself is far less rigid and in consequence more sensitive. The natural period of vibration of the system can be adjusted by means of the reed. The arrangement also represents an improvement of the magnetic circuit over that of the ordinary receiver and enables the air gap to be adjusted with accuracy. In place of one central hole in the earpiece, several smaller holes are employed. With these telephones very much smaller currents can be heard than with the ordinary types. Experiments have shown that their substitution for ordinary telephone receivers increases the range of audibility by the equivalent of 5 miles of standard cable.—London *Elec. Eng.*, Dec. 25, 1913.

Telephone Call Meter.—As a result of numerous complaints from telephone subscribers the British Post Office Department has evolved a simple checking meter which can be installed at the subscriber's end of the line. A high-resistance (4000 ohms) electromagnet, entirely copper-clad, actuates a Veeder dial through the usual mechanism. It is connected between the ringing side of the line and earth and is arranged so that as the armature is attracted the circuit of a 1000-ohm resistance in parallel with the 4000-ohm winding is closed, so that an augmented current flows over the line. This current, when augmented, passes through a relay at the exchange, lights a lamp on the switchboard, and so indicates to the operator that the call has been recorded at the subscriber's end. The subscriber's meter is worked by the operator by the same meter key through a relay in the existing cord circuit, which connects an 80-volt battery to the answering relay between the line and earth. The subscriber's meter is not affected by the usual ringing current, as the copper covering of the coil gives it sufficiently high inductance to prevent any considerable alternating current from passing through it. The meter is no more likely to register ineffective calls than the one at the exchange, in conjunction with which it works, and is dependent on the operator to the same extent. The subscriber can, however, immediately notify the exchange if he sees an ineffective call registered.—London *Elec. Eng'ing*, Dec. 25, 1913.

Wireless Telegraphy on the "Imperator."—An illustrated description of the wireless-telegraph equipment of the *Imperator.*—London *Electrician*, Dec. 12, 1913.

Wireless Telegraphy.—The conclusion of the description of the Dubilier system of wireless telegraphy, with some additional notes on wireless telephony. The most important principles of the latter system are the oscillator and the wave-filter circuits. Some notes are added on the condensers employed.—London *Electrician*, Dec. 19, 1913.

Units, Measurements and Instruments

Vibration Electrometer.—H. Greinacher.—When an alternating-current emf is impressed on a Wulf string electrometer the quartz fibers begin to vibrate and their vibration can be easily detected with a microscope. This fact can be made use of for employing the electrometer as a zero instrument on account of the great sensitiveness with which the electrometer reacts to the application of the alternating emf. It may also be employed as an indicator for electric and magnetic alternating fields, as, for instance, for a system of wireless telegraphy. Fig. 2 shows the latest construction of such a vibration electrometer. Box G is closed by the cover D, to which is firmly attached the electrometer system, so that the latter can be removed together with the cover D. The electrometer proper consists of a metallic rod S, to which is welded the vertical strip L. Opposite this is a fine platinum wire P so that the distance of the strip L from the platinum wire is about 1 mm. The platinum wire is connected at its upper end with the cover which bears the terminal K, while the metallic rod S is connected to the other terminal K. The lower end of the platinum wire P is fastened to an insulating horizontal quartz fiber Q, stretched between the ends of the bow B. The alternating emf is applied to the terminals K_1 and K_2. The vibration of the platinum wire is observed through the opening O in the front wall of the box. A corresponding opening in the back wall serves for illuminating the wire with a mirror.—*Elek. Zeit.*, Dec. 25, 1913.

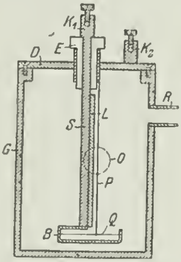


FIG. 2—SECTION OF VIBRATION ELECTROMETER

Book Reviews

Einfuhrung in die Elektrotechnik. By Otto Nairz. Leipzig, Germany: Johann Ambrosius Barth. 415 pages, 351 illus.

An elementary electrical-engineering textbook for students in technical colleges. It contains much original matter arranged in somewhat unusual order. The chapters into which the work is divided relate to the following subjects: The magnetic field; the electric field; electric current; the electromagnetic field; the absolute system of units; thermal applications; chemical actions of the current; electrochemical actions; magneto-mechanical generators; variable currents; single-phase alternating currents; the influence of iron on the alternating-current circuit; transformers; the generation of single and polyphase currents; energy transmission; and radio-frequency oscillations. The treatment of the subject-matter is essentially electrotechnical and didactic, the demonstrations being partly algebraic and partly geometric. The last chapter on oscillatory-current circuits is particularly good. The book will interest not only students of electrical engineering acquainted with the German language but also teachers of electrical engineering interested in comparing their methods with those of German colleagues.

Recent Physical Research. An account of some recent contributions to experimental physics. By David Owen. London: England: *The Electrician* Printing & Publishing Company, Ltd. 156 pages, 53 illus. Price, 3s. 6d.

In the preface of this very entertaining book the author pertinently remarks concerning the rapid contemporaneous advance of physics: "The textbook, even when fresh from the press, is perhaps necessarily several years behind the wave-front of advancing knowledge." This is another way of saying that he who stops to record and present the acquisitions of physicists must necessarily allow the advance guard to pass him by. The book seeks to present to those interested in physical research the more recent advances which have been made and which have not yet had time to filter into textbooks. The thirteen chapters of the book relate to the following topics: Positive rays; Rutherford's work on the alpha particle; Curie's work on magnetism; the aurora; Brownian movements; the pressure of radiation; short electric waves; free electrons in metals, and magnetic bodies composed of non-magnetic elements. The treatment of the subjects dealt with is very skilful. They are presented forcefully and clearly with the minimum of extraneous material or unnecessary mathematics. The result is very interesting reading to the interested physicist. The book will attract students of physics and scientific readers generally.

Handbook of English for Engineers. By Wilbur Owen Sypherd. New York: Scott, Foresman & Company. 314 pages, illus. Price, $1.50.

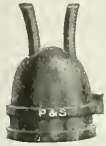
This little volume will be of real service to embryonic technical writers and young engineers who are face to face with their first reports or letters of application or of recommendation. Although written primarily for the foregoing and to serve as a practical textbook of English for engineering students, it also serves as a handy reference book to older members of the profession who find that their inability to write clearly and concisely constitutes a stumbling block to advancement and greater achievements. As a handbook for engineers it is practical in every respect, containing as it does numerous quotations from current technical papers and magazines and engineering reports. Its pages include, in fact, examples of practically every kind of writing that the young engineer or student may be called on to do. The book is divided into five chapters and two appendixes. Chapter I covers the general problem of engineering writing, including the planning and presentation of technical papers and the uses of paragraphs, sentences and words. Chapter II deals with the mechanical details, giving rules for using abbreviations, numbers and capitals and for hyphenation and punctuation. Chapters III, IV and V contain respectively numerous examples of letters, reports and technical articles. In Appendix A are given directions for proofreading, while materjal for criticism, consisting of faulty paragraphs and sentences, is presented in Appendix B.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Weatherproof Locking Sockets

The weatherproof, keyless socket shown herewith is the product of the Pass & Seymour Company, Syracuse, N. Y., and is included among the "Shurlock" sockets already manufactured by the same company. The socket is made of mica compound. A recessed locking screw, which can be removed with a key that fits over its triangular head, is forced against the base of the lamp. The end of the screw is pointed and locks the lamp securely in the socket.

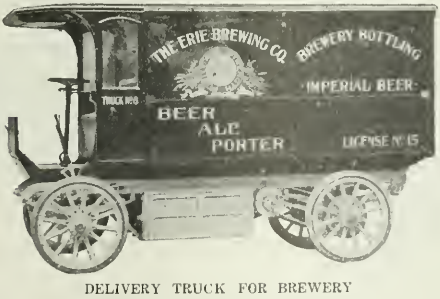


WEATHERPROOF KEYLESS SOCKET

Light Electric Delivery Truck for Breweries

The Baker Motor Vehicle Company, Cleveland, Ohio, is putting on the market a light delivery truck for the use of brewers in handling bottled goods in small towns and in the residence districts of large cities.

The body is neat in appearance, as shown herewith, and it has a loading space 106 in. long, 46 in. wide and 60 in. high, carrying fifty-four beer cases of twenty-four bottles each per load. The cases are arranged in two rows, nine cases long by three tiers high. The side panels of the body are made of two sliding doors, each one-half the length of the body. No opening in the rear is provided. The doors slide on roller bearings on an overhead track which is always free from dirt. Each door has a spring lock which cannot be opened without a key. By using this system of doors the driver can take out any case of bottles without disturbing the rest, an arrangement which saves considerable time. The floor of the body slants toward the center on each side, thus preventing the cases from sliding against the doors and making it hard to open them.



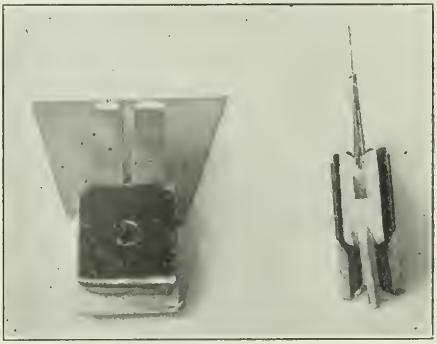
DELIVERY TRUCK FOR BREWERY

Similar types of bodies have been displayed to handle full loads of 2.5 tons (ninety standard cases) and 4 tons (145 standard cases) of bottled goods.

Repulsion Fuse

The fuse shown in the accompanying illustration, which has been developed by the Metropolitan Engineering Company, Brooklyn, N. Y., consists of constricted zinc ribbons bent in the shape of a U over a thin mica separator. The constrictions are at the bend and at the end of the separator so that upon rupture due to overload the fuse is broken in two parallel strips of equal length, one on either side of the separator, and each with its upper end free.

Since the current in the parallel legs of the U flows in opposite directions, a force of repulsion is exerted between the two. The ends of these legs are fixed, but after fusion the ruptured ends are free and maximum movement is possible at the ends where the arc occurs.



REPULSION-TYPE FUSE

The force actually resulting is considerable and can, for any definite condition, be calculated from the formula.

$$F = \frac{.4\,\pi I^2}{100\,d} = \text{dynes per centimeter,}$$

where d is the thickness of the insulated separator, and I is the current flowing.

A 60-amp fuse, by calculation from oscillogram records, would, under short-circuit conditions, generate a repulsion force (F) as great as 190 lb.

The greater the overload the more widely the fused ends become separated, resulting in a prompt suppression of the arc.

In addition to the fundamental principles of repulsion, two other principles are utilized, namely, the magnetic blowout and a tendency of the metallic vapors produced at the rupture to force the limbs of the fuse apart.

The magnetic blowout is quite noticeable at moderate overloads but is masked by the repulsive effect at great overloads. The effect of the expanding gas has been traced in some tests but is not a very important feature.

The complete fuse consists of a porcelain fuse holder, an insulating barrier, a fuse element and copper contact plates.

Electric Hammer

An electric hammer for tracing, lettering and carving stone and for other light work has been developed by the American Electric Tool Company, Petersburg, Va. The regulating mechanism is contained within the grip or nose of the hammer. By twisting the grip to the right or left the plunger can be caused to strike light or hard blows as desired. The operation of the Paulero electric hammer, as this tool is called, is automatic. The hammer is worked by inserting a chisel or other tool in the socket and pressing it against the work. Only the natural pressure of the hand to keep the tool in place is necessary, and as soon as the device is lifted away from the work, thus relieving the pressure, the energy supply is cut off and the hammer stops immediately. The casing of the hammer is made of aluminum, and the regulating mechanism, the plunger, the tool socket and other parts subjected to wear are of hardened tool steel. When in action the plunger strikes 1800 to 2000 blows per minute.

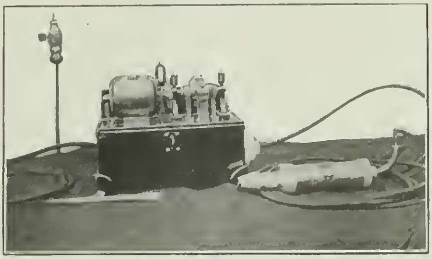


FIG. 1—COMPLETE EQUIPMENT FOR DIRECT CURRENT

The magnet coils for the hammer are wound directly on a single-piece brass spool. The wire used is insulated with enamel and will withstand a temperature of more than 500 deg. Fahr. All electrical parts are thoroughly insulated from the frame. The hammer is equipped with the necessary apparatus for operating from direct-current or alternating-current lighting circuits at pressures ranging from 110 volts to 250 volts. Fig. 1 shows a complete outfit for direct-current operation, consisting of hammer, commutating switch and all necessary cable connections. In Fig. 2 is shown the equipment for alternating-current work. A small motor-generator set with commutating switch is provided. The motor-generator set is small, taking up scarcely 14 cu. in., and can be placed on a shelf out of the way of workmen.

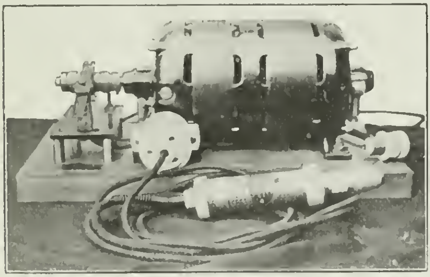
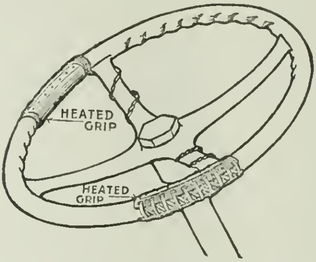


FIG. 2—COMPLETE EQUIPMENT FOR ALTERNATING CURRENT

Electrically Heated Wheel Grips for Motorists

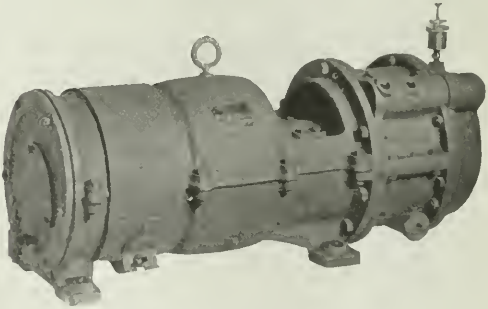
To avoid the objections to winter motoring caused by numb hands, electrically heated grips for steering wheels are being manufactured by the Motorist's Warm Grip Company, Marshall, Tex. These heated grips may be laced onto the steering wheel rim and are heated by energy from the battery or low-tension magneto. The consumption of energy is low, being about one-half that required for one pair of electric head-lamps. Flexible cords wound around the spokes of the wheel connect the grips with the battery and switch, which may be fastened to the dashboard.



ELECTRICALLY HEATED GRIPS

A 1-kw Turbo-Generator Lighting Unit

To provide electric light for limited areas where steam is available but suitable electric motor service is not, such as in the case of contracting operations, in small industrial plants, on steam launches, etc., the Westinghouse Electric & Manufacturing Company, Pittsburgh, has recently put on the market a small turbo-generator which will operate an arc lamp and a few incandescent lamps, or about forty 25-watt tungsten lamps or their equivalent. The unit is very compact, being only 3 ft. long and 1.5 ft. high, and it can be installed wherever provision is made to keep it horizontal. Little attention is required for its operation, and all parts are easily accessible.



TURBO-GENERATOR FOR LIGHTING

The turbine and generator are mounted on the same frame. The turbine is of the impulse type and has a governor which keeps the speed uniform for all variations of load and steam pressure. The full rating of 1 kw is developed on 90 lb. steam pressure, and satisfactory operation can be obtained with pressures up to 250 lb. The weight of the unit is 283 lb. The rated pressure of the generator is 120 volts.

Lighting of Automobile Service Station

The Ford Motor Company is using 100-watt clear-bulb tungsten lamps to illuminate the interior of its new service station at San Francisco, Cal. The arrangement shown herewith is typical of the floors above the first or garage floor, four units, fastened at the ceiling, being allotted to each bay. The first floor has a higher ceiling than the other floors, which permits the use of a large lamp in the center of the bay.

LIGHTING OF AUTOMOBILE SERVICE STATION

The bays shown in the illustration are 25 ft. by 28 ft., making the power expenditure 0.57 watt per sq. ft. The height of the ceiling is 12 ft. 2.5 in., and each reflector is suspended so that the bottom is 11 ft. 5.5 in. above the floor. The ceiling is white and the floor is of concrete. A photometric test showed that the average intensity for this floor is 4.13 ft.-candles.

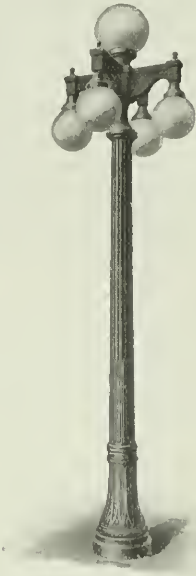
The reflectors are made of glass in one piece and are covered on the outside with a coating of silver which is protected by a green elastic backing. A fire glaze is given to the inner surface. These reflectors are known as the X-Ray beehive reflectors and are manufactured at the plant of the National X-Ray Reflector Company, in Chicago, Ill.

Magnetic Separators in Rubber and Steel Plants

Removing iron particles from ground scrap rubber in the reclamation plant of a rubber mill and extracting the metallic iron from crushed slag in a steel plant are two new applications recently found for Cutler-Hammer magnetic separators. The separation is effected by simply passing the ground or crushed material on a beft over the magnetized pulley which picks out the metallic particles and allows the remainder to be cast forward to a conveyor or chute.

Cast-Iron Lamp-Posts

The Central Foundry Company, 90 West Street, New York, has developed a new line of cast-iron lamp-posts for arc and incandescent lamps. In the illustration is shown a five-lamp standard, one lamp, with a globe 16 in. in diameter and an 8-in. fitter, being upright in the middle, and the other four, with globes 12 in. in diameter and 6-in. fitters, being inverted from horizontal arms. The shaft, which is fluted, is 10 ft. 3 in. high and has a diameter of 6 in. at the top. It is fastened to the base by four ⅞-in. bolts. The diameter of the bolt-hole circle is 20 in. A threaded nipple is provided for fastening the upper part of the standard to the shaft. Threaded nipples are also used for fastening the lamp fitters. The overall height of the standard is 13 ft. 6 in.



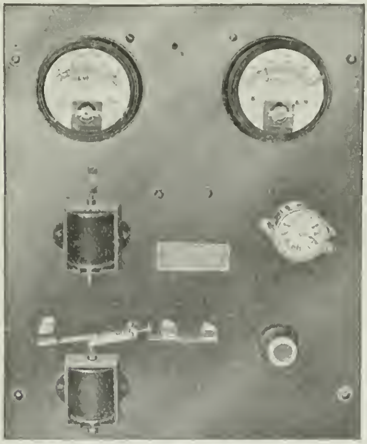
FIVE-LAMP CAST-IRON STANDARD

Farm-Lighting System

A lighting system for farm use, consisting of a storage-battery lighting plant with an automatic switchboard, which is illustrated herewith, is being put on the market by the Electrical Testing Company, Peoria, Ill. As the generator is nearly always belted to a large gasoline engine, which is doing other work, the plant is not designed for self-starting on account of the unnecessary draft which this would put on the battery.

In operating a plant of this kind it is first necessary to start the engine; then the automatic switchboard connects the battery on charge and throws the balancing cells in series with the lighting circuit to maintain the proper voltage. When the battery becomes fully charged the cut-out acts, and the charging is discontinued. This action does not stop the engine, but a small time switch in the ignition circuit can be set so as to shut down the engine at any time. In nearly every case the engine can be working while the battery is being charged. If the battery should become fully charged, it will be automatically cut out, and the engine will continue to work until shut down.

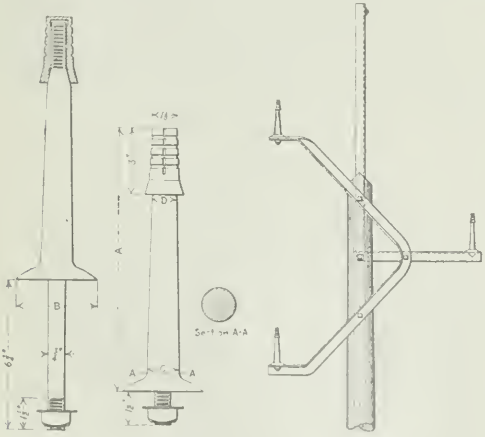
Owing to the automatic features it is not necessary to install the plant entirely in one place. The generator can be installed in a shed or shop with the engine, the battery in a basement and the switchboard in any convenient place available. Steady light can be obtained from the generator while the batteries are on charge. Any style of gasoline engine can be used with this type of equipment.



AUTOMATIC SWITCHBOARD

Forged-Steel High-Tension Pin

Messrs. Hubbard & Company, Pittsburgh, Pa., are putting on the market a forged-steel pin of the center-bolt, separable-thimble type for supporting high-tension insulators. The pin is made in two styles, that shown in Fig. 1 with a long shank for wood or channel-steel arms and that in Fig. 2 with a short shank for arms of angle section similar to those shown in Fig. 3. The tapered collar of the thimble, which is made of malleable iron, greatly reinforces the pin at its smallest diameter. This thimble can also be used with high-tension steel clamp pins for wooden and steel angle arms and various kinds of pole-top pins. The pin is furnished either plain or galvanized.

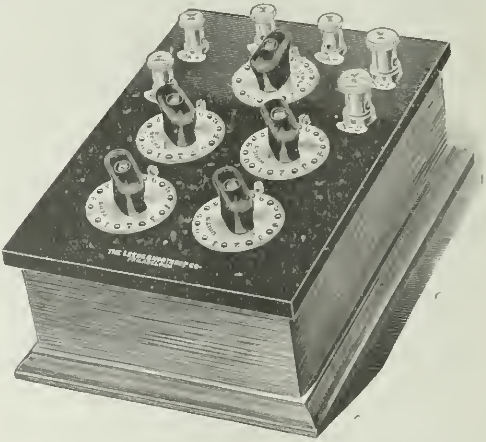


FIGS. 1, 2 AND 3—LONG-SHANK AND SHORT-SHANK PINS, AND PINS USED ON ANGLE SECTIONS

Dial-Type Laboratory Wheatstone Bridge

The dial-type of resistance apparatus has the advantage of being easy to manipulate, and as there are no loose plugs, possibility of delay or inconvenience which might follow the loss of any of the parts is avoided. The unit-type Wheatstone bridge, as it is called, which is illustrated herewith, is for use in laboratories and is similar in construction to a portable instrument described in the *Electrical World* of April 26, 1913. Boxes are made with two, three or four dials.

All coils are wound on metal spools, thus preventing the resistance values of the coils changing on account of variations in the dimensions of the spool, as may happen when wooden spools are used. A new decade arrangement is used by means of which all resistance values are obtained by combinations of five coils. Each decade, consisting of five resistance spools, a dial switch and mounting, is made up as a separate unit. The dial contacts are all mounted within the box and are therefore protected from dust and dirt. The contacts are inverted so that should dust get into the box it cannot gather on the contact surfaces. All the parts, however, are easily accessible for cleaning. The switches are made of three leaves of phosphor bronze, each having an independent bearing on the contact plates. The ends of the switches are bent so that they do not lie tangent to the path of travel, and the possibility of wearing rings in the plates is, therefore, eliminated.



LABORATORY WHEATSTONE BRIDGE

A ratio-control arrangement is used for this Wheatstone bridge by means of which one dial controls both bridge arms. When making a measurement the rheostat value, when a balance is obtained, is multiplied by the ratio-dial setting. The values of these multipliers are 0.001, 0.01, 0.1, 1, 10, 100 and 1000.

These instruments, which are inclosed in well-finished mahogany boxes, are manufactured by the Leeds & Northrup Company, Philadelphia, Pa.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Exporting Electric Ranges to South America.—In a recent conversation with a representative of the *Electrical World*, G. A. Hughes, of the Hughes Electric Heating Company, Chicago, remarked that the electric-range business is in a satisfactory condition at the present time. The export sales of the company to South American buyers have been especially encouraging, one carload of stoves having been shipped within a few days to points in the southern half of the continent.

Electric Vehicle Growth in New York City in 1913.—According to the records of the Automobile Bureau of the New York Edison Company, the increase in the number of electric vehicles in use in New York City during 1913 was 479, or an average monthly increase of about forty cars. The greatest increase was recorded in April, when seventy-two new cars were registered, and the lowest figures were shown for January, when but four additions were made. The energy consumed by these additional vehicles is estimated at about 3,178,000 kw-hr. per annum.

Incandescent Lamp Importers Look for Good Business Under New Tariff.—Deuth & Company, of New York, recently gave out a statement on the incandescent-lamp outlook from the importer's point of view which was marked by an apparent feeling of optimism concerning the future of that business. According to E. J. Deuth, of the above company, the indications are that the year 1914 will produce a larger volume of business in that line than did 1913. He states that there is a large and growing demand in this country for high-grade tungsten lamps of foreign make and that the imports of these lamps are increasing rapidly.

Company to Make Industrial Trucks.—The Electromobile Company, of St. Louis, Mo., was organized recently with a capital stock of $100,000 to manufacture small industrial electric trucks for use in factories and shipping houses and on steamship docks where materials and packages are to be conveyed only a short distance. Sanford J. Bernheimer is the organizer, and Ralph Kalish, patent attorney, is secretary and treasurer of the company. The truck, which is designed for a load of 2000 lb., can exert a tractive effort of 5000 lb. to 8000 lb. The total length of the truck is 8 ft., all of which is loading space except 1 ft. devoted to the operator.

Quicksilver Production Low in 1913.—According to the preliminary figures of the United States Geological Survey, the domestic production of quicksilver in 1913 was 19,681 flasks of 75 lb. each, with an estimated value of $774,054. These figures are stated to be the lowest since 1860. There has been a gradual decline in the market price of quicksilver since 1910. Exports of the metal in 1913 amounted to approximately 82,442 lb., valued at $41,722, a marked increase over the figures for 1912. Imports during 1913 are estimated at 152,375 lb., valued at $66,943, also an increase over the corresponding figures for the previous year.

No Concentration of Lamp Factories Contemplated.—A rumor to the effect that the National Lamp Works of the General Electric Company were planning to consolidate their twenty-five factories throughout the country into one large plant at Cleveland was emphatically denied by F. S. Terry in a statement recently to an *Electrical World* representative. Mr. Terry said that such a plan would be exactly the opposite of the company's set policy of distributing its factories as widely as possible consistent with economical operation. He said that it was desired to make the lamps as near to the consuming market as possible, both as a question of economy in transportation and as a matter of policy. The several lamp companies under the control of the General Electric Company are on a quasi-competitive basis at the present time, each having its own production and sales forces as well as a separate management. The most important point in which they act in combination is in the engineering research work, carried on mainly in Cleveland, which is on too large a scale to be practicable for one company.

Recent Large Boiler Sales.—The last report of the Babcock & Wilcox Company, of 85 Liberty Street, New York, on the larger of its recent boiler sales shows an aggregate of 28,000 hp in installations of over 1000 hp. The Norfolk & Western Company took the largest single order recorded, 6770 hp, for its Bluestone (W. Va.) plant, and the second largest order was placed by the Commonwealth Edison Company, of Chicago, for 6100 hp for its Northwest Station in that city. C. C. Moore & Company have ordered for the Mount Whitney Power & Electric Company, of Visalia, Cal., 1809 hp in steam boilers of the same make. The other sales were for use in industrial plants or in public buildings.

Louisville Manufacturer Installing Motor Drive.—The Bills Mirror Plate Company, Louisville, Ky., which has been using electric motors for the operation of its special machinery for several years, recently had a fire which destroyed practically its entire plant. In rebuilding, the company had occasion to decide whether or not to continue the use of electric power and central-station service, and promptly determined to do so. It has contracted with the Louisville office of Fairbanks, Morse & Company for the installation of ten motors, with an aggregate capacity of 75 hp. and will continue to use current furnished by the Louisville Gas & Electric Company. The Bills company maintains a boiler plant, but this is only for heating purposes, hot water being needed for its manufacturing operations.

Foreign Markets for American Electrical Equipment.—In Denmark, Norway and Sweden there is an increasing demand for electric elevators of the automatic push-button type, with a capacity of three or four passengers. This type of car and control seems to be favored, whether there is an operator or not. Both alternating and direct current at voltages of 110 and 250 are common. In Budapest, Hungary, there is a preference for American-made wiring supplies, but the Austrian and German manufacturers practically control the market. The goods of the latter have gained a foothold because of their comparative cheapness and because longer credit is given by them than is customary with American manufacturers. On a basis of quality the American goods can generally resist competition. American manufacturers who wish to enter this territory will generally have to send their own agents, as the contracts of the local selling agents with manufacturers of other countries nearly always forbid the sale by them of American-made goods. Electrical goods are sold generally on a credit of four to six months and payment is seldom made within three months. In the cities of Mersina, Tarsus and Adana, in Asiatic Turkey, there are a number of factories and other enterprises using electric energy, and American electrical supplies have not yet been introduced. China is largely dominated by the British and German interests and little electrical material of American make is sold, although American wiring standards are used in many cases. Such trade as there is seems to be handled through the local importing houses, rather than direct or through branch offices. A 230-volt, direct-current, three-wire, earthed-return system is largely used for operating fans and electric lamps in Bombay, India, although in the suburbs of that city there is 230-volt alternating current available. Most of the wiring is open, carried on cleats, but in government buildings some steel-armored conduit is used. There are a number of native dealers in electrical supplies in Bombay, and many of them claim to be electrical engineers. The result is that a highly competitive condition exists and a strong tendency has been manifested to turn to the cheapest grade of goods in order to secure the limited trade possible. At present a large part of the electrical goods sold there are of British manufacture.

Ford Motor Company Orders Novel Engine Equipment.—Contracts have been placed by the Ford Motor Company, of Detroit, Mich., for an electric generating plant which will contain some distinctly novel features. The object of the new station will be to provide a means for utilizing the heat ordinarily wasted in the operation of a producer-gas-engine-driven generator. In the proposed plant four Hamilton Gray engines built by the Hooven-Owens-Rentschler Company, of Hamilton, Ohio, will be used to drive the same number of 3750-kw, 250-volt engine-type direct-current generators of Crocker-Wheeler make. The plan view of one of the new engines will resemble that of a cross-compound steam engine, with two cylinders in tandem on each side. One pair of these cylinders will be operated by producer gas and the other by steam. The feed water for the boiler supplying the steam cylinders, will be carried through the water jackets of the gas engine and then further heated by the exhaust gases from the latter and by waste heat from the producer gas plant. The difference in characteristics between the gas and the steam-engine cylinders will be compensated by the use of a heavy flywheel. The generators in these units will be designed for much higher efficiencies than are usual in commercial installations. Full-load efficiencies of over 94½ per cent are predicted. The utilization of waste heat for preheating of the boiler-feed water is expected to make the plant a very economical one. In order to facilitate the transportation of the generator armatures from Ampere, N. J., where they will be built, to Detroit, where they will be finally assembled, the split form of construction will be used.

Statement of the Copper Producers' Association for December

On Jan. 1 the stock of copper on hand in the United States exceeded 70,000,000 lb. for the first time since April, 1913. This rise from low-record figures in three months has resulted from a marked reduction in the domestic consumption, in spite of a general increase in foreign deliveries. Production seems to be reaching a more uniform basis, as shown in the following table:

	December, pounds		November, pounds	
Stocks on hand in the United States on first of month		47,929,429		32,566,382
Production		138,990,421		134,087,708
		186,919,850		166,654,090
Domestic deliveries	21,938,570		48,656,858	
Foreign deliveries..	73,542,413		70,067,803	
		95,480,983		118,724,661
Stocks on hand at end of month...		81,438,867		47,929,429

NEW YORK METAL MARKET PRICES

	Jan. 6		Jan. 13	
Copper:	Bid	Asked	Bid	Asked
Standard, spot*	.....	.....	.....	.....
	Selling prices		Selling prices	
	£	s. d.	£	s. d.
London, standard, spot*..	64	3 9	62	17 6
Prime Lake	15.00	.....	14.50	.....
Electrolytic	14.25	to 14.62½	14.25	.....
Casting	14.25	to 14.50	14.00	to 14.12½
Copper wire base......	15.75	.....	15.50	.....
Lead	4.15		4.10	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter..	7.50		7.50	
Spelter, spot	5.25	to 5.35	5.25	to 5.35
Tin, spot	36.77½	to 37.12½	36.85	to 37.00
Aluminum:				
Prompt delivery	18.50	to 19.00	18.75	to 19.00
Future	18.25	to 18.75	18.50	to 19.00

*OLD METALS

Heavy copper and wire........................	13.50	13.50
Brass, heavy	8.75	8.75
Brass, light	7.75	7.75
Lead, heavy	4.05	4.05
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to Jan. 13..14,175

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*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Eastern Power & Light Reorganization.—The official staff of the Reading Transit & Light Company has undergone a change recently, following the decision of W. S. Barstow to resign as active head of the company. Mr. Barstow's place has been taken by N. McD. Crawford, formerly president of the Mahoning & Shenango Railway & Light Company, which is controlled by the Republic Railway & Light Company.

Pennsylvania Charters Granted.—Articles of incorporation were filed recently by eleven electrical companies which propose to supply energy to a number of towns in the eastern part of Bucks County, Pa. The incorporators were S. D. Warriner, H. F. Baker and R. H. Wilbur, all officials of the Lehigh Coal & Navigation Company, which controls, through the Lehigh Navigation Electric Company, a large steam generating station at Hauto, Pa., now nearing completion.

Southwestern Utility Merger. — The Seven Cities Company has been organized with an authorized capital stock of $250,000 and $250,000 bonds as a consolidation of the Russellville (Ark.) Water & Light Company and the smaller concerns operating in the towns of Dardanelle, Bentonville, Rogers, Morrilton, Springdale and Fayetteville, Ark. The Russellville company has a combined hydroelectric and steam plant and will furnish the main source of power for the merger at the present time.

Mexican Northern Power Company Passes Bond Interest.—In a circular issued recently to its stock and bondholders the Mexican Northern Power Company cited some of the conditions which led to the deferring of payment of the interest, due Jan. 1, on its outstanding $10,000,000 of first mortgage thirty-year 5 per cent bonds. The unsettled state of affairs in Mexico has prevented active work on the dam and power plant of the company on the Conchas River, Chihuahua, but a little progress has been made and no damage has been done to the properties by the military operations in the vicinity.

Canadian Utility Plans Additional Generating Units.—An announcement recently made by the Western Canada Power Company, Ltd., tells of the plans of that concern regarding additions to its generating equipment at the Stave Falls plant during the coming year. It is proposed to double the capacity of the present station by the addition of two units of 12,500-hp rating. One of these units is to be installed early in the year and the other toward the end of the year. The dam at Stave Falls was raised 10 ft. during 1913, and it is proposed to add another 10 ft. this year and the final 10 ft. in 1915.

Sterling-Meaker Company Matters.—Early in December the Sterling-Meaker Company, of Newark, N. J., maker of electric railway supplies and apparatus, executed a license agreement giving to the Lord Manufacturing Company, of Bush Terminal, Brooklyn, N. Y., the exclusive right to manufacture and sell the Sterling-Meaker products. The agreement was approved by the holders of the company's bonds, who authorized the sale of the plant and material. A. H. Favour and C. H. Baum have been appointed a committee to represent the bondholders and to take charge of the company's finances, with special reference to the discharging of its obligations.

Wisconsin Utilities Issue Bonds.—Approval has been obtained from the Wisconsin Railroad Commission for the issue by the Milwaukee Electric Railway & Light Company of $3,500,000 of refunding and extension mortgage bonds, to bear interest at the rate of 4½ per cent per annum, and to be pledged and deposited with the Bankers' Trust Company, as security for a like amount of bonds previously issued, bearing a higher interest rate. The Green Bay Gas & Electric Company has been authorized to issue $78,000 in first mortgage bonds to be used in discharging an existing indebtedness of $70,200, and permission has been granted to the Wisconsin Public Service Company to issue the same par value of 5 per cent bonds. These are to be used to purchase the issue of the Green Bay company, the remaining property of which will shortly be taken over by the Wisconsin Public Service Company.

Canadian Company Increases Dividend Rate.—A quarterly dividend of 1½ per cent has been declared on the $2,000,000 outstanding stock of the Kaministiquia Power Company of Montreal, Canada, payable next month. This rate compares with those of 3 per cent per annum paid from May, 1910, to November, 1911, and with quarterly rates of 1 per cent from February, 1912, to November, 1912, and 1¼ per cent from May, 1913, to November, 1913. The issue of $200,000 new stock at par has been authorized by the stockholders.

Alabama Traction, Light & Power Rushing Coosa River Plant.—During the past week word has been received of the completion of the dam at Lock 12 on the Coosa River and electric operation will follow shortly. This is the first of a number of hydroelectric generating stations which the Alabama Traction, Light & Power Company proposes to build along the Coosa, Tallapoosa and Tennessee Rivers in Alabama, and which will eventually be connected in one large system supplying light and power to the district around Birmingham and Montgomery.

Receivership for the Idaho Railway Light & Power Company.—Upon the application of the Westinghouse Electric & Manufacturing Company, which is creditor to the amount of $40,000, the property of the Idaho Railway Light & Power Company was placed in the hands of a receiver by Judge Dietrich in the United States District Court, at Boise, Idaho, on Dec. 23. O. G. F. Markhus, former general manager, has charge of the property, and a plan for general reorganization of the company is being considered. The receiver is in direct charge of the company's generating properties, including the Swan Falls power plant and transmission lines and the distributing stations at Nampa, Caldwell, Middleton, Star and Eagle, Idaho. The traction properties of the company are not directly affected by the receivership at the present time, and they will be operated by the Idaho Traction Company as lessees. These properties include the street railway lines in Boise and the interurban line conecting Boise, Nampa, Caldwell and Middleton.

Barcelona Traction, Light & Power Company Matters.—The Barcelona Traction, Light & Power Company is completing the construction work on the Seros concession on the Ebro River near Barcelona, Spain, started December, 1912. The generating equipment to be installed in the power house at this location consists of four units of about 15,000 hp, one of which is expected to be in operation by the end of January, and the other three by the end of April of the present year. Provision has been made for the future installation of another unit of the same size when the demand requires it. For the purpose of carrying out its program in Spain, a company was formed under the name of the Ebro Irrigation & Power Company, Ltd., with a capital stock of $2,500,000 owned entirely by the Barcelona company, which is in turn controlled by the Pearson interests. The above development is one of a number which are in progress or contemplated in various sections of Spain, and a network of transmision lines is planned which will distribute electricity to a large territory around Barcelona.

Pennsylvania Corporations Increase Capital Stocks.—Many millions of dollars were added to the capital stock and indebtedness of various Pennsylvania corporations during the closing weeks of the old year. In December forty-eight corporations filed notices at the State Department of their purpose to increase their capital stock or their debt and in some instances both. The electrical interests represented in this final movement under the old law were the Shohola Falls Hydroelectric Company, Milford, stock, $6,000 to $500,000; Westinghouse Gear & Dynamotor Company, Pittsburgh, stock, $5,000 to $1,500,000; Beacon Light Company, Philadelphia, stock, $120,000 to $500,000; Edison Electric Illuminating Company, Mount Carmel, stock, $150,000 to $200,000; Wellsboro Electric Company, Wellsboro, stock, $20,000 to $40,000; Trumbauersville Electric Light & Power Company, Norristown, stock, $5,000 to $12,500; Richland Electric Light & Power Company, stock, $5,000 to $10,000; Paupack Electric Company, Hawley, stock, $20,000 to $65,000; Harrisburg Light & Power Company, Harrisburg, debt, $1,750,000; Perry County Telephone & Telegraph Company, Landisburg, debt, $5,500; St. Mary's Electric Light Company, stock, $50,000 to $75,000, debt, $25,000 to $75,000.

Business Notes

Edwards & Company, electrical manufacturers, of New York, have opened a branch office in Chicago, at 629 West Jackson Boulevard, in charge of G. C. Richards.

The National Electric Sign & Construction Company, of 130 North Main Street, Mansfield, Ohio, has just installed machinery equipment and stock in its new factory.

Verne W. Shear & Company, Flatiron Building, Akron, Ohio, have been appointed Ohio representatives of the Condit Electrical Manufacturing Company, of Boston, Mass.

The Nachod Signal Company, Inc., is the new name of the concern formerly located at 214 South Twelfth Street, Philadelphia, and known as the Nachod Signal Company. The new address of the company is 50 Church Street, New York.

The Westinghouse Lamp Company will remove its administrative, executive sales, treasury, auditing and purchasing departments from Bloomfield, N. J., to the Martin Building, 1261 Broadway, New York. The new quarters will be occupied on Jan. 19, 1914.

The Pittsburgh High-Voltage Insulator Company, of Derry, Pa., has established a Chicago office at 320 New York Life Building and has appointed as its Canadian representative the Canadian General Electric Company, King and Simcoe Streets, Toronto, Ont.

The Utilities Engineering Corporation, with headquarters in the Michigan Trust Building, Grand Rapids, Mich., is now prepared to undertake the construction, operation or management of public utility properties. A. I. Snyder is president and manager of the company.

The Electric Contracting Company, of Trenton, N. J., has completed arrangements for carrying on its electrical contracting repair and supply business with offices at 23-25 Chancery Street in that city. Walter Eldridge is president and treasurer of the company and F. J. Carr is its secretary.

The Electrical Testing Laboratories, Inc., of New York, have recently made a number of changes in their official and executive staff. At present the officers are as follows: J. W. Lieb, Jr., president; Dr. C. H. Sharp, vice-president and technical director; P. S. Millar, secretary and general manager, and F. M. Farmer, chief engineer.

The National Supply & Equipment Company, Inc., has opened an office in the Bulletin Building, Philadelphia, Pa., as consulting engineer and dealer in steam, electrical and hydraulic equipment. The officers of the company are: H.. W. Bishop, president; T. T. Taylor, vice-president; F. T. Finch, secretary; C. B. Dungan, treasurer, and B. J. Morrison, general manager.

The C & C Electric & Manufacturing Company, of Garwood, N. J., has discontinued its Pittsburgh office, and the territory formerly handled from that center will be taken care of by J. C. Chamberlin from the Philadelphia office. F. A. Saylor, with offices in the Greenwood Building, Sixth and Vine Streets, Cincinnati, Ohio, has been appointed agent of the company for the southern part of Ohio.

The Chicago Electric Motor Car Company has been taken over by the Carl Electric Vehicle Company, 641 Ohio Building, Toledo, Ohio. Note was made in the Dec. 13 issue of the *Electrical World* concerning the decision of the former company to enter upon the manufacture of electric commercial vehicles, but at that time nothing was known of the proposed merging of the two companies. No details are available as to the probable organization changes following this consolidation.

The Cutter Electrical & Manufacturing Company, of Philadelphia, Pa., which manufactures I-T-E circuit-breakers, has opened a new office in the Telephone Building, Indianapolis, in charge of Lynn O. Morrow, whose territory will include southern Indiana, southern Illinois, Kentucky, Tennessee and Missouri. The new Indianapolis office will be under the general supervision of Henry F. Darby, Jr., Chicago district manager. Mr. Morrow has been connected with the Cutter company for over six years, having spent about four years in the engineering department.

Hermann Boker & Company, of 101 Duane Street, New York, announce the transfer of W. H. Kissam from their New York office to the managership of their Cleveland branch office. H. G. Harrington, formerly assistant sales manager of the Driver-Harris Wire Company, has been appointed manager of the wire and nickel department at the New York office.

The Swedish General Electric, Ltd., with headquarters at 1009-1012 Kent Building, Toronto, Ont., and branch offices at Montreal, Calgary and Vancouver, has taken over the business of Kilmer, Pullen & Burnham, Ltd. The change is rather of name than of organization, as Frank Pullen is president of the new company and the same lines will be handled as formerly.

The Hammer-Beach Electric Company has opened offices at 97 Seneca Street, Geneva, N. Y., to handle an electrical contracting and supply business. The president of the company, A. R. Page, was formerly with the Wheeler-Green Electric Company, as was E. T. Beach, vice-president. H. O. Palmer, secretary of the concern, is also vice-president of the Empire Gas & Electric Company, of Geneva.

The Atlas Electric Sign Company, of 742 South Wabash Avenue, Chicago, Ill., which has been established about two months, has already placed a number of large electric signs and has a good outlook for business in the future. A. W. Losee, president of the company, as well as V. C. Thompson, its secretary, and Charles Husum, construction superintendent, were formerly with the Chase Electric Company.

The General Storage Battery Company has located its office and plant at 2005 Locust Street, St. Louis, Mo., and will be ready about Feb. 1 to handle orders for automobile ignition, lighting and starting batteries, and for laboratory and other special batteries. Joseph Desloge is president of the company. Its vice-president, Louis Desloge, was formerly connected with the Union Electric Light & Power Company, and E. A. Downey, its secretary, was with the Wagner Electric Manufacturing Company previously.

New Industrial Companies

The Manhattan Brass & Electrical Company, of New York, N. Y., has been incorporated with a capital stock of $14,000 by Harry Hilfman, Samuel and Henry Denemark, 117 McKibbin Street, Brooklyn, N. Y.

The Guth Electrical Company, of Perth Amboy, N. J., has been incorporated with a capital stock of $50,000 by M. J. Dahl, A. Guth and D. Guth, of Perth Amboy. The company proposes to do a general electrical and mechanical engineering business.

The Atlantic City Electric Company, of New Jersey has been chartered with a capital stock of $250,000 to do a general electrical and mechanical engineering business. The incorporators are T. D. Finizio, of Cliffwood; L. Biondi and B. A. Turcott, of New York, N. Y.

The Toll & Leeds Company, of Newark, N. J., has been incorporated by W. S. Leeds, of Clifton, N. Y.; S. E. Toll, of New York, N. Y., and W. A. Seeley, of Newark. The company is capitalized at $500,000 and proposes to manufacture motors, electrical machinery, etc.

The A. & T. Storage Battery Company, of New York, N. Y., has been chartered with a capital stock of $1,000,000 by J. Splitdorf, D. B. Nally and A. L. Kull, of New York, N. Y. The company proposes to manufacture and deal in storage batteries, generators for light, heat, power, etc.

The Machinery Equipment Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $10,000 to carry on a general mechanical and electrical engineering business. The incorporators are F. R. Hansell, of Philadelphia, Pa.; G. H. B. Martin and S. C. Seymour, of Camden, N. J.

The Fowler Standard Lamp Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $400,000 for the purpose of manufacturing and selling electrical machinery. The incorporators are J. M. Satterfield, of Dover, Del.; C. R. Duscher, of Jenkintown, Pa., and W. C. Arnold, of Lansdowne, Pa.

Trade Publications

Cord.—The supply department of the General Electric Company has issued price list and data of cords and portables of National Electric Code standard.

Lighting Fixtures.—The F. W. Wakefield Brsas Company, Vermilion, Ohio, is issuing an invitation to dealers to send for its new electric-lighting fixture book, No. 14.

Mica.—The Producers' Mica Company, of Chicago, issued a novel New Year's greeting, in which its message was printed in letters of gold on a card of transparent mica.

Test Clip.—A leaflet recently issued by R. S. Mueller & Company, 423 High Avenue, Cleveland, Ohio, refers to the "Big Brute" test clip, which will carry 100 amp indefinitely without heating.

Induction Motors.—An eight-page leaflet, No. 4005, has been issued by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., which contains illustrations and a description of its polyphase motors.

Refillable Fuses.—A sixteen-page booklet has been issued by the Multi Refillable Fuse Company, 817 Washington Boulevard, Chicago, Ill., covering its complete line of refillable fuses and stamped links.

Calendar.—The Nungesser Carbon & Battery Company, 3803 King Avenue, Cleveland, Ohio, has issued an attractive little calendar, on which is illustrated the "1900" dry battery and the "Acme" rapid-fire battery.

Portable Buffer.—The Stow Manufacturing Company, Binghamton, N. Y., is mailing an illustrated leaflet referring to its portable electric buffing machine for use on automobiles and for brass signs on metal work.

Heating Pad.—The Hotpoint Electric Heating Company, Ontario, Cal., is distributing a leaflet referring to its latest improved heating pad, called the "El Comfo." Being concave on one side and consequently convex on the other, it is easily adjusted to any part of the body.

Ammonia Compressors.—The Huetteman & Cramer Company, Detroit, Mich., manufacturer of ice and refrigerating machinery, is sending out a folder referring generally to its experience in the design of ice machinery and specifically to its safety ammonia compressors.

Telefault.—"Matthews Telefault" is the subject of a leaflet recently issued by W. N. Matthews & Brother, St. Louis, Mo. This instrument is used to locate all cable conductor troubles except "opens." It will discover dead short-circuits or faults with a very high resistance.

Window Advertising.—A folder has recently been issued by the Electro Novelty Company, 160 North Fifth Avenue, Chicago, Ill., entitled "Does Your Store Window Pay?" In it are illustrated various "mysteries," electrically operated, for attracting the attention of the passer-by to the merchant's window.

Indirect Lighting.—The National X-Ray Reflector Company, Chicago, Ill., has begun the publication of "Eye Comfort." This will be issued monthly to disseminate information on the latest discoveries in scientific illumination. Vol. I, No. 1, contains simplified data for laying out "Eye Comfort" installations and other material of interest.

Electric Motors for Printing Presses.—The Jenney electrical department of the American Rotary Valve Company, of Chicago, is sending out a reproduction of a page advertisement in the Indianapolis *News* showing that every wheel that revolves in the operation of that paper, from typesetting to delivery, is turned by a Jenney electric motor.

Wire Rope.—John A. Roebling's Sons Company, 117 Liberty Street, New York, has issued in bulletin form advance sheets of an article on "The Wire Rope at Panama" that will appear in "The History of the Panama Canal: Its Construction and Builders." Some excellent illustrations are given showing various application of the wire rope, and a brief history of wire-rope making from the time of its earliest use in this country makes interesting reading. An illustration is shown of a wire rope 3.25 in. in diameter, which has six strands of thirty-seven wires each twisted around an independent wire rope of six strands of nineteen wires each, which in turn are twisted around a blue hemp center.

Personal Mention

Mr. Asa Williams has been appointed superintendent of the municipal electric light and water plants of Fresno, Cal.

Mr. C. C. Adams has succeeded Mr. J. S. Johnston as superintendent of the Cynthiana (Ky.) Electric Light Company.

Mr. A. E. Potter has been appointed superintendent of the Baraboo (Wis.) Gas & Electric Company, vice Mr. G. I. McFarland, resigned.

Mr. James De Young, manager of the Consumers' Power Company's branch in Owosso, Mich., tendered his resignation, effective Feb. 1.

Mr. J. C. Rushin, of Atlanta, Ga., has been appointed manager of the new-business division of the Havana (Cuba) Electric Railway, Light & Power Company.

Mr. W. Cobb, of Kalamazoo, Mich., has been appointed manager of the Consumers' Power Company's branch in Owosso, Mich., vice Mr. James De Young, resigned.

Mr. G. I. McFarland has resigned as superintendent of the Baraboo (Wis.) Gas & Electric Company and removed to Salt Lake City, where he will engage in other business.

Mr. E. A. McCoy, who has been manager of the commercial division of the Columbia (S. C.) Railway, Gas & Electric Company since 1911, has resigned from its service.

Mr. Harry H. Wells, district manager for the Public Service Electric Company of the Orange district, has been appointed divisional agent of Essex County for the company.

Mr. O. H. P. Fant, vice-president of the St. John's Light & Power Company, of St. Augustine, Fla., has been appointed superintendent of the system in charge of operation.

Mr. E. L. Wells has resigned as manager of the Marshall (Tex.) Electric Company, the Marshall Ice Company and the Marshall Traction Company and has been succeeded by Mr. G. H. Caffery.

Mr. B. C. Candee has resigned as superintendent of the municipal electric-light plant of Dunkirk, N. Y., and accepted the position of secretary of the Buffalo (N. Y.) Metal Goods Company.

Mr. F. E. Schornstein, former manager of the Salina (Kan.) Light, Power & Gas Company, has been appointed general manager of the Eakin-Donelan Company, with headquarters at Concordia, Kan.

Mr. Richard R. Young, formerly division agent of the Public Service Gas Company and the Public Service Electric Company, Newark, N. J., has been made new-business agent for the State of New Jersey for these two companies.

Mr. E. A. Bell has resigned as electrical engineer of the Elgin lighting department of the Aurora, Elgin & Chicago Railway Company to devote his time to the motor and repair company which he recently founded at Elgin, Ill.

Mr. George H. Caffery has been appointed manager of the Marshall (Tex.) Electric Company, the Marshall Ice Company and the Marshall Traction Company. Mr. Caffery was formerly manager of the United Electric Light & Water Company, of Norwalk, Conn.

Mr. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, Chicago, has been awarded the Octave Chanute medal by the Western Society of Engineers, as the author of one of the best three papers presented before that society during the year 1913.

Mr. N. I. Garrison has been appointed assistant manager of the Fort Smith (Ark.) Light & Traction Company. Mr. Garrison, who was previously associated with this company, has been for the past year connected with the Western States Gas & Electric Company, at Stockton, Cal.

Mr. Palmer Yorke, former treasurer of the Fitchburg (Mass.) Gas & Electric Light Company and recently in charge of the publicity work of the Tenney Company, has been made assistant to the president of Charles H. Tenney & Company, public utility manager of Boston, Mass.

Mr. F. J. Derge, manager of the light, heat and power departments of the Toledo (Ohio) Railways & Light Company, was operated on for appendicitis at St. Vincent's Hospital on Jan. 4. The operation is said to have been successful, and Mr. Derge is now on the road to recovery.

Mr. C. A. Hoppin, general superintendent of the electric department of the Central Illinois Light Company of Peoria, Ill., has resigned to engage in consulting engineering practice. Mr. Hoppin, who is a graduate of the Illinois State University, has been connected with the Central Illinois Light Company for more than six years.

Mr. George F. Maddock has been appointed manager of the examinations and reports department of H. M. Byllesby & Company, Chicago, succeeding Mr. Harold Almert, resigned. Mr. Maddock has been the engineering representative of Byllesby & Company on the Pacific Coast for a number of years, residing in Berkeley, Cal. The appointment was effective Jan. 1.

Mr. C. W. Clark has resigned as superintendent, electrical engineer and purchasing agent of the Marion, Bluffton & Eastern Traction Company and the Bluffton, Geneva & Celina Traction Company, Bluffton, Ind., with which he has been connected since July 15, 1906. Mr. Clark will take charge of the Bluffton Electric Light & Water Works as general manager. He has been connected with interurban railway and electric light work since February, 1901.

Mr. W. W. Cole, consulting engineer for Day & Zimmerman, of Philadelphia and New York, was tendered a banquet at the Venango Club, Oil City, Pa., on Jan. 3. Since last March Mr. Cole has been managing the affairs of the Citizens' Traction Company, superintending its improvements and extensive work of the parent company, the Venango Light & Power Company. The banquet was planned by prominent business and professional men in appreciation of what Mr. Cole did for the good of the city during his ten months' residence there.

Mr. W. C. Gordon has been appointed transportation engineer for the Canadian General Electric Company, Ltd. Mr. Gordon, who is a graduate of Cornell, has had wide experience in connection with city, interurban and trunk-line electric railways. In 1899 he entered the testing department of the General Electric Company at Schenectady, and while with the railway construction department he had charge of the installation of the Manhattan Elevated Railway system in New York, and later of the installation of the Northwestern Elevated Road in Chicago and other roads in that territory. He was also closely associated with the electrification of the New York Central and the Interborough Rapid Transit lines. He went to Australia for the General Electric Company and was manager and engineer of the North Melbourne Tramways & Lighting Company, Ltd., engineer for the National Electrical & Engineering Company, Ltd., which handled the New Zealand business for the General Electric Company, and until his return to Canada was engineer for the Brisbane Tramways Company, Ltd.

Obituary

George J. Weber, a well-known inventor and builder of gas engines, died at his home in Kansas City on Jan. 7. He was formerly president of the Weber Gas & Gasoline Engine Company. Mr. Weber was sixty-five years old.

Richard Nolt Dyer, for many years chief patent attorney for Mr. Thomas A. Edison and a member of the law firm of Dyer, Dyer & Taylor, died at his home in Orange, N. J., Jan. 13. Mr. Dyer was born in Calais, Me., fifty-six years ago and was graduated from the Columbian University, Washington, D. C. He was admitted to the bar in Chicago in 1879, and two years later went to Menlo Park, N. J., as Mr. Edison's attorney. He fought the famous patent case of the incandescent lamp through all the courts to the United States Supreme Court, obtaining numerous decisions which ever since have been quoted in patent cases. He also prepared the patents on the phonograph and kinetoscope and carried these cases through the courts. Later he became counsel for the Sprague Electric Company and for several years had charge of the patent work of the General Electric Company.

Construction

New England

DAMARISCOTTA, MAINE.—The Portland Pwr. & Devel. Co., of Damariscotta, expects to purchase material for distribution system (regular purchases) and some electrical appliances and supplies. J. K. Waterhouse is general manager.

WATERVILLE, MAINE.—The Central Maine Pwr. Co., of Waterville, has purchased an extensive water-power privilege in Skowhegan from the Skowhegan El. Co., recently incorporated.

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 31 for the construction of two 300-ft. towers and concrete foundations at the United States naval station, Boston, Mass. Separate proposals will be entertained for structural steel work and for concrete foundations. The cost of the work is estimated at $12,000. Plans and specifications may be obtained on application to the bureau or to the commandant of the naval station named. H. R. Stanford is chief of bureau.

WESTFIELD, MASS.—At a town meeting held Jan. 5 the voters rejected the proposal to purchase electricity from the Amherst Pwr. Co. to operate the municipal electric-light system and voted to issue $25,000 in bonds for the purchase of new equipment for the municipal plant. The plans provide for a 300-hp boiler and a 500-kw generator.

WESTERLY, R. I.—The Westerly Lt. & Pwr. Co. expects to erect a fireproof substation in Watch Hill within the next six months. M. H. Spellman is general manager.

Middle Atlantic

ELLENVILLE, N. Y.—Bids will be received by H. Westlake Coons, secretary of the Ellenville school board, until Feb. 2, for the construction and completion of a high school building, including heating, electrical work, plumbing, etc.: a separate bid is to be submitted for heating. Plans may be seen at the office of the school board, Ellenville, or at the office of S. O. Lacey, architect, 415 Phelps Building, Binghamton.

NEWARK VALLEY, N. Y.—At a special election held recently the proposal to issue $13,000 in bonds for the installation of an electric-light plant was carried. Steps will be taken at once to begin work on the system.

NEW YORK, N. Y..—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 13, for a non-interfering local fire-alarm system at the United States Appraisers' Warehouse, New York, N. Y. For details see proposals columns. O. Wenderoth is supervising architect.

NEW YORK, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Feb. 2, for a fire-alarm system at Manhattan State Hospital, Ward's Island, N. Y. Drawings and specifications may be consulted and blank forms of proposal obtained at the Manhattan State Hospital, Ward's Island, N. Y., at the office of the State Hospital Commission, No. 1 Madison Avenue, New York, N. Y., and at the office of Lewis F. Pilcher, state architect, Capitol, Albany. J. H. B. Hanify is secretary of commission.

WATERTOWN, N. Y.—In his message to the Common Council, Mayor I. R. Breen recommends the installation of a municipal electric-lighting plant. The present cost of lighting the streets and public buildings is about $30,000 per year.

BENTON, PA.—Within the next six months the Benton El. Co. expects to purchase two small three-phase, 60-cycle, 2300-volt alternators (about 35-kw and 50-kw) and two 18-in. water turbines; also material for a single-phase transmission line, about 4 miles long, and a series tungsten street-lighting system, consisting of 40 100-watt lamps. Glen Appleman is superintendent.

LANCASTER, PA.—The capital stock of the Conestoga Trac. Co., of Lancaster, has been increased from $4,000,000 to $5,000,000, the proceeds to be used for improvements to the entire system. W. W. Griest, of Lancaster, is president.

McCALL FERRY, PA.—The Pennsylvania Wtr. & Pwr. Co., of McCall Ferry, is contemplating increasing the output of its plant by 17,000 hp and will install an additional water turbine and generator. James L. Rintoul, assistant treasurer, United States Fidelity & Guaranty Building, Baltimore, Md., is in charge of purchasing department. John. A Walls is chief engineer.

PHILADELPHIA, PA.—Bids will be received by A. F. Hammond, superintendent of supplies, Room 392, City Hall, Philadelphia, until Jan. 1, for lighting fixtures (gas and combination) for the new Horace Furness School building at Third and Mifflin Streets. All necessary information, specifications, etc., may be obtained upon application to the office of the superintendent.

READING, PA.—The Reading Merchants' Ice Co. is installing a new vertical ammonia compressor of 175 tons refrigerating capacity, made by the York Mfg. Co., of York, to be driven by a 300-hp General Electric motor with eight small Westinghouse motors to drive the necessary auxiliaries. All switches and switchboards will be furnished by the General El. Co. The Metropolitan El. Co., of Reading, will furnish electricity from a direct-current 2300-volt, three-phase, 60-cycle trunk line to operate the ice plant. William E. Zieber is secretary of the ice company.

STATE COLLEGE, PA.—Bids will be received until Jan. 28 for the construction of a liberal arts building at State College, Pa., including heating, plumbing and electrical work. Plans and specifications may be seen at the offices of President Edwin E. Sparks, State College; McKee, Mitchell & Alter, Park Building, Pittsburgh; State superintendent of grounds and buildings, Capitol, Harrisburg, and Day & Klauder, architects, 925 Chestnut Street, Philadelphia. For further particulars apply to the architects.

WILKES-BARRE, PA.—Bids will be received at the office of the city clerk, Wilkes-Barre, until Jan. 27, for furnishing all labor and material for installing one 14-circuit switchboard and one 20-circuit protector board, together with batteries and battery racks for fire-alarm system. For further information address Fred H. Gates, city clerk. Joseph G. Schuler is superintendent of Department of Fire and Public property.

TRENTON, N. J.—A report submitted recently to the city commission by John H. Gregory, of the firm of Hering & Gregory, 170 Broadway, New York, N. Y., consulting engineers, engaged to consider the question of constructing a garbage disposal plant, recommends the installation of a garbage incinerator and power plant, at a cost of $195,000, which will generate power to operate the pumps planned for the sewage-disposal plant to raise sewage from the outfall sewer to the septic sewer.

WHIPPANY, N. J.—The Hanover Brick Co., of Whippany, is contemplating equipping its works with electrically operated machinery. The company has contracted with the Morris & Somerset El. Co., of Morristown, for electricity to operate its plant, which will erect a new transmission line to the works from its Whippany-Boonton line at Monroe.

BALTIMORE, MD.—Plans have been prepared by Robert J. McCuen, superintendent of lamps and lighting, for the proposed extension of an ornamental system of street-lighting in the business and residential section, including both arc and tungsten lamps. Arc lamps are to be installed in the business section, of which there are to be 400 (6.6-amp lamps) surmounted on ornamental standards especially designed by the municipal art commission and known as the "Baltimore post." When these additional lamps have been installed a total of 800 of this type of lamp will be in service in the business section of the city. Approximately 300 tungsten lamps of 60 cp, with alba globes, surmounted on ornamental standards of the same type as the arc standards, only smaller, will be installed, making a total of 1000 lamps of this type in the residential section. All of these lamps will be maintained by the underground service. The arc lamps will be installed by the Consol. Gas, El. Lt. & Pwr. Co., of Baltimore, and the tungsten lamps will be installed by the working force of the Department of Lamps and Lighting.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 14 for furnishing and installing on foundations provided by the government in the central power plants, United States navy yards, at Mare Island, Cal., and Puget Sound, Wash., two motor-driven fire pumps of 1000 gal. per minute capacity, 400-ft. head, and two steam turbine-driven heating system pumps of 1000 gal. per minute capacity, 150 lb. per square in. gage, to cost approximately $14,000. Plans and specifications may be obtained upon application to the above bureau or to the commandants of the navy yards named. H. R. Stanford is chief of bureau.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 3 for furnishing at the various navy yards and naval stations the following supplies: Brooklyn, N. Y., Schedule 6255—one steam-driven air compressor; Schedule 6273—1100 ft. soft-steel controller, armored cable for searchlights, 500 ft. soft-steel, lead and armored interior communication cable, 1000 ft. soft-steel, leaded and armored single-conductor wire; Schedule 6272—15,000 ft. stranded, portable ship-lighting cable, 10,000 ft. twisted telephone wire. Bids will also be received at the same place until Feb. 10 for miscellaneous voltmeters, ammeters and wattmeters at Mare Island, Cal., as per Schedule 6258. Applications for proposals should designate the schedule desired by number. T. J. Cowle is paymaster general, U. S. N.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D C., until Jan. 27, for furnishing at the various navy yards and naval stations the following supplies: Norfolk, Va., Schedule 6240—two ventilating blowers. Brooklyn, N. Y., Schedule 6236—40-pair lead-sheathed telephone cable. Philadelphia, Pa., Schedule 6242—six watchmen's clocks, miscellaneous sleeves and sockets for Morse taper shank twist drills. Bids will be received at the same place until Feb. 3 as follows: Puget Sound, Wash., Schedule 6231—fuel-oil burning apparatus. Mare Island, Cal., Schedule 6230—two sets storage batteries for use in electric trucks; Schedule 6234—25,000 yd. condenser tube packing. East and West, Schedule 6228—8200 dry cells. Bids will also be received until Feb. 17 for furnishing at the Brooklyn navy yard three 5-kw radio sets for shore installation as per schedule 6246. Applications for proposals should designate the schedule desired by number. T. J. Cowie is paymaster general, U. S. N.

North Central

BOYNE CITY, MICH.—The Boyne River Pwr. Co. expects to purchase within the next 12 months a complete outfit for 4-amp luminous arc-lamp lighting system, adding 17 arc lamps to its present system, consisting of 33 arc lamps.

COLDWATER, MICH.—The managers of the municipal electric-light plant expect to purchase within the next three months two (300-hp each) water-tube boilers. William H. Friedrich is superintendent.

DETROIT, MICH.—The State Railroad Commission has granted the Detroit Edison Co. permission to increase its capital stock from $15,000 to $25,000,000 and to issue $3,400,000 in bonds. Improvements and extensions involving an expenditure of $3,000,000, it is understood, will be made in Detroit during 1914. Alexander Dow is president and general manager.

EAST JORDAN, MICH.—Within the next 12 months the East Jordan El. Lt. & Pwr. Co. expects to purchase 50 or 75 lamp-posts for lighting Main Street. The company has recently installed one 12-in. by 24-in. by 30-in. tandem Corliss engine, directly connected to 250-kw generator; two 72-in. by 18-ft. boilers, pumps, condensers, exciters, switchboards, etc. L. G. Balch is superintendent.

GLADWIN, MICH.—Within the next 30 days the Gladwin Lt. & Pwr. Co. expects to purchase one 100-kva, three-phase, 60-cycle, 2300-volt generator (belted), one water-wheel, one generator panel, transformers, etc. S. B. Wiggins, 709 Kirby Building, Saginaw, Mich., is consulting engineer.

HOLLY, MICH.—The Independent Pwr. Co. is contemplating extending its transmission lines south and east of Holly to Davisburg. The company will furnish electricity to the farmhouses along the line. George C. Weber is manager.

KITZVILLE, MICH.—The Village Council has granted the Chisholm El. Co., of Chisholm a franchise to furnish electricity for lamps and motors here. The Council has also entered into a contract with the company for lighting the streets of the city.

LANSING, MICH.—The city of Lansing will need about one-half mile of underground conduit for the municipal electric-light system; also material for distribution system; nothing definite decided upon at this time. C. D. Dodge is superintendent.

LOWELL, MICH.—The town of Lowell is contemplating the installation of a rectifier and more street lamps. Nothing definite has yet been decided upon. Frank J. McMahon is superintendent.

MARCELLUS, MICH.—The board of commissioners is contemplating the installation of an additional engine and generator to furnish electricity for lamps and motors (day service) As yet nothing definite has been decided upon. Frank L. Knight is superintendent of water and light department.

MENOMINEE, MICH.—The Menominee & Marinette Lt. & Trac. Co. expects to install within the next two months a 200-kw motor-generator set for street-railway service. Edward Daniell is general manager.

MILLINGTON, MICH.—Oliver B. Whipple, owner of the local electric-light plant, expects to purchase within the next six months one 50-kw, three-phase, 60-cycle generator, or a 50-kw, 250/125-volt, three-wire, direct-current generator, one 25-kw, 125-volt compound-wound generator, also one 2½-kw generator and material for street-lighting system for town of about 800. Mr. Whipple is also planning to erect 4 or 5 miles of transmission lines.

MORENCI, MICH.—Within the next four months the Morenci-Fayette Lt. & Pwr. Co. expects to purchase one compound condensing engine with a rating of from 200 hp to 250 hp and two step-down transformers with a rating of about 80 kva. George F. Avis is secretary and treasurer.

PERRINTON, MICH.—A complete electric-lighting system is being installed here. Already 25 100-watt lamps have been erected on the streets, and it is expected to install about 300 lamps in the stores and residences. Electricity for operating the system is furnished from the [illegible] of the Lucas & Schultz Milling Co.

PICKFORD, MICH.—It is proposed to install a small electric-light plant in Pickford to furnish electricity for lighting the telephone exchange and other places of business. If satisfactory, a larger plant will be installed later on.

ST. JOSEPH, MICH.—The local electric-light company has submitted a proposal to the City Council offering to furnish and maintain 25 street lamps at $45 each per year, provided that the city erect the poles and install the wiring. To increase the output of the municipal electric-light plant to provide for the increased service would cost about $15,000.

WOLVERINE, MICH.—Within the next 12 months Preston & Sowton, owners of the local electric-light plant, expect to purchase a few small transformers, arresters, insulators and possibly 50 poles (25-ft. and 30-ft.), also a small supply of electrical appliances and supplies. O. B. Preston is manager.

BELLEFONTAINE, OHIO.—The City Council has authorized an issue of $36,000 in bonds, the proceeds to be used for increasing the output of the municipal electric-light plant.

BOLIVAR, OHIO.—The Bolivar Lt. & Pwr. Co. has applied to the Public Utilities Commission for permission to issue capital stock to the amount of $10,000. Of this stock $3,000 is to be delivered to N. L. Nash, in payment for the electrical distributing system in the village of Bolivar, the proceeds of the remaining $7,000 to be used for improvements and extensions to the property.

HURON, OHIO.—The Board of Trustees has engaged the United Engineering & Construction Co., of Cleveland, to take charge of remodeling the municipal electric-light plant, the installation of new generating equipment and a new street-lighting system. E. E. McCormick, president of the board of trustees, it is said, is ready to receive bids on electrical equipment.

NEW CONCORD, OHIO.—The Public Utilities Commission has granted the New Concord Wtr. & El. Co. permission to issue $17,000 in bonds, of which the proceeds of $7,255 will be used to pay for construction of plant, etc., and the remainder for future extensions and improvements.

BARBOURVILLE, KY.—The Barbourville El. Lt. & Pwr. Co. has purchased the franchise offered by the city. Plans are being considered by the company for extensive improvements and extensions to its system.

BOWLING GREEN, KY.—Plans are being considered for increasing the output of the municipal electric-light plant to provide electricity for maintaining an ornamental street-lighting system, which is being promoted by the business men and others.

COLUMBIA, KY.—The Columbia Ltg. Co. expects to purchase within the next six months one 37½-kva, single-phase, 60-cycle, 1100-volt or 1150-volt generator. A. H. Ballard is secretary and treasurer.

JACKSON, KY.—The Day Lumber & Coal Co., of Jackson, has purchased the property of the Swann-Day El. Co. Within the next two months the company expects to install meters in some portions of the town which now have flat-rate service; also to purchase some incandescent street lamps with gooseneck posts for street-lighting. George D. Lawrence is manager of the light plant and ice factory.

LEITCHFIELD, KY.—Within the next 30 days the Leitchfield El. Lt., Ht. & Pwr. Co. expects to purchase one 50-kw, three-wire, 250-volt directly connected generating unit, one 100-hp boiler, 125-lb. pressure (internally fired preferred), heater, pumps, etc. W. N. Moss is superintendent.

LONDON, KY.—The London El. Lt. & Pwr. Co. expects to purchase within the next 30 days one 14-in. double leather belt about 130 ft. long. W. F. Raymer is president and general manager.

MADISONVILLE, KY.—The Madisonville & Nortonville Lt., Pwr. & Trac. Co., recently incorporated under the laws of the State of Delaware, has asked the City Council for a franchise to furnish electricity for power purposes in Madisonville; the company also has offered to purchase the municipal electric-light plant. The construction of an interurban electric railway between Madisonville and Nortonville, a distance of 12 miles, is also contemplated by the company.

WINCHESTER, KY.—The city of Winchester, it is reported, is contemplating the establishment of an electric-light plant to maintain the ornamental street-lighting system recently installed.

CORYDON, IND.—Within the next 12 months the Corydon Lt., Wtr. & Ice Co. expects to erect about 1 mile of new line and to purchase one boiler, coal and ash handling system, poles, incandescent lamps, electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. Frank R. Wright is proprietor.

GOSHEN, IND. — Arrangements have been made by the city of Goshen for a temporary loan of $35,000 to provide funds for reconstructing the municipal electric-light plant.

PLYMOUTH, IND.—The Plymouth El. Lt. & Pwr. Co. has erected poles to Walkerton, a distance of 14 miles, for a 13,500-volt transmission line. As soon as this line is completed the company will build a line to Culver, 12 miles distant. The company is also contemplating extending its service to several small towns. Material for above extensions has been purchased. C. D. Snoeberger is owner and manager.

ATLANTA, ILL.—The capital stock of the Atlanta El. Lt. & Pwr. Co. has been increased from $10,000 to $30,000.

BYRON, ILL.—G. W. Petit, Jr., of Byron, has submitted a proposal to the City Council asking for a franchise to furnish electricity for lamps and motors; also a contract for street-lighting.

CAIRO, ILL.—The capital stock of the Cairo Ry. & Lt. System has been increased from $150,000 to $300,000.

EFFINGHAM, ILL.—The Effingham El. Lt. & Pwr. Co. has increased its capital stock from $15,000 to $105,000.

LITCHFIELD, ILL.—The United Gas & El. Co., of Litchfield, has increased its capital stock from $100,000 to $250,000.

MATHERVILLE, ILL.—The capital stock of the Matherville Lt. & Pwr. Co. has been increased from $10,000 to $40,000.

MOMENCE, ILL.—The capital stock of the Momence Utilities Co. has been increased from $25,000 to $75,000.

OAK FOREST, ILL.—The contract for the electrical work on the new county buildings under construction here has been awarded by the Board of County Supervisors to W. F. Cummings, 3407 West Monroe Street, Chicago, at $69,975.

PAXTON, ILL.—The Central Illinois Utilities Co., of Paxton, has obtained franchises in Melvin, Thawville, Danford, Ashkum, Chifton, Chebanse and Rankin. The company expects to extend its transmission lines to these towns this spring. L. N. Boisen is chief operating engineer, and C. H. Lindsay, of Watseka, is district superintendent.

SIDNEY, ILL.—The Homer El. Lt. & Pwr. Co., of Homer, recently granted a franchise in Sidney, will erect a high-tension line from Homer to Sidney, a distance of 6 miles. About 300 chestnut (30-ft.) poles and 12 miles of wire will be required for the proposed line. U. S. Thompson, of Homer, is proprietor and manager.

EAU CLAIRE, WIS.—The Chippewa Valley Ry., Lt. & Pwr. Co., of Eau Claire, informs us that it does not contemplate the construction of a new hydroelectric plant at Paint Creek the coming season, as reported in the issue of Jan. 3.

MANITOWOC, WIS.—The city of Manitowoc has taken over the electric plant of the Manitowoc El. Lt. Co. for a consideration of $145,000. It is planned to take over the gas plant and consolidate it with the electric and water-works plants.

ARGYLE, MINN. — The electric-light committee expects to purchase within the next six or eight months material for an ornamental street-lighting system. Martin Glende is superintendent.

AUSTIN, MINN.—Within the next 12 months the Board of Public Works expects to purchase a coal and ash-handling system, material for underground conduit, distribution cable, wire and posts. William Todd is superintendent.

BRAINERD, MINN.—The National Lt., Ht. & Pwr. Co., of Brainerd, has sold its property to the Cuyuna Range Pwr. Co., of Deerwood. The latter company has a hydraulic plant on the Crow Wing River, 10 miles from Brainerd, equipped with two generating units consisting of two 48-in. Morgan Smith horizontal water turbines and an Allis-Chalmers 600-kva, 2300-volt generator, and a transmission line, 35 miles long, erected on steel or concrete poles, transmitting electricity at 35,000 volts, serving towns and mines on the Cuyuna Range with electricity for lamps and motors. The company also has a 250-hp steam auxiliary plant and a 400-hp gas-producer plant. Construction work was completed Jan. 1, 1914. T. H. Croswell is vice-president.

DE GRAFF, MINN.—At an election held Dec. 23 the proposal to install a municipal electric-light plant was carried. The plant will be driven by a gas or kerosene engine. C. D. Noonan is city clerk.

FOLEY, MINN.—Within the next six months the Foley El. Lt. & Pwr. Co. expects to purchase one 30-hp and one 60-hp crude-oil or gas engine, two direct-current, 250-volt generators, one 20-kw and the other 40-kw. Herman E. Becker is general manager.

GRACEVILLE, MINN.—The Otter Tail Pwr. & Lt. Co., of Fergus Falls, has purchased the municipal electric-light plant and will operate the local system with electricity generated at its plant in Fergus Falls. The company has also erected a new auxiliary plant in Graceville. William McDonnell is village recorder.

HEIBERG, MINN.—Within the next few months J. F. Heiberg, owner of the local electric-light plant, expects to purchase one rectifier for charging auto batteries for lighting, etc.

MINNEAPOLIS, MINN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 30, for an electric passenger elevator, electric push-button lift, electric push-button dumb waiter, hydraulic freight and hydraulic ash lift in the United States post office at Minneapolis, Minn., in accordance with drawings and specifications, copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

MINNEAPOLIS, MINN.—Adolph F. Meyer, consulting engineer of St. Paul, engaged to make an investigation as to establishing a power plant at the government canal to supply electricity to the cities of St. Paul and Minneapolis and the University of Minnesota, has submitted his report to City Engineer F. W. Cappelen and Dean F. C. Shelden of the engineering department of the University of Minnesota, in which he recommends the installation of a power plant to cost about $700,000, which would provide for a development of 15,200 hp. The government has already spent $800,000 in the modification of the navigation to provide for the utilization of the water-power.

NEW PRAGUE, MINN.—Within the next three months the Electric Light and Water Works Department expects to purchase one 66-in. by 18-ft. high-pressure tubular boiler for 160 lb. working pressure; also to purchase within the next 12 months 20 5-amp and 10-amp, 250-volt direct-current meters and one carload of 25-ft. (7-in. top) cedar poles. Joseph T. Rynda is superintendent.

NEW ULM, MINN.—Bids will be received by A. F. Reim, clerk of the Independent School District of the city of New Ulm until Feb. 10 for all labor and materials for seven separate contracts as follows: (b) plumbing, (c) heating, (d) ventilating-fan equipment, (e) temperature regulation, (f) vacuum cleaning system, (g) electric installation, for the high school building to be erected in New Ulm, in accordance with plans and specifications prepared by Tyrie & Chapman, architects, 320 Auditorium Building, Minneapolis, which are on file at the offices of the clerk of Independent School District, New Ulm; of the architects, Minneapolis, and also at the Builders' Exchanges in Minneapolis and St. Paul.

PARKER'S PRAIRIE, MINN.—The installation of an electric-light system in Parker's Prairie is reported to be under consideration.

ST. PETER, MINN.—Within the next three months the City Council expects to purchase 32 ornamental lamp standards for five-lamp clusters. F. N. Wilson is superintendent of the electric-light and water-works system.

AMES, IA.—Within the next six months the electric light commission expects to install a 500-kw Curtis turbine with Westinghouse condenser, new switchboard, etc., in the municipal electric-light plant; also to purchase within the next 12 months additional boiler equipment, meters, transformers, carload of poles, lightning arresters, one tub transformer, etc. Charles E. Warsaw is superintendent.

CORRECTIONVILLE, IA.—The Town Council has authorized an election to be held during this month to vote on the proposal to issue $15,000 in bonds to purchase the plant of the Union Lt. & Pwr. Co., to be owned and operated by the municipality.

DES MOINES, IA.—The Des Moines El. Co. is contemplating the erection of a high-tension transmission line to Oskaloosa to supply electricity for lamps and motors and to operate the street and interurban railways, work on which will begin next spring. High-tension lines will also be erected to several other cities in the spring. The company is seeking a frachise in Carlisle.

ELDON, IA.—The town of Eldon expects to purchase within the next 12 months a 66-in. by 16-ft. return tubular boiler for the municipal electric-light plant. C. A. Flint is superintendent.

FORT MADISON, IA.—The distribution system of the Fort Madison El. Co. is being rebuilt by the Stone & Webster Engnrg. Corpn., of Boston, Mass.; also a substation to enable the company to distribute energy (25-cycle) which it will purchase from the Mississippi River Pwr. Co. The company, it is expected, will close down the local plant in the near future. Alfred S. Nichols is manager.

MINDEN, IA.—At an election held recently the citizens voted to construct a municipal electric-light plant. John W. Crow is Mayor.

MOUNT VERNON, IA.—The Wapsie Pwr. & Lt. Co., of Mount Vernon, expects to erect about 20 miles of 33,000-volt transmission lines from Stanwood to Lowden and Clarence, Ia., within the next six months; also to purchase material for same, including poles, transformers, lightning arresters, insulators, cable, wire, etc. Kenneth Lindsay is manager.

SHELBY, IA.—The Avoca El. Lt. & Pwr. Co., of Avoca, is erecting a 6600-volt transmission line from its plant in Avoca to Shelby to furnish electrical service here. The franchise was granted Dec. 1, 1913. The plant will be completed by May 1 and the company expects to be able to furnish service here by Feb. 1. Material for this extension has been purchased. W. A. Torrey, of Avoca, is manager.

TRAER, IA.—Within the next four months the Traer El. Co. expects to purchase from 20 to 50 30-ft. steel poles, angle iron, tubular or tripartite. F. L. White is proprietor and manager.

BOONVILLE, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 11, for construction, complete (including mechanical equipment, interior lighting fixtures and approaches), of the United States post office at Boonville, Mo. Drawings and specifications may be obtained from Richards, McCarty & Bulford, architects, Columbus, Ohio, and from the custodian of site at Boonville, or from the above office. O. Wenderoth is supervising architect.

EDINA, MO.—Within the next two months the Edina Lt. Co. expects to purchase one boiler with a rating of from 150 hp to 200 hp; also to purchase within the next three months a series street-lighting system. C. Hunter is secretary.

FARMINGTON, MO.—The City Council is contemplating placing stokers under the boilers in the municipal electric-light plant, consisting of two 72-in. by 18-ft. O'Brien tubular boilers. C. M. Thomsen, superintendent of the municipal plant, would like to receive catalogs, prices, etc., from manufacturers and dealers in stokers.

FULTON, MO.—The Water and Light Department is contemplating the purchase of a new generating unit, consisting of a Corliss engine and generator, directly connected. W J. McCarroll is superintendent of water and light plant.

LAMAR, MO.—The City Council is contemplating extending the municipal electric distribution system about 6 miles. Steps have been taken by the management of the electric-light plant to introduce electrical heating and cooking apparatus, vacuum cleaners, washing machines, etc. Charles B. Hall is superintendent.

LINN CREEK, MO.—Burns & McDonnell, of Kansas City, Mo., consulting engineers, are making surveys, estimates and preparing report for a 10-000-hp hydro-electric power project in Camden County

RICHLAND, MO.—The City Council has granted W. I. Diffenderffer, of Lebanon, a 20-year franchise to construct and operate an electric-light system in Richland, subject to the approval of the voters. The Council has also entered into a contract with Mr. Diffenderfer to furnish 12 40-watt street lamps for a period of five years at $24 each per year.

SEDALIA, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 17 for a conduit and wiring system and lighting fixtures in the United States post office, Sedalia, Mo., in accordance with plans and specifications. For details see proposals. O. Wenderoth is supervising architect.

SWEET SPRINGS, MO.—Within the next three months the city of Sweet Springs expects to purchase one 75-kva generator and a 100-hp engine. E. Reans is city clerk.

LEAD, S. D.—The Homestake Mining Co. is reported to be contemplating extensive improvements to its properties, involving an expenditure of $350,000, which will include the installation of a steam electric generating plant, at a cost of $45,000; a boiler plant, to cost $100,000, and a new hoist.

SIOUX FALLS, S. D.—Within the next 12 months the city of Sioux Falls expects to purchase 76 magnetite-arc lamps and iron poles with underground installation and rectifier for 100 lamps. P. O. Hanson is electrician.

YANKTON, S. D.—Bids will be received by the Mount Marty Hospital Association, at the Sacred Heart Hospital, Yankton, S. D., until Feb. 16, for construction of a brick and reinforced-concrete hospital building, including general work, heating, plumbing, electric systems and elevators, in accordance with plans and specifications prepared by Hartford & Jacobson, 601 Capital Bank Building, St. Paul, Minn. Plans are on file at the office of the architects, at the office of D. B. Gurney, Yankton, and at the Builders' Exchange, St. Paul, Minn.

ASHLAND, KAN.—Within the next three months the managers of the municipal electric light plant expect to purchase material for distribution system, including transformers, poles, lightning arresters, insulators, distribution cable and wire, meters, electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc. A. W. Hawes is manager.

BLUE RAPIDS, KAN.—Within the next eight months the Marshall County Pwr. & Lt. Co. expects to make extensive repairs to its water-power plant and install two additional waterwheels from 100 hp to 150 hp each, a generator of about 75 amp and additional governor and exciter; also within the next six months to purchase 50 washing machines, 100 irons and cooking devices. The company contemplates extending its service to furnish energy to the mills in Marshall and surrounding towns. J. G. Strong is manager.

DOUGLAS, KAN.—Bids will be received at the office of the city clerk, Douglas, Kan., until Jan. 26, for furnishing material and constructing electric-light plant and water-works system as follows (1) For furnishing all material and labor for constructing power house, low service pump house and pit, settling basin, filter, clear well, filter house and all concrete work; (2) furnishing and installing filter unit, equipment and all piping in filter house; (3) furnishing all machinery and electrical equipment; (4) erecting machinery and electrical equipment; alternate bids for sections 3 and 4, for furnishing and erecting machinery and pumping equipment; (5) furnishing and erecting 50,000-gal. tower and tank 100 ft. high; (6) furnishing and laying water pipes, hydrants and valves; (7) furnishing and erecting one 300,000-gal. filter unit. Plans and specifications are on file at the office of the city clerk, Douglas, and at the office of Albert C. Moore, consulting engineer, Bartlett Building, Joplin, Mo. A complete set of plans may be obtained upon payment of $5 to cover the cost of prints, or $1 for specifications for any one section of specifications. Dr. C. A. Ogg is city clerk.

GARDEN CITY, KAN.—We are informed that the United States Sugar & Land Co., of Garden City, has placed all contracts for its new power plant. F. A. Gillespie is treasurer.

KANSAS CITY, KAN.—Within the next two months the city of Kansas City expects to erect an addition to the municipal power house to provide for increasing the output of the power plant to supply electricity for power purposes; also to install within the next three months one 3000-kva, three-phase, 60-cycle, 2300-volt turbo-generator, and to purchase wire and insulators for 6 miles of 6600-volt transmission line; also to purchase within the next six months coal and ash-handling apparatus to serve 2700 hp in boilers. F. E. Williams is electrical engineer.

LEON, KAN.—Plans and specifications are being prepared by Albert C. Moore, Bartlett Building, Joplin, Mo., for the new municipal electric-light plant and water-works system in Leon. An election will soon be called to vote on the proposal to issue bonds for same.

WELLINGTON, KAN.—Plans are being considered for rebuilding the municipal electric-light plant when the new water-works system is installed, probably some time this year. N. E. Stone is superintendent.

Southern States

BOONE, N. C.—Messrs Hartzog & Moretz, it is reported, are contemplating the installation of a generator to furnish electricity for lighting the town.

ALLENDALE, S. C.—The city of Allendale has awarded the contract to the J. B. McCrary Co., of Atlanta, Ga., for the construction of a municipal electric-light plant. The equipment of the proposed plant will consist of two 80-hp boilers, one 100-hp high-speed automatic engine, one 60-kva generator, directly connected to engine, switchboard, transformers (2200/220/110-volt), 10 miles of No. 8 wire, 200 30-ft. poles and 50 100-watt incandescent street lamps. It is not yet decided when contracts will be awarded.

ATLANTA, GA.—The special committee appointed by Mayor L. C. Hayne to make investigations in regard to the establishment of a municipal electric-light plant has recommended the installation of a lighting plant, the cost not to exceed $250,000. T. W. Pilcher, member of the City Council, is chairman of the committee.

LEESBURG, GA.—The contract for construction of the proposed municipal electric-light plant has been awarded to the J. B. McCrary Co., of Atlanta. The equipment will consist of one 100-hp boiler, one 100-hp high-speed, automatic engine, one 60-kva generator, switchboard, transformers (2200/220/110 volt), 8 miles of wire, 150 30-ft. poles and 30 100-watt incandescent street lamps.

STILLMORE, GA.—Within the next eight months the Stillmore El. Lt. Co. expects to erect a cotton gin, grist mill, planing mill, and also to purchase a 30-hp oil engine and wire for about 1 mile of distribution line. W. L. Clarke is proprietor.

BOCA GRANDE, FLA.—The Charlotte Harbor & Northern Ry. Co. is reported to have awarded a contract to Hampton & Buerke for the installation of an ornamental street-lighting system, Worthington surface condenser, erection of 2 miles of three-phase transmission line, rebuilding present lines, to install 700 kw in transformers and to remodel the electric equipment at the terminals. L. M. Fouts, 5 Nassau Street, New York, N. Y., is general manager.

KEY WEST, FLA.—Bids will be received of the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 31, for the construction of three 300-ft. towers, erected upon concrete foundations furnished by the government at the United States naval station, Key West, Fla., to cost about $15,000, in connection with a station for radio-telegraphic service. Plans and specifications may be obtained on application to the bureau or to the commandant of the naval station named. H. R. Stanford is chief of bureau.

HALLS, TENN.—The property of the Halls Lt., Wtr. & Ice Co. was purchased by the city of Hall at a public sale held Jan. 3. Improvements will be made to the plant.

ABERDEEN, MISS.—The electric light and water-works commissioners expect to purchase a 150-hp engine next spring. E. A. Stimson is superintendent

GREENWOOD, MISS.—The Electric Light and Water Works Commissioners expect to purchase within the next three months a 500-kw, three-phase, 60-cycle, 2400-volt (high-pressure) turbo-generator, with auxiliaries, switchboard, etc. R. Stott is manager.

RULEVILLE, MISS.—Within the next two months the electric-light commission expects to purchase one armature for a 6-kw Wood generator, two transformers, 10 poles, 20 cross-arms and 3000 ft. No. 10 weather-proof wire. O. S. Anderson is superintendent.

PRESCOTT, ARK.—The Board of Electric Light Commissioners expects to purchase within the next six months a 75-kva generator and automatic slide engine (directly connected). A. R. Taylor is superintendent.

RAYNE, LA.—Within the next 30 days the managers of the municipal electric-light plant expect to install one 60-hp Snow crude-oil engine. E. J. Bertrand is superintendent.

CARLSBAD, TEX.—Plans are being considered for the erection of a State Tuberculosis Sanitarium, including lecture hall, storeroom and dormitory to accommodate 50 patients; also steam heat, electric lighting, water-works and sewerage systems, to cost about $30,000. The cost of the buildings is estimated at $34,000. An architect has not yet been selected. George J. Bird, of San Angelo, is vice-chairman.

JEFFERSON, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 20 for changes in plumbing, gas piping, conduit and wiring system and lighting fixtures in the United States post office and court house in Jefferson, Tex., in accordance with plans and specifications. For details see proposal columns. O. Wenderoth is supervising architect.

SAN DIEGO, TEX.—The local electric-light plant, owned by S. G. Smith, has been purchased by Arthur Blankenship, who, it is said, will make improvements to the plant.

TEMPLE, TEX. — The Southwestern Trac. Co., of Temple, is erecting a substation near here to distribute the energy which it will obtain from the power plant of the Temple Pwr. & Lt. Co. in Temple, which will be used to operate the interurban railway of the Southwestern Trac. Co., between Temple and Belton. The old plant of the traction company, 4 miles west of here, will be used for emergency and reserve purposes only.

Pacific States

BELLINGHAM, WASH.—The Puget Sound Trac., Lt. & Pwr. Co. is contemplating making extensive improvements to its local power plant.

SEATTLE, WASH.—The commissioners of King County have granted the Puget Sound Trac., Lt. & Pwr. Co., of Seattle, a franchise to erect transmission lines on 50 county roads in the territory between Bothell, Bellevue, Medina, Lake Sammamish and Lake Washington.

SEATTLE, WASH.—The condemnation of the Lake Cushman power site has been made possible without further bond issue by the passage of an ordinance by the City Council giving the people a right to transfer $200,000 from an issue voted for the Cedar River watershed. The question will be submitted to the voters on March 3.

TACOMA, WASH.—A petition has been presented to Nicholas Lawson, light commissioner, asking for the installation of luminous-arc lamps on Eleventh Street from C to Tacoma Avenue or K Street.

AUMSVILLE, ORE.—Application has been made to the City Council by the Aumsville Flour Mill Co. for a franchise to install and operate an electric-light and power system in Aumsville.

PORTLAND, ORE.—Preparations are being made by the Portland Ry., Lt. & Pwr. Co. to install 200 arc lamps on the east side of the Willamette River, principally in the Lents, Mount Scott and adjoining districts.

BERKELEY, CAL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 18 for the construction, including mechanical equipment and approaches, of the United States post office at Berkeley, Cal. Drawings and specification may be obtained at the above office, or from the custodian of site at Berkeley.

FALL RIVER MILLS, CAL.—The Pit River Pwr. Co., which proposes to build a power plant at Fall River Mills, has applied to the State Railroad Commission for permission to supply electricity in the northeast portion of Shasta County and in Modoc and Lassen Counties.

LINDSAY, CAL.—The State Railroad Commission has granted the Tulare County Pwr. Co., of Lindsay, permission to issue $80,000 in capital stock, the proceeds to be used to enlarge its steam plant and for the erection of new transmission lines and distribution systems.

LOS ANGELES, CAL.—The Vernon substation of the Pacific Lt. & Pwr. Corpn., of Los Angeles, was completely destroyed by fire on Jan. 7, causing a loss of about $68,000.

LOS ANGELES, CAL.—Within the next six months the Nevada-California Pwr. Co., Title Insurance Building, Los Angeles, Cal., expects to erect 160 miles of 55,000-volt transmission line and to purchase six 55,000-volt automatic switches; also one 2000-kva synchronous condenser within the next three months. C. O. Poole is chief engineer.

PASADENA, CAL.—At the present time the city of Pasadena is putting into commission 600 ornamental lamp-posts and is adding 200 meters per month to the municipal electric-lighting system. Within the next two years the city expects to install a 3000-hp crude-oil Diesel engine. C. W. Koiner is general manager of the municipal plant.

REDLANDS, CAL.—Preliminary plans are being made by the Coachella Valley El. & Ice Co., of Redlands, for the erection of a high-tension transmission line from Banning to El Centro, this line running through the Coachella and Imperial Valleys, paralleling the Southern Pacific Railroad. The company will erect a substation and distribution system in the Coachella Valley to serve that territory. The connection with Banning will be with the Southern Sierras Pwr. Co., which is building a transmission line from San Bernardino to that point. It will be a pole line with aluminum wire, to carry 55,000 volts. W. G. Driver is secretary.

SAN FRANCISCO, CAL.—The Ocean Shore R. R. Co. has been authorized to issue $500,000 in bonds, of which the proceeds of $200,000 will be used for electric equipment and for improvement of service. The balance will be reserved for future requirements.

SAN FRANCISCO, CAL.—Within the next 12 months the Coast Valleys Gas & El. Co., 58 Sutter Street, San Francisco, expects to erect 10 miles of 22,000-volt transmission lines and to purchase material for same; also electrical appliances and supplies as required to meet demands. F. J. Blanchard is auditor.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Pwr. Co., 58 Sutter Street, San Francisco, expects to build a pressure pipe 3000 ft. long and from 40-in. to 60-in. in diameter within the next 12 months: also to purchase material for 20 miles of distribution lines and electrical appliances and supplies as demands require. F. J. Blanchard is auditor.

SANTA MARIA, CAL.—Within the next 12 months the Midland Counties Public Service Corp., of Santa Maria, expects to erect about 30 miles of distribution lines; also to purchase electrical heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc., amounting to about $1,000.

WINEHAVEN, CAL.—Plans have been prepared by the California Wine Association for construction of sewer system. 100 reinforced-concrete bungalows, fire-alarm system and equipment, reinforced-concrete social club, administration building, water-works, etc., to cost about $100,000.

BLACKFOOT, IDAHO.—Plans are being considered by D. H. Bietham and others for the construction of a power plant on Warm River to supply electricity in Blackfoot and other nearby towns. It is estimated that 7000 hp can be developed.

BURKE, IDAHO.—The Canyon Creek El Lt. Co., of Burke, expects to purchase within the next 12 months incandescent lamps, costing about $1,200. E. McHarness is cashier.

NEW MEADOWS, IDAHO.—W. H. Hills and B. Gustad have secured a site on the Little Salmon River, where a hydroelectric power plant will be erected. The plans provide for the construction of a concrete and timber dam with wooden-stave pipes to the power house, the installation of a 327-hp turbine and a 250-kw generator and other equipment.

MURRAY, UTAH.—The city of Murray has just completed the construction of a power house, equipped with two generating units of 400 kw each; also erected a double transmission line (6 miles long) to a substation with transformer capacity of 750 kw. The equipment of the power house consists of two Westinghouse generators (400 kw each) directly connected to Pelton-Doble waterwheels of 600 hp each. Dickinson governors are used on the wheels; two Westinghouse exciters (15 kw) and electrolytic type arresters are used at the plant and substation. The city expects to complete about 10 miles of distribution lines in the near future and to purchase a 50-lamp tub transformer for arc-lamp lighting system. Harvey R. Margetts is superintendent.

TEMPE, ARIZ.—The Water Users' Association has awarded the contract for building the concrete foundations for the new crosscut power house, across the Salt River from Tempe, to Martin & Gillis, of Tempe, for $34,000. Seven large sections of concrete founded on rock are to be constructed. The waterwheels and feed pipes will be embedded in the concrete.

DENVER, COL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 16, for the mechanical equipment (except roof drainage and elevators) of the United States post office at Denver, Col. Bids will also be received at the same time and place for an elevator plant. Drawings and specifications may be obtained at the above office or at the office of Tracy, Swartwout & Litchfield, 244 Fifth Avenue, New York. O. Wenderoth is supervising architect.

Canada

CALGARY, ALTA.—The Calgary Pwr. Co., it is reported, contemplates the construction of a dam (100 ft. high) at the outlet of the lake at Kananaskis, to cost about $1,000,000.

POINT GREY, B. C.—Preliminary plans have been prepared by DuCane, Dutcher & Co., Rogers Building, Vancouver, for the construction of a municipal electric-light plant in Point Grey, to cost approximately $240,000.

GRAND FALLS, N. B.—The Grand Falls Co., it is stated, will soon begin work on the construction of large pulp and paper mills in Grand Falls, on the St. John River. It is understood that a large amount of power will be developed and transmitted to towns along the river. Sir William Van Horne is interested in the enterprise.

ELORA, ONT.—The ratepayers on Jan. 5 voted in favor of the by-law authorizing a contract with the Hydro-Electric Power Commission of Ontario for electricity.

HANOVER, ONT.—A by-law submitted to the ratepayers on Jan. 5 authorizing a contract with the Hydro-Electric Power Commission of Ontario for electricity was carried.

KEMPTVILLE, ONT.—The ratepayers on Jan. 5 voted in favor of the bylaw authorizing a contract with the Hydro-Electric Power Commission of Ontario for electricity.

OSHAWA, ONT.—On Jan. 5 a by-law authorizing a contract with the Oshawa El. Lt. Co. to supply electricity to operate the water-works pumping plant was carried.

RICHMOND HILL, ONT.—At the election held Jan. 5 the by-law authorizing an expenditure of $4,000 on an electric-light plant was carried.

STOUFFVILLE, ONT.—On Jan. 5 the by-law authorizing the purchase and improvement of the local electric-light plant, at a cost of $7,000, was carried. The price paid for the plant was $5,000, and the remaining $2,000 will be used for improvements.

STRATHROY, ONT.—A by-law submitted to the ratepayers on Jan. 5, authorizing the city to enter into a contract with the Hydro-Electric Power Commission of Ontario for electricity was carried.

TORONTO, ONT.—The question of utilizing electricity supplied by the Hydro-Electric Power Commission of Ontario was submitted to the voters in eight municipalities and was carried in seven of them. As soon as energy is delivered to these new customers the Hydro-Electric Commission will then give service to 101 cities, towns and villages.

WALLACEBURG, ONT.—At an election held Jan. 5 a by-law authorizing a contract with the Hydro-Electric Power Commission of Ontario for a supply of electricity was carried.

HUMBOLDT, SASK.—A by-law authorizing an expenditure of $20,500 for extensions to the electric-light system has been passed by the ratepayers. C. W. Anderson is Mayor.

WILKIE, SASK.—We are informed that no definite action has been taken (and probably will not be for some months) with regard to extensions and improvements to the municipal electric-light plant, as reported in the issue of Jan. 10. T. A. Dinsley is secretary and treasurer.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Feb. 3, for furnishing motor-driven air compressors, exciter sets, auto-transformers, switchboard, steel rails, pressure oil distributer, agricultural plow, doors, windows, sash and lumber. Blanks and general information relating to this circular (No. 822) may be obtained at the above office. For further details see proposals columns. Major F. C. Boggs is general purchasing officer.

ILOILO, P. I.—The Iloilo El. Co. expects to establish a day service within the next three months and will probably purchase some fans, motors, etc. R. R. London is general manager.

New Incorporations

WILMINGTON, DEL.—The Huntsville Consol. Gas Co. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000 for the purpose of generating and selling gas, electricity and oil for lamps, heaters and motors. The incorporators are: F. D. Buck, B. M. Grawl and G. W. Dillman, of Wilmington.

CHICAGO, ILL.—The Consumers' Pwr. & Lt. Co has been incorporated with a capital stock of $100,000 to generate electricity for lamps and motors. The incorporators are Jerome N. Frank and Harvey R. Willard.

CISSNA PARK, ILL.—The Electric Service Co. of Cissna Park has been incorporated with a capital stock of $15,000 to generate and distribute electricity in Cissna Park. The incorporators are Ernest F. Lindner, Emma S. Lindner and Dorothy W Atkins.

URBANA, ILL.—The Champaign County El. Co. has been incorporated with a capital stock of $6,000 to generate and distribute electricity and gas for lamps, heaters and motors; also to distribute water for domestic purposes. The incorporators are William I. Saffall, Lewis E. Ford and C. L. Van Doren.

VINE GROVE, KY.—The Citizens' Ltg. Co. has been organized with a capital stock of $3,000. The company will take over and operate the local electric plant. W E. Crutcher is interested in the company

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 6, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,083,285. Electrical Ignition System for Internal-Combustion Engines; F. Kratz, Stuttgart, Germany. App. filed Dec. 6, 1912. Has supplementary means controlling the electromagnetic interrupter for starting purposes.

1,083,287. Process for Producing Soluble Potassium or Sodium Compounds Out of Feldspar or Mica or the Like; A. R. Lindbald, Ludvika, Sweden. App. filed Oct. 22, 1912. Heats in electric furnace with material which will decompose the silicon dioxide.

1,083,306. Electric Signaling System; J. D. Taylor, Edgewood Park, Pa. App. filed April 18, 1908. Rails conductively continuous and having portions of increased impedance consisting of magnetic laminas at the sides of and underneath the rails.

1,083,331. Incandescent Electric Lamp; T. W. Lowden, London, Eng. App. filed Jan. 14, 1913. Metallic filament having integral portions twisted to form supports for the filament.

1,083,354. Insulating Compound; T. A. Edison, Llewellyn Park, Orange, N. J App. filed Jan. 27, 1911. Contains tetrachloronaphthalene and asphalt.

1,083,356. Storage Battery; T. A. Edison, Llewellyn Park, West Orange, N. J. App. filed April 8, 1911. Active material for positive electrode of alkaline storage batteries consisting of nickel hydroxide containing small percentage of cobalt hydroxide.

1,083,375. Electrical Foot-Warmer; T. Plimley, Victoria, British Columbia, Canada. App. filed July 28, 1913. Electrically heated foot support for bootblack stand.

1,083,386. Electrically Heated Instrument; J. A. Chapman, Fort Worth, Tex. App. filed May 6, 1913. Scissors with electrically heated wire exposed along the cutting edge of one blade.

1,083,406. Telephone Desk Set; H. L. Knight and B. W. Sweet, Cleveland, Ohio. App. filed April 19, 1906. Switch, hook and transmitter all supported on a tubular skeleton standard which fits in the hollow column of the instrument.

1,083,418. Contact Holder. A. Sundh, Yonkers, N. Y. App. filed March 25, 1908. Spirally fluted contact block and correspondingly shaped holder therefor.

1,083,431. Automatic Switch for Trolley Roads; R. V. Cheatham, St. Matthews, Ky. App. filed Sept. 2, 1913. Switch-throwing device inoperative as long as a train of cars with trolley wheels is adjacent to the critical part of the trolley wire or track.

1,083,456. Translating and Selecting System; E. C. Molina, Boston, Mass. App. filed April 20, 1906. Mechanical selection of lines employed in telephonic transmission.

1,083,520. Portable Electric Light; C. F. Burgess, Madison, Wis. App. filed July 5, 1912. Has resistance which may be cut in when the battery is new and stronger than the normal intended voltage of the lamp.

1,083,525. Speed Control for Motor Cars; S. K. Evans, Elmsford, N. Y. App. filed March 26, 1913. Maximum speed of car is fixed by a lock which sets an adjustable contact in respect to the contact finger of a speedometer.

1,083,534. Electrically Heated Flatiron. M. I. Grimes, Winthrop, Mass. App. filed May 3, 1913. Rotation of the handle of the iron controls the switch.

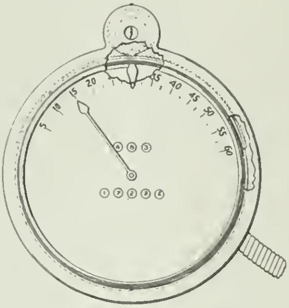
1,083,541 Perforating Device; A. Kettnich, Denver, Col. App. filed Feb. 20, 1912. Electromagnets serve, when energized, to project members which form connections from the striker to the punches.

1,083,542. Switching Socket of Connector; G. C. Knauff, Chicago, Ill. App. filed Feb. 26, 1913. Plug longitudinally movable in the socket for purpose of making or breaking circuit and held locked in either position by bayonet slot construction.

1,083,557. Electrically Heated Cooking Apparatus; J. W. Phelps, Detroit, Mich. App. filed March 1, 1912. Case clamped in heat-conducting contact with metallic lining of heat-insulating chamber and electric-heating unit secured in recess in outer face of the case.

1,083,566. Relay; S. R. Stone, New York, N. Y. App. filed Aug. 11, 1911. Double-ended magnet whose opposite poles operate to some extent independently of each other.

1,083,569. Protector for Telephone Transmitter; H. Van Hoevenberg and R. W. Pope, North Elba, N. Y., and Elizabeth, N. J. App. filed May 17, 1913. Closure locked over the mouthpiece of the transmitter to prevent use by unauthorized persons.



1,083,525—Speed Control for Motor Cars

1,083,580. Monitor; H. C. Zenke, Richmond Hill, N. Y. App. filed Nov. 12, 1910. Record is made upon a chart having a space devoted to each of the several machines supervised by the monitor and a space upon which time record is kept.

1,083,592. Electrical Drying Oven; H. J. Cary-Curr, Elmhurst, Ill. App. filed July 25, 1913. Box vented through top and bottom, rotary regulating valves to bottom vent openings, slab in box wound with resistance wire, switch and automatically operating means in the box for opening switch.

1,083,658 Electric-Arc Lamp, H. H. Boney, Chicago, Ill. App. filed Sept. 20, 1911. Carbons automatically replaced as they burn out.

1,083,669. Electric Traffic-Controlling System; F. L. Dodgson, Rochester, N. Y. App. filed May 6, 1910. Resistance in the track circuit sufficient to reduce the flow of induced current in the shunt circuit through the relay below the holding valve.

1,083,671. Telephone Mouthpiece with Antiseptic Attachment; T. Duquette, Sr., North Grosvenor Dale, Conn. App. filed Sept. 27, 1913. Annular member strung upon telephone mouthpiece and cover hinged thereto and supporting an absorbent body.

1,083,677. Method of Producing High Vacuums in X-ray Tubes and the Like; C. A. Friedrich, New York, N. Y. App. filed Oct. 11, 1910. Heats to red heat both the anode and cathode during evacuation by means of low potential currents.

1,083,691. Process for Obtaining Aluminum; P. C. McIlhiney, Great Neck, N. Y. App. filed Aug. 18, 1913. Includes electrolyzing a fused mixture of the fluorides of aluminum and a fluxing reagent.

1,083,715. Trolley; E. Washington, Pittsburgh, Pa. App. filed Aug. 1, 1912. Pivoted spring-closed upstanding retaining jaws overlap the trolley wire.

1,083,726. Circuit-Breaker Connection for Electric-Railway Systems; F. E. Case, Schenectady, N. Y. App. filed Nov. 2, 1910. When car passes from one section to another, arcing is avoided by breaking the circuit at a circuit-breaker instead of at the trolley or collector.

1,083,729. Dynamo-Electric Variable Gearing; F. Collischonn, Frankfort-on-the-Main, Germany. App. filed June 30, 1909. Electrical change-speed gearing interposed between the engine and the road wheels.

1,083,730. Driving Mechanism for Motor Vehicles; F. Collischonn, Frankfort-on-the-Main, Germany. App. filed Feb. 24, 1910. Includes engine-driven generator, electromotors and differential gearing.

1,083,755. Insulating Material and Process of Making the Same; J. C. Peabody, Boston, Mass. App. filed Oct. 6, 1910. Adds free resin to paper pulp, beats mixture to distribute uniformly, extracts liquid and subjects to heat and pressure.

1,083,756. Connector for Electric Conduits; J. C. Phelps, Springfield, Mass. App. filed Oct. 23, 1912. Separable cover on the elbow member of the conduits permits the cable to be readily drawn through.

1,083,785. Process for Precipitation of Zinc; F. L. Wilson and S. E. Bretherton, Berkeley, Cal. App. filed Jan. 28, 1913. Adds zinc carbonate and ammonium carbonate to form in the electrolytic zinc bath an ammonium salt which acts as a catalytic agent in the electrolyte.

1,083,788. Loud-Speaking Telephone Receiver; C. Adams-Randall, Boston, Mass. App. filed May 16, 1913. Resonator, to which the diaphragm is rigidly connected, takes the place of the usual megaphone.

1,083,817. Electric Hammer; J. O. and R. L. Fields, Zanesville, Ohio. App. filed Jan. 13, 1912. Travel of the hammer head is varied by an adjustable contacting device which is actuated by the beam of the hammer.

1,083,822. Space Block; H. Geisenhöner, Schenectady, N. Y. App. filed Jan. 16, 1911. Space block secured to the laminations of the rotating body by clips which engage in notches in the space block.

1,083,834. Secondary Clock; W. M. Jeffreys and W. H. Creahen, Youngstown, Ohio. App. filed Oct. 22, 1912. Designed particularly as a recorder for steam, water and vacuum gages.

1,083,839. Ticket-Sales Register; A. Kiparski, St. Petersburg, Russia. App. filed Oct. 19, 1911. Dials indicate the total number of tickets taken from the various boxes.

1,083,840. Automatic Ticket Registering and Indicating Device; A. Kiparski, St. Petersburg, Russia. App. filed Oct. 19, 1911. Includes contact-making devices actuated by withdrawal of the tickets from the various boxes.

1,083,842. Controller Attachment; G. C. Ludgate, Brooklyn, N. Y. App. filed June 3, 1913. Moving controller handle in one direction controls motor and in opposite direction controls air brakes.

1,083,859. Heating System; P. Robert, Paris, France. App. filed May 19, 1911. Provides thermic accumulators with independent heating appliances having electric resistances which utilize the excess of current supplied by hydroelectric or like plant.

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Stock Without Par Value

In his presidential address before the Wisconsin Electrical Association, Mr. William H. Winslow suggests the device of issuing stock without par value to encourage new public utility enterprises. His recommendation is based on his conclusion that the public utility and stock and bond laws, although beneficial for established utilities, have made the financing of new enterprises difficult or impossible. This is in general the effect of strict regulative laws. Rightly administered they tend to give stability to established properties, but this does not help the small struggling communities that would rather pay a high price in a return on inflated capitalization than to be without service. Many communities wanting such service have cheerfully paid rates that permitted interest on bonds representing the approximate full cost of the property, and in addition a return on stock issued partly or wholly as a bonus to underwriters. Mr. Winslow's suggestion in effect is that stock without par value be substituted for the stock issued with par value under former methods. It is open to question, however, whether a strict regulating commission would permanently permit a schedule of rates high enough to provide earnings on stock that had no admitted or claimed value or whether it would sooner or later restrict earnings closely to a return on actual value. That, however, is a question for promoters to reckon with. If they are satisfied to take chances on stock without par value, as they formerly did in many cases on stock with par value but without much if any actual value in physical property, the industrial development of the smaller class of communities is sure to be furthered.

Putting the Cards on the Table

Nothing is so effective in removing mutual distrust as full, frank and free discussion. A symposium of this sort characterized the "open session" of the recent Milwaukee meeting of the Contractors' Association of Wisconsin. Representatives of the contractors, large supply dealers (or jobbers, as they are often called), manufacturers and consulting engineers told one another candidly why their relations were not altogether satisfactory, and pointed out remedies. At times the remarks made in the running debate were sharp and pointed, but the general result of the discussion was decidedly salutary. After it was over it was apparent that everybody felt better. The men taking part in the discussion relieved their minds and gained something of the other fellow's point of view. The meeting ended with a more sympathetic understanding of the difficulties encountered in the various branches of the industry. It was somewhat as though a storm had freshened the atmosphere. The main complaint of the large dealers was that the contractors now place their little emergency orders with them and give their big orders to the manufacturers. The contractors on their part complained that the large dealers encourage the irresponsible so-called contractors or "curbstoners," by eagerly seeking their business at the same prices as are offered to the legitimate contractors. It was also charged that the dealers sell directly to large consumers, thus invading the field of the contractors. No definite action was taken at the meeting, but there seemed to be some progress toward a recognition of the fact that both the legitimate contractor and the large supply dealer have a place in the electrical industry and that each should recognize and respect the rights of the other.

Real Co-operation in Wisconsin

One pleasant and encouraging feature of the last two conventions of the Wisconsin Electrical Association has been the practical co-operation manifested by the Railroad Commission of Wisconsin. The commission made valuable educational exhibits at both of these conventions and the central-station men profited by them. In addition, engineers, accountants and employees of the commission attended the convention in considerable numbers, took part in the discussions, explained the exhibits and mingled with the electrical men present, making clear the work of the commission to all interested—and all the Wisconsin central-station men are very much interested. Mr. C. M. Larson, chief engineer of the commission, recently read a paper on "Street Railway Traffic Surveys," and Mr. Halford Erickson, member of the commission, honored the association by preparing for it a paper entitled "Some Facts Relating to Depreciation and Rate-Making." The commissioner mentioned the fact that there is a considerable demand on the part of the public for a uniform meter rate, but he showed how such a flat rate would tend to reduce the profits of the electric-service utilities and to increase the prices that they would have to charge. He also showed that such rates would tend to keep the central station from entering into the industrial development of the day and would undoubtedly be disadvantageous to the public, although the prospect of a uniform flat meter rate, such as is made in the case of the gas and water service, is an alluring one to the average citizen. The relations of the state commission and the state association of central-station men in Wisconsin are admirable and worthy of emulation in all states having public utility commissions. The electrical men recognize the high character of the Wisconsin commission and the spirit of justice which pervades it. They are striving earnestly to comply with the commission's requirements, and in its turn the commission talks things over with the utility men and does not put any new regulations into effect without first giving the men vitally affected an opportunity to present their views of the situation.

The Resistivity of Copper

The increase of resistivity in copper with rise of temperature between the freezing and boiling points of water is a very definite phenomenon. While it has many drawbacks, such as the increase in joulean losses as the temperature of a dynamo-conductor rises, yet it has a few counterbalancing advantages. One of these is the facility afforded for determining the mean change of temperature of a coil as a function of the change in its electric resistance.

We know that in the case of standard commercial copper the resistivity between 0 deg. and 100 deg. C. follows a straight-line law, such that the resistivity would fall to zero at — 234.5 deg. C. That is, the resistivity of standard copper between these temperature limits is directly proportional to the virtual absolute temperature of the metal, the absolute temperature of gas pressure being at — 273 deg. C. and the virtual absolute temperature of copper resistivity being at — 234.5 deg. C. In rising, therefore, from a temperature of 20 deg. C. to a temperature of 50 deg. C., the resistivity increases in the ratio 284.5 : 254.5. Of course, this absolute zero of resistivity at — 234.5 deg. C. is fictitious, because measurements have shown that the resistivity is small, but quite appreciable, at that low temperature. This means that the curve deviates from the straight line at low temperature.

In the January number of the *Journal of the Franklin Institute* Dr. Edwin F. Northrup publishes a series of measurements on the resistivity of copper from 20 deg. to 1450 deg. C. The experimental difficulties in the way of securing accurate measurements at such high temperatures are considerable. The results indicate that the straight-line law of resistivity from a fictitious zero at — 234.5 deg. C. substantially persists up to say 500 deg. C. Thereafter the curve becomes somewhat steeper, but does not greatly deviate from a straight line until the temperature approaches the melting point of copper, which is in the neighborhood of 1080 deg. C. In changing from the solid to the liquid state the resistivity jumps up suddenly and roughly doubles itself within a few degrees. Finally, from 1100 up to 1450 deg. C., the highest temperature attained, the resistivity of liquid copper again conforms to a rising straight line substantially parallel to that below the melting point.

The curve of resistivity ordinates versus temperature abscissas over the range here considered is thus reported to be nearly a straight line throughout, except for a sudden jump of resistivity on a nearly constant temperature, in rising through the melting point, thus producing a pair of parallel slopes with a precipice between them. The results, assuming them to be reliable, add considerably to our knowledge of copper resistivity. The abrupt doubling up of the resistivity at the melting point which was encountered both on rising and falling temperatures ought to be useful in securing automatic regulation of temperature in the neighborhood of 1080 deg. C., since the sudden increase in resistance of a properly protected copper conductor might serve to cut off heat from an electrically operated furnace system.

Sag-Temperature Relations in Suspended Conductors

The increasing use of tower construction for supporting high-tension transmission lines has caused engineers to devote much attention to the science of sags and spans. The conductors have to be erected in position without unnecessary slack, in such a manner that they shall not be stressed beyond the elastic limit when the temperature falls to the winter minimum, with a reasonable load of sleet on the wires and with a reasonably strong wind blowing across the line. This means that the constructing gang must be provided with definite information as to the tension to be placed on the conductors over a given span and at a given temperature.

It is fairly easy to compute the sag which must be allowed in a given span, for a given size of conductor, in order that an assigned tension may be attained in the span. The matter becomes more complicated, however, when sleet, wind and changes of temperature have all to be taken separately into account. The degree of complexity depends also upon the geometrical assumptions concerning the form of the suspended conductor. Strictly speaking, this form is a catenary curve, or the form of a freely suspended perfectly flexible uniform chain suspended between the two given tower cross-arms. In practice there is ordinarily so little difference between the catenary and parabola that the latter is nearly always assumed for simplicity.

The article by Mr. H. M. Hall appearing in this number introduces a new property of a suspended wire; namely, the sag which will occur at 0 deg. Cent., after the sleet load has melted off and the transverse wind has disappeared. This release sag is presented as a very simple factor in the initial sag which would correspond to the elastic limit. From the release sag the effects of temperature change can be readily deduced, with the aid of a graphical process. The assumptions are that the wire hangs parabolically between two supports at the same level and that the tension is uniform at all points in the span, so that Hooke's law of extension may be considered to apply. The difference between the length of wire in the span and the horizontal distance between supports is also ignored. All of these propositions may be regarded as substantially met in ordinary span construction. Various methods have been presented in the past for attacking the problem above indicated. In practice they all lead to sets of working tables, or curves, from which the required information can be derived by the line foreman. The methods thus far developed differ chiefly in regard to the steps by which the working tables or curves are arrived at.

The President and Industry

President Wilson's message is pacific in tone. At the same time it expresses many of the radical proposals that have been made in recent years. There is no inveighing against business, no picture of business as an enemy. Instead, Mr. Wilson happily assumes that he is talking with and for the best business ideas of the day, arising from business men themselves. This spirit promotes consideration of his measures. It arrests condemnation until their meaning and effect can be definitely understood. It fosters the co-operative attitude which alone can make the presidential policies a success and an inspiration to trade and industry. The language in which these policies make their appearance is necessarily general on some points. The concrete expressions will come in the bills that Congress will consider or pass to make the recommendations effective. Comment, therefore, is restricted to the general terms used by the President until such time as more explicit language appears in laws, potential or actual.

Passing the reassurances to business to which one-third or more of the message is devoted, we find the President's declaration that the program is founded upon the conviction that " 'private monopoly is indefensible and intolerable.' " As in the previous utterances of Mr. Wilson, there is no definition of monopoly, but he thinks that a definition by statute, item by item, is possible. Manifestly it is monopoly in trade and manufacture which is criticised, not monopoly in public utility service, the wisdom of which is generally admitted. Where the statute fails to give the needed light the President would rely on an interstate trade commission. Presumably there would be, as there should be, a sharp line to show where the judicial processes of the law end and the administrative processes of the commission begin. "Further and more explicit legislative definition of the policy and meaning of the existing anti-trust law" is urged. If the law is made more definite, the duties of the new commission will be lessened. That is desirable because the jurisdiction of this commission will be so wide and the problems seeking solution so many that the burden laid upon it will be heavy. It will take over duties now performed by the Attorney-General, who, without specific authority of law but in the absence of any governmental body delegated to act, has dealt with corporations accused of infractions of the statute. In the suggestion that the commission will administer corrective processes when dissolution becomes necessary we find the administration opinion that such processes will be necessary. However, if the trade commission holds its rightful place in our economic structure its functions will be less in destructive processes than in construction of upbuilding trade practices. The commission cannot create enterprise and ability where the germs of these qualities do not lie. But it can develop policies to promote wholesome business as well as policies to tear down unwholesome practices. If it does not exercise as much courage in the one direction as it will be likely to create discouragement in the other, it will fail to be the helpful factor in business that it ought to be.

It is a surprise to read the President's declaration that "we are agreed that holding companies should be prohibited." Speaking for ourselves, we are not by any means agreed on that if the prohibition is intended to apply to all forms of holding companies. Some of these have great powers of economy and efficiency. If rightly managed, they are an agency for good to the public. Nor do we see how, with proper management, holding companies controlling widely separated public utilities can be inimical to the public interest. The electrical central-station industry is full of examples of cases where holding companies control plants without physical connection, without even geographical nearness, and consequently without possibility of competition. The plants are not more monopolistic than if they were owned and operated independently, and monopoly of the service they render in each community is in the public interest. Like every other good agency, the central-station holding company is liable to abuse. But its advantages are many and it should not be done away with lightly. If the law is to regulate such properties, it ought to do so with the object of preventing misuse and of preserving existing and future advantages due to centralized production, transmission and management. It is conceivable that the President's policies are designed to apply to trade and not to public utilities, but if so the laws which are likely to follow should explicitly so state.

It is, of course, impossible to read out of the President's message the definite proposals which he has made for a vastly greater extension of governmental power over trade and industry. It is equally impossible, however, to read out of the message the spirit of "peace, honor, freedom and prosperity," to use his words, in which he seeks, according to his judgment, to better business practices. It is impossible to accept the regulation and ignore the hand that goes with it. If Congress will keep the atmosphere of the message and not only the rigorous proposals, it will help business over the pending changes without loss to itself and with benefit to the country. Mr. Wilson's remarks concerning the fatal effect of uncertainty on business, applied by him to the immense area of uncertainty left by the present anti-trust law, may well be heeded by Congress. Congress should be spurred to act without unnecessary delay on such corrective legislation as is needful, but it should first hear and weigh carefully the views of business men affected.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

The President's Message on Industry

President Wilson read his message on business to Congress on Jan. 20. Extracts from the message follow:

"What we are purposing to do is, happily, not to hamper or to interfere with business as enlightened business men prefer to do it, or in any sense to put it under the ban. The antagonism between business and government is over."

"The government and business men are ready to meet each other half way in a common effort to square business methods with both public opinion and the law."

"Fortunately, no measures of sweeping or novel change are necessary. It will be understood that our object is not to unsettle business or anywhere seriously to break its established courses athwart."

"These are the changes which opinion deliberately sanctions and for which business waits:

"Laws which will effectually prohibit and prevent such interlockings of the personnel of the directorates of great corporations as in effect result in making those who borrow and those who lend practically one and the same.

"A law which will confer upon the Interstate Commerce Commission the power to superintend and regulate the financial operations by which the railroads are henceforth to be supplied with the money they need for their proper development.

"Further and more explicit legislative definition of the policy and meaning of the existing anti-trust law.

"Something more than the menace of legal process in these matters . . . the advice, the definite guidance and information which can be supplied by an administrative body, an interstate trade commission. The opinion of the country would instantly approve such a commission.

"We are agreed, I take it, that holding companies should be prohibited. This question I venture for your consideration."

Massachusetts Public Service Commission Overruled on Bond Issue

The Supreme Court of Massachusetts has handed down a unanimous decision rendering void the recent order of the Public Service Commission which approved the petition of the New York, New Haven & Hartford Railroad for authority to issue $67,552,000 in convertible debenture bonds. The court particularly disapproved of the proposed convertibilty of the bonds into stock at some future date and said in part:

"The approval by the commission of an issue of stock must relate to the present and not to a remote future. This is required by the legislative intent disclosed by a review of the statutes. The amount of stock which the commission intelligently can approve to be issued is inseperable from the price at which it is to be issued. The price at which the public interest may require that it be issued during a period of ten years beginning five years hence is impossible of ascertainment now. But the approval of convertible debentures with the right to take stock at par in payment during that period involves fixing a price of the stock during the like period. An order entered now that stock be issued at par during that period of time can afford no security that the corporation will get an adequate return for its stock, or that rates and charges fixed upon such a capitalization will be fair, or that the rights of other stockholders will be guarded properly."

New York State and Niagara Power

Representatives of New York State have appeared before the foreign affairs committee of the House of Representatives at Washington to ask for greater rights in the development of water-power and the control of power companies at Niagara Falls than are now held. A bill is pending before the committee permitting the Secretary of War to divert 4400 cu. ft. of water per second from the American falls at Niagara and to say by whom and for what purposes this water may be used. Governor Glynn of New York has written to the committee contending that the functions of the federal government end with permission to divert the water, and that the power to be created is solely the property of New York State. Governor Glynn declared that it is his fondest hope as Governor to inaugurate a State-wide policy for the utilization of all available water-powers of the State for the benefit of the whole people. He expressed the opinion that a law dealing with the subject will be passed at the present session of the Legislature.

Franchise Negotiations in Cincinnati

At a meeting of the committee on light of the City Council of Cincinnati Mr. W. W. Freeman, vice-president of the Union Gas & Electric Company, urged that the old schedule of rates be retained for another period of ten years. He said that the schedule is fair and that only five large cities, in which water-power is used for generation, have a more favorable rate. He also stated that the company has completed plans for the construction of a new plant on the river front which will require an investment of $7,500,000 and that, unless assurance is given that a reasonable return for this money will be allowed, it will be impossible to proceed with the improvement. The present maximum rate is 11 cents per kw-hr., but Mr. Freeman said that the maximum really charged is 10 cents. The average rate is approximately 5 cents.

Former City Solicitor Bettman argued that, while all wanted to allow the company a fair rate of income, a temporary contract should be made until the Public Service Commission can make a valuation of the property and determine the cost of production. He said that the fact that the company is arranging to build a new plant is argument enough against the renewal of the old contract. The introduction of new machinery, he said, may greatly reduce the cost of production and the people will not benefit from the improvements. The modern doctrine, he contended, is against long-term franchises of any kind.

Mr. Freeman said that the Council should be willing to place the company in a position where it could have the credit of reducing the rates, if it becomes possible to do so, instead of attempting to force down the rates at present, when it is impossible to say what can be done in the future.

Southern Hydroelectric Developments Nearing Completion

Mr. G. G. Shedd, in an address before the meeting of the American Association for the Advancement of Science held in Atlanta, Ga., recently, described two Southern hydroelectric developments which have been in course of construction for about eighteen months. The development at Stevens Creek, on the Savannah River, about 8 miles from Augusta, Ga., will be in operation shortly and will develop 31,000 hp for the Georgia-Carolina Power Company. The station is designed to supply the market around Augusta, where many industrial plants are situated. A dam 2700 ft. long creates a lake of 4200 acres, extending 14 miles up the Savannah River. Navigation will not be interfered with, but will be improved by a lock 30 ft. wide and 150 ft. long, which has a lift of 27 ft. and which will give 6 ft. of water at all stages of the river. Generating equipment with a rating of 15,600 hp. has already been installed, and a complete system of transmission lines and substations has been built.

The second development, which will also be in operation this month, is that of the Parr Shoals Power Company at Parr Shoals, on the Broad River, 27.5 miles from Columbia, S. C. There is a dam 2740 ft. long, thrown across the river, a generating station designed for eight units with an aggregate rating of 29,000 hp, and a double-circuit steel-tower transmission line, 26 miles long, and a substation at Columbia. The latter will also be used as a distributing station for energy from the present hydroelectric and steam plants of the Columbia Railway, Gas & Electric Company. All the energy generated by these two stations and by the Parr Shoals hydroelectric plant will pass through the new station. The Stevens Creek and the Parr Shoals developments were started in June 1912. Mr. E. W. Robinson, of Columbia, S. C., is president of the Parr Shoals Power Company and Mr. J. H. Pardee, of New York, is president of the Georgia-Carolina Power Company.

Western Red Cedar Association

The Western Red Cedar Association held its annual meeting at Spokane, Wash., Jan. 12. In addressing the association, President H. C. Culver commented on the recent inactivity in the pole industry but predicted a more healthy condition during 1914. Stocks are not large, he pointed out, but they are fairly well assorted. Owing to lack of snow the output during the present winter will be greatly restricted. In the United States alone, said Mr. Culver, there are 800,000 miles of pole lines carried on 32,000,000 poles, for which 4,000,000 poles are required annually for renewals. Of the above large figures, cedar poles comprise about 65 per cent.

Steps were taken to urge the National Electric Light Association to adopt the cedarmen's classifications for Western red-cedar poles. Officers were elected as follows: President, Mr. M. P. Flannery; vice-president, Mr. W. M. Leavitt; secretary-treasurer, Mr. W. L. Bayne, and directors, Messrs. R. G. Jones, H. C. Culver and C. P. Lindsley.

Convention of Heating and Ventilating Engineers

More than 200 members of the American Society of Heating and Ventilating Engineers attended the annual meeting of the society held at New York Jan. 20, 21 and 22. Among the papers presented were the following: "Work of the Ventilation Division, Chicago Health Department," Dr. E. Vernon Hill, Chicago; "Heat Transmission in a Pressed-Steel Radiator," Prof. John R. Allen, Detroit, Mich.; "Flow of Steam in Pipes," Mr. W. F. Verner, Ann Arbor, Mich.; "Cooling Rooms in Residences and Hospitals," Mr. A. M. Feldman, New York; "Life of Building Power Plants," Mr. A. M. Ripley, New York; "Heating Practice in France," Mr. Gustave Debesson, Paris, France; "Heating Practice in Sweden," Mr. H. G. T. Theorell, Stockholm, Sweden, and "Heating Practice in Germany," Mr. W. E. Müllenbach, Hamburg, Germany.

Mr. S. R. Lewis, Chicago, was chosen president of the society for the ensuing year; Messrs. E. F. Capron, Chicago, and D. D. Kimball, New York, were elected vice-presidents, and Mr. J. A. Donnelly, New York, treasurer. The new directors chosen were: Messrs. J. F. Hale, Camden, N. J.; W. W. Macon, New York; John R. Allen, Ann Arbor, Mich.; F. E. Chapman, New York; J. M. Stannard, Chicago; F. G. McCann, New York; E. I. Cooper, Boston, and H. M. Hart, Chicago.

Wireless Transmission

On Jan. 19 Prof. Elihu Thomson, of Lynn, Mass., delivered an illustrated lecture before a joint meeting of the New York Electrical Society and the New York Companies' Section of the National Electric Light Association on the "Wireless Transmission of Electrical Energy." He pointed out in a simple manner how radio-communication phenomena resemble and differ from the laws of propagation of Hertzian waves. He also showed wherein the electrostatic flux propagated from a wireless antenna differs from that emitted by a Ruhmkorff coil fitted with an oscillator, and how it resembles that surrounding a transmission wire. By considering the wireless station antenna as one-half of an oscillator—the other half being the "image" below the earth's surface—and the earth's surface as a conducting film he showed why the electrostatic waves follow the curvature of the earth instead of being propagated in straight lines as was predicted at first.

The mutual interference of waves emitted from a single source was explained by saying that some of the electrostatic flux follows short-cuts around obstacles, and as the wave-lengths remain the same it is possible that waves which finally join may be out of phase.

Professor Thomson advanced an interesting theory to account for the relative difficulty in transmitting in daylight at high frequency, as compared with nighttime or low-frequency transmission, which was based on the ionization by sunlight which sets free negative charges, thereby diminishing the value of the impulse received at the distant point.

When the frequency is high a positive wave reaches the territory of free negative charges before these have time to become dissipated, and they combine with an equal number of positive charges, thus further weakening the wave.

Professor Thomson said that by raising the voltage and thus increasing the amplitude of the wireless wave longer-distance wireless communication can be obtained. The corona loss which now occurs on antennas with high voltages can be eliminated by constructing large-diameter cylindrical towers with large balls supported at the top.

In closing, Professor Thomson stated that he believed efficient transmission of energy for industrial purposes would always require a conductor core to guide the energy to its destination.

Electric or Gas Lighting for Indianapolis Parks and Boulevards

An investigation has been begun by the Indianapolis Board of Park Commissioners into the relative merits of gas and electric lighting for park and boulevard lighting. A contract for lighting the parks and boulevards with gas has expired and the board has continued the gas lighting from month to month by contract. It is believed, however, that some of the commissioners now favor electric lighting.

Meeting of New York State Contractors

The New York State Electrical Contractors' Association held its midwinter meeting on Tuesday, Jan. 20, at Shanley's Restaurant, 117 West Forty-second Street, New York. The morning session was devoted to a closed session for members only. Following a luncheon an open meeting was held at which a number of manufacturers were also present. Mr. J. M. Wakeman, general manager of the Society for Electrical Development, delivered an address relating to this society. Mr. T. I. Jones, chairman of the Commercial Section of the National Electric Light Association, delivered an address on the work of that section. An informal reception was held immediately after this meeting, followed by a theater party and supper in the evening.

Brooklyn Company Section Meeting

Mr. T. I. Jones, chairman of the Commercial Section of the National Electric Light Association and general sales agent of the Edison Electric Illuminating Company of Brooklyn, delivered on Jan. 12 his annual address before the Brooklyn Company Section of the N. E. L. A. on the developments in the electrical field in Brooklyn during 1913. More than 700 members of the section and a number of out-of-town visitors connected with the industry turned out to listen to Mr. Jones's talk, which was illustrated with lantern slides covering specific installations to show the trend toward the use of electricity in Brooklyn homes, factories and stores. One feature brought out was the fact that within the limits of Brooklyn there are a number of farms that are completely equipped for electric service, including motors for cow-milking machinery.

Following Mr. Jones's talk short addresses were made by a number of the visitors present, among whom were included Messrs. T. Beran and H. H. Barnes, of the General Electric Company, New York; Messrs. C. G. M. Thomas and C. A. Barton, of the New York & Queens Electric Light & Power Company, Long Island City; Messrs. P. S. Young and R. R. Young, of the Public Service Electric Company of Newark, N. J.; Messrs. C. A. Littlefield and A. A. Pope, of the New York Edison Company; Messrs. W. J. Clark and W. L. Secord, of the Westchester Lighting Company, Mount Vernon, N. Y.; Mr. L. A. Coleman, of the United Electric Light & Power Company, New York; Mr. C. A. Greenidge, of J. G. White & Company, New York, and Mr. L. R. Wallis, of the Edison Electric Illuminating Company of Boston.

Preceding Mr. Jones's address Mr. E. A. Leslie presented a paper entitled "Central-Station Service for Manufacturers." Mr. Leslie's paper was well received and brought forth spirited discussion from a number of members. Those who participated in the discussion were Messrs. T. Bates, F. L. Leitner, J. L. Wiltse, W. H. Grove, G. J. Leibman and C. H. Stevens. The evening's session was closed with an excellent vaudeville entertainment by employees of the Edison company.

Annual Dinner of the Ithaca Section, A. I. E. E.

The seventh annual dinner of the Ithaca Section of the American Institute of Electrical Engineers was held on Saturday evening, Jan. 17, with Messrs. B. A. Behrend and F. C. Henderschott as the out-of-town speakers. Nearly a hundred local members and guests were in attendance. The meeting was opened by Chairman E. L. Nichols, who introduced the toastmaster, Prof. C. F. Hirschfeld, in charge of instruction in gas-power engineering in Sibley College. Mr. Behrend was the guest of honor, and he gave a stimulating address on the relation of the industries to their workers. He also emphasized the importance of considering engineering problems as a whole as well as in individual parts. It is possible, said he, for the solution of a great problem to be perfect in each detail, considered separately, and yet a failure as a whole. This is true in social problems as well. He argued for the highest possible development of the individual as the chief element of social success.

Mr. Henderschott explained briefly the organization of the National Association of Corporation Schools, which is now an assured success. This was described in detail in his paper delivered before the Institute at the Cooperstown meeting. Prof. S. O. Orth, of the department of political science at Cornell, made an eloquent plea for the cultivation of the emotional side of the engineer's nature if he is to be a real success. Director A. W. Smith of Sibley College congratulated the Ithaca Section upon the prospects ahead in view of the successful efforts made and being made for the conservation of our national resources, particularly of human life. Prof. Frederick Bedell, of the department of applied electricity, gave many amusing quotations from early writers on electricity and magnetism, showing the lack of the scientific spirit and contrasting this with the point of view of Dr. Gilbert, to whom he referred as the great exponent of the scientific spirit. Prof. H. H. Norris, formerly head of the electrical engineering department, gave some results of observations made during a recent tour in which many colleges were visited, pointing out that the vital element in a successful curriculum is not so much what is studied but how each study is approached. He suggested that every part of the college course should be treated as a problem.

Several of the speakers referred to the desirability of nominating Prof. Harris J. Ryan for the presidency of the Institute in 1915, and the suggestion aroused a hearty response. As a center of Institute activity next year will be in California, it was considered appropriate that a man so well and favorably known from coast to coast and now a loyal Californian should thus be honored by the Institute and at the same time have given to him an exceptional opportunity to serve it.

Louisville Company Invites Publicity

The Louisville (Ky.) Gas & Electric Company has notified the People's Protective League of that city, which is planning a legal fight to dissolve the merger company, that its books are open to any committee authorized to investigate its affairs. The league opposes the terms on which the merger of public-service companies in Louisville was permitted.

Work on Panama-Pacific International Exposition

The accompanying illustration shows a part of the main exhibit section of the Panama-Pacific International Exposition to be held in San Francisco in 1915 in celebration of the official opening of the Panama Canal. The photograph gives an excellent idea of the present state of the site chosen for the celebration. The grounds are in the city limits of San Francisco and face north on the shores of San Francisco harbor just inside its "Golden Gate" entrance to the Pacific Ocean.

PANORAMIC VIEW OF PANAMA-PACIFIC INTERNATIONAL EXPOSITION, SAN FRANCISCO, CAL.

On the left of the photograph in the background are the hills of San Francisco and nearer at hand the fence which incloses the exposition grounds on the south. In the center background are the hills of the United States Presidio military reservation, which extends into San Francisco Bay as far as Fort Point, which marks the south limit of the Golden Gate.

More than 80,000,000 ft. of lumber is being used on the main exhibit section of the exposition alone. Fourteen of the huge exhibit palaces are under construction, some of them rising as high as 160 ft. When completed the tallest structure will rise 430 ft.

Unification of Electric Supply in Paris

On Jan. 1 the Compagnie Parisienne de Distribution d'Électricité absorbed the six electric-supply companies previously operating in their respective districts in Paris. These companies—the Compagnie Électrique du Secteur de la Rive Gauche de Paris, the Compagnie Parisienne de l'Air Comprimé, the Société l'Éclairage Électrique du Secteur de la Place Clichy, the Compagnie l'Éclairage Électrique du Secteur des Champs-Elysées, the Compagnie Continentale Edison, and the Société d'Éclairage et de Force par l'Électricité à Paris—have hitherto held the right to supply electricity in Paris. The tenure of their concessions was eighteen years, the dates at which these began varying from 1889 to 1890. The terms of the concessions, however, did not give the city any mandatory powers in regard to the purchase of the power houses, though the mains laid revert to it. The desirability of consolidating the supply of Paris led to the Municipal Council taking up the question, and in 1906 definite proposals were put forward. Negotiations were entered into with a syndicate of the existing companies under the name of Unions des Secteurs, the companies being called "secteurs" because their areas approximated to "secteurs" of the whole of Paris taken as a circle. This union developed into the concern now styled the Compagnie Parisienne de Distribution d'Électricité.

The dates of the concessions were all adjusted so that they expire on the last day of 1907, and the date for the Compagnie Parisienne to begin operations was fixed at Jan. 1, 1914. During the interval of six years the entities of the companies practically disappeared and were replaced by the Comité de l'Union des Secteurs. This in turn is displaced by the Compagnie Parisienne d'Électricité, which will own the concession until June 14, 1940, a committee of control being appointed, as representing the municipal and public interests, to which certain points of executive detail are referable before the company can put them into operation.. This company since 1907 has been engaged in preparing the necessarily involved distributing scheme and erecting and equipping the two new generating stations which are to supply areas of the Secteurs.

The scheme has been carried out in such a way as to minimize the work on the actual distributing system and also to obviate opening up roads as far as possible. With this purpose in view the existing substations have been used and certain other substations built, so that the energy delivered from the two main generating stations will be transformed to the voltage required on the various local distributing networks. The latter remain largely as at present, but a certain amount of relaying is to be gradually carried out, the mains to be laid immediately being the high-tension mains connecting the new generating stations with the substations and coupling centers (about 280 miles) and the feeders connecting the substations with the consumers' distributing network.

The whole area of Paris will be divided up into three sections—western, central and eastern. The western will be supplied with single-phase current, the central with direct current, and the eastern with two-phase current.

The energy will be generated at 12,300 volts, two-phase, 41.6 cycles. In the western zone this will be delivered to four substations (Muette, Sèvres, Gobelins and Les Ternes), where the voltage will be reduced for the distribution network to 3000 volts and farther transformed down to 110 volts (single-phase) by transformers on consumers' premises. At the central zone the same high-tension current will be delivered to eleven substations (Bondy, Trudaine, Saint Roche, Mauconseil, Sévigné, Puteaux, Bergère, Pasquier, Temple, Voltaire and Saint Antoine), where it will be converted to direct current. In the thinly populated eastern zone there will be five coupling centers (Dondeauville, Laumière, Menilmontant, Charonne and Daumesnil), where the same high-tension supply will be divided up and delivered (two-phase) to a large number of transformer stations, where the voltage will be reduced to 110.

The rating of the North station at St. Ouen-les-Docks is 50,000 kw, and that of the South station at Issy-les-Moulineaux 25,000 kw. Each of the stations can be doubled in size if necessary. The output taken over by the new company is in the neighborhood of from 80,000,000 kw-hr. to 90,000,000 kw-hr. per annum.

In respect to lighting, the company will hold a monopoly, but not as regards the energy for motors. Further, the Paris municipality reserves the option of providing for future demands by taking a bulk supply if necessary from any hydroelectric plant; in fact, serious consideration has been given to the question of a hydroelectric station on the Rhone, which would also be able to provide for supply to the departments in the intermediate territory.

Electric-Vehicle Meeting at Salem, Mass.

A meeting of the New England Section of the Electric Vehicle Association of America was held at Salem, Mass., on Jan. 15, with Chairman J. A. Hunnewell presiding. To stimulate local interest in the possibilities of the electric truck and passenger car, a parade under the auspices of the Salem Electric Lighting Company was given in the afternoon over an 11-mile route through Salem, Peabody and Beverly. Fifteen different makes and styles of electric vehicles were in line.

START OF ELECTRIC-VEHICLE PARADE IN SALEM, MASS.

The principal speakers at the meeting were Mr. Day Baker, president of the Electric Motor Car Club, of Boston; Mr. H. F. Thomson, of the research division, department of electrical engineering, Massachusetts Institute of Technology, Boston; Mr. Frank J. Stone, New England manager of the Electric Storage Battery Company, Boston; Mr. George W. Holden, New England representative of the Edison Storage Battery Company, Boston, and Mr. Howard T. Sands, general manager of the Tenney companies, Boston. Sample storage cells were exhibited and lantern slides illustrating electric-vehicle and battery service were shown. Mr. Thomson pointed out the simplicity of the electric vehicle as compared with the gasoline machine, and stated that the general result of the researches conducted at the institute upon motor transportation indicates that for city service the electric vehicle is more economical than the horse or the gasoline-driven machine. A final bulletin upon motor-vehicle research will be issued in about a month.

The announcement was made that at the February meeting a paper upon "Traffic Conditions in Boston" will be presented by Mr. W. W. Scott, of Pawtucket, R. I., and that the March meeting will be devoted to the consideration of a new form of rectifying apparatus. Twelve new members have been added since Nov. 14. A spring meeting will be held at Hartford, Conn. The garage committee announced that six of the leading garages in Boston have agreed upon standard charging rates. The results of the electric-vehicle campaign in Massachusetts on Dec. 31 were as shown in the accompanying table:

ELECTRIC-VEHICLE REGISTRATION, MASSACHUSETTS

	Dec. 31, 1912	Dec. 31, 1913
Passenger cars.	487	604
Commercial cars and trucks	262	409
Total	749	1013
Per cent gain during year	17	35

Illinois Electrical Contractors Meet

The midwinter convention of the Illinois Electrical Contractors' Association was held at the Hotel Leland, Springfield, Ill., Jan. 16 and 17. At the opening session Mr. G. A. Harter, of Chicago, voiced the sentiments of the manufacturers present in a statement to the effect that three schedules of prices should be maintained, namely, a jobber's price, a contractor's price and a consumer's price. This would protect the interests of the jobber and the contractor, so that both could do a profitable business. It was also brought out that contractors who cultivate the acquaintance of their customers after wiring jobs have been secured are often a factor in the sale of fixtures, motors and other electrical appliances. Others who discussed the three-price schedules were Messrs. G. H. Lounsbery, of Chicago; C. W. Beach, of Cleveland, and C. R. Hunt, of Chicago. Mr. V. A. Swett, of Chicago, said that it is desirable to do business with an established firm and he believed an agreement which excludes the dealer having no credit to be desirable.

The Society for Electrical Development and the National Electrical Contractors' Association, said Mr. Ernest Freeman, both stand for co-operation and both seek to better the business conditions for those in the industry. After outlining the plan, contemplated by the Society for Electrical Development, of sending men into the field to study conditions where the local central station and contractors are not co-operating, the speaker urged all reputable contractors to become members of the society.

Licensing of Contractors

At the morning session on Jan. 17 Dr. M. G. Lloyd, of Chicago, gave a short talk on a contractors' license law, stating that investigations of laws of other states should be made with the idea of eliminating all weak and objectionable features from the Illinois bill.

Mr. J. E. Latta, representing the Underwriters' Laboratories, stated that wiring rules are not made by an autocratic organization but that the ideas of all are solicited. He said that the laboratories were not run for profit, but most of the physical property was owned by the fire insurance companies, and the fees charged were based on the actual cost of making tests and paying men in the organization.

Speaking on the subject of state license, Mr. C. R. Kreider, of Chicago, said that few states at present have license laws and that municipal laws where they now exist are but a monetary proposition, the contractor paying a price for a certified tag. This condition, he said, is wrong in principle, for the workman as well as the contractor ought to be qualified. The law should require working electricians to pass an examination.

Discussion showed that several members favored an act establishing a master electrician's license, and Mr. Ernest Freeman moved that the association go on record as favoring an act regulating the installation of wiring and electrical appliances. The motion was carried.

Co-operation

Reading a paper on "Local Associations," Mr. W. J. Collins, of Chicago, said that if the contractors would drop their present mockery of independence and cooperate, increased profits, more satisfied customers and a better standing would be the result. Mr. A. M. Knauber, of Oak Park, spoke briefly in favor of local associations, stating that competition should be prevalent in the matter of quality but that there should be no competition in price.

Mr. J. C. Marron, Rock Island, said that as a rule the central stations are willing to co-operate with contractors in all undertakings but that it should be a task of the Society for Electrical Development to bring about a further mutuality of interest. The speaker suggested that each contractor report annually to the central station the amount of business which has been secured for the electric-service company through his solicitation or individual efforts. Such a report, said the speaker, will show the central-station man how valuable an ally the electrical contractor is.

Through the co-operative efforts of the contractors and the electric-service company in Chicago, Mr. W. J. Collins said, 110 old houses have been wired in the last three months. Contractors competing with a central station on an equality basis should have no fear, for the greater volume of business will come to them because of the natural prejudice of the public against the lighting company.

Mr. J. Hughes, of Champaign, Ill., related experiences showing that contractors should be careful in criticising the work or service of central stations, as these criticisms generally reach the electric-service company.

After a long discussion on rates and payments of liability insurance, a committee of five was appointed to investigate the advisability of forming a mutual company to carry the contractors' risk. It is estimated that about $40,000 can be saved annually if such a company is formed.

At a short afternoon session Mr. F. L. Decker, of Chicago, read a paper on "Business Education" in which he stated that the cost-keeping system adopted by the majority of contractors in the State had been quite successful.

As the result of discussion in closed session and the subsequent deliberation of a committee, the association decided to employ a representative to travel among the members and boost the association to the contractors in the State who are not members. His duties will correspond closely to those of the national traveling representative. Members of the association will be assessed pro rata on gross business to pay the expenses incurred by this "booster."

President W. J. Ball, of Moline, announced at the close of the meeting that the next convention of the society would be held in Danville, Ill., June 19 and 20, 1914.

Contractors, Dealers and Manufacturers Have a Heart-to-Heart Talk in Milwaukee

Lively and outspoken discussion marked the open session of the convention of the Electrical Contractors' Association of Wisconsin at Milwaukee on Jan. 13. Representatives of the contractors, supply dealers and manufacturers told one another their faults, in a business sense. There were some brisk exchanges, but the disputants felt better after freeing their minds, and the meeting ended in the most harmonious spirit.

Benefits of Association

Mr. Ernest Freeman, of Chicago, president of the National Electrical Contractors' Association, led off with a non-controversial speech setting forth why all contractors should join the association of which he is the head. In relation to interpretations of the National Electrical Code, he said that the association had made ten appeals and had been upheld in every one. Speaking of the association's bookkeeping system, he promised that the society, at its own expense, would send a man into any city to teach the system to some bookkeeper designated, if the local contractors expressed sufficient interest. Mr. Freeman advocated the establishment of a school to teach estimating on electrical construction work.

Mr. D. Elmer Roberts, of Racine, Wis., a contractor and retail dealer, said that the estimating sheet issued by the association had proved valuable. Another gentleman asked if the East did not dominate the national association, and Mr. Freeman said that there was nothing in that idea. Mr. Low added that while it was true that Eastern men—large contractors whose problems were not the same as those of the men in the Wisconsin association—dominated the association four or five years ago, that condition of affairs did not exist at present.

The Large Supply Dealer and the Contractor

Mr. W. W. Low, president of the Electrical Appliance Company, Chicago, read a paper on "The Relation of the Supply Dealer to the Contractor." He began by saying that there is no such person as an electrical jobber. Mr. Low said that he did not know anyone handling electrical material in wholesale quantities exclusively. He used the term "supply dealer." He told of one supply house where an examination of a month's business showed an average charge of $18. In Mr. Low's own business over 60 per cent of the orders received from contractors are for $10 or less. Most of these small orders are really handled at a loss. Mr. Low made an earnest plea to the contractors to be friendly with the large dealers. It is not practicable for the contractor to place his little orders with the manufacturer. Consider the delay and the cost of freight. "If the dealer is good enough to take care of your emergency orders," said the speaker, "you owe him your larger orders, so that he can make a reasonable profit." Mr. Low devoted considerable time to the so-called jobbers' sliding scale of small-quantity prices. These prices vary with the size of the order. They have been a good thing for the legitimate contractor and have protected him from the "curbstoner." The latter is being eliminated by the contractor who purchases his material in quantities. But the contractors have tried to break down the sliding scale. This course is unwise. The dealer has a place in the industry and the contractor should give his business to the dealer. Mr. Low also recommended the contractors to cultivate friendly relations with their competitors; confidence among competitors is a great asset.

Mr. Roberts, of Racine, took issue with Mr. Low.

The vital question to the small contractor, he said, is the unfriendly position of the jobber toward the contractor. Jobbers' salesmen call diligently on the "curbstoners" and on consumers and give them the same prices as they do to the contractor. This is not fair; it is not done in any other than the electrical business. Until the dealer protects the contractor things will go wrong. The jobber should stop retailing and peddling. He should act friendly as well as talk friendly.

Mr. Low said that Mr. Roberts was mistaken in his ideas. The contractor should buy in large quantities. The so-called jobber is not a wholesaler; he is just a large dealer. The sliding scale guarantees the contractor a profit. All dealers are not responsible for the small proportion who go through a city with a fine-tooth comb looking for orders. Mr. R. J. Nickles, of Madison, Wis., alluded to one large supply house as "pirates." A representative of the Central Electric Company, of Chicago, came to the defense of the supply dealers. Mr. Low arose again to say that the small contractor and dealer ought to improve his own selling organization. Mr. Benjamin Burdick, of Milwaukee, asked if the contractor could not be recognized by the large dealer and obtain a reduced price because he is engaged in the business. Apparently, large consumers get the same prices as the contractors. Mr. Low fully agreed that it would seem that in fairness every contractor and central station ought to get a reduced price from the large dealer. This was the case several years ago, but the government has stopped the practice.

Quality Versus Price

Mr. F. F. Skeel, Chicago, Crouse-Hinds Company, read a paper urging the contractors to insist on better goods and better prices. His subject was "The Relation of the Manufacturer to the Contractor." He said that the average consumer thinks of the manufacturer as a robber and the contractor as a middleman who is no better. The speaker viewed the middleman as affording the most economical means of distribution. He urged an advocacy of the policy of quality rather than the policy of price. Among manufacturers the commonly accepted idea is that it is no use to talk higher priced material—that is, quality—to an electrical contractor. That is the reason why in many cases the high-grade manufacturer feels that he must work against the contractor. Too often the contractor is willing to work under specifications which are a sort of a cross between a dog license and a chattel mortgage. Thousands of contractors, in defending themselves from one another, do not dare to buy good goods. The average electrical contractor has the reputation that he will accept anything that will "get by." No department of justice would have anything to say against competition based on quality. A price campaign will never build up a business. "Don't be afraid," said Mr. Skeel, "that you will take too much on a job. Your next job may take away half of the profit on the first one." The speaker quoted approvingly Ruskin's dictum that "those things called dear are, when justly estimated, the cheapest."

Mr. Burdick said he believed the blame to rest largely with the underwriters. They establish standards. If there is so much cheap and shoddy material on the market, it is high time that the protesting manufacturers took the matter up with the underwriters. The consumer says that what is good enough for the underwriters is good enough for him. Mr. Skeel met this by saying that the underwriters are in the position of defending life and property from material which is available. Things get through as "safe" that are not of the highest excellence. Standards are too low, and contractors are much to blame.

Mr. F. J. Natwick, contractor, Grand Rapids, Wis., was willing to admit some of the charges against the contractors, but jobbers sometimes take advantage of contractors. On big jobs consumers can buy material as cheaply as the contractors. The contractor cannot make a profit on labor alone and live. The contractor, acting perhaps as the agent of the jobber, should be protected by a margin of, say, 5 per cent when a big job comes along. The lamp situation is on a satisfactory basis now from the point of view of the contractor. Mr. Burdick asked if recognized channels for handling electrical products, as manufacturer to dealer to contractor to consumer, could not be arranged. In other industries this seems to be done.

The Engineer and the Contractor

Mr. F. A. Vaughn, consulting engineer, Milwaukee, prepared a paper on "The Relation of the Consulting Engineer to the Contractor," which was read by Mr. A. J. Sweet. Mr. Vaughn contended that the consulting engineer should stand for higher conditions by adhering to ethical standards. An important duty is laid on the engineer in preparing specifications of high quality. The contractor must do his part in equally high-grade construction. Architects should relegate engineering problems to engineers. They should be included in the co-operative scheme. Engineering specifications should be very clear and definite and sufficiently minute. The engineer should co-operate with the high-grade contractor and protect him from cut-throat competition.

Mr. Sweet added that if a perfectly definite plan is placed before the contractor it is hardly likely that he will take the business on a losing basis. It is where latitude is allowed that poor materials creep in. Thus the effort of the consulting engineer to establish quality is in the truest sense co-operation with the legitimate contractor. As to standards, it is to be remembered that the underwriters' requirements must be safe for all classes of installations, for factory as well as office building. The problem seems to be how to get consulting engineers on practically all of the business of the contractor. That seems very difficult, but why could not the contractors of a given community pass on quality themselves by fixing certain standards in concert?

The Contractor's Side of It

Mr. A. C. Langstadt, of Appleton, Wis., a contractor, considered the relations of manufacturers, dealers and contractors. He said that jobbers should not compete with contractors for retail business. If they do, they cannot blame the contractors for retaliating by buying of manufacturers. The contractor should be somebody in his own locality; he should keep up his credit and have an established place of business. Manufacturers and jobbers should draw their credit lines closer and should not extend credit to the fly-by-night so-called contractors. Prospective buyers not known should be investigated. The jobber should not secure two poor customers in place of one good one. The best of feeling exists between consulting engineer and contractor where both are competent. But engineers should not write one part of the specifications and expect the contractor to guess at the other nine parts. Mr. Langstadt indorsed the sliding scale of prices defended by Mr. Low. "If you will play square with the manufacturer and jobber, you will get value received every time," he said.

Mr. Low said that the majority of large dealers do not desire the business of "curbstoners." Inquiries from unknown persons are often referred to some responsible contractor or the central-station man. The supply dealer should go after the business of the contractor, the central station and large industrial establishments. Mr. Natwick asked where the line should be drawn between the local contractor, usually also a small dealer, and the large dealer, in selling supplies to large industrial concerns. Mr. Low thought some basis could be agreed upon. Possibly the contractor should get the ordinary day-by-day business and the large dealer the business due to an extension of the works or some broad expansion of the electrical development of the house.

Mr. Roberts, the last contractor to speak, said that the history of the art shows that the manufacturer and jobber have not been fair to the contractor. Many honest contractors have been hammering on quality for years, but for some reason they don't seem to get along. The speaker drew a vivid word picture of the difficulties that beset the contractor. "Talk justice to us," he urged vehemently; "don't talk quality merely. Treat us fairly."

Mr. A. A. Gray, Chicago, *Electrical Review and Western Electrician*, made a strong plea for the Society for Electrical Development.

Mr. Martin J. Wolf, Chicago, Hotpoint Electric Heating Company, spoke briefly on co-operation. "We all want to co-operate when we want to buy something," he said, "but we are not so keen about it when we have something to sell. Let electrical men of all pursuits be frank with one another."

Several closed sessions were occupied with discussions of business policies. Eleven new members were elected. Officers were chosen as follows: President, Mr. W. R. Johnson, Wausau; vice-president, Mr. L. W. Burch, Madison; treasurer, Mr. George Knoerr, Milwaukee; secretary, Mr. Albert Petermann, Milwaukee; directors, Messrs. R. J. Nickles, Madison; George F. Rohn, Milwaukee, and A. C. Langstadt, Milwaukee. The summer meeting will be held in Detroit, Mich., in July during the annual convention of the National Electrical Contractors' Association.

Convention of the National Telephone Association

The seventeenth annual convention of the National Independent Telephone Association met at the Hotel La Salle, Chicago, Jan. 13-15. At the first session of the convention Mr. J. Adam Bede, St. Paul, delivered an interesting address on the solution of American problems.

At the Wednesday morning's meeting Mr. Richard Yates, former Governor of Illinois, now a member of the Illinois State Public Utilities Commission, addressed the convention on the functions of the commission as adjuster of affairs between the State's utilities and the people.

Mr. William Fortune, Indianapolis, Ind., spoke on needed amendments to the income tax law.

In his annual address President Manford Savage, of Champaign, Ill., called attention to the present growth of the doctrine of decentralization, as marked by the dissolution of interlocking directorates of the Morgan companies and the recent agreement of the American Telephone & Telegraph Company with the United States Department of Justice.

In declaring the principles for which the National Independent Telephone Association stands, the president said that the local or independent companies should at all times supply the local wants of the people, and that the long-distance service of the country should be supplied over lines owned by a nation-wide concern.

According to the convention programme, Thursday's session was to have been occupied largely with a "conference on toll connections between independent companies and the Bell Telephone Company, including explanation of the recent agreement between the Attorney-General and the American Telephone & Telegraph Company, by Mr. N. C. Kingsbury, vice-president of the American Telephone & Telegraph Company. Serious illness prevented Mr. Kingsbury's attendance, but in a short telegram he conveyed to the convention the fact that the details of the co-operative plan in acordance with the ideas of the now famous "Bell letter" were being worked out.

In its report the committee on resolutions embodied the ideas set forth by the president of the society in his address.

The annual banquet of the association on Jan. 14 was attended by approximately 350 members and guests.

Judge N. G. Hunter, Wabash, Ind., was elected president for the ensuing year. Election of other officers was deferred until a subsequent meeting of the board.

Wisconsin Electrical Association at Milwaukee

According to the estimate of Secretary Allison, about 250 persons attended the sixth annual convention of the Wisconsin Electrical Association in Milwaukee on Jan. 15 and 16. This number included a few ladies and a large number of supply men. The average character of the papers presented was exceptionally high. Mr. William H. Winslow, of Superior, Wis., vice-president of the Superior Water, Light & Power Company, the president of the association, presided. The delivery of his address was the first important feature of the proceedings.

President Winslow's Address

In a brief, well-reasoned address Mr. Winslow said that from the somewhat scanty figures available it is judged that the electric-service utilities of Wisconsin made a considerable gain in business, comparing the years ended June 30, 1912 and 1913. But the increase comes from a few of the larger plants, and it is apparent that there are a number of central-station companies in the State that are making little progress. The association should help to develop these latent possibilities. The electric-railway companies of the State show an apparent loss in both gross earnings and gross income. Cost of operation has gone up, but the nickel fare remains stationary. "With none of the manifold ways of increasing business open to the light and power companies," said Mr. Winslow, "it would seem that the street-railway companies have a very difficult problem." Perhaps fares should be readjusted on a basis of length of haul. Legislative matters received much attention from the officers of the association last year. Possibly consolidation with the Wisconsin Gas Association should be considered, to the end that there shall be one strong utility association in the State. As to the effect of the original public utility regulation and stock and bond laws of the State, the president said that he believed the result had been, on the whole, beneficial to established utilities. But financing of new enterprises has been made difficult or impossible. It is possible that the issue of stock bonuses cannot be revived. Mr. Winslow expressed his approval of an amendment to the stock and bond law permitting the issuance of stock without par value, or profit-sharing certificates, as they are sometimes named. Such issues would facilitate the financing of new enterprises and the consolidation of small and inefficient plants. The study of the subject of supplying electricity to farms and rural districts was recommended.

This address was referred to a committee consisting of Messrs. Wheeler of Eau Claire, Lord of Waupaca and Gonzenbach of Sheboygan, all past-presidents. Later this committee made a report commending the address and requesting the new administration to appoint a committee on co-operation with other associations and another on rural extensions.

Mr. George Allison, of Milwaukee, secretary and treasurer, presented a report showing the finances of the association to be in good condition.

Accounting for Small Central Stations

Mr. H. G. D. Nutting, Milwaukee, gave an illustrated paper on "A Practical Accounting System for Small Central Stations." A complete system was recommended suitable for Class B and Class C companies as classified by the Railroad Commission of Wisconsin. Mr. Nutting's system is based on the commission's requirements. A number of forms devised for this system were shown on the screen.

There was some discussion. Mr. Nutting explained the difference between earnings and cash received. Cash collections are not necessarily earnings. The examiner of accounts of the Railroad Commission, who was present, said that accounting forms had been devised by the commission and that the commission's system differed materially from that of Mr. Nutting. It is not compulsory, however, to use the form of the commission. Mr. Nutting said that the small company should look on both systems as merely tentative. The commission and the state association should get together and agree upon a practical system. By vote the association established an accounting committee.

New Laws Affecting Wisconsin Utilities

Mr. John B. Sanborn, a lawyer of Madison, who has represented the association before the Legislature, read a short paper reviewing the laws relating to public utilities passed by the Wisconsin Legislature last year. There have been some changes in the workman's compensation act by which the defense of contributory negligence is wiped out where the employer has four or more employees. Every employer must now take out indemnity insurance or convince the state industrial commission that he does not need it. The stock and bond law has been amended to permit an increase of stock up to the actual value of the property. Municipalities may now acquire public utilities lying wholly or in part outside of the boundaries of the municipality. Electric-light companies have now the right to condemn property if the courts decide that the property is necessary and proper for the use of the company. City councils are compelled to put in special ornamental lighting if the residents of a street petition for it. The 1913 water-power act has yet to stand the test of the courts. All future development of water-powers in the State to the extent of 250 hp or more, where the power is to be sold to the public, must be made under franchises granted only to corporations organized under the new law or to municipalities or to existing utilities. The Railroad Commission of Wisconsin must approve the applications. Various restrictions are provided. Mr. Sanborn gave it as his opinion that the prospects for new water-power development in Wisconsin are not bright under the new law.

Liability Insurance

Mr. Ernest Gonzenbach, of Sheboygan, presented a brief informal report on liability insurance. There has been no particular change in the attitude of the committee since the report of a year ago. The committee tried to work out a co-operative insurance plan for the member companies of the association, but nothing tangible has resulted.

Methods of Making Line Extensions

President Winslow spoke of the diversity existing in the methods of electric-service companies in making line extensions for customers. At his request Mr. Nutting, of Milwaukee, explained a system that he has worked out. Companies usually require that the estimated gross revenue from the extension in a year shall be at least as much as the cost of the extension. Sometimes the revenue for two or three years is accepted, and in some cases no rule is followed. Sometimes the prospective customer contributes part of the cost of the extension. Under these circumstances Mr. Nutting has tried to work out a method to be followed on some rational basis. He made an analysis of the cost of taking on new customers and worked out a formula for general use based on the various costs entering into the extension. The formula provides for the interest on the new investment, depreciation, taxes, operation and maintenance, as well as overhead charges. It was decided to appoint a committee to consider uniformity in making extensions.

Co-operation with Contractors

Mr. F. J. Natwick, Grand Rapids, Wis., an electrical contractor, addressed the convention twice, urging the central-station men to adopt some form of direct and systematic co-operation with the contractors of the State. He invited the central-station men to attend a conference to be held in Milwaukee next April by the Electrical Contractors' Association of Wisconsin. A motion was passed directing that a committee be appointed to attend this April meeting.

Street-Railway Papers

Mr. E. W. Hammett, of Sheboygan, presented the report of the committee on train dispatching. Mr. C. M. Larson, chief engineer of the Railroad Commission of Wisconsin, read a paper on "Street Railway Traffic Surveys in Relation to Railway Operation." Mr. E. Taylor, General Electric Company, and Mr. Clarence Renshaw, Westinghouse Electric & Manufacturing Company, read papers on maintenance of car equipment. Mr. Larson's able paper caused an interesting discussion. Mr. R. B. Stearns, vice-president of the Milwaukee Electric Railway & Light Company, said that he regarded the work of the Railroad Commission of Wisconsin as most important. He described the new zone system to be put into effect in and near Milwaukee for charging street-railway passengers according to the distance carried. Mr. Larson made the statement that electric-service utilities are adapting themselves to present-day conditions more rapidly than the street railway utilities.

Electric-Service Rules in Wisconsin

Mr. F. A. Vaughan, of Milwaukee, made a valuable report as chairman of the committee on electric-service rules revision. The new rules for electric service of the Railroad Commission of Wisconsin were put into effect on Oct. 9, 1913. The commission has worked in harmony with the state association and has also held public hearings on the subject. The rules adopted are being copied by other states. In relation to maximum-demand meters, the commission, at the instance of the electrical men, did not insert the tentative Rule No. 28, which would have required the testing of maximum-demand instruments in as careful a manner as required for watt-hour meters. The committee saw that this was impracticable at the present time, and on promising to make strenuous attempts to standardize the practice and develop proper maximum-demand meters through the manufacturers, the commission agreed, for the time being, to strike out Rule No. 28 and withhold any further rulings on maximum-demand indicators for one year.

Discussion

Mr. John N. Cadby, service engineer of the commission, complimented the association on the work of its committee. He said that the rules for electric service are not perfect yet, but they are fairly satisfactory for a start. Unquestionably it was wise to hold up for a time action on maximum-demand-indicating devices.

Mr. F. A. Kartak, of the University of Wisconsin, described the work of the Standards Laboratory, operated by the electrical engineering department of the university in conjunction with the Railroad Commission of Wisconsin. He described the testing of portable standard watt-hour meters and said that the laboratory is working out a standard shipping box to be used for shipping meters to and from the laboratory.

The very efficient committee on electric-service rules revision was continued. Mr. Vaughan is chairman of the committee, and Mr. S. B. Way, vice-president of the Milwaukee Electric Railway & Light Company, and Mr. George Allison are the other members.

Co-operative Advertising and Publicity

Mr. George B. Wheeler, of Eau Claire, made a brief report for the committee on publicity. He said that since the committee was formed two years ago, the need for co-operative effort by the members of the association has been largely eliminated by the number of private concerns now engaged in preparing advertising matter and conducting publicity campaigns for central-station companies. The committee asked the secretary of the association to prepare a list of all the private concerns engaged in preparing and selling publicity matter, this list to be sent to all the members of the Wisconsin Electrical Association. The committee advocated daily newspaper advertising and spoke of the necessity of the utility furnishing the public information as to its plans and methods. It should take the public into its confidence. Utilities have nothing to conceal in their business relations with customers.

Inspection of Overhead Construction

Mr. S. B. Way, of Milwaukee, presented the report of the committee on overhead inspection. The necessity of employing good design, material and workmanship in overhead construction was emphasized. In a measure all employees should be trained to report defects, but in addition to this general alertness overhead lines should be inspected at regular intervals. The length of these intervals depends on the character of the overhead lines. The committee recommended that overhead lines carrying 7500 volts or more be inspected every three months; lines carrying from 1000 volts to 7500 volts should be inspected every six months, and lines carrying less than 1000 volts should be inspected once a year. Blanks should be provided for the use of inspectors.

Discussion

Messrs. W. E. Haseltine, of Ripon; Vaughan, of Milwaukee; P. H. Korst, of Janesville; Winslow, of Superior, and others took part in the discussion. The point was brought out that the companies should not only inspect their lines at regular intervals, but should stand ready to prove in a court of law at any time that the lines have been inspected. This will show, in case of accident,, that the company was not negligent. The industrial commission of the State of Wisconsin is now at work on standards for electrical work, but the rules as proposed do not contemplate inspection. The association, therefore, should develop its own rules for overhead inspection and submit them to the commission for adoption. The report of the committee was accepted and the committee was continued.

Voltage Regulation

Mr. G. G. Post, electrical engineer of the Milwaukee Electric Railway & Light Company, gave an illustrated paper on voltage regulation. He reviewed present-day practice, and among other things described the booster system for regulation in use in the downtown direct-current district of Milwaukee. In relation to alternating-current regulation, a scheme of connection for series transformer and line-drop compensator in the neutral of a three-phase unbalanced feeder was illustrated. Typical charts taken from graphic recording instruments were shown.

Discussion

In the discussion one operator of a Class B plant said that it is hard in the smaller towns to maintain the voltage within the 3 per cent variation required by the state commission. Mr. C. R. Phenicie, of Green Bay, wanted to know if automatic voltage regulators will not be required eventually on many of the lighting feeders, even in small-town plants. Mr. Vaughan said that engineers should be firm in specifying apparatus to insure good regulation. Mr. V. A. Hain, of the General Electric Company, spoke of the desirability of making a careful voltage survey. He discoursed briefly on the subject of voltage regulation, and asked the central-station men to remember that every minute the voltage is low every meter is running slow.

European Practice in Relation to Small Customers

Mr. S. E. Doane, of Cleveland, chief engineer of the National Lamp Works of the General Electric Company, gave an extremely interesting talk on his investigations of the relations of European central stations to their small customers. Mr. Doane found that in many respects the central-station men of European countries are far in advance of those in this country. This is particularly the case in relation to securing the business of small lighting customers. In Milan, for instance, a city about the size of Cleveland, the central stations have more than 90,000 customers, while in Cleveland the corresponding number is 40,000. In Milan there are 25,000 customers with an average connected load of less than 22 watts and with an average number of lamps installed of 1.8. Limiting devices are used in most cities for the very small consumers, but not in all cities. The limiting device used costs about $1.50. Mr. Doane mentioned the psychology of advertising so as to reach small customers. The better-off people will take electric light if the poor people can afford it, but the rule does not work the other way. Therefore small customers have a value from this point of view. Some of the billing methods used are new to this country. Nearly everywhere there are harmonious relations with the contractors. The latter act practically as the agents for the central stations. European electric-light men are familiar with practice in this country, much more so than American electrical men are with theirs. The Europeans read the American electrical papers and so keep in touch with the developments here.

Discussion

Mr. Doane's talk on foreign practice aroused much interest, and questions were asked by Mr. Vaughan, Mr. C. M. Axford and Mr. C. R. Phenicie, of Green Bay; Mr. Way and others. Answering these, Mr. Doane that he had brought back with him from Europe about thirteen types of limiting devices. These pieces of apparatus are light in weight, operated on the solenoid principle, and are inexpensive but effective. They will no doubt come into greater use in this country. The expense for wiring houses is often spread over a long term. Practically all city governments have functions of regulation. Municipal ownership is not a shining success, although it is true that men of high character usually direct the municipal undertakings in Europe. It is quite the ordinary thing for the company to accept the contractor as a solicitor. The central station carries the account for the wiring. In answer to Mr. Way, Mr. Doane said that the plan of serving the extremely small customers in European cities was not adapted to anything but lighting. Flatirons, for instance, could not be used on the circuits. However, lighting is a great advertisement for the use of electricity and helps to bring about a larger use on metered circuits.

High-Efficiency Lamps

Mr. Doane devoted part of his talk to the new high-efficiency tungsten nitrogen-filled lamps. He said that the remarkable and outstanding fact about these lamps is that incandescent lamps are now made without a vacuum. He exhibited a lamp in service taking 750 watts and giving approximately 1000 cp measured spherically. Mr. Doane said that he believed that, rating for rating, the new incandescent lamps are as efficient as flame-arc lamps. Greater improvements may be looked for in incandescent lamps, perhaps, as the latest types are only 12 per cent efficient. The trend of the times is distinctly away from free lamp renewals. Under the new conditions the consumer should pay for his own lamps.

PRESIDENT-ELECT P. H. KORST

Depreciation and Rate-Making

A paper entitled "Some Facts Relating to Depreciation and Rate-Making," prepared by Mr. Halford Erickson, member of the Railroad Commission of Wisconsin, was read by Mr. F. W. Doolittle, of the commission, in the absence of Mr. Erickson, who was detained at his home by illness. Mr. Erickson considered depreciation under four heads—wear and tear, general decay, obsolescence and inadequacy. In the second part of his paper, devoted to rate-making, Mr. Erickson expounded the well-known theory of the Wisconsin commission that rates should be based on the cost of service. Ordinarily, he said, no part of the service should have rates so low as not to cover operating expenses and at least some part of the general expenses. There is a considerable demand on the part of the public for a uniform meter rate, but it is logical that various classes of customers should be charged in proportion to their demand, the expense of serving them and general output expenses. The author said that the demand method of charging seems to be reasonable and just, and he believed that a uniform meter rate would be unjustly discriminatory. It would prevent the central station from taking a large amount of industrial business now available. It would, in fact, tend to reduce profits and to increase rates. Mr. Erickson does not think that advantageous rates would be obtained by enforcing a uniform meter rate of charge. The paper was a scholarly production and made a deep impression. There was some discussion, and the belief was expressed that few utilities in Wisconsin have actually set aside depreciation funds. Depreciation reserve has been usually invested in plant.

Mr. A. A. Gray, of Chicago, made a plea for the Society for Electrical Development, in the absence of Mr. J. M. Wakeman.

Election of Officers

On the recommendation of a nominating committee, of which Mr. O. C. Irwin, of Berlin, was chairman, officers for 1914 were elected as follows: President, Mr. P. H. Korst, Janesville; first vice-president, Mr. M. C. Ewing, Wausau; second vice-president, Mr. W. E. Haseltine, Ripon; third vice-president, Mr. B. F. Lyons, Beloit; secretary-treasurer, Mr. George Allison, Milwaukee.

Mr. Philip H. Korst, the new president, is secretary and manager of the Janesville Electric Company, and also is secretary and manager of the Edgerton Electric Light Company. The Janesville company operates both steam and water-power generating plants and supplies electrical energy to Newville, Fulton and Indian Ford, in addition to the cities named. Mr. Korst is one of the progressive central-station managers of his State. He was a charter member of the old Northwestern Electrical Association, and also of its successor, the present Wisconsin Electrical Association. In 1908 he was elected president of the Northwestern Electrical Association, and he has now been promoted from the vice-presidency of the Wisconsin association. He was born in Chillicothe, Ohio, fifty years ago, and has been engaged in electrical pursuits for over thirty years. For fourteen years he has been manager at Janesville, and for eleven years before that he was manager of the property at Racine.

Social Features

A theater party followed by a supper was given on the night of Jan. 15. Mr. Ernest Gonzenbach, of Sheboygan, acted as toastmaster, and informal speeches were made by Messrs. C. E. Searles, of Milwaukee; C. M. Axford, of Green Bay; Sam A. Hobson, of Chicago; P. T. Bowler, of Milwaukee; George Allison, of Milwaukee; L. E. Gould, of New York, and George B. Wheeler, of Eau Claire.

A rejuvenation of the Jovian Order was held on the night of Jan. 16. Twenty-four candidates were initiated. At the dinner Mr. P. T. Bowler, Jovian statesman, presided, and there were speeches by Messrs. T. M. Kiewert, Sam A. Hobson, H. E. Niesz, A. A. Gray, C. E. Searles, Ernest Gonzenbach, Charles Dean, George Allison and George C. Richards. Messrs. J. C. Stadelbauer and W. H. Patton gave an amusing burlesque sleight-of-hand performance.

Railroad Commission's Exhibit

Following the plan of last year, the Railroad Commission of Wisconsin made an exhibit at the convention. The exhibit of a year ago related principally to meter testing, street lighting and voltage regulation.

This year the exhibit covered entirely different features, there being no repetitions. The commission's new rules of service were displayed about the room. A rather elaborate exhibit showed the stream-gaging work which was recently begun by the Wisconsin commission in conjunction with the United States Geological Survey in administering the water-power law passed by the last Wisconsin Legislature.

The commission has issued forms for accounting, billing and the keeping of various records in compliance with numerous requests for suggested forms which have been made from time to time. Photographs and blueprints showing the accuracy of precision instruments and timing devices employed at the laboratory jointly maintained by the commission and the university were descriptive of the testing laboratory's work. Many recent publications of the commission and recent laws administered by it were on hand for distribution.

Public Service Commission News

Wisconsin Commission

The commission has made a valuation of the Manitowoc Electric Light Company's plant and has fixed upon $137,500 as the price to be paid for the property by the city of Manitowoc. The city is to take over the property under the indeterminate permit law.

The Endeavor Electric Light & Power Company has been authorized to increase its rates for electric lighting from 10 cents to 15 cents per kw-hr.

The Madison Gas & Electric Company has been ordered to restore service to a consumer to whom such service had been refused on the ground that bills contracted at previous places of residence had not been paid. It was decided that service cannot be withheld from one who is willing to comply with the rules and regulations requiring the furnishing of security for the payment of current bills when due, although he may be owing the company for past service at the time. The commission remarked that this rule may seem to work a hardship at times but that it should have the effect of greater scrutiny of credits on the part of the company in the future and a more extensive application of the rule relating to deposits.

New York Commission.

Pending a physical valuation of the property of the New York Telephone Company, an offer has been made by the company to the New York Public Service Commission, Second District, to reduce rates 10 per cent on all contract charges. The reduction will apply to all private branch exchange contracts and to all the various residence and business contracts, including extension telephones taking measured service, charitable rates and municipal discount rates. It will not apply to flat rates or to toll rates of any description or to rates of any kind which may be payable under old contracts for less than the present published standard tariff charges.

Indiana Commission

With the conclusion of evidence and the argument in the Indianapolis street-railway strike case before the Indiana Public Service Commission the members of the commission now have to prepare a decision. Afterward they will turn their attention to more than 300 cases which have been brought up from various cities and towns.

Evansville, Union City, Greencastle, Terre Haute, Lafayette, South Bend, Gary, Richmond and many other places have issues involving electrical properties. The rate cases in Indianapolis are still pending.

Current News Notes

Large Connecticut River Development Foreshadowed.—Our attention has been called to an error that occurred in the article under the above heading which appeared in the Dec 20 issue. The Northern Connecticut Securities Company, so we are informed, has absolutely no control or interest in the United Electric Light & Water Company, nor does it control any electric lighting properties in Windham and Tolland Counties.

* * *

South Hadley Adopts Municipal Lighting.—At a special meeting held in South Hadley, Mass., on Jan. 12 it was decided by a vote of 169 to 44 to adopt municipal lighting. The town does not propose to manufacture electricity, but will buy it and distribute it, having already received offers for the supply of energy in bulk to the amount now used at 1.75 cents per kw-hr. The Amherst Power Company, which controls the South Hadley Falls Electric Light Company, received sixty days in which to file a bill of sale which the town can accept, but if the price is exorbitant the town will appeal to the courts to set the price.

* * *

Long Sault Development Suit.—The validity of the act by which the New York State Legislature of 1907 gave the Long Sault Development Company water rights on the American side of the St. Lawrence River amounting to about one-third of all the developed water-power in the United States was attacked in the Court of Appeals at Albany, N. Y., by State Attorney-General Carmody on Jan. 6. During 1912 the State Treasurer refused to accept the annual payment of $25,000 from the power company. The company brought suit to compel acceptance, and while the case was in the Appellate Division the Legislature repealed the act granting the charter.

* * *

Hydroelectric By-law Defeated in Sandwich, Ont.—By-laws authorizing the purchase of electrical energy from the Hydro-Electric Power Commission of Ontario were laid before the electorate in eight municipalities in the Province of Ontario on Jan. 5, and were carried in Richmond Hill, Oshawa, Strathroy, Wallaceburg, Hanover, Elora and Kemptville. Sandwich, however, would have none of it. The electors decided against the purchase of electricity from the Hydro-Electric Power Commission of Ontario and also voted down the expenditure of $8,430 for the construction of a distribution system. Sandwich receives its energy from the Sandwich, Windsor & Amherstburg Railway and is near the Michigan border line. When energy is delivered to the seven municipalities above noted the Hydro-Electric Power Commission will have 101 cities, towns and villages on its circuits.

* * *

Suggested Ordinances for Small Municipalities.—The National Board of Fire Underwriters of New York and the National Fire Protection Association of Boston, Mass., have devised for adoption by towns and small cities suggested ordinances characterized by brevity, simplicity and the avoidance of conflict with one another. These ordinances provide for fire limits and the construction and equipment of buildings in small towns and villages, for the regulation of automobile garages, for the regulation of the equipment and operation of picture machines and premises wherein the same are used, for the inspection of premises by the fire department to safeguard the public and property against fire, for the cleanliness of streets, alleys and premises, for the burning of refuse, for the storage of explosives, for regulating the discharge or firing of fireworks and other pyrotechnic displays, and for fire escapes. The Underwriters would like to see the code enacted in its entirety, previous legislation, if any, being annulled by its adoption. Such slight changes as are necessary can be made by municipal attorneys without disturbing the main paragraphs.

* * *

Minneapolis Street-Lighting Contract.—By a contract with the city which went into effect on Jan. 1 the Minneapolis General Electric Company will operate 2800 6.6-amp magnetite-arc lamps for street lighting instead of 2400 as in 1913. The rate was decreased from $62.50 to $60 a year. The new lamps will be used for extensions and for replacing about 100 gas lamps. In addition the company operates 935 ornamental posts for curb lighting. These posts support five 60-watt tungsten lamps. The top lamp burns all night and the others until midnight.

* * *

A Test of Underground Construction.—At the time of the recent subsidence of the surface of Randolph Street between State Street and Wabash Avenue, Chicago, when the street level sank about 8 ft., water pipes burst and other underground utilities were badly damaged. The Edison cables alone were self-supporting and remained suspended in mid-air in the conduit line containing them, with almost no damage. This was a severe test of the mechanical strength of the underground conduit construction of the Commonwealth Edison Company, and the manner in which it was met indicates the workmanship put into this type of construction.

* * *

Local Public Utilities Department Planned for Chicago.—On the suggestion of Alderman Merriam it has been decided to eliminate all commission features from the proposed municipal public service department of Chicago. As originally planned there was to be a board consisting of the city electrician, city comptroller and a commissioner of public utilities to be appointed. It is now proposed that there shall be created a new department of the city government, to be known as the Department of Public Service, in charge of one official to be called the commissioner of public service. The proposed department would include bureaus of local transportation, gas inspection, telephone supervision and electric-service supervision. It would handle complaints. It is proposed that the heads of these bureaus shall be selected by civil-service methods.

* * *

Young Technical Men Affiliate with Trades Union Movement.—The Chicago Technical League, of Chicago and vicinity, is an organization that may either prove to be the nucleus of a movement of some importance or fail to attract widespread support as the future may determine. It consists of about 125 young men connected with the civil-engineering profession. About 90 per cent of these are college-trained men. One striking feature of this organization of trained technical men is that it is affiliated with the American Federation of Labor. The ultimate object is to endeavor to raise the salaries or wages of the younger men connected with civil-engineering offices and to standardize positions and wages. The constitution and by-laws of this interesting society are not as yet in print. The office of the Chicago Technical League is at 32 North Fifth Avenue, Chicago.

SOCIETY MEETINGS

Chicago Joint Meeting.—At a joint meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers, to be held in the Western Society rooms, Chicago, on Jan. 26, Mr. Bion J. Arnold will present an illustrated paper on "City Transportation, Subways and Railroad Terminals."

* * *

Boston Edison Company Section.—At the first meeting of the Boston Edison Company Section of the N. E. L. A. for the year, scheduled for Jan. 20, the program included a visit to the principal exchanges of the New England Telephone & Telegraph Company in the Boston business center and a talk upon "The Operation and History of the Telephone," by Mr. Frank H. Clark, of the traffic department of the New England company.

* * *

Jovian Electrical League of Southern California.—The regular weekly meeting of the Jovian Electrical League of Southern California was held Jan. 14 at Christopher's, Los Angeles, Cal. Mr. Martin Betkouski, one of the city fathers, delivered an address on "A Councilman—His Relations to the Public," and Prof. Edward B. Warman, lecturer and writer, gave a short talk, his subject being "Human Electricity." Entertainment was furnished by a local theater. A permanent degree team has been appointed and will make its first appearance at the next rejuvenation, which will be held Feb. 6.

* * *

Wisconsin Electrical Exhibitors at Milwaukee.—At the Milwaukee convention of Jan. 16 the Wisconsin Electrical Exhibitors' Association elected officers as follows: President, J. C. Schmidtbauer, Milwaukee, Julius Andrae & Sons Company; vice-president, W. H. Tompkins, Milwaukee, Western Electric Company; secretary-treasurer, H. F. Boggis, Milwaukee, C. J. Litscher Electric Company. Exhibitors at the Milwaukee convention of the Wisconsin Electrical Association were: Allis-Chalmers Manufacturing Company, Julius Andrae & Sons Company, Central Electric Company, Duncan Electric Manufacturing Company, Electric Appliance Company, Federal Sign System (Electric), General Electric Company, Harter Manufacturing Company, Illinois Electric Company, C. J. Litscher Electric Company, Moloney Electric Company, National X-Ray Reflector Company, Charles Polascheck & Brothers Company, Western Electric Company.

* * *

Membership List of Society for Electrical Development.—The Society for Electrical Development, Inc., has issued a list of its members bearing date of Jan. 15. This list contains 1195 names classified as follows: Manufacturers, 167; central stations, 251; jobbers, 239; electrical contractors, 522; miscellaneous, 16. The membership list of the society dated Nov. 15, 1913, contains 951 names, showing that during the fifty business days intervening there has been an increase of 244 members. Among those who have recently joined the society are the Toronto Hydro-Electric System, Toronto, Ont.; R. Thomas & Sons Company, East Liverpool, Ohio; Varney Electrical Supply Company, Indianapolis, Ind.; F. D. Lawrence Electric Company, Cincinnati, Ohio; American Platinum Works, Newark, N. J.; George Cutter Company, South Bend, Ind., and the MacAllen Company, Boston, Mass. The board of directors will hold a meeting in the Engineering Societies Building, New York City, Jan. 26.

Interconnected Electric Service at Warren, Ohio

Steam, hydraulic and gas-engine-driven stations of the Trumbull Public Service Company connected by transmission lines—Street lighting, commercial methods and growth

PRIOR to June 1, 1911, the city of Warren, Ohio, had two electric-service companies known as the Warren Water & Light Company and the Hydroelectric & Gas Company. The first-named corporation furnished electric service within the city limits of Warren only, while the "Hydro" company included in its field of operation, besides Warren, the neighboring towns of Niles, Leavittsburg and Newton Falls.

On the date above mentioned the two companies were consolidated under the name of the Trumbull Public Service Company and their operation was taken over by the Doherty Operating Company, 60 Wall Street, New York. The Trumbull Public Service Company is controlled by the Northern Ohio Gas & Electric Company, which is in turn associated with the Consolidated Cities Light, Power & Traction Company.

Since the consolidation the company has more than doubled its output of electricity. Extensions have been made in the territories formerly served by the old companies, so that the Trumbull company now serves in all eight cities and villages—Warren, Niles, Newton Falls, Leavittsburg, Phalanx, Windham, Garrettsville and Hiram. At Garrettsville and Windham small generating stations have been replaced by three-phase transformer installations supplied with energy over high-tension transmission lines. A new substation has been built near Mahoning from which the village of Windham and the Portage Silica Sand Company receive service.

The old Hydroelectric company had approximately 2100 hp in connected load. In two years the merger company has more than doubled that amount, and at present it has a total connected motor rating of over 5000 hp, including installations in sand plants, sawmills, lumber yards, feed mills, farms, paint mills, lamp works, machine shops, stove works, laundries and electrical manufacturing companies. The sand mills were taken on during 1913, and each has a load of 250 hp.

The most recent addition to the company's lines is the village of Garrettsville. This town has about 1000 inhabitants and about 330 residences. From a canvass of the community, just finished, it was found that of these 330 houses 200 are wired and their occupants are using electricity. During the week spent in Garrettsville by representatives of the company's commercial department orders were taken for wiring fifty houses and about sixty electric irons were sold.

A rather unusual condition exists at Warren in that the "peak" comes on during the day, as shown in Fig. 6. This is caused by the large motor load already referred to. The management is therefore making a determined effort to "even things up" by installing electric signs and securing new residence lighting. So far these efforts have been very successful. In the last twelve months the company has sold and erected about fifty-five signs, and it is adding from two to four new residence consumers daily. In the meantime, however, the motor load keeps "piling up" so that it looks as though the central station might have a day peak for some time to come.

Steam Generating Station

Five power stations house the generating equipment of the Trumbull Public Service Company, the principal station, a combination steam and hydraulic plant, being situated on the Mahoning River in the outskirts of Warren. This plant, together with the pumping station, also a property of the company, is shown in Fig. 1. An 1800-kw General Electric steam turbine exhausting into a Westinghouse condenser is the largest generating unit of the company. This machine is shown in the background of Fig. 2. A second and smaller turbine drives a 500-kw General Electric generator with a Fort Wayne condenser.

In striking contrast to these compact units, a 600-hp Cooper Corliss engine, operated condensing, drives a 400-kw, 2300-volt, 60-cycle alternating-current General

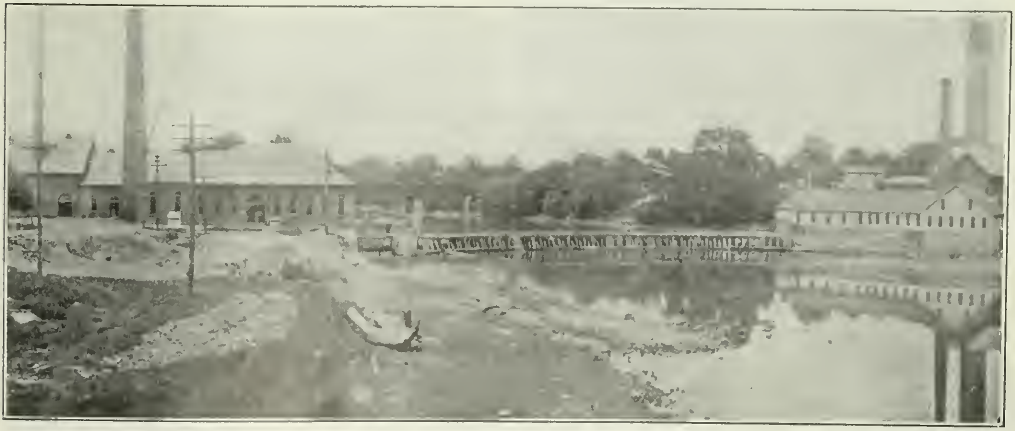


FIG. 1—MAIN GENERATING STATION, DAM AND PUMPING PLANT ON THE MAHONING RIVER, WARREN, OHIO

Electric generator and a 200-kw, 575-volt direct-current General Electric generator. Belted to the same shaft in the east wing of the station are one 200-kw, 2300-volt, 60-cycle General Electric alternator, one 150-kw, 550-volt Westinghouse Electric & Manufacturing Company direct-current generator, and one single-action Hamilton pump with capacity of 1,500,000 gal. of water every twenty-four hours. This apparatus is driven by a 450-hp Hamilton Corliss engine operating with a Dunn-Gordon condenser.

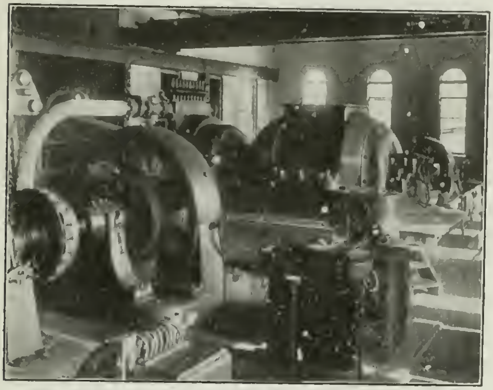


FIG. 2—1800-KW TURBINE WITH 200-KW DIRECT-CURRENT GENERATOR IN FOREGROUND

When the flow of the river is moderate, a 61-in. Trump vertical waterwheel operating on a 6-ft. head may be directly connected to the water pump and belted to the line shaft to relieve the Corliss engine. The dam which furnishes the head for this wheel is shown in Fig. 1. The exciter equipment of the station is separated into two units, one a 35-kw turbo-generator and the other a 30-kw motor-generator set, both manufactured by the General Electric Company. The engine room is served by a 12-ton crane built by the Euclid (Ohio) Crane & Hoist Company.

Up to the present 2100 hp in boiler rating has been installed in the station. This hand-fired steam-generating equipment is divided among a 500-hp Erie City boiler, a 400-hp Stirling boiler and two 600-hp Stirling boilers. Two steel stacks 135 ft. and 180 ft. high respectively and a 134-ft. brick stack provide draft for these boilers.

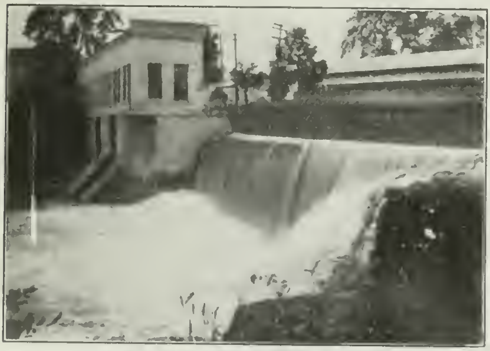


FIG. 3—WEST FORK PLANT, NEWTON FALLS

Water for the entire battery of boilers is furnished by a National coil-type closed feed-water heater. Two feed pumps, one an 8-in. by 5-in. by 10-in. single-action steam-driven pump and the other is a 7.5-in. by 5-in. by 10-in. duplex pump, deliver water from the river to the feed-water heater. Both pumps are products of the Union Steam Company, Battle Creek, Mich.

During the floods of March, 1913, the rapid rise of the river gave considerable trouble. Recurrence of this, however, has been anticipated by building a high concrete retaining wall along the river on the upstream side of the station.

The main switchboard of the steam plant consists of fourteen panels. Beginning in the foreground, the first two panels control the feeders of several large factories in the vicinity, among which are a motor-driven brickyard, the Peerless Electric Company, Trumbull Mazda Lamp Company and the McMyler foundry. The third panel carries a Tirrill regulator. Direct current for the downtown district and for four motor-driven pumps which have never been changed over from an old system is furnished from the fourth and fifth panels of this board, while the sixth panel controls the station exciters. Switching for the 1800-kw Curtis turbine is done from panel No. 7. Panels Nos. 8 and 9 control respectively the 400-kw alternating-current generator and the 500-kw turbo-generator set. From panel No. 10 the feeders for the Ohio Lamp Works of the General Electric Company, the Packard Transformer Company, the Borden Die Works and the Warren City Tank & Boiler Works are controlled. On panel No. 11 are mounted the switches for the outgoing high-tension lines. The next two panels, Nos. 12 and 13, control the single-phase alternating-current residence lighting in Warren. Street lamps are lighted and switched off from panel No. 14.

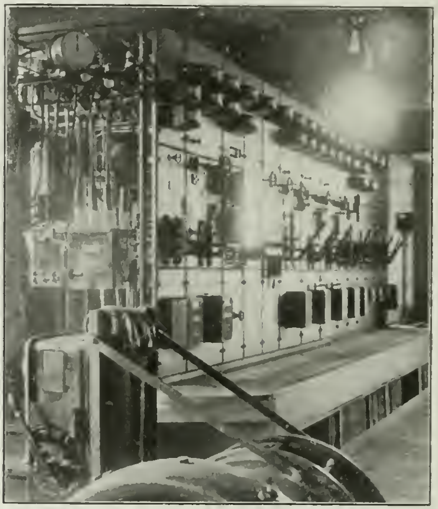


FIG. 4—MAIN SWITCHBOARD, WARREN, OHIO

Besides this main board, there are two auxiliary boards in the station, one being a four-panel direct-current board for controlling two feeders and two small generators. In order to give flexibility to the series street lighting which is plentiful in the city, three plug boards are installed in the station.

No transformer equipment has been placed in this plant, energy being transmitted to the Park Avenue substation, where nine 100-kw, 2200-volt Peerless transformers step up the potential from the generator rating to 22,000 volts for transmission purposes.

Gas-Engine Plant

Just at the rear of the Erie railroad station in Warren is situated the gas-engine plant which formerly belonged to the Hydroelectric & Gas Company. Here a 350-hp two-cylinder, four-stroke horizontal Olds gas engine is belted to a 250-kva, 2300-volt, 60-cycle, three-phase Burke alternator. Excitation for the main unit is furnished by a 25-kw, 125-volt Peerless electric direct-current generator. An 8-hp Olds gas-engine-driven pump supplies compressed air for starting. The gas-engine set is now used only in times of emergency, delivering energy at 2300 volts to three 100-kw Peerless transformers, where it is stepped up to 23,000 volts for transmission. As soon as conditions will permit, the use of the gas engine will be discontinued.

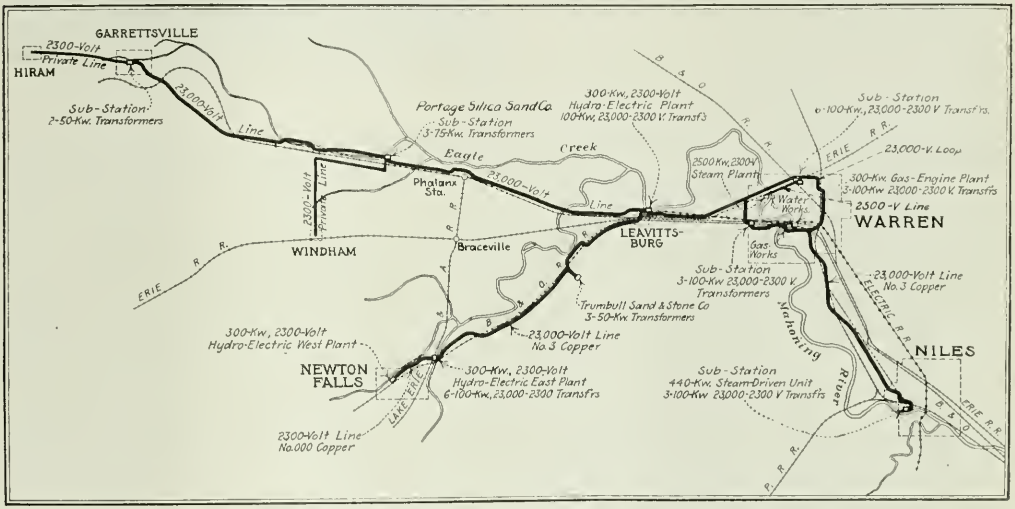


FIG. 5—ELECTRIC-SERVICE SYSTEM IN TRUMBULL COUNTY, OHIO

Hydroelectric Plants

On the upper Mahoning River two small hydroelectric stations, known as the West Fork plant and the East Fork plant, deliver energy to the high-tension lines of the company. The station on the west fork is driven by one 34-in. and two 49-in. vertical waterwheels operating on an 18-ft. head. The wheels are geared to a horizontal shaft, which is direct-connected to a 300-kw, 2300-volt, 60-cycle, three-phase alternator made by the Electric Machine Company. The exciter is rated at 15 kw. The switchboard in this plant consists of one generator panel, one feeder panel and one exciter panel. Energy from this station is delivered at 2300 volts to the East Fork plant, where it is stepped up for transmission.

The East Fork plant is driven by three 49-in. vertical waterwheels made by the Dayton Globe Iron Works Company. These wheels operate on a 16-ft. head and are geared to a horizontal shaft which is direct-connected to a 300-kw, 2300-volt, 60-cycle, three-phase generator, a duplicate of the machine in the West Fork plant. The exciter for this unit is rated at 25 kw. Six transformers rated at 100 kva, 23,000 volts, step up the pressure at this station for the outgoing transmission lines.

Further down the Mahoning River just below its junction with Eagle Creek is the Leavittsburg hydroelectric plant. Three 54-in. vertical waterwheels operating on a 9-ft. head are geared to a horizontal shaft, which is belted to a 300-kw, 2300-volt, 60-cycle, three-phase alternator. A 14-ft. flywheel on the same shaft steadies the action of these machines. Excitation is furnished by a 15-kw direct-current generator.

Transmission Lines

Interconnecting transmission lines reach all five plants of the company, the steam and gas-engine station being established on the "factory loop." From the busbars of the main steam plant two 2300-volt transmission lines, one of No. 0000 copper and the other of No. 0 copper, transmit energy to the Park Avenue substation, where it is transformed from 2300 volts to 23,000 volts by nine 100-kva transformers. The buses in the substation are sectionalized so that in case trouble occurs on either outgoing line the other may be used. Both of these 2300-volt lines for factory service can be handled from the main power house by remote-control switches.

At the substation serving the Peerless Electric Company the line is sectionalized with air-brake switches, one set of which is kept open at all times. Any break or other damage occurring on the line may be thus quickly located, and by proper switching continuous service can be restored.

From the gas-engine plant a three-phase No. 2 copper transmission line carries energy to Niles for street lighting and commercial service. Electric service at Niles was formerly furnished by a steam plant of 440-kw rating, but at present there are six 100-kw transformers at the Niles end of the line. A 2300-volt, three-phase line of No. 1 copper ties in the Leavittsburg hydroelectric plant to the factory loop, and this line is extended through the Leavittsburg station to the East Fork and the West Fork plants at Newton Falls. However, between the West Fork and the East Fork plants transmission is carried on at 2300 volts over a No. 000 insulated copper-wire line. From the East Fork plant to Leavittsburg the line is built of No. 3 copper. At a point about midway the Trumbull Sand & Stone Company has installed three 75-kw transformers and is taking energy for the operation of its quarries.

The most recent construction undertaken by the company is the line west from Leavittsburg to Garrettsville and Hiram. From Leavittsburg to Garrettsville energy is transmitted at 23,000 volts, and at the midway point between Leavittsburg and Garrettsville a 2300-volt line is taken to Windham and a short spur is run in the opposite direction to the 225-kw substation of the Portage Silica Sand Company.

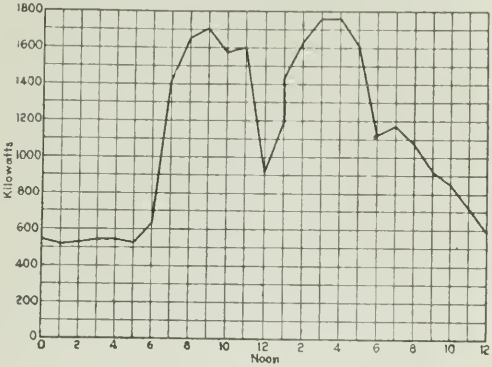


FIG. 6—TYPICAL DAILY LOAD CURVE

The former engine-driven station at Hiram has now been replaced by the utilization of service from a 2300-volt transmission line being erected from Garrettsville to Hiram. This line is owned by a Garrettsville man, Mr. Bruce, who by contract sells energy to the village of Hiram. In order that Mr. Bruce and the village of Hiram may share the energy losses of the transmission line equally, the meters have been placed at the midway point between the two villages.

The pole-line construction used between Leavittsburg and Garrettsville differs somewhat from the usual equilateral triangular spacing of conductors. The top ground wire and one phase of the high-tension line are placed on the top arm, while the other two phases are carried upon the second arm. The cross-arms are 62 in. long and are spaced 3 ft. apart between centers. For signaling a telephone line is carried on a short cross-arm 6 ft. below the lower high-tension arm. A second ground-wire occupies a position just below the telephone arm. All transmission lines of the company are constructed on wooden poles, most of which are about 45 ft. high with 7-in. tops. Wherever practicable the poles have been spaced forty to the mile. On the factory loop railway right-of-way has been followed wherever possible. The location of the majority of the factories on or near railroad tracks has helped to make this plan feasible.

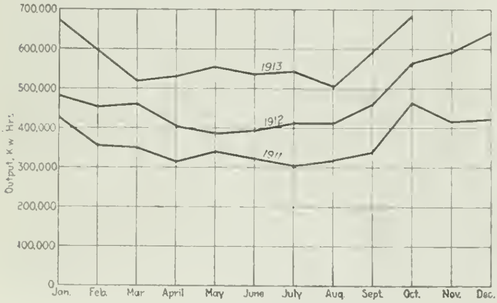


FIG. 7—LOAD CURVES FOR THREE YEARS

"White-Way" Lighting at Warren and Niles

Warren, although now a town of about 15,000 inhabitants, is one of those pretty Ohio communities which grew up around a park-like courthouse square. The streets bordering on this square are well lighted, three-lamp standards having been used on the side of the roadway opposite the park and one-lamp standards on the park side. There are in all about 125 of these ornamental posts in the city. Sixty-watt lamps are employed in the bottom globes, while 80-watt lamps are used in the top positions. In the single-lamp standards 80-watt lamps are used throughout. While the bottom lamps on the three-lamp standards and the single-lamp standards are extinguished at 12 o'clock, the top lamps of the three-lamp standards burn all night. These ornamental posts are spaced from 80 ft. to 100 ft. apart.

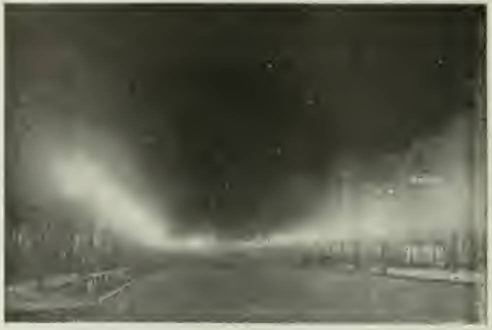


FIG. 8—ILLUMINATION ON WARREN BUSINESS STREET

For lighting the outlying districts where ornamental posts were considered too expensive, 815 shaded 80-watt tungsten units are suspended on gooseneck hangers from the poles of the distribution system. All lighting is done from one side of the street, and care has been taken with the alignment of the construction so that the lamps form a straight line when lighted. Practically every street in town is thus lighted, and the illumination is even and well distributed, although many trees border the streets.

The surface intensity of street illumination in Warren is augmented by the numerous electric signs of the local merchants. One of the most notable of these is Warren's slogan sign, a photograph of which is reproduced herewith (Fig. 16). The word "Warren" in the center of the sign is lighted continuously. Then appears the word, "Opportunity" with a question-mark. This is followed by the expression "It's here," and a few seconds later the phrase "The City of Modern Methods" comes

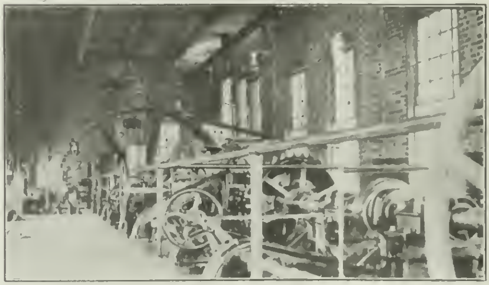


FIG. 9—WATERWHEEL EQUIPMENT, LEAVITTSBURG

to view. The sign is about 50 ft. long and 40 ft. high and contains approximately 3500 five-watt tungsten lamps.

In the city of Niles five-lamp and single-lamp standards are used. Posts are spaced at 100-ft. intervals on both sides of the streets. These standards are about 12 ft. high and each carries a 16-in. globe at the top. The circuit for this series lighting is strung on the trolley poles, the method of wiring being rather unique. Above each standard a wood strain is inserted in the circuit and taps are taken from each side of this insulator to the brackets on the capital of the ornamental post. The method is inexpensive and is not at all unsightly where the streets are lined with trees as in Niles.

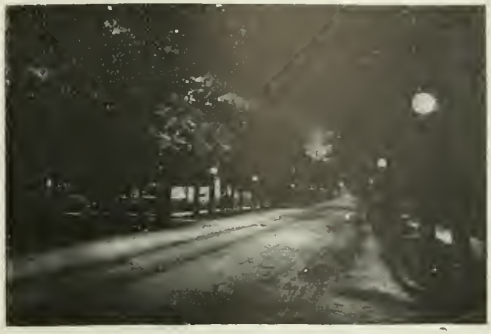


FIG. 10—NIGHT SCENE IN NILES

Commercial Methods and Their Results

Since June, 1911, the new-business department of the company has conducted four electric-iron campaigns, with the result that approximately 600 irons have been sold in a territory which had already been worked by the competing electric-service companies before consolidation. Amicable relations with contractors have been maintained by avoiding conflicts in the sale of appliances by the company and by referring all wiring jobs to the contractors. In many instances the profit made on appliances sold by solicitors during campaigns was also turned over to the contractors. Although Warren is the home of a widely known gasoline automobile, the little city nevertheless boasts of fifteen electric pleasure cars.

FIGS. 11 AND 12—22,000-VOLT TRANSMISSION LINES

Relying upon electric signs to fill the 6 o'clock dip in the daily load curve, Mr. R. A. Wood, contract agent for the company, has been paying special attention to this branch of the business. A good measure of success has attended his efforts, for nearly every merchant in the city has either a display sign or a well-lighted show window. Even the churches have appreciated the benefits of the electric sign, some having placed "Welcome" signs over their doors.

FIG. 13—NIGHT SCENE ON WARREN'S PUBLIC SQUARE

Co-operating with the real-estate men, the central station makes an effort to let no wired property in Warren stand vacant. Cards are furnished by the electric-service company for use in advertising vacant wired houses which are for rent. These cards bear the legend "To Let, Wired for Electric Lights," with a blank space for the realty company's name.

One of the things which impress the visitor to Warren's factory district, especially if on a dark day, is the flood of light emanating from the windows of the rooms containing the aging racks in the tungsten lamp factories. At night light from these windows sometimes illuminates the street and surroundings so brightly that one can read fine print at a distance of 100 yd. These lamps in the aging racks furnish a twenty-four-hour lead for the electric-service company, the demand ranging from 8 kw to 50 kw in the different factories.

FIGS. 14 AND 15—STREET-LIGHTING UNITS, NILES

A typical daily load curve of the steam station and yearly load curves of the system for the past three years show the present demands on the generating equipment and point to the steady growth enjoyed by the company since its formation. For example, the increase in load for October, 1913, over the same month last year was 112,250 kw-hr. The load-factor is now above 50 per cent.

During the past summer the construction department wired a tennis court for night playing, the installation consisting of ten 250-watt tungsten lamps carried on messenger cables. This lighting has proved a great success. The demand was so great for the use of the court (which is situated in a public park) that plans have already been made for wiring six more courts early in the spring.

FIG. 16—WARREN'S "OPPORTUNITY" SIGN

Meadowbrook Farm Installation

Along the many transmission lines of the company enterprising farmers are using electrical energy for lighting their houses and barns, and in many instances electric motors have been called in to displace the gasoline engine. One of the most complete installations of this kind is that at Meadowbrook Farm near Leavittsburg. The total connected load aggregates 50 hp and electricity is used for threshing wheat, chopping feed, separating cream, lifting hay, pumping water, grinding meat, operating a shearing machine, and driving an electric vacuum cleaner for horses. The owner had formerly used a gasoline engine but is now an enthusiastic advocate of electricity for farm service.

In the home of Mr. M. R. Turner, manager of the farm, sixty-five 60-watt lamps are installed, while the main barn and the horse stable are each illuminated with 40-watt lamps. Other houses and smaller barns on the place are lighted by from three to eight lamps, making a total of about 180 lamps in the various buildings on the farm. General illumination of the barnyard at night is provided by three 250-watt tungsten lamps suspended on gooseneck hangers from the platform of the water tank. Heavy work about the farm, such as threshing, filling silos and the like, is done by a 20-hp motor mounted on the running gears of a farm wagon. Connections between the starting panel on the rear of the wagon and the motor are made permanent and a flexible insulated cable is employed for completing connections to the transformer secondary taps.

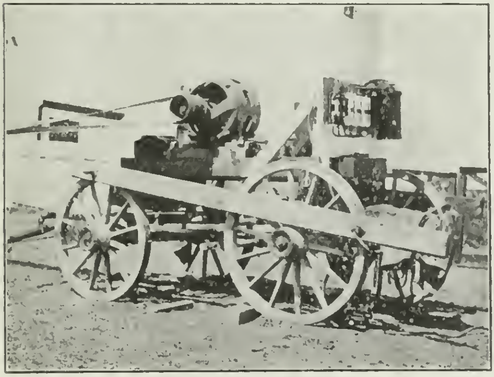


FIG. 17—23-HP MOTOR DRIVING THRESHING MACHINE, MEADOWBROOK FARM

Among the eight other small motors used about the farm, three 3-hp units drive the milking machines, vacuum pump, dairy appliances and feed cutters; two 2-hp motors drive water pumps and meat choppers, and two fractional-horse-power motors operate the horse cleaners. Motor-driven washing machines, electric irons and other appliances are used in the homes of the manager and tenants. Crocker-Wheeler 220-volt motors are used exclusively in this installation.

According to Mr. R. H. Turner, the average bill for gasoline and repairs on an engine formerly used for pumping and general purposes was more than $25, but now, with electric service at a price ranging from 6 cents to 2.5 cents per kw-hr., the monthly bill is generally about $15. However, says Mr. Turner, the size of the two bills in no way measures the value of the services rendered, for now the electric service is used in practically every operation in the day's work.

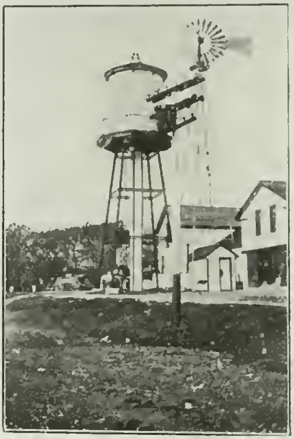


FIG. 18—POLE-TYPE TRANSFORMER FOR MEADOWBROOK FARM, AND LIGHTING UNIT ON WATER-SUPPLY TANK

As evidence of the fact that the motors are money savers it is stated that two silos, one measuring 16 ft. by 36 ft. high and the other 14 ft. by 36 ft. high, were filled at a cost for electrical energy of less than $10 each. Another application recently added was an electrical milking system. A motor driving a countershaft in the dairy house exhausts air from a tank and the "vacuum" is transmitted to the barns through a series of pipes. This system applied to a herd of sixty-five cows effects a saving of $195 per year.

Staff Organization

The heads of each department meet once a month at an informal luncheon to hold a general discussion of the problems that have arisen during the previous thirty days and to talk over future plans. In this way each department keeps in close touch with the others.

The Trumbull Public Service Company is under the management of Mr. George Daugherty. Assisting him are Mr. W. J. Marshall, contract agent, who has recently succeeded Mr. R. A. Wood, promoted to be new-business manager for the Brush Electric Company at Galveston, Tex., and Mr. A. V. Wynne, chief engineer and electrician.

Sag-Temperature Relations in Suspended Conductors

Method of calculating the sag of conductor spans under varying weather conditions with regard to temperature changes. By H. M. Hall

So many articles upon the subject of sag and temperature have lately appeared in the technical publications that one hesitates to enter the field which has already been so well and ably covered. However, as far as the writer is aware, the matter has never been treated in exactly the following manner, which seems much simpler and more complete than many of the published methods, while at the same time practical accuracy has not been sacrificed to simplicity.

Nomenclature

S = span length in feet.
W = weight per foot per square inch of bare conductor.
W' = weight per foot per square inch of conductor section of loaded conductor.
$f = \frac{W'}{W}$
D_0 = sag to develop elastic limit in unloaded conductor.
D_1 = sag to develop elastic limit in loaded conductor.
D_2 = sag when load goes off, without temperature change.
D = any sag in unloaded conductor $> D_0$.
T_0, T_1, T_2, T = tension per square inch corresponding to $D_0, D_1, D_2\ D$.
$L_0, L_1, L_2 L$ = arc length corresponding to D_0, D_1, D_2, D.
C = elastic deformation due to change in tension.
M = elastic modulus.
a = coefficient of linear expansion per deg. Fahr.
N = deg. Fahr. necessary to change D_2 to D.

From the definition of elastic modulus it follows that

$$T_1 - T_2 = \frac{L_1 - L_2}{S} M \left(\text{very closely; strictly should be } \frac{L_1 - L_2}{L_2} M\right) \tag{1}$$

$$T_0 - T_2 = \frac{L_2 - L_0}{S} M \left(\text{very closely; strictly should be } \frac{L_2 - L_0}{L_0} M\right) \tag{2}$$

But, since $T_1 = T_0$ = elastic limit stress (or any other definite stress),

$$T_1 - T_2 = T_0 - T_1 \tag{3}$$

and consequently:

$$L_1 - L_2 = L_2 - L_0 \tag{4}$$

or

$$L_2 = \frac{L_0 + L_1}{2}. \tag{5}$$

From the well-known arc-length formula

$$L_0 = S + \frac{8\,D_0^2}{3\,S} \tag{6}$$

$$L_1 = S + \frac{8\,D_1^2}{3\,S} \tag{7}$$

$$L_2 = S + \frac{8\,D_2^2}{3\,S} \tag{8}$$

Substituting (6), (7) and (8) in (5) gives

$$S + \frac{8\,D_2^2}{3\,S} = \tfrac{1}{2}\left(2\,S + \frac{8\,D_0^2}{3\,S} + \frac{8\,D_1^2}{3\,S}\right) \tag{9}$$

which reduces to

$$D_2 = \sqrt{\frac{D_1^2 + D_1^2}{2}} \tag{10}$$

But

$$D_0 = \frac{S^2 W}{8\,T_0} \tag{11}$$

and

$$D_1 = \frac{S^2 W'}{8\,T_1} = \frac{S^2 f W}{8\,T_1} = f D_0 \text{ (since } T_0 = T_1\text{)} \tag{12}$$

Therefore (10) becomes

$$D_2 = D_0 \sqrt{\frac{f^2 + 1}{2}} \tag{13}$$

Equation (13) gives, in very simple form, the sag acquired by the conductor upon the disappearance of whatever external wind and ice load was assumed to produce D_1 and T_1. Of course, this assumes that f becomes unity without change in temperature, but this is not an unreasonable assumption, since the majority of ice loadings occur very close to 32 deg. Fahr., so that a negligible temperature rise is sufficient to cause the ice to disappear.

As far as the writer knows, the sag acquired by the conductor upon the disappearance of the external load has had little or no attention in the current discussions of the general problem of sags. This release sag is, however, of much greater importance than appears to be generally realized, and an accurate determination of it renders much simpler the calculation of the movement of the conductor due to subsequent temperature changes.

Having determined as above the values of D_0, D_1 and D_2, assume a value for the sag equal to D greater than D_2; that is, D occurs at a higher temperature than D_2. Then

$$L - L_2 = \frac{8}{3\,S}(D^2 - D_2^2) \text{ (from the arc length formulas)} \tag{14}$$

and

$$T_2 - T = \frac{S^2 W}{8}\left(\frac{1}{D_2} - \frac{1}{D}\right) \tag{15}$$

From the definition of elastic modulus

$$C = \frac{T_2 - T}{M} S \left(\text{strictly} \frac{T_2 - T}{M} L_2\right) \tag{16}$$

The change $L - L_2$ is made up of two parts, that due to temperature and that due to the change in tension caused by the change in sag. That is

$$L - L_1 = SaN - C \text{ (strictly } L_2 aN - C\text{)} \tag{17}$$

or

$$N = \frac{L - L_2 + C}{Sa} \tag{18}$$

By means of (14), (15) and (16), (18) becomes

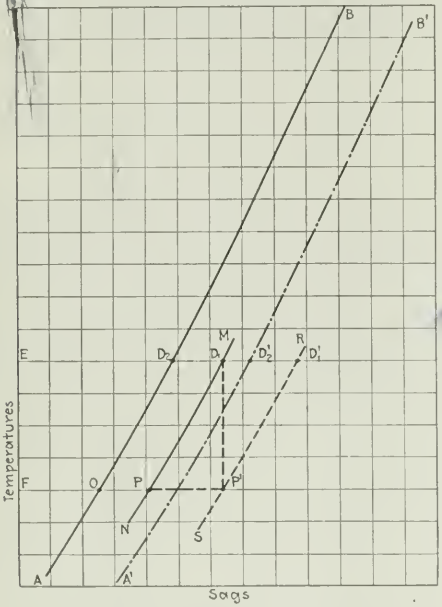
$$N = \frac{8}{3\,aS^2}(D^2 - D_2^2) + \frac{S^2 W}{8\,aM}\left(\frac{1}{D_2} - \frac{1}{D}\right) \tag{19}$$

Equation (19) thus gives the number of degrees of temperature change necessary to change D_2 to D. If $D > D_2$, N is positive, and shows a rise above the temperature at which D_2 occurs. If $D < D_2$, N is negative and indicates a drop below the temperature of D_2.

In applying the above method to any given conductor, span and loading conditions, the procedure is as follows:

Find D_0 from (11) and (D_2) from (13) and then assign to D several different values greater and less than D_2. With these values of D find from (19) the corresponding values of N. From these values for N and D a sag-temperature curve can be drawn through the point corresponding to the temperature and sag of D_2. This curve will completely define the motion of the unloaded conductor due to temperature rise and fall and can be used by the erecting crew for stringing the conductor.

Under certain conditions the above method should be amplified somewhat in order to avoid stressing the conductor beyond the elastic limit.



SAG-TEMPERATURE CURVE

Let it be required that the conductor carry a given ice load and at the same time be subjected to a certain fall in temperature below that at which the ice is assumed to form.

In the diagram AB is a sag-temperature curve drawn as above, D_2 being the release from D_1 such that T_1 is the elastic limit. E is the temperature at which D_1 and D_2 occur and F is the assigned minimum temperature. Through D_1, parallel to AB, draw the curve MN. P is the sag attained by the loaded conductor at the minimum temperature, and here the tension exceeds the elastic limit by the ratio of $\frac{D_2}{O}$.

In order to find the minimum loaded sag which will not exceed the elastic limit, construct the right triangle $D_1, P\,P'$, thus locating P' at a sag equal to D_1. Draw RS parallel to MN through P'; D'_1 will then be the new maximum loaded sag, at the temperature of ice formation. From D'_1 locate D'_2 so that $D'_2 = \frac{D'_1 D_2}{D_1}$. Through D'_2 draw $A'B'$ parallel to AB. $A'B'$ will then be the sag-temperature curve for the bare conductor, so taken that the loaded sag can decrease from D'_1 to P' without exceeding the elastic limit.

An entirely similar method can be employed in case it is desired to consider a wind load continuing during a considerable temperature change.

Thus the above method completely covers the motion of a suspended conductor caused by temperature changes, whether it be entirely unloaded, loaded and unloaded at a definite fixed temperature, or be subjected to a wind or ice load simultaneously with a given temperature variation.

The above-described method has been very carefully checked by experiments on a 660-ft. test span, and the agreement between actual and calculated results was very satisfactory, being well within the unavoidable experimental errors and, indeed, far closer than the accuracy maintained by the ordinary line gang. This close agreement between theory and practice shows that the practical accuracy of the above method is not impaired by the use of span lengths, instead of arc lengths, in equations (1), (2), (16) and (17). This was to have been expected from general considerations, since, with a 700-ft. span and a 20-ft. sag, for example, the difference between arc length and span length is only 0.2 per cent, while it is proportionally less with small spans and sags.

A Remotely Controlled Water-Power Plant

The National Copper Mining Company is to electrify its property in the Cœur d'Alene district of Idaho and will purchase energy from the Washington Water Power Company under a contract which makes it desirable for the mining company to maintain its load at as high a power-factor as possible. The mining company has water-power rights from which approximately 600 hp can be developed, and besides utilizing this energy to supply part of the power requirements of the mine and mill, the generating stations will also be used to improve the system power-factor.

To develop the 600 hp above mentioned two hydroelectric plants will be built on Dead Man's Creek, and installed in each will be an impulse-type waterwheel driving a 200-hp, three-phase, sixty-cycle generator. As no attempt will be made to regulate the load taken by these plants, the waterwheels will not be supplied with governors of the ordinary design but overspeed governors will be installed serving to deflect the waterwheel nozzles in case, through accident, the load on either or both of the plants should be disconnected, allowing the wheels to race.

When the machines are operating in parallel with the power company's lines, the frequency delivered by the latter will necessarily fix the speeds at which the local generators can run, and they will then take as much of the mining company's load as the water running through the waterwheels will permit. By adjusting the fields of the generators a very high power-factor will be secured on the entire load.

One of these hydroelectric plants has been designed for operation in the usual manner by an attendant in the station. The other plant is planned to be run without attendance, the generator being connected to or disconnected from the load from a distant point (the compressor station at the mine) by means of electrically operated switches. The governor on the waterwheel will also be controlled by the same mechanism which operates the switches, so that the plant can be stopped or started without anyone going near it.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

The Fruits of Unified Service

The Louisville Gas & Electric Company is running a series of newspaper advertisements of what might be called the "good-will" type. The latest shows some of the advantages of the consolidation of the numerous companies formerly in the field and reads in part as follows:

"Formerly in Louisville the best efforts of the electric and gas companies were devoted to fighting one another; to getting the business easiest to serve and secure, while the interests of the small householder received less attention.

"Unification means that the ingenuity, money and energy formerly exerted in trying to capture another company's business will be devoted to serving the people better, more comprehensively, more adequately and at lower cost.

"Unification has produced a program of vast improvement to the manufacturing and distributing systems in Louisville, of which the enlargement of the electrical production capacity of the Waterside power station by more than 12,000 hp is the first step."

Electrical Pages Resumed at Cleveland

For four years past the Cleveland (Ohio) Electric Illuminating Company has published an electrical page in the daily newspapers during the seasons of the year in which advertising is thought to be timely. Resuming this educational campaign after a brief interval, Mr. M. E. Turner, contract agent for the Cleveland company, says that the concerted effort afforded by such publicity cannot fail to produce results.

Electrical pages are now being printed in three of the four daily papers published in the city. The scheme followed in each is practically the same. Little stories on electrical subjects of popular interest are "run" in the center of the page, and about these are grouped the appliance and wiring advertisements of the electric-service company and other electrical firms. Manufacturers of appliances are also notified when their particular lines of goods are to be featured in the electrical page. Thus they have a chance to take increased advertising space calling attention to their own products. The idea of concerted effort in advertising is kept continually uppermost.

Small-Town Electric Service from Flour Mills

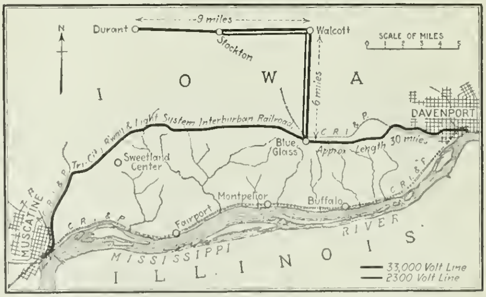
Some of the possibilities of central-station operation in connection with other industries in small towns are indicated by the expansion of the electric-lighting business of the Dawson Milling Company, of Dawson Springs, Ky. Several years ago a lighting plant was put in with a rating of less than 10 kw. The demand for service gradually increased until a 60-kw generator was installed a few years ago. The Dawson Light & Power Company has now been organized to operate the lighting business, which has grown so large as to make its separation from the milling business desirable. E. A. Stevens, head of the mill company, is likewise manager of the lighting company. The latter company plans to increase its generating capacity from 60 kw to 100 kw, and also to change from direct to alternating current.

An interesting feature of the business is the fact that Dawson Springs is a summer resort well known in its section. The company has built up a big business among patrons of the hotels, furnishing electric fans at the rate of $2.50 a month, $1.50 being for rental and the other $1 for maintenance. Several hundred of these fans are thus kept going all during the summer months.

The combination of flour mills and electric-light plant is popular in other Kentucky towns, Mr. W. E. Arnold, a miller of Owenton, having just installed a 30-kw generator and storage-battery equipment for lighting his community. The James Clark, Jr., Electric Company, of Louisville, furnished the equipment.

Co-operative Electric Threshing by Iowa Farmers

With the completion of 15 miles of 33,000-volt line and of 10 miles of 2300-volt circuits centering about the town of Blue Grass, Ia., and reaching Wolcott, Stockton and Durant, the People's Light Company, of Davenport, Ia., has begun a campaign for securing rural customers. Along the 2300-volt line extending as shown from Wolcott to Blue Grass and to Stockton twenty-two farmers have already been connected. A 33,000-volt outdoor substation has been erected at Wolcott, and from this equipment are fed the 2300-volt circuits leading south and west from the city. Customers' motors are connected to 220-volt taps from the transformers, and lighting circuits are operated at 110 volts.



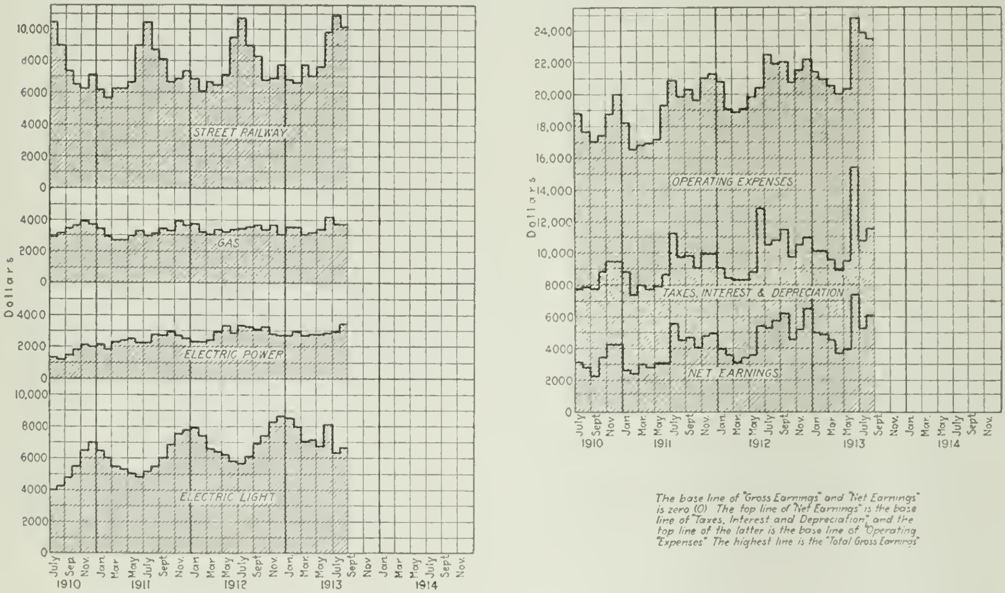
TRANSMISSION LINES IN VICINITY OF DAVENPORT, IA.

All lines and transformers for the rural customers have been furnished by the electric-service company, the customers in return guaranteeing a four-dollar minimum monthly bill. When a resident living at such a distance from the company's lines that an extension would not be justified desires service, the company offers to erect a line to his property at a cost of $7 a pole. The charge for energy for service in this case is the same as that to other rural patrons. Meter reading is taken care of by a local garage man in Wolcott who charges the company only for the actual time he is engaged in his monthly rounds.

Forming a co-operative association, the farmers along the lines have determined to do their 1914 threshing electrically. A 20-hp motor will be purchased by the association and mounted with its control equipments on a wagon so that it may be taken from one farm to another as the work of the "threshing ring" progresses.

Manager's Graphic Report to Board of Directors

The manager of a prosperous utility in the Northwest has hit upon a compact and novel plan for presenting his monthly report to the board of directors. As is very often the case, many of the owners have little knowledge of "kilowatts," "kilowatt-hours" and other electrical units, although they show a very keen appreciation of any increase in the net earnings of the company. In this particular instance the electric-service company operates electric-lighting, street-railway and gas properties. At the left of the sketch herewith the income from each branch of the business is represented by a separate graph, while the right half of the drawing shows the operating expenses, interest and depreciation, and also the net earnings for each month.



The base line of "Gross Earnings" and "Net Earnings" is zero (0) The top line of "Net Earnings" is the base line of "Taxes, Interest and Depreciation" and the top line of the latter is the base line of "Operating Expenses" The highest line is the "Total Gross Earnings"

MANAGER'S GRAPHIC REPORT

The work of getting out such a report as this is not so great as might appear at first thought, for a tracing has been provided, and as the reports for the month are finished the results are added to those already on this sheet and then transferred to as many blueprints as are needed. In addition to the convenience afforded by such a graphic chart, this system shows at a glance all the past records of the company.

The rather consistent peaks of net earnings in June show in a way the conservative financial policy followed by the management, for in this month the fiscal year of the company is brought to a close. Instead, however, of there being always a few forgotten debts to drag down the June showing, the balance generally gives a comfortable sum to be added to the net earnings column.

Getting Down to "Brass Tacks" in Selling Signs

A glance at many typical central-station load curves will show the need of business to fill the depression occurring about 6 p. m. between the afternoon motor load and the evening lighting peak. Many managers have realized this condition and have set their new-business men at work selling electric signs and increasing window illumination to flatten out the curve. Selling signs, however, is the work of a specialist who knows the sign business and who is capable of presenting designs and ideas with which the average central-station solicitor is unfamiliar. Although lighting-company salesmen can often talk to prospective customers and create enthusiasm, the sign man submitting concrete designs and talking facts about signs is the one who has least difficulty in closing contracts.

In the past one of the main objections which central-station men have urged against electric-sign salesmen was that too often the sign man visiting a city would "run" into the lighting company's office, inquire if there where any live "prospect," appear piqued if several signed orders were not handed to him, and then leave on the next train without himself making an honest effort to secure business which the central-station man felt sure a good sign salesman could get. One sign manufacturer, realizing the fallacy of this "high-spot" method of selling his wares, is now placing competent salesmen in the medium-sized cities of the Middle West with instructions to "remain there and get the business." In most cases the local lighting company supplies the sign company's man with lists of live prospective customers and other data and gives him desk room in its own office so that he may have permanent headquarters and get in touch with local conditions.

Where this scheme of selling has been tried its success has been notable. In one Iowa City of 50,000 inhabitants the sign salesman has averaged nearly three signs a week for a period of six weeks, and in a Missouri city with a population of 85,000 fifty-eight signs were sold within less than a year. The central-station salesmen and the sign specialist are working hand in hand in these cases, and the results of true co-operation are making themselves manifest.

Queen Carnival's Electric Float

One of the features of the parade held during the carnival at South Bend, Ind., not long ago was the artistically decorated electric truck of the Indiana & Michigan Electric Company, which supplies central-station service in South Bend and nearby cities. Appropriately enough, this electric float was used for the purpose of conveying "the queen of the carnival" and her retinue of maids of honor, and as it moved majestically through the streets in the night procession it presented a truly regal appearance.

ELECTRIC CARNIVAL FLOAT AT SOUTH BEND, IND.

One of the company's Studebaker trucks was utilized, its commercial outlines being hidden by soft blankets of white flowers and festoons of immortelles. Scattered through the decorations and in the flowers on the columns were dozens of varicolored electric lamps. The columns and throne and even the parasol of the flower girl were also outlined with these miniature units. Energy to operate the decorative lamps was obtained from a separate storage battery carried on the truck for the purpose.

The truck was used in the evening parade, and its tasteful decorations and attractive passengers made the display easily the prize-winner of the procession.

Rewards for Prospective Customers

During the month of January the Pittsfield (Mass.) Electric Company has been conducting an active washing-machine campaign with the aid of the manufacturers of the devices, local contractors, the department stores and the employees of Pittsfield electrical concerns, including the central-station itself. Two types of machines were handled—the "Thor Electric," selling at $85 complete, installed in the house, but not including any wiring, and the "Red Electric," installed under the same conditions, at $50. Customers who did not desire to pay cash were permitted to deposit $10 on receiving the machine and to pay $1.50 a week thereafter. A week's free trial was offered to any one expressing a desire to try one of the devices.

With the beginning of the new year the Pittsfield company offered to give $5 in gold to any one of its employees who turned in the name of a prospective customer who afterward purchased a washing machine. The award was collectible as soon as the first $10 was paid on the account. The same offer was open to local contractors and to their employees.

A customer purchasing a washing machine was also granted $5 credit for every washing machine he was able to sell, provided that the company's representative was not already working on the case.

In connection with this washing-machine campaign, according to Mr. H. W. Derry, contract agent, the manufacturers furnished cuts for newspaper advertising, fliers, post cards (some written in Chinese), billboard posters, etc. Literature was inclosed with monthly bills sent to customers, besides being distributed among company employees in the effort to reach persons not users of electricity.

During the first week of the campaign names of more than 100 prospective customers were handed in to the new-business department, and it is expected that responses will continue to be received at the same rate during the campaign. Advertisements were run in the local newspapers each day, and before the campaign was started all the electrical contractors of the city were invited to a discussion of the plan of campaign and their hearty co-operation was solicited.

Electric Cooking Tests at Kansas City, Kan.

What is said to be the first electric show conducted by a municipal electric-lighting plant was held in the city hall of Kansas City, Kan., during December, 1913. At various sessions during the week visitors at the show were addressed by Mayor C. W. Green; Mr. L. H. Chapman, commissioner of water and light, and Mr. F. E. Williams, chief electrician, of Kansas City, Kan. Short talks were also given by Prof. G. C. Shaad, Kansas State University; Mr. G. A. Hughes, Chicago; Mr. Allen Pratt, Chicago, and Mr. Kenneth Rennie, Kansas City, Mo.

ELECTRIC COOKER AND APPLIANCES ON EXHIBITION AT KANSAS CITY, KAN.

Of particular interest were the electrical cooking tests conducted as a part of the show, as well as other tests made just prior to the opening of the exhibit. The purpose of these demonstrations was to furnish to visitors authentic information on the cost of electric cooking in Kansas City, Kan., where the municipal plant's rate for electrical energy used for cooking is 3 cents per kw-hr.

The tests made before the opening of the exhibition were not conducted on a strictly scientific basis, but an attempt was made to ascertain the actual cost of the usual electric cooking operations as performed by the average American housewife. Apparatus borrowed from several manufacturers was placed in the homes of eight representative families, and the women doing the cooking made records of the food cooked and the time required for each operation. The meters in these homes were read daily by employees of the central-station company. No attempt was made to place the apparatus in the hands of experienced operators and the only instructions given merely stated that for economical operation the cooking devices should be disconnected from the line as soon as any operation was completed.

TABLE I—TESTS OF ELECTRIC COOKING IN PRIVATE HOMES

	Energy in Kw-hr.	Cost in Cents
Open Disks or Plates:		
Rendering 9.5 lb. lard (on two disks, starting cold)	1.165	3.495
Frying 0.5 lb. steak (cold disk)	0.2191	0.74
Boiling 0.5 gal potatoes	0.666	1.998
Boiling 1 qt. water (cold disk)	0.216	0.6482
Boiling 1 gal. water (cold disk)	0.4163	1.25
Frying 4 eggs and 4 slices of bacon, boiling 2 qt. of water	0.66	2.00
Frying 0.75 lb. veal steak and 9 medium potatoes, warming 1 can of corn, 1 qt. tea and boiling 2 gal. of water	2.33	7.00
1 lb. steak, three eggs fried, 5.5 lb. chicken, twelve medium potatoes, gravy, 1 qt. tea, boiling 2 gal. water	4.00	12.00
Frying twelve pieces of mush, four eggs and six medium potatoes; 1.5 qt. coffee, boiling 2 gal. water	2.00	6.00
Ovens or Semi-Inclosed Cookers		
Baking twelve medium biscuits	0.408	1.225
Baking six large potatoes	0.408	1.225
Baking twelve medium biscuits and six large potatoes together	0.45	1.35
Roasting 2 lb. meat	0.733	2.20
Baking large loaf corn bread	0.596	1.79
Roasting 4 lb. meat and baking six large potatoes together	1.00	3.00
Inclosed or Air-tight Cookers with Compartments		
1 qt. beans, 2 qt. mush, 0.5 lb. round steak	0.80	2.40
5.5 lb. chicken, twelve medium potatoes, toasted bread	1.00	3.00
4 lb. roast, six large potatoes, 1 qt. tea	0.50	1.50
3 lb. ham, twelve potatoes, small head cabbage	0.50	1.50
Six pieces of bacon and four eggs	0.20	0.60
1.5 lb. steak, six potatoes	0.50	1.50
2 lb. steak, twelve potatoes, 1 qt. spaghetti	0.90	2.70
4 lb. roast, 1.5 lb. fruit pudding, 1 qt. scalloped potatoes	0.90	2.70
3 lb. pork roast, six large sweet potatoes, can of corn, warming 1 lb. fruit pudding	0.90	2.70

TABLE II—ELECTRIC-COOKING TESTS MADE AT AUDITORIUM

	Energy in Kw-hr.	Cost in Cents
1 peck potatoes, thirty large sweet potatoes	3.00	9.00
5 lb. bass, one chicken	1.00	3.00
Coffee for thirty persons	0.50	1.50
Baking two loaves of bread	0.75	2.25
6 lb. roast, four loaves of bread	1.75	5.25
4 lb roast, two loaves of bread	2.00	6.00
Twenty-four rolls (hot oven)	0.25	0.75
4 lb. roast	1.50	4.50
Six large potatoes alone	1.00	3.00
Baking cake (hot oven)	2.00	6.00

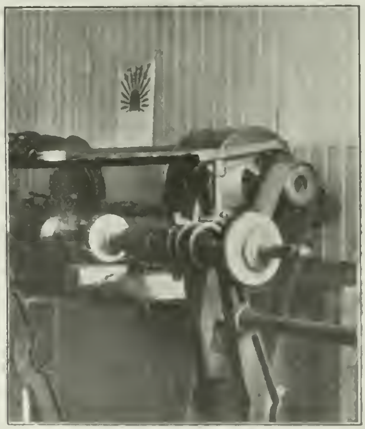
Results of the tests were given to the public with the cost in cents of each operation, the energy consumption being also indicated as shown in the accompanying tables. Three types of cookers were used on the tests, namely, open disks or plates, ovens containing heating disks or plates, and inclosed cookers which were practically air-tight.

In addition to the results given in the tables certain instances were found where an especially economical housewife had made a record for low cost. Among these was the case of a family of three, where one week's cooking was done electrically at a cost of 73 cents; another family using an inclosed cooker operated the appliance for one week at a cost of 19.5 cents; in another home three dinners for four persons were cooked at an energy cost of but 8 cents. In discussing the sentiments expressed by the housewives whose assistance made the tests possible, Mr. F. E. Williams, chief electrician for the plant, says that without exception all were high in their praise of the electrical apparatus, the semi-inclosed and inclosed cookers meeting with especial favor.

Data from tests made by demonstrators at the electric show are given in Table II.

Electrifying the Shoe-Repair Shop

Electric drive is rapidly coming into favor as a means of lightening the toil of the craftsman in footwear repairs, and many outfits of buffing, trimming and polishing tools are now being equipped along the lines illustrated herewith. This class of motor service is particularly well adapted to city shoe-repairing establishments where a large volume of business has to be handled in a limited time. In the installation shown, which is operated by a 3-hp, 220-volt General Electric motor, the tools driven include a finishing shaft for heels and bottoms, bottom pad, bead wheel, heel pad, edge setter, buffing roll, heel breaster, four-part trimmer, heel pad and a Goodyear rapid stitcher. The apparatus is all mounted in a common frame and is equipped with suitable clutches to cut down the power requirements when not in use. A blower for the removal of leather dust is also included. In the plant illustrated, which is that of the "Goodyear Shufix," Boston, the motor is compactly mounted on a timber platform supported by wall posts at one end and by metal clamps attached to the bar of the repair outfit at the other. A 4-in. motor pulley and a 10-in. main shaft pulley are required. Energy is supplied from the local Edison mains and the repair machinery is leased by the United Shoe Repairing Machinery Company, Boston.



COMPACT MOTOR INSTALLATION IN SHOE-REPAIR SHOP

Illumination and Wiring

A Giant Electric Sign for the Scranton Schools

According to reports coming from Scranton, Pa., it is contemplated to erect there one of the largest electric-sign displays ever built. The sign planned will be 420 ft. long and 48 ft. high, with 12-ft. letters reading "International Correspondence Schools. We Teach the World." When this sign is erected, Scranton, according to the Scranton Electric Company, will have both the largest electric sign and the largest school in the world.

Lamps and Lighting of the Future

At the Jan. 13 meeting of the Washington Section of the American Institute of Electrical Engineers, Dr. Herbert E. Ives, of the United Gas Improvement Company, Philadelphia, Pa., gave an illustrated talk on the topic "Lamps and Lighting of the Future." In speaking of high efficiency in illuminants Dr. Ives pointed out that in order to produce an efficient illumination advantage must be taken of selective radiation rather than black-body radiation. This he illustrated by several energy curves. He then told Charles Lamb's story of the origin of roast pig and declared that at present we are doing as the old Chinese who set fire to their houses in order to roast their pigs; we are virtually burning down our houses in order to get a small amount of visible radiation. Dr. Ives said that the efficient selective radiation of the firefly is not so efficient as it seems, although it is much more efficient than any present-day illuminant. He discussed daylight illumination from windows and showed several schemes by which the artificial equivalent of daylight illumination from windows can be produced. During the day, as the speaker demonstrated, the lower parts of an interior are brightest, while at night, with ordinary so-called indirect illumination, this order of things is reversed and it is the upper part of the room which is flooded with light.

To illustrate the crudeness of present lighting installations Dr. Ives said that if a blind person were brought into a room illuminated by daylight and the intrinsic brilliancy of the objects and the walls of the room were represented by paper of different thickness pasted on the objects and walls the thicknesses of paper required would vary from thin tissue paper on the walls to heavy cardboard on the windows. If, however, the blind man was brought into a similar room lighted by electricity or gas, the paper gradations would range from the thickness of a piece of tissue paper to long spear-like projections and the shocks which the blind man would experience by bumping against these would be similar to the shock given the eye of a person looking at the source of illumination.

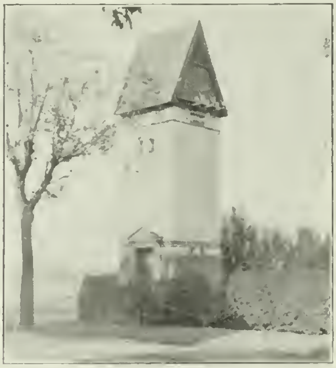
In conclusion, Dr. Ives said that whenever the needs of the public become urgent for any commodity its development is sure to follow and he made the prophecy that in the near future illuminants will be devised to give luminous outputs as high as 50 to 60 candles per watt.

Discussion

In the discussion of the paper Mr. C. B. Mirick pointed out that the selective radiation of the firefly, in which the radiation is confined to one particular portion of the visible spectrum, gives a monochromatic light, and he asked whether this light would be desirable from a color standpoint. Dr. Ives answered that for some uses the color would be desirable, and that where it was not desirable light from other monochromatic sources could be combined to give the color desired. Mr. Mark Woodward pointed out how monochromatic light might permanently injure the eye. Mr. Irving G. Priest said that daylight illumination from windows has been in use only a few hundred years while daylight illumination from the sky is thousands of years old. From this comparison he concluded that perhaps the eye is better accustomed to bright overhead lighting than illumination from the lower parts of a room.

An Ornamental Transformer House

The building shown in the accompanying illustration might well be mistaken for a bell tower, the neat brick base and stucco finish and the steep gable roof with its ornamental bargeboard and the louver in the gable lending a belfry effect. Amid its rustic environs one would almost aver it to be a feature of some quiet village from which a tolling message could be sent forth periodically to the neighborhood. But the building, as the wires and arresters indicate, serves a very practical purpose. The structure is a transformer house and is located near Fredericia, Denmark. It merely goes to show what can be done, and is done in Denmark, to help beautify the surrounding country by means of suitably designed buildings.



TRANSFORMER HOUSE IN DENMARK

House-Wiring Campaign at Louisville, Ky.

The Louisville (Ky.) Gas & Electric Company has begun a house-wiring campaign which is expected to bring good results. Investigations made by Mr. E. L. Callahan, who is in charge of the new-business department, have indicated that the field for development in Louisville, in spite of the competitive conditions previously existing, is unusually large. It is believed that between 30,000 and 40,000 dwellings are still without electric service, and a sharp drive for business is to be made in the case of these.

Half-page advertisements in the newspapers started the campaign, while following this display the force of solicitors was considerably augmented. The company has arranged to have the fixtures and wiring installed at its expense, the payments to be collected from the customers along with the charges for service during the twelve months succeeding. It is expected that the campaign will continue at least a year.

A "Show-Me" Window-Lighting Campaign

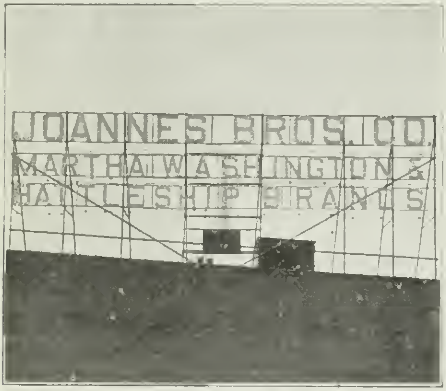
A campaign for proper and more efficient window lighting which bears all the earmarks of real Missouri endeavor is now being carried on by the new-business department of the Kansas City (Mo.) Electric Light Company.

When told that their methods of lighting window displays were not only inefficient but failed to display the goods at their best, the merchants of the city, like true Missourians, demanded that they be "shown" the better way if one existed. And the new-business department, being also imbued with the Missouri spirit, did show the merchants the better way.

Purchasing complete outfits of reflectors and proper lamps for each window, the electric-service company, with the help of the local contractors, installed the equipment for the merchants outright, asking only the latter's permission to make the change. If when the change was completed the merchant was not better satisfied with the new installation than he had been with his previous method of lighting, no charge was made. In all cases, however, the effect created by the improved illumination was so marked and showed the goods to so much greater advantage that the merchants willingly defrayed the cost and accepted the installations from the company.

Grocer's Electric Roof Sign

The Joannes Brothers Company, Green Bay, Wis., is one of the largest wholesale grocery firms in the Northwest, having a floor space of approximately 143,000 sq. ft. To advertise some of its leading brands, the company recently installed a large roof sign containing 709 five-watt tungsten lamps. The display measures 53 ft. long by 23 ft. high, and is controlled by a flasher. First the name of the firm appears and remains lighted for a moment, after which the two lower lines are flashed on. The entire sign is then extinguished for a few seconds, and then all three lines come on simultaneously, remaining lighted until the start of the next cycle.



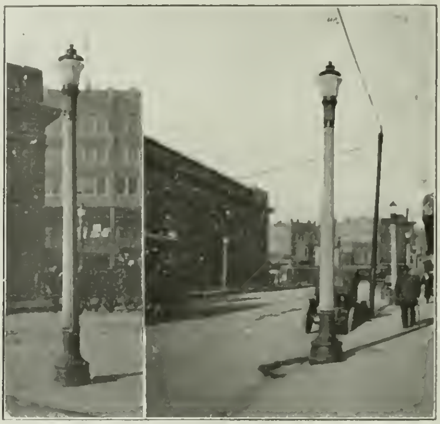
ROOF-TOP SIGN OF WHOLESALE GROCERS

The Green Bay Gas & Electric Company, which furnishes energy to operate this sign, offers a flat rate for show windows, electric signs, etc., which are lighted at dusk and turned off at 11 p. m. The monthly charge is made equivalent to the cost of the watt-hours consumed by the installation, burning four and one-half hours nightly, at the rate of 6 cents net per kw-hr.

Inverted Flame-Arc Lighting at Milwaukee

Work of installing the first two blocks of Milwaukee's new inverted flame-arc lighting system has been completed, although the finished installation will when completed comprise more than 200 lamps.

The lamps, which are a recent product of the Adams-Bagnall Electric Company, are of the series type and are rated at 3500 cp each. Spacings of 50 ft. to 60 ft. have been used between the ornamental corrugated shafts which support the lamps at a height of about 15 ft. above the sidewalk. The standards are both simple and graceful in design.



STANDARDS WITH INVERTED FLAME-ARC LAMPS

According to the plan upon which these lamps have been installed, the Commonwealth Power Company purchases the units, supplies energy for lighting, and maintains the lamps. In return the electric-service company collects 15 cents per front foot per month from each merchant on the improved thoroughfare.

Methods of Lighting a Small Residence

A paper entitled "The Lighting of a Simple Home" was read by Mr. A. L. Powell before the New York Section of the Illuminating Engineering Society on Jan. 8. The author gave an account of changes made in the fixtures, glassware and lamps constituting the lighting equipment of an apartment. The house was originally provided with an assortment of carbon and graphitized-filament lamps of various voltages. The total connected lighting load of the original installation was 800 watts. As arranged at present, use is made throughout of tungsten lamps, and the connected lighting load is 555 watts.

The original lighting equipment of the porch consisted of a ceiling-type holder with a crystal-ball globe roughed inside and a 50-watt clear carbon lamp. The lamp was replaced by a 10-watt clear tungsten lamp and the globe by an opalescent inclosing ball of an attractive design roughed outside. The front hall, a small room having a floor area of 45 sq. ft. and a white ceiling and dark-green walls, was originally equipped with a combination gas and electric fixture. The 50-watt clear carbon lamp formerly used was replaced by a 10-watt clear tungsten lamp, the clear glass shade by a pressed opalescent glass reflector, and the inclosed ball by an acorn-shaped opalescent inclosing unit roughed outside.

In the living room, where comfort is especially desirable, a semi-indirect system of illumination was substituted for the original four 50-watt clear carbon lamps and shades. This room has an area of 170 sq. ft. The fixtures were replaced by pressed opalescent bowls roughed outside and antique in finish, brass chains suspending the bowls. Sixty-watt clear tungsten lamps, which are about 7 ft. 6 in. from the floor, are used. A baseboard receptacle was also installed to supply an iridescent glass portable lamp placed on the music stand. In the body of this lamp is a 15-watt clear round-bulb candelabra-type tungsten-filament lamp; in the base there is a 15-watt clear tubular-bulb candelabra-type tungsten lamp. On the piano is a brass portable lamp, with a matte aluminum interior reflecting surface and a tubular 25-watt tungsten lamp.

In the illustration herewith is shown the arrangement of accessories in the dome used in the dining room. An amber art-glass hemispherical dome is hung 4 ft. 9 in. above the floor and is equipped with two 50-watt clear carbon lamps in sockets placed at angles and controlled by a wall switch. As it was desired to use various electric cooking utensils and no baseboard or floor receptacle was available, one of the sockets in the dome is utilized for this purpose. The attachment cord is passed through an opening in the top of the dome. When not in use this cord is coiled about the supporting rod and is hidden from sight by the decorations at the top. A 45-deg. socket was substituted for the second socket, and a clear 60-watt tungsten-filament lamp with a clear prismatic reflector furnishes the illumination. The entire base of the dome is covered by a screen of light yellow messaline held in place by a flexible wire ring as shown. An art-glass window in the wall above the buffet in this room is illuminated from without by three 15-watt clear tungsten lamps in a mirrored trough reflector. When the window is lighted the room has the effect of receiving a flood of sunlight, for the glass is of a warm hue and the reflector is so constructed as to give a relatively strong directional effect. The intensity on a 3-ft. horizontal plane, with the room illuminated by the window, is very low near the wall, rises to a maximum at about 4 ft. out, and then gradually decreases.

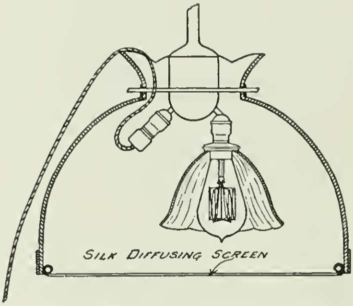
In a room called the "den" used for reading, playing cards, writing, etc., a totally indirect unit is now used consisting of a one-piece mirrored glass reflector in a casing of an Egyptian design having a sand-blasted finish and equipped with brushed-brass high lights. The chain suspension is of such a length as to bring the lamp 7 ft 3 in. from the floor. A 100-watt clear tungsten lamp is used.

The old equipment in the pantry, consisting of a straight-pipe combination gas and electric fixture with a shade and a 50-watt clear carbon lamp at an angle of 45 deg. with the vertical, 6 ft. from the floor, was replaced by a canopy and a nipple, with an indirect shade holder, holding a cased opalescent bowl-shaped glass reflector. A 15-watt clear tungsten lamp is now used.

The original equipment of the bathroom was a gas and electric combination bracket 5 ft. 6 in. from the floor, with a crystal shade and a 50-watt clear carbon lamp. The fixture was replaced by a bracket in the form of an L, with the key socket pointing upward, holding a 25-watt clear tungsten lamp and a bowl-shaped opalescent glass reflector. At the right side of the mirror a cylindrical metal reflector with a right-angle pull socket and a 25-watt all-frosted tungsten lamp in a tubular bulb were installed. This unit is used only while shaving.

In one of the original bedroom installations provision was made originally for only one outlet, which was not adequate. The lighting unit, which was neither decorative nor efficient, was a combination gas and electric wall bracket, 5 ft. 6 in. from the floor. The socket pointed outward at an angle of 45 deg., and a 50-watt clear carbon lamp was surrounded by a crystal shade. The room is very prettily furnished, having a white ceiling, white and light-blue wall paper, white woodwork and furniture decorations in light blue. It was necessary to secure glassware which would harmonize with these colors. The wall bracket was fitted with a 45-deg. socket, a current tap, a 15-watt round-bulb clear tungsten lamp and a cylindrical-shaped diffusing shade. The latter is made of cased glass having an etched design. The base portion is white, the background tinted gray, and four light-blue medallions with a white classic head in the center complete the design. A white silk-covered cord extends from the current tap, by way of the picture molding, to the center of the ceiling. A three-chain ring-type fixture finished in verde and supporting a deep glass bowl, which is equipped with a diffusing shade and a 40-watt clear tungsten-filament lamp, is hung 7 ft. 8 in. from the floor.

The author stated that the kitchen is one of the few rooms in the house where evenly distributed illumination from properly placed lamps is of more importance than appearance. The old equipment was a straight-pipe combination gas and electric fixture, bringing the crystal shade and a 50-watt clear carbon lamp only 6 ft. 3 in. from the floor. Shadows were pronounced and the light distribution was very unsatisfactory. This fixture was replaced by a short pipe and chain hanger, a 40-watt clear tungsten lamp and an extensive prismatic reflector, hung 7 ft. 6 in. from the floor. For easy control a ceiling switch was installed. The distribution of light is excellent, but it would have been desirable to have two outlets, using small lamps.



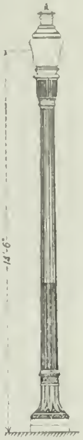
DOME USED IN DINING ROOM

In the cellar one unit is located near a workbench. By using a flat dome-shaped enameled metal reflector with a 40-watt clear tungsten lamp, a wide spread of light has been secured which is adequate for the other parts of the cellar.

Although the total lighting load has been decreased, the revenue to the central station remains the same or even greater. This is more or less of a paradox, but can be demonstrated by a few concrete examples. For instance, the porch now has a 10-watt lamp in place of a 50-watt lamp. When callers are expected this lamp is allowed to remain in service all evening, whereas the larger lamp would be merely turned on and off when a person was entering and leaving. Again, the den is probably the most used room in the house. With the three small lamps in the chandelier, one or two would probably be all that would be used, whereas the indirect fixtures must be turned on in their entirety, thus requiring a load of 100 watts.

Detroit Adding 900 Street Lamps

Nine hundred and fifteen new street and boulevard lighting fixtures, the appropriation for which became available last July, are now being installed in Detroit, Mich., by the local Public Lighting Commission. Of these, 240 4-amp arc lamps, to be fed from underground circuits, will be erected on Gratiot and Michigan Avenues. As a step toward lighting the entire length of Grand Boulevard, a distance of 11 miles, as contemplated by the commission, 100 inverted magnetite-arc lamps are being installed on this boulevard. A section is already equipped with thirty-eight lamps of this type, and as the new lamps will be staggered at intervals of about 159 ft., measured center to center, less than 7 miles remains to be similarly lighted. The type of pole to be used on the boulevard is shown in the accompanying drawing and will be furnished by the George Cutter Company, South Bend, Ind., and the Morris Iron Company, Frederick, Md. These fixtures will also receive energy from underground circuits.



ORNAMENTAL POLE

Five hundred and seventy-five 4-amp lamps will be distributed throughout the city as required and fed from overhead circuits. All of the poles for the 4-amp lamps are being made by the city.

Construction work on the underground conduit runs is completed, and more than half of the cables are already pulled into place. Clay conduits containing from one to twenty-four ducts are employed, according to the locality, so that cables may be replaced or more pulled in without tearing up the streets.

Recent Telephone Patents

Messrs. R. R. Ireland, of East Orange, and S. F. F. Gilson, of Closter, N. J., have jointly patented a hand-telephone set with the transmitter and receiver parts mounted upon a handle. The handle in this set is made of sheet metal, one piece forming the body piece and providing mountings at the two ends for the transmitter and the receiver respectively. The other piece is a box-like cover piece which incloses a terminal plate mounted upon the base piece. This makes the handle of convenient thickness. Through the cover piece an elongated push-button is projected which may be grasped by the hand to operate the switch contact controlling the circuits. A second convenient position is available for flash-signal purposes. This patent is assigned to the Western Electric Company.

A receiver-supporting device is the subject of a patent granted to Mr. H. C. Raiber, of Pittsburgh, Pa. Two head receivers are supported on a bow which in turn is carried on a lug clamped to the stem of a desk-stand set. The bow swings vertically about a horizontal axis on its own plane. A notch in one leg is arranged to press the hook-switch lever down when the bow is elevated to the vertical position.

A selective lock-out system has been invented by Mr. I. F. Manny, of Milwaukee, Wis. This is a step-by-step system operated by a clock train and spring. One novel feature is a magnetic device for rewinding the clock spring. The apparatus has the usual ratchets and pawls, and the selection of any station depends upon the angular displacement of all the sets in synchronous action.

Letters to the Editors

Quick-Firing Arrangement of Boilers to Relay Water-Power

To the Editors of the Electrical World:

Sirs:—Referring to the article with the above title in your issue of Dec. 6, it would seem that some of the expense and complication of installing the heating coil in the blow-off tank might be eliminated.

From Fig. 5 it will be seen that large piping has been connected between the blow-off tank and the boiler drum, and that after the steam from the main steam header has passed through the heating coil in the blow-off tank it then passes into the drum connection. Since the water in the blow-off tank receives the total heat of the steam by mingling with it, the heating coil seems unnecessary. The desired result could be obtained more readily by directly connecting the live-steam connection into the bottom of rear header or mud drum of boiler. The difficulty encountered in preparing a fire on the chain grate might well be obviated by installing auxiliary oil burners for use in bringing the boiler up to temperature quickly, and the cost of installing the burners is comparatively low. Where fuel oil can be obtained one should not overlook the aid in emergency fire control which oil burning allows. The disadvantage that arises from injury to the setting by quick firing is much lessened by maintaining hot water in the boiler as above mentioned and keeping the boiler dampers and doors closed until the fire is ready to be started.

Columbus, Ohio. B. W. Dennis.

Public Service Corporations and the Public

To the Editors of the Electrical World:

Sirs:—In your issue of Jan. 3, 1914, I note with interest the article of Mr. Alton S. Miller upon the subject of "Public Service Corporations and the Public," in which it is said that the existing antagonism on the part of the public toward the public service corporation is largely the result of the ignorance of the public with regard to the corporation, its investments, its policies, its obligations and the service it is rendering.

The author states that in a number of places in the country there is complete understanding between the public utilities company and the people, and that in such places the corporation is favorably recognized by the community which it serves.

Mr. Miller advocates acquainting the public with the problems of the companies and says: "Such a general educational movement should be started through the associations representing the principal public service activities. After the details are worked out a concerted movement should be begun all over the United States to enlighten the public, and thereby secure its effectual co-operation. . . . It is suggested that such a plan is Utopian, and the answer is that it has been followed in many places and has produced the desired results."

Apparently Mr. Miller is unaware of the fact that the Society for Electrical Development is intended to do just this work. As Mr. Miller says, "Though the companies may have been more than fair in the treatment of their customers, their duty does not end there. The public must be informed of all the facts and thereby convinced that the company is fair."

If the public service corporations of this country wish to take the excellent advice of Mr. Miller, they can have just such educational work done for them by becoming members of the Society for Electrical Development.

J. M. WAKEMAN,
General Manager
Society for Electrical Development.

New York, N. Y.

The Ampere-Hour Meter and the Storage Battery

To the Editors of the Electrical World:

SIRS:—Five years ago the ampere-hour meter as a commercial measuring instrument was practically unknown in the United States. Mercury and other motor type ampere-hour meters, as well as electrolytic meters, had been used abroad for a number of years, principally as house-service meters, but these types had found no favor in the United States owing to the feeling which has always existed that only an energy-recording meter should be used for such service. Some attempt had been made in the early part of this century to use ampere-hour meters in connection with certain large central-station batteries, but the meters themselves were very faulty and these attempts were stopped until 1908.

At that time Mr. Ernest Lunn, then chief engineer of batteries of the Commonwealth Edison Company, Chicago, suggested to the writer that ampere-hour meters would be a desirable adjunct for use with central-station batteries and also with batteries on electric vehicles and in train lighting. As a result of this suggestion the Sangamo Electric Company developed and in the latter part of 1908 brought out a few ampere-hour meters which were used by the Commonwealth Edison Company both with stand-by batteries and on electric trucks. The results were so satisfactory that regular production of ampere-hour meters was begun by that company in 1909, these being the first successful motor-type ampere-hour meters manufactured in the United States.

Great difficulty was experienced at that time in convincing engineers, storage-battery manufacturers, electric-vehicle people and railway men of the necessity or even desirability of an ampere-hour meter, and one prominent railway electrical engineer remarked that while the ampere-hour meter appeared to be a very pretty mechanical device, his company was getting very satisfactory results with its batteries and he couldn't see any use spending money for such meters. To-day that same man is the most enthusiastic advocate of the use of ampere-hour meters with every system of railway-train lighting, and when he became converted about two years ago he inaugurated the use of these meters on every electric-lighted car of the great railway system with which he is connected.

A prominent electric-vehicle engineer stated that the meter might be very good for stationary-battery service or in railway train-lighting service but that the volt-ammeter was the only thing for use on an electric vehicle and that people could not understand or use an ampere-hour meter. He even went so far as to maintain that it was reasonable to expect a lady to get out of her car and use a hydrometer in order to ascertain the condition of the battery on the car. The company with which that man was connected is to-day using a distant dial ampere-hour meter on every car it produces, and the volt-ammeter is forgotten.

Another large storage-battery company, which tried one of the first ampere-hour meters in 1909, said that it looked like a good device but was not necessary. To-day every piece of literature this company sends out dealing with the care and operation of batteries mentions the desirability and great value of the ampere-hour meter.

During the summer of 1909, shortly after the ampere-hour meters were brought out, effort was made to prove to the Navy Department of the United States government the value of these meters in connection with storage batteries used for propulsion of submarines when running submerged. Apparently their value could not be seen at that time, but every submarine built for the United States government in the last year or two has as standard equipment ampere-hour meters for the main recording and indicating devices on the storage batteries.

Many other such examples might be cited but this is hardly necessary as the whole trend of the present day is toward the use of the ampere-hour meter—the instrument which indicates the true condition of a battery with respect to charge.

R. C. LANPHIER,
Secretary and General Manager
Sangamo Electric Company.

Springfield, Ill.

Conflicting Dates of Society Meetings

To the Editors of the Electrical World:

SIRS:—The article on "Preventing Conflicts in Dates of Societies' Meetings" in your issue of Dec. 20 deserves attention particularly with reference to the assignment of dates for the conventions of public utility associations.

Some of these associations are able to hold their conventions or annual meetings at almost any time of the year without inconvenience to themselves or their members, while others are limited by local or sectional conditions to a very narrow range of dates. Owing to certain local conditions of business and the location of meeting points, the Southwestern Electrical & Gas Association, for example, is virtually compelled to hold its conventions during the latter part of April or the first part of May, and in doing so it has found for the last two or three years that these dates often conflict with those of other public utility organizations. In 1912, for example, the Natural Gas Association met on almost the same dates as the Southwestern association, while the National Electric Light Association met the week afterward. Not only was the Southwestern association thus deprived of some of its best gas members, but also of some of its best electrical men, for with the close proximity of the N. E. L. A. date and that of our convention it would have been too much to ask managers or heads of departments to absent themselves from business for two weeks consecutively.

This letter is therefore written to suggest that the secretaries of public utility or engineering organizations form some central bureau where matters of meeting dates can be arranged by timely correspondence, at least, so that the dates for these periodical meetings may not conflict and rob one or the other of the organizations of the attendance it would receive if these dates did not conflict.

Besides affecting the active members of the organizations, this matter of conflicting convention dates very vitally interests supply men who attend and make exhibits at these conventions or annual meetings. I personally know of instances where such a conflict last year nearly tripled the attendance and exhibition expenses of one electrical supply concern, and the same thing is probably true of many others.

It will cost very little to attempt by correspondence the proper adjustment of conflicting dates during the coming year, and the writer will be glad to do anything to expedite the result desired.

H. S. COOPER,
Secretary
Southwestern Electrical & Gas Association.

Dallas, Tex.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Motor-Driven Gas-Engine Haulage Outfit

At the site of the power house now being erected on the Rock River, near Sterling, Ill., gas engines were formerly employed to haul the carts bearing rock blasted from the wheelpits and tailrace up a steep incline of the river bank. To eliminate, however, the starting troubles experienced on cold mornings, use is now made of electric motors supplied with energy from the circuits of the Illinois Northern Utilities Company to drive the haulage apparatus. The accompanying illustration shows the rather unusual method employed for retaining the winding drum and gasoline engine on its foundation after the electric motors had been placed in operation. The piston and connecting rod were removed from the engine and a belt was run over the flywheel to the pulley on the motor.

GAS ENGINE DISPLACED BY MOTOR

During the working periods of the day the motor is operated continuously, and when a cart full of rock is ready to be hauled up the grade the operator moves the lever shown in the illustration, meshing the gears and pulling the load upon the motors. The gasoline engine is thus now doing duty simply as a flywheel.

30,000-Ton Subaqueous Coal Bunker, Kansas City, Mo.

During December the submerged coal bunker at the Metropolitan plant of the Kansas City (Mo.) Railway & Light Company was filled for the first time. The bunker measures 340 ft. in length and 82 ft. wide throughout the most of its length and has a capacity of 30,000 tons of coal when its contents are heaped above the water line. The plan of the bunker, showing the relative location of the power house forming one side of the pit and the railroad tracks from which the coal is delivered, is reproduced herewith.

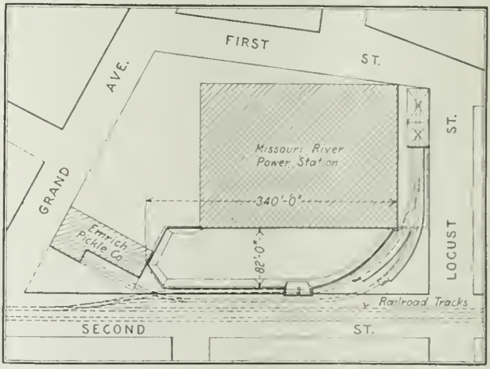
Construction methods employed in excavating the pit were unique and perhaps even more interesting than the project itself. At the site of the present pit a mound of clay and soft earth formerly stood by the side of the station. To remove this small hill and to make an excavation of proper depth a turbine-driven boiler-feed pump supplying water at 200-lb. pressure was connected to a pipe line leading from the boiler room to the site of the bunker. By playing a heavy stream of water from this pipe line onto the soft earth, the soil was loosened and washed beneath the power house, through a drain under First Street, and ultimately down to the Missouri River, about ½ mile distant. Warm waste circulating water which would otherwise have been diverted to the drain was used to feed the hydraulic excavating outfit, so that there was no great increased demand on the water system of the plant.

With the work of excavation completed, the walls and bottom of the bunker were then built up of concrete reinforced with 0.75-in twisted steel rods. Heavy concrete buttresses were placed in the interior along the south wall of the pit to withstand the strain imposed by the movement of heavy trains along the tracks at that side of the bunker, the tracks being on a level with the top of the concrete wall.

Motor-Driven Pumps for Moving Coal About the Pit

For conveying coal from one part of the pit to another and for loading the belt conveyors carrying the supply to the bucket conveyor system of the plant two motor-driven Worthington pumps have been installed. Each pump is capable of moving 1 cu. yd., or about 1300 lb., of coal per minute. Both pumps are belt-driven from a single 100-hp motor placed upon a concrete-pillar foundation above the water line in the pit.

In freezing weather, when it becomes impossible to move the coal by means of the pumps, a 2-cu. yd. dragline bucket will be placed in service. By this arrangement the coal will be carried to a crusher where both coal and ice will be ground into pieces small enough to be conveniently handled by the conveyor systems.



PLAN OF STATION AND UNDER-WATER COAL-STORAGE PIT

Mr. Charles E. Fritts, electrical engineer of the Metropolitan Street Railway Company, Kansas City, Mo., designed and superintended the building of this coal bunker.

Operating Data on Battery-Driven Tractor

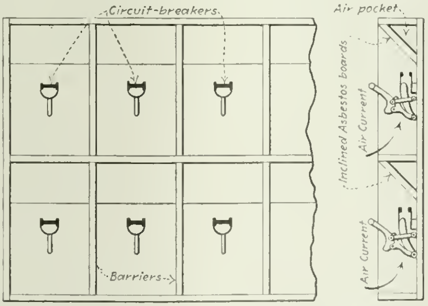
Some data are given in the accompanying table on the daily performance, cost of maintenance and operation, etc., of the battery-driven tractor used by the Pennsylvania Railroad for hauling freight cars through the streets of Jersey City, N. J. This tractor, which was described on page 727 of the *Electrical World* of April 5, 1913, was placed in regular service on Feb, 4, 1913, and during the seven months which followed hauled 4935 cars, having a total weight of 165,574 tons, a distance of 2076 miles. The cost of handling these cars with the electric tractor was $4,672.88, as compared with $9,179.10 had horses been employed, thus representing a return of 64.5 per cent on the capital invested in the tractor. The figures in the accompanying table include the cost of all repairs made on the equipment.

OPERATING DATA, BATTERY-DRIVEN TRACTOR

Cost of maintenance and operation, seven months......	$3510.21
Interest at 6 per cent on $13,400, seven months.......	476.00
Depreciation on $13,400 (less tires and battery, $4,200, equals $9,200), at 5 per cent, seven months........	268.33
Depreciation on battery, $3,200 at 20 per cent, for seven months	373.34
Total charges for seven months..................	$4627.88
Total charges if horses had been used (4935 cars × $1.86)	9179.10
Saving by electric tractor, seven months..............	$4551.22
Saving over investment by electric tractor, per cent....	58.5
Saving including investment (58.5 + 6 per cent), per cent	64.5
Cost of service per car ($4,627.88 ÷ 4935)............	0.938
Cost of service per ton ($4,627.88 ÷ 165,524).........	0.028
Average number of cars per mile.....................	2.4
Cost of service per ton mile (0.028 × 2.4)............	0.067
Total number of cars handled (4935 + 2788)..........	7723
Number tons handled per hour......................	121
Cost of service by electric tractor per working day..	$27.87
Cost of service by team per working day.............	$55.29

Helping the Air Currents to Extinguish Arcs

When circuit-breakers are mounted in tiers and separated from each other by horizontal barriers it frequently happens that if the switch opens under load the arc occurring at the contacts will linger longer than when the breaker is not surrounded by partitions. This phenomenon is probably caused by the division walls obstructing the air currents which usually extinguish the arc at a breaker mounted in the open.

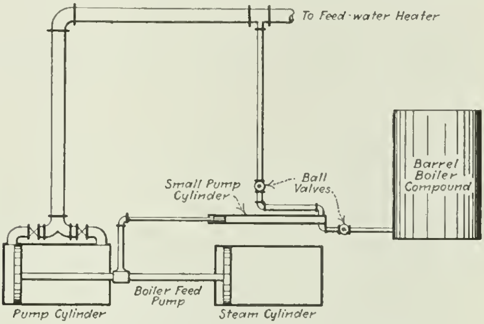


ARRANGEMENT OF INCLINED BOARD TO AID AIR CURRENTS

A simple method of overcoming this objection to barriers between circuit-breakers is shown diagrammatically herewith. By fastening asbestos boards below the horizontal barriers in an inclined position so as to cover the air pocket above each breaker, the air currents caused by the heat of the arc are assisted in their normal upward flow. This scheme is being tried in the Oneida Street generating station of the Milwaukee (Wis.) Electric Railway & Light Company.

Pump for Apportioning Boiler Compound and Feed Water

In one of the steam plants of the Illinois Northern Utilities Company, on the banks of the Rock River at Sterling, Ill., a small pump cylinder has been attached to the boiler-feed pump in such a manner that at every second stroke a predetermined amount of boiler compound is added to the feed water. As shown in the accompanying diagram, the cylinder of the small compound pump is held stationary while its plunger moves with the piston rod of the boiler-feed pump. Thus at alternate strokes of the latter the proper amount of compound is injected into the main carrying the feed water to the heater. Ball valves placed in the piping prevent a reversal of flow in the compound pipe line. Mr. A. W. Bush, superintendent of the Sterling company, says that the only attention needed by the apparatus is an occasional vigorous stirring of the boiler compound in the barrel. This detail is attended to by the boiler-room force.



PUMP FOR APPORTIONING BOILER COMPOUND

Electric Water Heater for Car-Washing Service

In installing an electric water heater for washing its cars, the Cincinnati Traction Company was prevented from using the customary forms of heaters for the following reasons: First, hot water was desired throughout the year and therefore could not be furnished by the steam-heating plant. Second, car washing was done in one end of the paint-shop bay, so that a coal heater could not be employed unless it was installed at some outside point. Third, it was desirable to have hot water under pressure, which could not be obtained continuously with an ordinary coal-type hot-water heater.

Confronted by these limitations, a home-made electric water heater was therefore designed and installed. Although the cost of heating water electrically is more expensive than by other methods, it has met all the requirements, and the energy actually used is so small as to make the cost not prohibitive. For all practical purposes this home-made water heater is instantaneous. It consists of a box 8 ft. long by 2 ft. square in section, built of 1.25-in. yellow pine. The box is lined with

0.25-in. transite board to insulate the wood from the heater coils. Eight 17-amp electric coil heaters are installed on the bottom and sides of the box and arranged in two circuits. These are sufficient to maintain a temperature of 210 deg. in the box. The heater coils in the bottom of the box serve as supports for the 1-in. wrought-iron pipe coils, which are arranged in a rack four coils high and six coils wide. These pipes are placed in a continuous coil connected with the city water supply at one end and to a hose connection at the other. When the two water taps provided at each end of the coil are open cold water flows through the pipe coils, which are built up with return bends. The temperature maintained in the box by the electric heaters is sufficient to raise the water nearly to the boiling point before it reaches the hose connection. In actual service this heater has been found of ample size to supply four scrubbers with hot water continuously during a sixteen-hour day. Energy for the heaters is supplied from the 550-volt trolley wire through a knife switch.

Electrically Controlled Prony Brake

A single prony brake when used to absorb energy from a rotating flywheel will not ordinarily maintain a constant engine speed even when frequently adjusted by hand. This is due largely to the change in the coefficient of friction between the flywheel and the brakeshoe caused by heating, presence of oil and by varying conditions of lubrication. An electrically controlled dynamometer which will automatically maintain a constant engine speed, even under the conditions mentioned above, was described by Mr. Nathan C. Johnson, New York City, at the annual meeting of the Society of Automobile Engineers recently held in New York City.

The principle of this modified prony brake is shown in Fig. 1. Instead of manually adjusting the grip of the brake band, the latter is automatically controlled by an electromagnet which acts through a toggle joint. The exciting current for this magnet is furnished by a small magneto belted to the engine shaft. If the engine speeds up slightly the magneto drives more current through the electromagnet, thereby increasing the pressure on the brake band and restoring the engine speed to normal. The brake arm rests on a knife edge on the scale platform and a counterweight overcomes the tendency of the brakeshoe to fall inwardly against the flywheel. The thrust of the brakeshoe caused by friction with the flywheel is transmitted in a direct line to the knife edge by a compression member. No strains are caused in the engine shaft by using this brake as the thrust of the shoe is taken up entirely by bearings on each side of the flywheel.

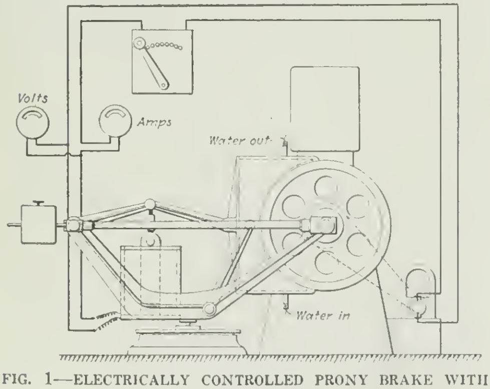


FIG. 1—ELECTRICALLY CONTROLLED PRONY BRAKE WITH SOLID SHOE

In the circuit between the magneto and electromagnet are an adjustable resistance and a wattmeter or a voltmeter and ammeter. By varying the resistance the brake load can be changed and read on the scale beam as usual. The volt-ampere readings, or watts, and the internal losses in the magneto should be added to the brake readings to obtain the total power developed by the engine.

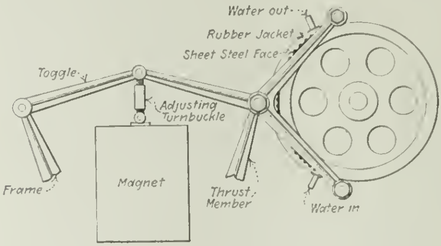


FIG. 2—FLEXIBLE PRONY BRAKESHOE ADAPTABLE TO ELECTRICAL CONTROL

Experiments conducted at Cornell University with this apparatus have shown that there is no perceptible variation in the speed or load. If the brakeshoe is made flexible, as shown in Fig. 2, it will fit flywheels of different diameters, and the heat caused by friction will be radiated faster than if a solid shoe is used. By placing two water-cooled shoes on opposite sides of the flywheel the radiating surface can be still further increased.

Cost of Producing Power with Different Oils

As the relative prices of different grades of oil vary in different localities, it is convenient to have a simple method for comparing the cost of operating an internal-combustion engine on various grades of fuel. The method described herewith makes use of the principle that 1 lb. of almost any petroleum oil contains approximately 19,000-lb.-Fahr. heat units.

UNITED STATES PETROLEUM STANDARD BAUMÉ (60 DEG.)

Baumé	Specific Gravity	Baumé	Specific Gravity
10.0	1.000	30.0	0.876
16.0	0.959	32.0	0.865
18.0	0.947	34.0	0.855
20.0	0.934	36.0	0.845
22.0	0.922	38.0	0.835
24.0	0.910	40.0	0.825
26.0	0.898	42.0	0.816
28.0	0.887	44.0	0.806

The specific gravity of the oil can, of course, be measured, and the manufacturer of the engine will furnish figures on the consumption per brake-hp-hour. With these data, to compare costs multiply the specific gravity of the oil in question by 8.33 (weight of 1 gal. of liquid having specific gravity of 1.00), which gives the weight per gallon. Divide this product by the guaranteed oil consumption per brake-hp-hour expressed in pounds, and the result will be the brake-hp-hour obtainable with 1 gal. of the specific oil. The cost of oil per brake-hp-hour may then be found by dividing the price of oil per gallon by the last result.

By substituting values for the letters in either of the accompanying formulas the same result may be obtained quickly by slide-rule operation:

$$\frac{p \times c}{sp.\ g. \times 8.33} = \frac{0.12 \times p \times c}{sp.\ g.}$$

= cost of oil per brake-hp-hour in cents,
where

p = price of oil per gallon in cents
c = guaranteed oil consumption in pounds per brake-hp-hour
$sp.\ g.$ = specific gravity.

Thus, by knowing the unit price and specific gravity of various oils suitable for the engine used, it is possible to determine the particular one which will afford the most economical results.

An example is given below comparing the costs of oil when two different grades are considered.

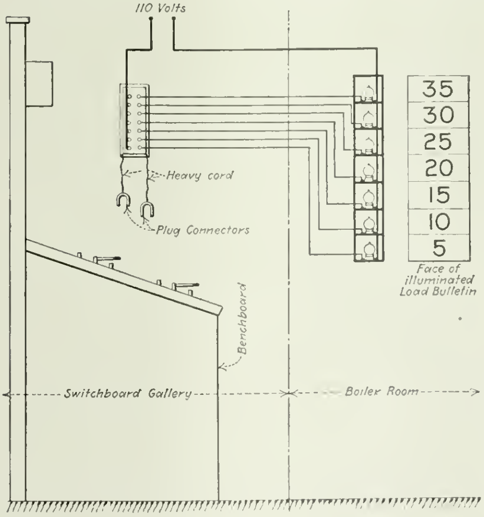
Fuel oil: $p = 2.75$; $sp.\ g. = 0.91$.
Kerosene: $p = 7.5$; $sp.\ g. = 0.816$.
$c = 0.6$.

$$\frac{0.12 \times 2.75 \times 0.6}{0.91} = 0.22 \text{ cent per brake-hp.}$$

$$\frac{0.12 \times 7.5 \times 0.6}{0.816} = 0.66 \text{ cent per brake-hp.}$$

When the density of the oil is expressed in degrees Baumé the accompanying table of equivalents may be used for translating values of specific gravity.

Visual Load Indicator for Boiler Room



VISUAL LOAD INDICATOR

In a combination railway and electric-lighting plant in the Middle West the station engineer has devised a scheme for showing the boiler-room force the load on the station at the moment, without the necessity of consulting the face of a small instrument. As shown in the accompanying illustration, the device consists of groups of lamps mounted behind a series of figures on a glass case. The main portion of the glass is painted red and the figures are in white. These lamps are connected through a plug board to a 110-volt circuit in such a manner that the switchboard operator, reading the station load from the totaling instrument, can connect the proper lamps to the energizing circuit so that the load indicator will show in "thousand kw" the output of the turbines and engines at that time. When the load is fluctuating rapidly two plugs are used, illuminating two of the section figures and indicating the limits between which the variations are ranging. As indicated from the sketch, the illuminated load bulletin is mounted out of way of the men in the boiler room while the plug connectors are placed near the end of the benchboard on the switchboard gallery.

Emf Delivered by Induction Coil

If interrupted direct current is allowed to flow through the primary winding of an induction coil, will the induced emf in the secondary be uni-directional or alternating? Please advise me whether the relation of the secondary and primary emfs depends entirely on the ratio of turns in their respective coils. H. S.

When a direct current is introduced into the primary winding of an induction coil there is produced a certain mmf which results in a flux in the core of the induction coil. The variation in this flux produces in the secondary coil an emf the value of which depends upon the rate of variation in the flux and not upon the value of the flux. The secondary emf is therefore high when the current is first introduced into the coil, reduces to zero as the current becomes steady, and then reverses when the current is removed from the primary coil. The secondary emf is therefore not uni-directional. The current in the secondary coil depends on the impedance of the total secondary circuit, including that of the arc when one forms. If the secondary circuit is open there will, of course, be no current whatsoever. Under any chosen condition of operation the actual value of the secondary emf varies directly with the number of secondary turns.

Break in Motor-Field Circuit Opens Circuit-Breaker

In our machine shop there is a shunt motor which drives all of the shop equipment. When starting this motor I place the speed-controller handle on low speed and bring the starting handle up to running position without any trouble. On turning the speed-controller handle to the contact which ought to give the required speed, however, the circuit-breaker invariably opens. When none of the shop machines is connected to the motor the same operation fails to open the breaker, but instead the motor speed increases to almost double its normal value. Will you please explain the reason for this trouble? B. K. G.

From your description the fault appears to be in the speed-control switch which regulates the shunt-field excitation. Possibly the switch contact which is used to give the desired speed is burned off so that it does not touch the controller handle, or it may be that the wire connecting this button with the resistance coils inside is severed. In either case the shunt-field circuit would be opened when the handle reached that particular contact. With no field flux except its own residual magnetization and with potential impressed across the armature brushes, the motor armature will receive a greatly increased current and will tend to speed up abnormally until the counter emf is practically equal to the voltage. When the speed is low and the acceleration retarded by a load on the motor, the armature draws considerably more than its normal full-load current, thereby opening the circuit-breaker. When unloaded the motor speed is higher and the acceleration more rapid; the current taken is smaller, but the speed rises to the abnormal rate you observed.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Lamps and Lighting

Radiation of the Carbon Lamp.—LUMMER.—A paper read before the German Illuminating Engineering Society. The author shows that from the experimental determination of the true temperatures of the carbon filament at different loads it is possible to determine the law of the total radiation of carbon filaments. It is found that carbon radiates as a "gray body"—that is, less than a "black body"—but for each wave-length by the same amount less for all temperatures. The total radiation from a carbon filament is $0.725 \times 10^{-12} \times T^4$ gram calories per sq. cm per second, where T is the absolute temperature. The relation between watts per hefner candle and absolute temperature is shown in Fig. 1, from which the following figures are taken:

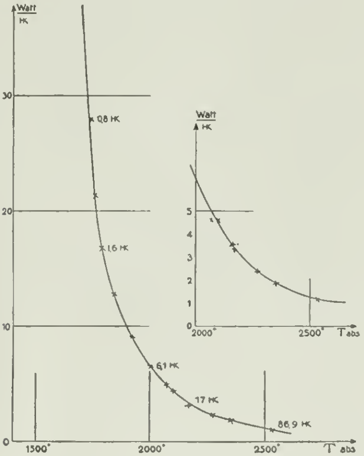


FIG. 1—RELATION BETWEEN WATTS PER HEFNER CANDLE AND ABSOLUTE EMPERATURE

Watts per Cp.	Temperature, Deg. Abs.
5.2	2057
4.8	2079
4.4	2100
4.0	2123
3.6	2150
3.2	2182

Hence if the temperature of the carbon filament is increased from 2100 deg. to 2182 deg.—that is, by only 82 deg.—the power taken per cp is reduced from 4.4 watts to 3.2 watts.—*Zeit. f. Beleucht.*, Dec. 20, 1913.

Generators, Motors and Transformers

Hunt Cascade Induction Motor.—F. M. DENTON.—A long article profusely illustrated by diagrams explaining the method of operation and arrangement of the windings of the Hunt cascade induction motor, which has a single winding on the stator as on the rotor.—London *Electrician*, Jan. 2, 1914.

Magnetic Fields.—L. BARBILLION.—The conclusion of his mathematical paper illustrated by diagrams on magnetic fields of various forms and the electromotive forces induced by them. In the present instalment the author gives a comparison of a single-phase alternating field with a rotary field and then discusses the calculation of the "reduction coefficients" of the fluxes and induced emfs with respect to their theoretical values.—*La Lumière Elec.*, Dec. 27, 1913.

International Standardization of Electrical Machinery.—An account of the extended discussion which followed Mr. Everest's paper at Birmingham and in which Messrs. C. Le Maistre, C. C. Garrard, T. F. Wall, G. Kapp, H. R. Hudson, C. T. Siebs, N. B. Rosher, W. J. Larke, M. Kahn and H. M. Hobart participated.—London *Electrician*, Jan. 2, 1914.

Generation, Transmission and Distribution

Protection of Transmission Lines by Ground Wires.—W. PETERSEN.—The value of ground wires as protection for transmission lines cannot be judged completely by theory because their protection against direct lightning flashes is outside of the realm of calculation. On the other hand, their behavior in the case of sudden variations of the earth's field (lightning flashes in the neighborhood) can be calculated just like the charging currents of a transmission line. The ground wire diminishes the charge caused by the earth field on the protected line. Further, it increases the capacity of the line against the earth. Since the voltage which the line assumes when the field breaks down is proportionate to the ratio of charge to capacity against earth, and since the charge is decreased and the capacity increased, the voltage produced on the transmission line is very much smaller than it would be if the line were not protected. A simple three-phase line for 20,000 volts can be protected by a ground wire so that the dangerous rises of voltage will be 40 per cent less than they would be without the ground wire. The energy set free is 55 per cent less. Other cases are also calculated. The author thinks that ground wires are the most important of all protective devices for overhead transmission lines. Transmission lines with well-insulated transformers and well-designed insulators are well protected by a ground wire. The dimensions of the ground wire do not have any effect on its protective action so that they should be chosen from considerations of mechanical strength.—*Elek. Zeit.*, Jan. 1, 1914.

Norwegian Water-Power Plant.—A fully illustrated description of the Rjukan water-power plant which supplies power to the nitrate works. The power plant contains ten turbines each of 15,700-hp rating, coupled to 17,000-kva, 10,000-volt to 11,000-volt alternators.—London *Elec. Review*, Jan. 2, 1914.

Handling Raw Materials at the Blast Furnace.—J. E. JOHNSON, JR.—A long and profusely illustrated article describing the methods of handling on a large scale raw materials at the iron blast furnace. At the present time no power is considered under any ordinary conditions except electricity, the supply being either from trolley wires or a third-rail. In the large majority of cases direct-current at 220 volts is used.—*Metall. and Chem. Eng'ing*, January, 1914.

French Transmission System.—A. SCHOEN AND M. CHARLET.—The first part of a profusely illustrated description of the transmission system of the electric company of Franche-Comté, which supplies energy to the cities of Besançon, Aranthon, Moulin du Pré, Montrambert, Auxonne and the surrounding country.—*La Lumière Elec.*, Dec. 27, 1913.

Installations, Systems and Appliances

Reinforced Concrete Affected by Electricity.—KURT LUBOWSKY.—An illustrated article in which the author investigates the effects of electric currents and discharges on reinforced concrete. He concludes that for installations which have been made properly there is no danger. Earth currents may be neglected in their effect on reinforced-concrete buildings, but must be taken into consideration with bridge structures. Tests are described which show the justification of the earthing regulations for reinforced-concrete poles for transmission lines. The article is to be concluded.—*Elek. Zeit.*, Jan. 1, 1914.

Electric Equipment of British Post Offices.—H. C. GUNTON.—A long, illustrated abstract of a paper read before the British Institution of Electrical Engineers. For lighting and power service in the London post offices there is now one generating station with three substations. Figures are given on the use of electricity for motor purposes, especially for electric elevators (in comparison with hydraulic elevators) and for electric lighting. An electric railway is to be erected for purely postal purposes between two districts in London.—London *Electrician*, Dec. 26, 1913.

Wires, Wiring and Conduits

Resistivity of Copper from 20 *Deg. C. to* 1450 *Deg. C.*—E. F. NORTHRUP.—An account of an extended and very careful investigation of the change of the electric resistivity of copper in the temperature range from 20 deg. C. to 1450 deg. C. The general arrangement of the tests and the electric furnace employed are described. Tests were made with rising as well as falling temperature. The results are given in tables and diagrams. The chief results are summed up in the accompanying table for copper of 99.39 per cent conductivity.—*Jour. Franklin Inst.*, January, 1914.

VALUES FOUND FOR COPPER OF 99.39 PER CENT CONDUCTIVITY

Temperature, Deg. C.	Resistivity, Microhms per Cm. Cube	Ratios ρ_t/ρ_{t_1}	Remarks
20	1.7347	$\rho_{1000}/\rho_{20}=5.129$	Metal solid.
1000	9.42		
1082.6	10.20		
1082.6	21.30	$\frac{\rho_m}{\rho_s}=2.088$	Metal molten.
1100	21.43	$\rho_{1450}/\rho_{20}=13.96$	Highest measurement was 1443 deg. C.
1340	23.39		
1450	24.22		

Elasticity of Copper Wire and Passage of a Current.—H. L. DODGE.—An account of determinations of Young's modulus of a specimen of copper wire at various temperatures between 20 deg. C. and 150 deg. C. with the object of ascertaining whether or not heating by an electric current has any effect other than that caused by the accompanying increase of temperature. Some of the results are as follows: A copper wire can be brought to a steady elastic state in which the stretch modulus becomes a function of temperature. In the present instance it was brought about by repeated stretching and by heating and cooling over a range of temperature of 20 deg. C. to 150 deg. C. Heating by an electric current has no effect other than that caused by the accompanying temperature. Young's modulus of a copper wire decreases with increase of temperature at an increasing rate. Heating and repeated stretching increases Young's modulus.—*Phys. Review*, December, 1913.

British Wiring Rules.—F. BROADBENT.—An article illustrated by diagrams pointing out that there is still a great lack of appreciation on the part of manufacturers and contractors of the conditions to be fulfilled in factory work in order to comply fully with the British Home Office requirements. This makes it exceedingly difficult for those whose business it is to plan and supervise such work to insure that the conditions are fulfilled without their being stigmatized as faddists or cranks. —London *Elec. Review*, Jan. 2. 1914.

Switchboard Rules.—A summary of the new switchboard rules of the German Association of Electrical Engineers with a comparison with the rules of other associations.—London *Elec. Review*, Jan. 2, 1914.

Oil Switches.—W. J. P. ORTON.—A sketch of the evolution of modern oil switches.—London *Elec. Review*, Jan. 2, 1914.

Electrophysics and Magnetism

Thermionic Currents.—IRVING LANGMUIR.—An account of an experimental research on the effect of space charge and residual gases on thermionic currents in high vacuum. The work indicates that the experimental conditions that have commonly been employed in the investigation of thermionic currents in vacuo have not been well adapted to eliminate important secondary effects. Proper conditions are an extremely high vacuum and the avoidance of large anodes. Contrary to the ordinary opinion, the general effect of very low pressures of gas is greatly to reduce the electron emission from an incandescent metal. This effect is especially marked at low temperatures. In most cases it probably disappears at very high temperatures. The normal thermionic current from tungsten in a "perfect" vacuum follows Richardson's equation accurately. Preliminary data are given for the electron emission from tantalum, molybdenum, platinum and carbon. The effect of the presence of other gases was also studied.—*Phys. Review*, December, 1913.

Equations of Electrodynamics.—H. R. HASSE.—A mathematical paper in which the author shows that it is not possible to deduce a unique system of electrodynamical equations for matter in motion by means of the principle of relativity, the corresponding equations for matter at rest being assumed to be known. In other words, the knowledge of the electrodynamical equations for matter at rest, which we may deduce from experimental evidence and not necessarily from any theory of the constitution of matter, together with the principle of relativity, is not sufficient for the deduction of the equations of electrodynamics for matter in motion. The author shows, however, how the principles of relativity, in combination with certain other conceptions, may be used to complete the scheme of electrodynamical equations.—*Philos. Mag.*, January, 1914.

Heating Effects at the Anode in Vacuum Tubes.—B. HODGSON.—The author found formerly that the energy communicated to the anode during discharge in air was approximately proportional to the current through the tube. In the present paper he presents the results of an investigation on the relation between current, gas pressure and energy given to the anode in oxygen, and, further, on the relation between the energy communicated to either electrode and the corresponding distance. The mechanism of discharge is also discussed. —*Philos. Mag.*, January, 1914.

Gamma Rays of Polonium, Radium and Radio-Actinium.—A. S. Russell and J. Chadwick.—A paper in which methods of separating radium D, radium E and polonium in the pure state in a form suitable for physical work are described in detail. The gamma radiations from polonium, from radium and from radio-actinium were investigated. Polonium emits gamma radiation of one type only. The radiation is due to the polonium itself and is not due to impact of the alpha rays of polonium against the metal on which it is deposited. The alpha rays of polonium are able to excite a soft gamma radiation in copper, though not to an appreciable extent in platinum or in lead. A very small quantity of beta radiation is also emitted by polonium. Radium itself freed from its products emits gamma rays. This gamma radiation consists of three types, one of which is much softer than the other two. The quantity of polonium separated from two different quantities of old radium of known age was about one-half or one-third of that which could be expected if the separation were approximately quantitative and the period of radium *D* were sixteen and one-half years. Radio-actinium emits two types of gamma rays.—*Philos. Mag.*, Jan. 9, 1914.

Delta Rays from Gases.—Norman Campbell.—A paper in which there is considered the theory of the conduction occurring through an ionized gas when the pressure of the gas is so low that the free path of an electron is not small compared with the distance between the electrodes and the number of ions made in the gas is not large compared with the number of delta rays made at the electrodes. The discussion is based mainly on the recent work of Franck and Hertz on the collisions between electrons and atoms. The results of some measurements published previously are also considered in the light of the theory. They seem in general accordance with that work. They cannot be explained quantitatively at present, but it appears that they make it necessary to believe that delta rays are emitted from ionized molecules of gases with velocities of the same order of magnitude as those from metals.—*Philos. Mag.*, Jan. 1, 1914.

Magnetic Susceptibility of Gases.—W. P. Roop.—An article in which a new method for determining gas susceptibility is developed which far exceeds previous methods in sensitiveness. An illustrative set of data taken with air and CO_2 leads to the value for oxygen of 0.144×10^{-6}—*Phys. Review*, December, 1913.

Units, Measurements and Instruments

Roentgen-Ray Tube.—W. D. Coolidge.—An illustrated description of a powerful Roentgen-ray tube with a pure electron discharge. As compared with tubes of the ordinary type, the new tube has the following special features: The pressure, instead of being a few microns, is as low as it has been possible to make it, that is, not more than a few hundredths of a micron. The cathode consists of a body which can be electrically heated (such as a tungsten or tantalum filament) and, suitably located with reference to that portion, a ring or cylinder consisting preferably of molybdenum or tungsten or other refractory metal. The ring or cylinder is connected either to the heated portion of the cathode or to an external source of current by means of which its potential may be brought to any desired value with respect to the heated portion. The heated portion of the cathode serves as the source of electrons, while the ring or cylinder assists in so shaping the electrical field in the neighborhood of the cathode that the desired degree of focusing of the cathode-ray stream upon the target shall result. The anti-cathode, or target, functions at the same time as the anode. The operation is satisfactory only when the vacuum is exceedingly high, so high that the ordinary tube would carry no current even on 100,000 volts.

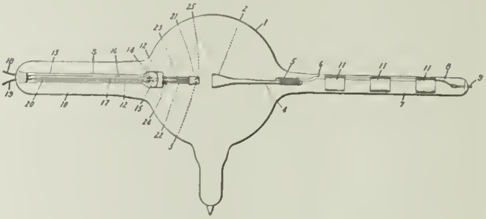


FIG. 2—ROENTGEN-RAY TUBE COMPLETE

Fig. 2 shows the tube complete and Fig. 3 gives details of the cathode and of the front end of the target. In the diagrams, 25 is a tungsten filament in the shape of a flat, closely wound spiral. It is electrically welded to the ends of two heavy molybdenum wires 14 and 15, to the other extremities of which are welded the two copper wires 16 and 17. These in turn are welded to the platinum wires 18 and 19. The molybdenum wires are sealed directly into a piece of special glass 12, which has essentially the same temperature coefficient of expansion as molybdenum. This first seal is simply to insure a rigid support for the hot filament, the outer seal being the one relied upon for vacuum tightness. The outer end, 13, of the support tube is of German glass like the bulb itself, and it is therefore necessary to interpose at *S* a series of intermediate glasses to take care of the difference in expansion coefficients between 12 and 13. The small glass tube 20 prevents short-circuiting of the copper wires 16 and 17. The filament is heated by current from a small storage battery which is well insulated electrically from the ground. In the circuit are placed an ammeter and an adjustable rheostat, and by means of the latter the filament current can be regulated from 3 amp to 5 amp by very fine steps. Over this current range the potential drop through the filament varies from 1.8 volts to 4.6 volts and the filament temperature from 1890 deg. to 2540 deg. absolute. The focusing device consists of a cylindrical tube of molybdenum 21. It is supported by the two stout molybdenum wires, 22 and 23, which are sealed into the end of the glass tube, 12. The electrode is metallically connected to one of the filament leads at 24. Besides acting as a focusing device, it also prevents any discharge from the back of the heated portion of the cathode. The anti-cathode or target, 2, which also serves as anode, consists of a single piece of wrought tungsten having at the end facing the cathode a diameter of 1.9 cm. Its weight is about 100 gm. By means of a molybdenum wire, 5, it is firmly bound to the molybdenum support, 6. The connections and the methods of operating are described and the character-

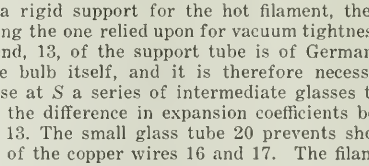


FIG. 3—DETAILS OF CATHODE AND FRONT END OF TARGET

istics of the new tube are summed up as follows: The tube differs in principle from the ordinary type in that the discharge current is purely thermionic in character. Both the tube and the electrodes are as thoroughly freed from gas as possible, and all the characteristics seem to indicate that positive ions play no appreciable rôle. The tube allows current to pass in only one direction and can therefore be operated from either direct or alternating current. The intensity and the penetrating power of the Roentgen rays produced are both under the complete control of the operator, and each can be instantly increased or decreased independently of the other. The tube can be operated continuously for hours, with either high or low discharge currents, without revealing an appreciable change in either the intensity or the penetrating power of the resulting radiations. The tube in question shows no fluorescence of the glass and no local heating of the anterior hemisphere. The starting and running voltage are the same. The tube permits of the realization of intense homogeneous primary Roentgen rays of any desired penetrating power.—*Phys. Review*, December, 1913.

Three-Phase Meters.—LEOPOLD SCHNACKENBURG.—The author points out that erroneous readings are often obtained with three-phase meters, not because the meters themselves are faulty, but for other reasons like faulty connections, accidental interruptions, etc. For different wrong methods of connection the magnitudes of the errors are investigated by means of diagrams, and examples from practice are given showing that such errors happen quite frequently. Means for avoiding such errors are also discussed.—*Elek. Zeit.*, Dec. 25, 1913.

Cable Testing.—M. KLEIN.—A translation of his recent German article on methods of testing cables.—London *Electrician*, Dec. 26, 1913.

Telegraphy, Telephony and Signals

Measuring Capacity in Telephone Circuit.—A note on a recent British patent (No. 2009, 1913) of G. A. Campbell, O. B. Blackwell and E. H. Colpitts and the Western Electric Company, of this country. To measure capacity unbalances in a telephonic phantom circuit, a testing set is used consisting of a variable capacity and means for connecting it in different combinations between an element of one of the pairs of elements of the phantom circuit and both elements of another of the pairs. Means are also provided for determining when the variation in the connected capacity has equalized the capacity between the elements, as well as for indicating the amount of the equalizing capacity. —London *Elec. Eng'ing*, Jan. 1, 1914.

Prepayment Telephones.—TEUFFERT.—The author describes a prepayment telephone system in which the user cannot get connection until he has paid the required fee. His money is returned automatically if the desired connection is not made. In the exchange the prepayment telephones are not marked differently from other telephones. The exchange operator does not ask the user to pay nor does she supervise the payment. The unskilled user cannot pay at the wrong moment. The mechanism employed is described and illustrated.—*Elek. Zeit.*, Jan. 1, 1914.

Miscellaneous

British Patents.—A list of British electrical patents which will expire during 1914. Among them is one of Marconi for the use of a transformer for coupling circuits in wireless telegraphy, whether receiving or transmitting, to the aerial, the circuit and the aerial being tuned to the same frequency or to a harmonic thereof; the patent of Duddell for his musical arc, Pupin's patent for loading telephone lines, a Cooper Hewitt patent for a mercury-vapor lamp, etc.—London *Electrician*, Jan. 2, 1914.

Book Reviews

TELEPHONE CABLES. A handbook of the design, construction and maintenance of the telephone cable plant. By J. C. Slippy. Pittsburgh, Pa.: J. C. Slippy. 147 pages, illus.

A useful pocket book of reference concerning the specifications, tests, records, inspection and maintenance of standard types of telephone multiple-conductor cable, compiled for the use of engineers and cable men. A number of tables and diagrams are given in the book, advantageously arranged for reference. Only standard sizes and types are considered. The eight chapters of the book relate to the following subjects: Specifications, plans, construction, records, long-distance work, inspection, troubles and costs. The volume will be useful to telephone engineers, cable men and "trouble" men, and all who are interested in the technique of telephone cable installation.

THE LIGHTING BOOK. A Manual for the Layman Setting Forth the Practical and Esthetic Sides of Good Lighting for the Home. By F. Laurent Godinez. New York: McBride, Nast & Company. 110 pages, illus. Price, $1.25.

A book intended for the uninitiated and those untrained in the technics of illumination, explaining the elements of useful and pleasing lighting by either gas or electric lamps. The book is divided into twelve chapters on the following topics: Light and the eye; the misuse of light; light and mind psychology; the modification of light; seeing by light transmitted; shading and redirecting light; light on the path; making the most of light; indirect lighting; individuality in lighting; light in the home; light and decoration. Interior artificial illumination has relations to effectiveness, beauty, protection of the eye, cost, gracefulness and psychological effect. It is wonderful how little the average man realizes these relations until they are brought to his attention specifically. The book should interest all who seek to arrange the lighting of their homes.

LES PROGRÈS DE LA CHIMIE EN 1912. A French translation of the annual reports on the progress of chemistry for 1912. Vol. IX. Issued by the Chemical Society, London. Paris, France: Librairie Scientifique, A Hermann et Fils. 405 pages. Price, 7.5 francs.

This volume indicates not only how much research work is being carried on in chemistry all over the world, but also how many branches of chemistry exist. A scientist would have to be a walking encyclopedia to be able to keep fully in touch with all these different branches. The sections into which the work is divided relate to the following branches: General and physical chemistry; mineral chemistry; organic chemistry; analytical chemistry; physiological chemistry; agricultural chemistry; mineralogical chemistry, and radioactivity. Each section has been drawn up by a separate specialist. Nearly 1200 experimenters and authorities are referred to in the course of the work, which interconnects with mathematics, mechanics and physics, to say nothing of geology, physiology and farming. The volume forms a useful reference book for the student of chemistry or chemical physics.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed
Manufactured Products of Interest to Electrical Readers

Combination Tail and License-Number Lamp

A combined tail and license-number lamp fixture, to which any size of number plate can be fastened, is being manufactured by the Combination Tail Light Company, Boston, Mass. The fixture consists of a single metal stamping, which, as shown in the accompanying illustration, has its inside coated with white enamel to reflect light onto the number plate through the slot at the bottom. The lamp socket, which is fastened to the stamping by a twist-lock joint, may be removed quickly and the entire fixture washed with a hose. These tail-lamp fixtures can be furnished with a single red or blue lens or with a combination of the two as favored by some state legislatures.

COMBINED TAIL AND LICENSE-NUMBER LAMP

Concrete Poles and Lamp Standards of Light Construction

Concrete poles and lighting standards weighing less than two-thirds as much as the ordinary types of concrete structures of the same length are being put on the market by the Chicago Concrete Pole Company, 29 South LaSalle Street, Chicago. It is said that the reduced weight of the poles renders them easily transportable, so that it will not be necessary to carry on construction work at the erection site. Fig. 1, a perspective drawing of a section of one of these poles, shows the position of the high-carbon steel reinforcing rods and illustrates the method by which they are secured in position by two soft-iron wires. The amount of concrete in the poles has been reduced to a minimum, only enough being left to cover the steel properly. Concrete cross webs which act as steps on the line poles are cast monolithic with the longitudinal ribs. Either steel or wooden cross-arms may be used with the line poles, two bolts hooking over the ribs of the pole at the back and being fastened at the front of the cross-arm with nuts and washer, constituting the approved method of cross-arm support. Braces are not needed.

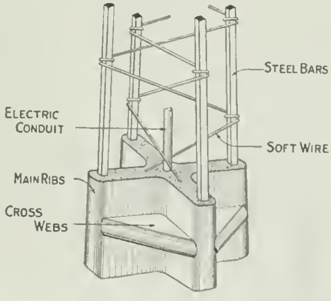
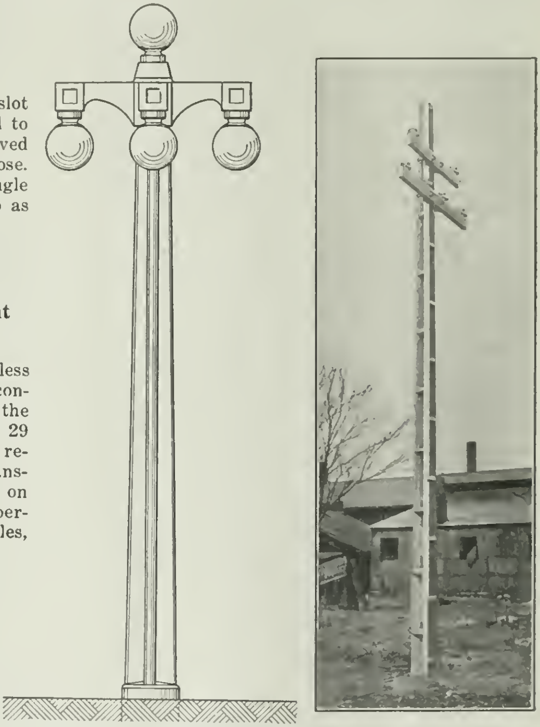


FIG. 1—CONCRETE SECTION AND REINFORCING

In a test conducted on a 35-ft. pole, such as is shown in Fig. 3, 2600 lb. applied at the top of the pole produced a 31-in. deflection with no permanent deformation. The pole was set 7 ft. in the earth. An examination made when the pole was at the point of greatest deflection failed to show any perceptible cracks. Such a 35-ft. pole measures 14.37 in. square at the base, 4.5 in. at the top and weighs 2200 lb.



FIGS. 2 AND 3—CONCRETE LAMP-POST AND CONCRETE POLE

The concrete lighting standards (Fig. 2) will not be equipped with steps for climbing nor will the soft steel wire be interlaced between the reinforcing rods. Conduit conducting the electric circuit up the center of the pole leads to a cut-out box at the joint of the extension arms. The switch box had been placed at this point in preference to the usual position near the ground line. The conduit in the extension arms acts as reinforcement for these members. The units will be made in either three-lamp or five-lamp styles, and where additional ornamentation is desired designs may be tooled on the exterior of the posts. Since crushed quartz and cement are the sole ingredients of these units the effect of tooling the exterior is to produce a surface which sparkles and flashes as the rays of the sun or the lamp are reflected from the faces of the exposed quartz crystals.

Electric Trucks in Government Service

The number of electric trucks in the service of the United States government is continually increasing, and the rapid expansion of the parcel-post field indicates that hundreds more of these vehicles will soon be added for that branch of the Post Office Department.

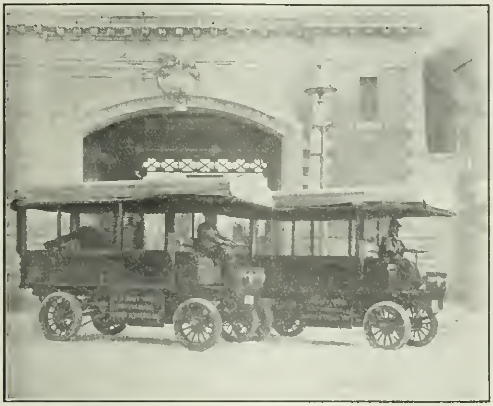


FIG. 1—TWO OF TWELVE ELECTRIC TRUCKS, BOSTON NAVY YARD

Eight navy yards, three arsenals, the Government Printing Office at Washington, a naval hospital and two army depots use electric trucks, while in Manila, P. I., approximately forty are in the service of the War Department and the various branches of the Philippine government. The latter's bureau of supply formerly hired horses and mules from the department of sanitation and transportation of the city of Manila to do its trucking and transportation work. In 1909 a 1-ton General Vehicle truck was installed by the division of cold storage, which furnishes ice, distilled water and refrigeration to the general public as well as to the various government offices. The satisfaction given by this truck was such that in the three years between September, 1909, and September, 1912, twenty-four more trucks of the same manufacture were installed. These wagons range in rating from 1-ton to 5-ton capacity and have given good service under the severe tropical conditions of the Philippine Islands.

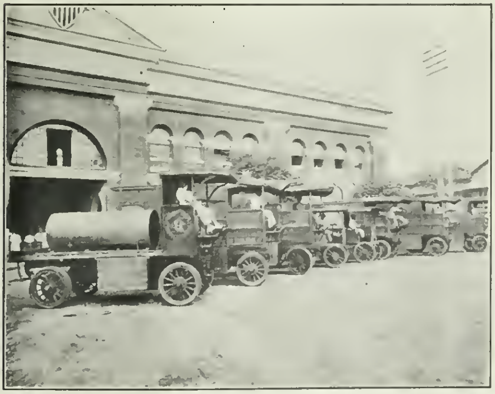


FIG. 2—ELECTRIC TRUCKS, DIVISION OF COLD STORAGE, MANILA, P. I.

Of the sixty-five General Vehicle Company trucks in the service of the United States government thirty-three are in Manila, twelve in New York City, two in Boston, two in Philadelphia, one at Frankford, five in Washington, two in Charlestown, two in Brooklyn, one at Portsmouth, N. H., and one at the Puget Sound navy yard. The library of Congress and the Bureau of Standards at Washington each have two.

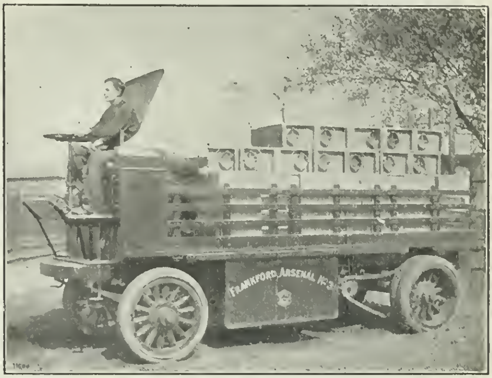


FIG. 3—FIVE-TON ELECTRIC TRUCK LOADED WITH SMOKELESS POWDER, FRANKFORD (PA.) ARSENAL

On account of its reliability and economy of operation the electric truck has earned the recognition of the government officials, and it is reported that one Washington department which replaced several gasoline and horse-drawn wagons with electric trucks about two years ago has thereby averaged savings amounting to $1,000 annually on each of the battery-driven cars installed.

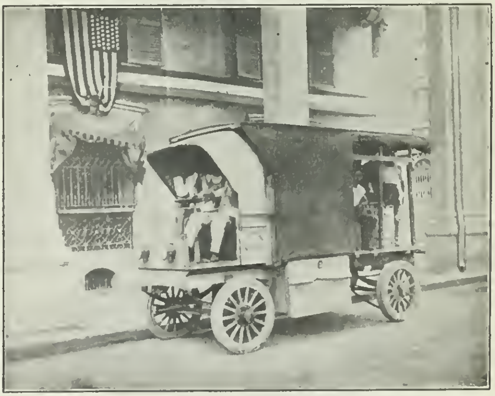


FIG. 4—TWO-TON TRUCKS USED BY PHILIPPINE CONSTABULARY

Iron Cross-Arm of Semi-Circular Section

The Specialty Device Company, Cincinnati, Ohio, has just placed on the market a type of cross-arm made up of seamless boiler tubing. In the process of manufacture, each of the iron tubes is split lengthwise and receives a muriatic acid bath to remove all scale and rust. The clean metal semi-circular sections are then coated with asphaltum paint.

CHARCOAL-IRON CROSS-ARM

For giving the arm a secure position in the pole gain, a filler plate is placed across the open side of the semicircle at the center of the arm. The hole for the screw board extends through both the arm and filler plate. Holes for placing pins and through-bolts are bored 0.5 in. in diameter, while holes for the braces are bored 0.375 in. in diameter. The pins used in connection with these arms are of iron cast in such shape that they conform to the circular sections of the cross-arms. No opportunity is given for the pin to slip in any direction after it has been bolted in place. The insulator thread is of the coiled-spring type.

Electric Heat-Storage Apparatus

An electric heat-storage device has been invented by Mr. Charles Hässler, of Stockholm, Sweden, by means of which energy can be utilized at off-peak periods and stored for use at all times. The apparatus consists of a heat-storing "magazine" 1 (Fig. 2), a heat-radiating cover 5, a heat-insulating material 2, the electrical resistors 7, and a heat-regulating device 3. When the heater is to be operated the damper 3 is closed so that all the heat generated by the electric resistors 7 is stored in the magazine, which is carefully insulated against heat losses. Whenever it is desirable to have the apparatus deliver heat the damper 3 is opened a certain amount. Heated air in proportional quantities is then forced to pass, as indicated by the arrows in Fig. 2, from the air channels 6 in the heat-storage magazine to the air channels 9 and finally back to 6, thereby giving off heat to the surface 5 and also causing the latter to radiate heat.

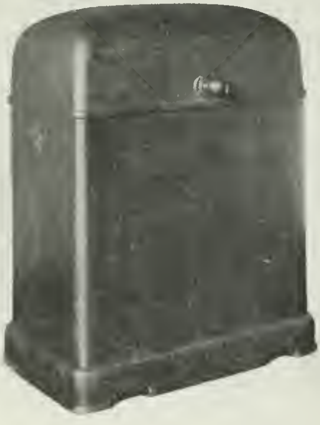


FIG. 1—HEAT-STORING APPARATUS

By properly adjusting the damper the heat generated by the electric resistances can be conducted at will either to the storage magazine or to the radiating surface, or to both of them. Regulation of the electrically generated heat can also be obtained both as to the time at which the stored heat is to be delivered and the rate at which the heat is to be generated, stored or delivered. Provided that the details of the apparatus are properly dimensioned, it is therefore possible to maintain the temperature of a room or of a certain amount of water or other liquid constant at all times, regardless of the time the electric current is switched off. The apparatus thus takes the place of an electric-heating plant with the electric current available at low off-peak-period rate.

The damper can be regulated manually or automatically by relays in combination with thermometers and circuit-breakers to obtain a constant temperature.

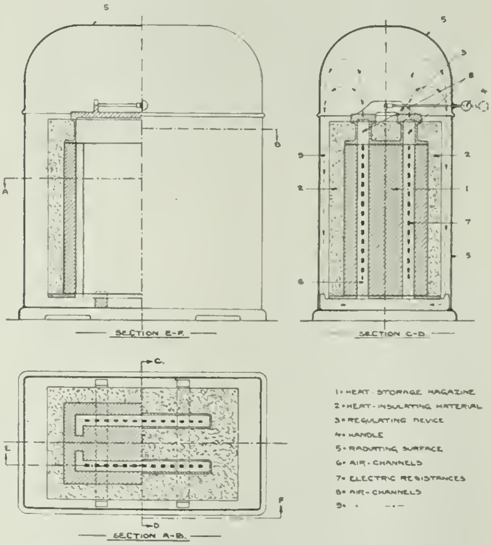


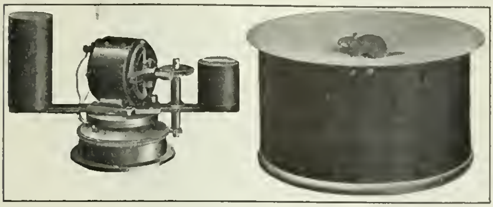
FIG. 2—SECTIONS OF HEAT-STORING APPARATUS

The construction of the apparatus in sections makes it possible to construct each part to suit best its own specific functions. The storing magazine proper is constructed so as to obtain the best storing capacity, while the outer surface is designed to radiate the heat in a uniform and rapid manner.

The fact that the heat-conducting air circulates in a closed system of channels within the apparatus is important. The temperature of the circulating air and the heat-storing magazine is therefore independent of the temperature of the surrounding atmosphere. It is possible, therefore, to use very high temperatures in the heat-storing magazine. By experiments with the apparatus shown in the illustrations herewith a temperature in the storing magazine of about 600 deg. C. has been obtained. The apparatus has a storing capacity of about 25,000 kg-cal., and it measures 34 in. high, 14.25 in. wide and 25.75 in. long. The initial cost of the equipment is quite low, owing to its simple construction. The device is patented in several European countries and also in the United States.

Motor-Driven Advertising Device

A motor-driven advertising display known as "the machine of a thousand mysteries" has been brought out by the Electro Novelty Company, 160 North Fifth Avenue, Chicago. A worm gear on the motor shaft drives an intermediate shaft, which in turn engages a rack on the fixed base of the machine. Through these reducing gears the motor thus drives the magnet at the end of its counterweighted arm. Toys placed on the surface of 22-in. glass disk are fitted with light steel bases, and as the revolving magnet sweeps under them the toys are attracted and follow the circular path of the revolving arm. Striking effects are obtained by placing more than one toy on the surface of the disk at one time, as only a portion of the figures will be carried by the magnet at each round.



ADVERTISING DEVICE

The completed black vulcanized fiber case measures 22 in. in diameter and is 11 in. high. Motors and magnets are supplied for use on either alternating-current or direct-current circuits. It is said that the device can be operated for about 1.5 cents a day.

Four-Ton Electric Dumping Truck

The Baker Motor Vehicle Company, of Cleveland, Ohio, has developed a new 4-ton dumping truck body which is mounted on the company's standard 4-ton chassis.

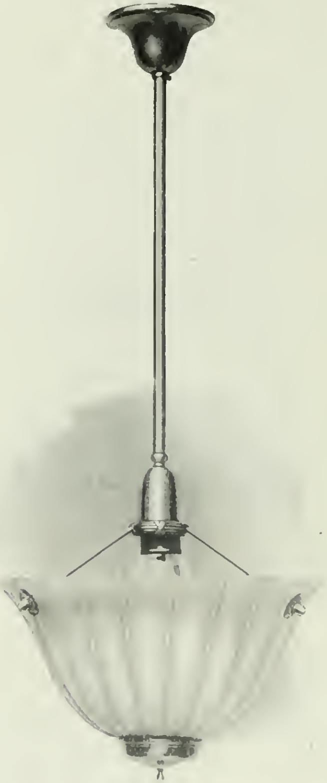
ELECTRIC DUMPING TRUCK

The dumping body is made of sheet steel reinforced with angle iron, and the floor is formed of steel channels riveted together and covered with a smooth steel plate. The tail gate is locked and unlocked by a lever at the side of the driver's seat. The body can be tipped to an angle of 45 deg. The tipping is done by two arms, one on each side of the body. These arms are fastened to a large steel crank shaft which revolves in one direction only. Two-thirds of a revolution is required to tip the body and one-third to lower it. This operation permits the body to come down to its position on the chassis frame in half the time required to raise it for dumping. The body may be raised and lowered back to its regular position in fifty seconds.

The dumping is done either by a hand crank or an auxiliary motor mounted under the seat, which is driven through a shaft and eight-spur worm-gear reduction on the crankshaft. This shaft runs in oil and is contained in a dust-proof housing.

Detachable-Bowl Semi-Indirect Lighting Fixture

The semi-indirect lighting fixture illustrated herewith is the product of the Multilux Illuminating Company, Cleveland, Ohio. The bowl, which is made of effulgent glass, is supported by three detachable brass-plated steel suspension rods. One end of each rod is ball-shaped and fits into a groove in the socket cover. The opposite end is equipped with a hinged ornamental stud which makes the bowl self-aligning and prevents the rod from falling out.

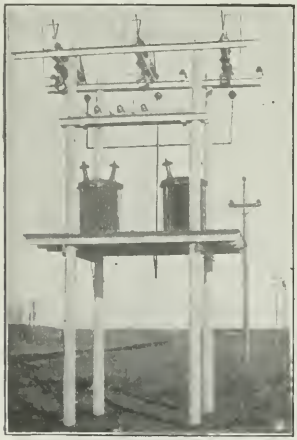


SEMI-INDIRECT LIGHTING UNIT

The glassware can be cleaned by simply lifting one of the suspension rods from the groove in the socket cover and swinging the bowl down on the other two rods. A spring-cap receptacle is attached to the bottom of the bowl for holding dirt accumulations which would otherwise mar the appearance of the bowl. This cap does not diminish the efficiency of the glassware to any great extent, nor does it cast an appreciable shadow because the intensity of light at the end of a tungsten lamp is not very high.

Outdoor High-Tension Substation

The increasing tendency toward standardization of equipment is well shown in the acompanying illustration of a standard 22,000-volt three-phase substation manufactured by the Delta-Star Electric Company, Chicago, Ill., which can be shipped complete and ready for erection. The central-station manager is thus enabled to order a complete "ready-to-use" station just as easily as a package of lamps or meters. All the parts of the outfit shown are of standard dimensions, and in erecting the equipment a minimum expenditure of time and money is therefore necessary. The high-tension control and protective equipment is of the "MRC" type, and the poles may be of either wood or steel as desired.

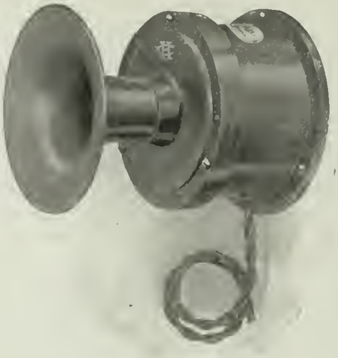


OUTDOOR SUBSTATION

Direct-Current 220-Volt Factory Horn

An electric factory horn designed to operate on 220-volt direct-current energy without sparking at the vibrator contacts has been developed by the Holtzer-Cabot Electric Company. The difficulty heretofore in making vibrator horns operate satisfactorily at this voltage was in finding a suitable resistance and condenser which combined would prevent arcing at the vibrator contacts. With the resistance wire selected and the method used in winding it the proper reactance for 220-volt operation is now obtained.

Electric horns are sometimes better adapted for code signaling than are bells, as the sound of the latter may be mistaken for the usual noises occurring around a factory, or vice versa. The electric horn illustrated is similar in most details to the other horns manufactured by the company. The life of the vibrator springs is considerably increased by clamping them between fiber rather than metal grips, as the latter hold the springs so rigidly that fractures are often caused by crystallization. The average power taken by these horns is about 20 watts, but when connected up with too small wire and operating on less than normal voltage the momentary starting current will cause energy losses in the wiring which should not be attributed to the horn. The horns will operate on one-third less voltage than that for which they are rated, although such practice is not recommended.



ELECTRIC FACTORY HORN

General Utility Portable Lamp

A portable lamp which can be adapted to a variety of conditions is being manufactured by the Wallace Novelty Company, 299 Madison Avenue, New York. This device consists of a lamp mounted on its base by a practically universal joint, while in the base is concealed a reel on which the flexible connecting cord can be wound to take up slack. Fastened to the lamp bulb by an ingeniously designed clip is a reflector which can be adjusted to any position, making the lamp suitable for the office, home or vacation trip. Also mounted in the base is a rubber suction cup and a combined hook and clamp for fastening the device to a mirror, chair, bed or wall. To wind the cord on the reel it is necessary to use the lamp bulb and socket as a crank. The portable lamp is 12 in. high and weighs only 1.5 lb. including 10 ft. of silk flexible cord and plug.

PORTABLE LIGHTING FIXTURE

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Information on Generating and Transmission Apparatus Wanted.—C. D. Orr, of Yazoo City, Miss., is anxious to obtain information from manufacturers of all equipment and supplies necessary for the erection of a 5000-kw generating station and a transmission line about 100 miles long. Catalog prices and correspondence are invited by Mr. Orr, addressed as above.

Small Michigan Station Making Good Showing.—The Hart Milling & Power Company, of Flushing, Mich., has in operation a 2300-volt, sixty-cycle plant, of 150-kw rating, supplying electric service to that village. Its business, started a short time ago, has shown such a rapid growth that it is contemplating within the year the installation of an additional 250-kw to 300-kw generating unit.

Electric Steel Company to Build New Plant.—The site for a new steel plant has been acquired by the Electric Steel Company, of Indianapolis, Ind., and construction work will be started shortly. The plant will be located at Speedway, a suburb adjoining the Indianapolis Motor Speedway, and in it there will be made a high grade of steel especially adapted for use in automobile construction. Electric furnaces are used in the production of this steel.

New Electric Truck Being Tested.—The Wagenhals Motor Company, of Detroit, Mich., has put out for test purposes a new electric commercial car. The general plan of the car is the same as that of the company's regular three-wheel gasoline vehicle of 800-lb. carrying capacity. A General Electric motor is used, supplied with energy from a twenty-four-cell "Exide" storage battery. The electric vehicle is planned to sell for about 15 per cent more than the gasoline car of the same carrying capacity.

Electric Vehicle Factory Closed for Inventory.—The Kentucky Wagon Manufacturing Company, of Louisville, Ky., maker of commercial electric vehicles, has been closed down for about two weeks, during the annual inventory, but will resume operations shortly. R. B. Board, president of the company, recently announced a complete reorganization of the factory force. No reduction of the force was made, except that several foremen were replaced. The sales department is to be reorganized before February.

Planning Western Lamp Factory.—The Westinghouse Lamp Company, which recently moved its executive offices from Bloomfield, N. J., to New York City, is contemplating the establishment of a Western factory, and the plant formerly used by the Kissel Motor Car Company, at Milwaukee, Wis., is favorably considered. Negotiations are now under way toward securing this factory. This move represents the first step in a general policy of expansion of manufacturing facilities to meet the growing demand for Westinghouse lamps.

Meter Shipments by Parcel Post.—In a test recently conducted by the Sangamo Electric Company, Springfield, Ill., four electric meters were shipped from the factory to Boston, Mass., over a route which necessitated four handlings at transfer points. The meters were packed in a corrugated board and a wooden box without excelsior. Upon their return to the factory over the same route tests showed them to be as accurate as when they left the factory. As the result of this trial and of the increase in parcel-post weight limit the Sangamo company are planning to use the mails extensively for shipments up to and including four meters.

Westinghouse Company Reduces Hours Temporarily.—Rumors to the effect that the Westinghouse Electric & Manufacturing Company had instituted a reduction in the salaries of its employees were explained by the recent statement of G. E. Tripp, chairman of the board of directors of that company, who said that no such step has been either taken or contemplated, but that the factory force has been put temporarily on a schedule of forty-five hours per week, instead of the usual fifty-four-hour schedule, because of a decline in production activity. C. A. Terry, vice-president of the company, stated to an *Electrical World* representative in a recent interview that this plan had been adopted in place of the usual method of reducing the force, as business showed a falling off.

$25,000,000 for Electric Auto Starters in 1914.—Mr. E. L. Jones, of the Jones Electric Starter Company, speaking before the Chicago Jovian League on Jan. 19, said that it had been conservatively estimated that $25,000,000 would be spent during the year 1914 for automobile electric-starting equipments. About $2,500,000 will go to the manufacturers of storage batteries and a like amount will be spent for gears and silent chains. The starter manufacturers' business will amount to about $15,000,000 and the remainder will represent profits of agents and dealers. Questioned about the extra cost of operating a car with an electric starter, Mr. Jones quoted from tests made by the Packard company on a 32-hp machine in which the additional expense as shown in the gasoline and oil bills was $7.20 for 10,000 miles. This test assumed that the car would be started once every three miles and that the lamps would be operated continuously.

Sulphur Mining Equipment for Texas.—Westinghouse, Church, Kerr & Company, of 37 Wall Street, New York, are at present engaged in the construction and equipment of a second plant for S. M. Swanson & Sons, at Freeport, Tex., where extensive sulphur mining operations are already being carried on. The process is a novel one and is said to be much more economical than the usual method of refining. The sulphur occurs in spongy rock strata about 800 ft. underground. Holes are drilled into these deposits and water at about 330 deg. Fahr, and between 100 and 250 lb. per sq. in. pressure, is forced into the sulphur veins. This hot water melts the sulphur, which is then brought to the surface by means of air lifts. The sulphur obtained in this way is said to be in a very pure state. A generating station is in process of construction and will probably be equipped with a Westinghouse three-phase, sixty-cycle turbo-generator. From this station a wooden-pole, three-phase, 2200-volt transmission line will be built to the company's docks to supply electricity for the ship-loading equipment and for pumping oil fuel for the boilers.

Commercial Vehicles to Be Sold Under New Plan.—The General Motors Truck Company, of Pontiac, Mich., has adopted a new policy, regarding the sale of its gasoline and electric commercial vehicles, which is worthy of notice. At the present time there is much agitation in every line of merchandising for the sale of a service along with the product sold, and the character of the service runs all the way from the maintenance of repair stations and the guaranteeing of rapid replacements to the providing of skilled operators. Also there has been a tendency toward longer credits, particularly in the automobile trade. This company claims to have found that its service arrangements and credit policy were not producing the best results, either for itself or its customers, and it proposes in the future to sell its product without service plan and on shorter credits, claiming that it can reduce the prices on its cars materially by so doing. In place of the old service arrangements, the company plans to put extra effort on the proper selection of units for each customer's individual needs, in other words to attack the trouble at its source and by good engineering at the time of sale eliminate to a large measure the necessity for service arrangements. It will be of interest to note what success attends this move, counter to the general tendency of the day.

Manufacturers of Transmission Line Specialties Busy.—The following statement by J. T. Hickey, of the firm of Hickey & Schneider, 227 Fulton Street, New York, makers of transmission line specialties, gives an idea of the present activity in that branch of the electrical industry as seen by his company. He says, in part: "We wish to state that business during 1913 was, on the whole, very satisfactory; in fact, greatly surpassed our expectations. As for the coming year, we have secured enough orders since the first of January for our line-disconnecting switches and splicing sleeves to keep us busy for many months to come, and we have in view and have quoted prices on about as much work as we can conveniently take care of, under present conditions, for the rest of the year. We expect to keep our present factory busy for some time to come."

Storage-Battery Business Satisfactory.—The Willard Storage Battery Company, of Cleveland, Ohio, is at present working on a schedule of 1000 cells a day and expects this activity to continue. A large part of this production goes into automobile equipment sets for starting and lighting and ignition, but a good business is done in train-lighting equipment, which line is growing steadily. In the latter field the company has recently prepared a particularly favorable contract form which guarantees the performance of the battery under proper handling and provides for replacement of positive elements which fail to meet the guarantee. Some export business is done and a method has been devised for shipping the batteries in a charged state without the electrolyte. The present battery put out by the Willard company is of specially rugged construction and is capable of being sealed up tight against both air and water. The burnt-lead connections are standard, but an excellent bolted connection is used where desired. For automobile work the 6-volt battery is predominant at the present time, but a gradual drift toward the 12-volt battery is noticed.

Unified Operation of Chicago Surface Railways.—The Mayor and City Council having sanctioned the unified operation of the surface street railways of Chicago owned or controlled by the Chicago City Railway Company and the Chicago Railways Company, an organization has been formed for unified operation, known as the Chicago Surface Lines. The board of operation provided for consists of Henry A. Blair, John M. Roach, Charles C. Adsit and Wallace Heckman, representing the Chicago Railways Company, and Leonard A. Busby, Ira M. Cobe and Frank O. Wetmore, representing the Chicago City Railway Company. Mr. Blair was elected chairman of the board, and he and Messrs. Cobe and Busby were made members of the executive committee, Mr. Cobe being chairman of the executive committee. John J. Mitchell, president of the Illinois Trust and Savings Bank, was elected umpire to determine any differences that may be referred to him. Officers of the Chicago Surface Lines, acting under the supervision of the board of operation, were elected as follows: President, Leonard A. Busby; vice-president, Williston Fish; general auditor, John J. Duck; treasurer, Markham B. Orde; assistant treasurer and secretary, Fred D. Hoffman; assistant secretary, Frank L. Hupp; general counsel, W. W. Gurley. Universal transfers will be given on Feb. 1, and through-routing will be put into effect gradually thereafter.

Cedar Pole News of Interest.—At the annual meeting of the Western Red Cedar Association in Spokane, Wash., on Jan. 12, some matters of interest to users of cedar poles were brought up in the address of H. C. Culver, retiring president of the association. Mr. Culver's remarks were in part as follows (referring to Western red cedar): "During the first part of 1913 poles, posts and piling moved freely at fair prices, but a general recession of trade took place during the latter half of the year, and to-day the industry is in a very unsatisfactory state. I believe, however, that a more healthy condition will shortly prevail. Stocks are low but fairly well assorted. Owing to several adverse factors, it is expected that the output during the present winter will be greatly restricted. In the United States there are more than 800,000 miles of pole lines in use by the electrical industry, and on these lines there are in service more than 32,000,000 poles. The annual renewal requirements are over 4,000,000, and of these large totals about 65 per cent are cedar. We should use our utmost efforts to have the National Electric Light Association adopt our specifications for cedar poles. Since large quantities of poles are purchased annually under specifications suggested by that body, the advantages of such action are obvious. A display of Western red cedar at the Forest Products Exposition in Chicago, April 30 to May 9, and in New York, May 21 to 30, would no doubt prove a great advantage to our industry." Favorable action was taken by the delegates upon the two suggestions offered.

Hydroelectric Expansion in New England.—Rapid progress is being made by the New England Power Company in the extension of its service throughout central Massachusetts and the Berkshire district of the State. Through its alliance with the Connecticut River Transmission Company there is now available an installation rated at about 50,000 hp on this system, and more than 200 miles of high-tension lines are in service. Construction is in progress on the 120,000-volt steel tower line between the operating center of the system at Millbury, Mass., and Providence, R. I., and in the late spring it is expected that energy will be delivered to the Narragansett Electric Lighting Company for local distribution. The Somerset (Vt.) reservoir of the New England company is now about one-half filled, and within a few weeks the full 23,000,000,000-gal. capacity of this new basin will be attained, if no unforeseen droughts occur. Generating plant No. 5 will be opened soon, augmenting by 120 per cent the developments already in operation on the Deerfield River. A notable increase of customers has also been gained. The company has closed contracts with the Amherst Power Company, Fitchburg Gas & Electric Light Company, Central Massachusetts Electric Company, Marlboro Electric Light Company, Gardner Electric Light Company, Worcester Electric Light Company and the Worcester Suburban Electric Company. Of the last-named organization the New England Power Company interests have purchased control. In addition to the large network of trolley lines operated in central and southern Massachusetts by this power system, the Hoosac Tunnel electrified train service of the Boston & Maine Railroad is now being operated by hydroelectric energy, the Zylonite turbine station being held in reserve. The Berkshire Street Railway is another recent purchaser of this energy. Gross earnings of the New England Power Company's affiliated transmission lines in 1913 totaled $777,846, and these are now running at the rate of over $1,000,000 per year. The gross earnings in 1912 were $514,445, those of 1911 being $405,206 and of 1910, when the first lines were placed in service, $270,202. Earnings for 1913 show a surplus of $70,000 above operating expenses, proportionate bond interest and dividend requirements of all the properties. Baker, Ayling & Company, of Boston, Mass., are financing these developments, which are under the active management of Chace & Harriman, Inc., of 50 Congress Street, Boston. An extended description of the New England Power Company's system was printed in the *Electrical World* of Dec. 28, 1912.

NEW YORK METAL MARKET PRICES

	Jan. 13		Jan. 20	
Copper:	Bid	Asked	Bid	Asked
Standard, spot*	.....	.. .	. .	14.50
	Selling Prices		Selling Prices	
	£ s. d.		£ s. d	
London, standard, spot*....	62 17 6		64 12 6	
Prime Lake	14.50	.	14.50	to 14.62½
Electrolytic	14.25	...	14.30	to 14.40
Casting	14.00	to 14.12½	14.15	to 14.25
Copper wire base	15.50	....	15.50	....
Lead	4.10		4.10	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter.....	7.50		7.50	
Spelter, spot	5.25	to 5.35	5.25	5.35
Tin, spot	36.85	to 37.00	37.70	to 38.00
Aluminum:				
Prompt delivery	18.75	to 19.00	18.75	to 19.00
Future	18.50	to 19.00	18.75	to 19.00

*OLD METALS

Heavy copper and wire.........	13.50	13.50
Brass, heavy..................	8.75	8.75
Brass, light	7.75	7.75
Lead, heavy	4.05	4.05
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to Jan. 20... 20,415

*From daily transactions on the New York Metal Exchange

Corporate and Financial

Montana Power Company Redeeming Bond Issue.—The outstanding $977,000 first mortgage sinking-fund 6 per cent gold bonds of the United Missouri River Power Company, dated March 1, 1906, have been called for redemption on March 1 by the Montana Power Company at 105 and interest.

Chicago Manufacturer Declares Stock Dividend.—The Kellogg Switchboard Company, of Chicago, Ill., has declared a stock dividend of 25 per cent, in addition to the regular 3 per cent quarterly dividend, which is payable Feb. 3. This move recalls the fact that a similar stock dividend of equal amount was declared last January. The officers and directors of the company for the past year have been re-elected.

Adams-Bagnall Electric Company Stock Increase.—At the recent annual meeting of the stockholders of the Adams-Bagnall Electric Company, in Cleveland, Ohio, a new issue of $300,000 in 7 per cent cumulative preferred stock was authorized. This stock will be taken by holders of the $600,000 existing stock and the proceeds of the sale will be used to finance the construction of new buildings and to pay for improvements already completed. Recently the company's earnings have been largely devoted to the expansion of its production facilities.

Mexican Light & Power Company, Ltd., Suspends Dividends.—In view of the unsettled state of Mexican affairs, the Mexican Light & Power Company, Ltd., has decided to suspend the payment of dividends on its common stock, which payment has been made at the rate of 4 per cent per annum for a number of years. The statement of this change of policy was preceded by an explanation to the stockholders of the reasons leading up to it. For some years it has been the custom to declare the quarterly dividends in advance on the basis of estimated earnings for the year. However, during the last three months the conditions in Mexico have not improved, and it is not possible to forecast the earnings with any degree of certainty, so it was judged best to discontinue, temporarily, the payment of common-stock dividends.

Pacific Coast Utility Floats Bonds.—Through a syndicate the Puget Sound Traction, Light & Power Company has just put on the market a seven-million-dollar issue of five-year 6 per cent mortgage gold bonds, which were sold to meet the maturing, on Feb. 1, of $7,500,000 of the company's two-year 5 per cent mortgage gold notes. The new issue is secured by a first mortgage on substantially all of the property formerly owned by the Seattle-Tacoma Power Company, before its consolidation, in January, 1912, with the Pacific Coast Power Company, the Seattle Electric Company, the Puget Sound Power Company and the Whatcom County Railway & Light Company. The other utility concerns now included in the Puget Sound system are the Pacific Northwest Traction Company and the Puget Sound Electric Railway. A present installed rating of 108,900 hp in electric generating equipment is possessed by the plants of the company, and of this over 70 per cent is hydraulically developed. During the fiscal year ended Dec. 31, 1913, the gross earnings of the system totaled $8,613,599 and the operating expenses plus taxes amounted to $5,008,375, leaving net earnings of $3,605,224. Upon payment of the notes falling due Feb. 1 the outstanding capitalization of the Puget Sound Traction, Light & Power Company will be $20,112,300 common stock (now paying 4 per cent) and $14,792,100 of 6 per cent cumulative preferred stock.

Annual Report of the Dayton Power & Light Company.—The annual report of the Dayton Power & Light Company for the fiscal year ended Dec. 31 showed that the gross business amounted to $740,349, representing a gain of $53,460 over the figures for 1912. Operating expenses, however, showed a very large increase during 1913, being $90,035 more than in the previous year, so that the effect of the increase in gross was more than offset and net earnings for 1913 were $45,635 less than in 1912. The surplus for 1913 was $10,150. In his report to stockholders F. M. Tait, president of the company, touches upon the effects of the spring floods and the present outlook as follows: "During the flood both of our plants were under water for more than fifty hours, and it was forty-eight hours later before the water receded sufficiently to allow us to get into the plant. The company was one of the first to aid the sufferers, and its contribution of $50,000 to the flood prevention fund did much to help swell the total to $2,159,744. Other help was extended gratis to the business men of the city, in the matter of supplying electric pumps to remove the water from the buildings. The value of the feeling of cordiality now entertained by the people of Dayton toward the company is amply demonstrated by the fact that 73 per cent more meters were installed in 1913 than in 1912. The outlook for business in 1914 is extremely bright, and I believe it will be the most profitable year the company has ever had."

Last Move in the Columbus Utility Merger.—At the annual meeting of the Columbus (Ohio) Edison Company stockholders voted to sell the property and assets of the company to the Columbus Railway, Power & Light Company for a consideration in stocks of the latter company, as provided under the merger agreement. The consolidation of all public utility properties in Columbus, with the exception of the Columbus Light, Heat & Power Company, will become effective Feb. 2, the Columbus Edison having been the last corporation to act on the consolidation. The Columbus Light, Heat & Power Company will remain outside the merger, but its properties will be operated by the Columbus Railway, Power & Light Company, under the existing lease to the Columbus Railway & Light Company. At the annual meeting of the Columbus Light, Heat & Power Company the board of directors identified with the Columbus Railway & Light interests retired and was succeeded by a new board representing the former officers and directors of the Columbus Public Service Company, which the Columbus Light, Heat & Power succeeded. C. L. Kurtz was elected the new president. It is expected that after the consolidation has been in effect for some time steps will be taken by which the Columbus Light, Heat & Power Company will also enter the merger and thus place all the public utility properties of Columbus under one owning, as well as one operating, corporation. In the *Electrical World*, issues of Nov. 29 and Dec. 6, details concernnig this merger were given. The reorganization, which has been contemplated for some time, was officially approved on Nov. 26, 1913, through the efforts of Mr. S. G. McMeen, president of the Columbus Railway & Light Company.

National Carbon Company Matters.—On Jan. 10 a circular letter was sent to the stockholders of the National Carbon Company, of Cleveland, Ohio, announcing the date of the annual meeting at Trenton, N. J., as Feb. 16. At that time the stockholders will be asked to approve a plan whereby the capital stock of the company will be increased from $10,000,000 to $17,600,000. At present the company has outstanding $5,500,000 of common and $4,500,000 of 7 per cent non-cumulative preferred stock. It is proposed to increase the common stock to $12,000,000 and the preferred stock to $7,600,000, making the latter 7 per cent cumulative. As a reward to its faithful employees the company plans to set aside $500,000 of the new common stock, which will be sold to such as are interested. In a letter from James Parmelee, president of the company, the reasons back of the proposed financing are explained as follows: "For several years past the company's business has grown largely along lines dictated by the requirements of the trade and industry, and the board of directors and officers of the company have been making investments and acquiring interests in these and other collateral lines which have been profitable and which require further expansion with equal promise of profit. The company has constructed a new plant in Canada and is now building one in New Jersey, and it has other plants in contemplation. The time has arrived when further expansion and expenditure—either in cash or stock—become necessary to maintain the company's business and meet the increasing and varying demands of the trade. The directors feel that by this financing they will be placing the company upon a more solid foundation, and that the preferred stock will be placed in an even stronger position than it is at present." The principal plant of the National Carbon Company is in Cleveland, and its other Ohio plants are at Fremont, Fostoria and Lancaster. It has factories at Noblesville, Ind.; Clarksburg, W. Va.; Jersey City, N. J., and Niagara Falls, N. Y., in addition to the new ones above mentioned.

Business Notes

The Sanborn Electric Company, of Indianapolis, Ind., has moved into its new store and offices at 309-311 North Illinois Street in that city.

Thomas Howe, formerly connected with the firm of Edwards, Sager & Wooster, has established an office of his own at 2 Rector Street, New York, for the practice of patent law.

The Wagner Electric Manufacturing Company, of St. Louis, Mo., has announced the removal of its Boston office to 77 Franklin Street. Brooks Faxon continues in charge of the office.

Charles G. Robinowitch has sold his interest in the Metropolitan Electrical Supply Company, of 76 West Thirty-sixth Street, New York, and established an office at 48 Warren Street in that city to deal in electrical specialties.

The Dubilier Electric Company, Inc., of 63 Fifth Avenue, New York, has secured the services of A. C. N. Herdling as general sales manager. Mr. Herdling was for twelve years with the American Telephone & Telegraph Company.

The De Laval Steam Turbine Company, of Trenton, N. J., has appointed as its Chicago manager, with offices in the People's Gas Building, S. Wolff, formerly manager of the Cleveland office of the Allis-Chalmers Manufacturing Company.

The Held Company, of 11-17 South Desplaines Street, Wilmington, Del., has started the manufacture of a line of ozone water sterilizing apparatus. E. S. Eppstein is president of the company; L. H. Hart, vice-president, and George Starmann, secretary.

H. M. Byllesby & Company, of Chicago, Ill., announce the appointment, effective Jan. 1, of G. F. Maddock as manager of their department of examinations and reports. Mr. Maddock has had an exceptionally broad training along public utility lines and is admirably fitted for the position.

The Hart & Hageman Manufacturing Company, of Hartford, Conn., has announced the election of Shiras Morris as president and treasurer, succeeding the late A. H. Pease. C. A. Pease is the new vice-president, A. L. Shipman is secretary, and McKew Parr is general sales manager.

Harold Almert, until recently in charge of the department of examinations and reports of H. M. Byllesby & Company, has opened an office for himself at 737 Insurance Exchange, Chicago, as an engineering expert in evaluation and rate-making. Mr. Almert is an associate of the American Institute of Electrical Engineers and a member of the Western Society of Engineers.

The Ideal Electric & Manufacturing Company, of Mansfield, Ohio, has recently reopened a Chicago office in the Fisher Building, under the direction of J. A. Adamson, who was formerly connected with the Mechanical Appliance Company, of Milwaukee, Wis. C. F. Reuter has succeeded R. H. Elder in charge of the San Francisco office of the Ideal company, at 425 Rialto Building.

New Industrial Companies

Griffiths & Pierce, Inc., of Utica, N. Y., has been incorporated by G. Griffiths, W. Griffiths and P. Jones, of Utica, N. Y. The company is capitalized at $50,000 and proposes to do a general contracting business, install electric systems, etc.

The American Electric Car Company, of Portland, Maine, has been incorporated with a capital stock of $1,500,000 to manufacture and deal in electrical and mechanical devices of all kinds and in automobiles. The officers are A. F. Jones, president, and T. L. Croteau, treasurer, both of Portland.

The Turbo Company, of Perth Amboy, N. J., has been incorporated with a capital stock of $125,000 to manufacture internal-combustion turbines, gas compressors, general machine and engineering work. The incorporators are W. H. Considine, G. W. Ryan and A. W. H. Griepe, of New York, N. Y.

The International Engineering & Development Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $300,000 for the purpose of carrying on a mining, civil and electrical engineering business. The incorporators are H. E. Latter, W. J. Maloney and N. P. Coffin, of Wilmington, Del.

The Century Manufacturing Company has filed articles of incorporation with a capital stock of $100,000 under the laws of the State of Delaware for the purpose of manufacturing and dealing in electric signs and supplies for manufacturers of same. The incorporators are J. Bard, H. H. Snyder and M. S. Rohrer, of Lancaster, Pa.

The Magno Supply Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $50,000, to install mechanical, pneumatic or other systems of signaling, interlocking, etc. The incorporators are F. R. Hansell, of Philadelphia, Pa.; George H. B. Martin and S. C. Seymour, both of Camden, N. J.

The E. R. Mason Company, of New York, N. Y., has been chartered with a capital stock of $30,000 to manufacture and deal in electrical and mechanical tools and devices. The incorporators are Edwin R. Mason, 2038 Grand Central Terminal; James Burke, Jr., 87 Nassau Street, both of New York, N. Y., and Bernard Rountree, of Oradell, N. J.

Trade Publications

Induction-Motor Panels.—Bulletin No. A4178, recently issued by the General Electric Company, describes its panels for controlling three-phase induction motors at voltages of from 110 to 2200.

Calendar.—The Archbold-Brady Company, Syracuse, N. Y., is distributing a calendar, on which is a pad 5¼ in. by 8¼ in., one sheet for each week, with space for memoranda for each day.

Railway Motors.—The General Electric Company has issued Bulletin A4171, devoted to a description of its ventilated railway motors. The bulletin supersedes a previous bulletin on this subject.

Charging Panel.—The Roller-Smith Company, 203 Broadway, New York, has issued a ten-page pamphlet fully describing and illustrating its automatic charging panel for use with isolated storage-battery lighting plants.

Electric Appliances.—The Dubilier Electric Company, Inc., 63 Fifth Avenue, New York, has recently sent out a set of bulletins describing and illustrating its resistance units, heating, medical, wireless and other apparatus.

Wire Specialties.—An elaborate illustrated catalog of 224 pages has been issued by the Wright Wire Company, Worcester, Mass., which shows the unusual variety of wire specialties manufactured by this company. The catalog is well printed and well arranged and contains a number of useful wire tables.

Oil Engine.—The Fulton Iron Works, St. Louis, Mo., have issued a four-page leaflet, containing across the entire center pages a photograph of the members of the St. Louis Engineers' Club taken in the testing department of the company on the occasion of an exhibition of the first Fulton-Tosi oil engine. The back page of the leaflet gives a brief description of this apparatus.

Switchboards.—Catalog 10 just issued by the Trumbull Electric Manufacturing Company, of Plainville, Conn., contains 200 pages of interesting information for the users of switches, panelboards, switchboards, cabinets, cut-outs, receptacles and various wiring supplies. Complete tables of dimensions and prices are included, together with a number of illustrations of the apparatus described and a good index.

Overhead Traveling Crane.—A late bulletin of the Pawling & Harnischfeger Company, of Milwaukee, describes and illustrates the "Type H" crane made by that company. This equipment is said to be as safe, serviceable and durable as can be made consistent with good crane operation. Each hoisting mechanism is provided with a limit switch which will automatically stop the lifting motor if the bottom block is raised too high.

Personal Mention

Mr. M. A. Macfadden has been appointed to the position of superintendent of street lighting at San Diego, Cal.

Mr. J. S. Schlumberger has been appointed superintendent of the municipal electric-light plant at Marietta, Ohio.

Mr. Henry Floy, consulting engineer, who has been on a pleasure trip in Cuba, returned to New York on Jan. 20.

Mr. Peter Reiss has been elected president of the Sheboygan (Wis.) Railway & Electric Company as successor to Mr. E. Gonzenbach.

Mr. James Loftus has been appointed business manager of the commercial department of the Ohio Light & Power Company, Tiffin, Ohio.

Mr. J. G. W. Johnson has resigned as superintendent of the Consumers' Power Company, of Stillwater, Minn., after twenty years of service.

Mr. Maurice Coster, manager of the export department of the Westinghouse Electric & Manufacturing Company, is now in Havana, Cuba, on business.

Mr. W. O. Pratt, for many years connected with the Southern Power Company, Charlotte, N. C., has opened up an office as engineer and contractor in Gastonia, N. C.

Mr. Howard J. Thompson, general manager of the State Center Electric Company, will assume full charge of the Bellefonte (Pa.) Electric Company on Feb. 1 as successor to Mr. C. G. MacAvoy.

Mr. B. Lund has been appointed superintendent of the Consumers' Power Company, Stillwater, Minn., as successor to Mr. J. G. W. Johnson, resigned. Mr. Lund has been with the company for three years.

Mr. J. B. Whitworth, superintendent of distribution for the Schuylkill Gas & Electric Company, Mahanoy City, Pa., has accepted a position with the Sterling Consolidated Electric Company, Tower City, Pa.

Mr. Howard S. McNair, formerly assistant treasurer and secretary of the New Orleans (La.) Railway & Light Company, is now the active head of the engineering division of the United Gas & Electric Corporation.

Mr. W. B. Malone, of the Montgomery (Ala.) Light & Water Power Company, has been appointed manager of the commercial department of the City Light & Traction Company, of Sedalia, Mo., as successor to Mr. J. E. Harsh.

Mr. J. W. Rutherford has resigned as manager of the new-business department of the Danbury & Bethel Gas & Electric Light Company, Danbury, Conn., to engage in consulting engineering work with an engineering organization in Newark, N. J.

Mr. Edwin N. Sanderson, of Sanderson & Porter, engineers and contractors, was on Jan. 19 elected president of the Federal Light & Traction Company, one of the large holding companies operating public utilities in various parts of the United States and having its principal place of business at 60 Broadway, New York City.

Mr. M. W. Offutt, until recently assistant to the vice-president and general manager of the Alabama Power Company of Birmingham, Ala., and at one time manager of the Schenectady (N. Y.) Illuminating Company, has been appointed general manager of the Porto Rico Gas Company, with headquarters in San Juan, Porto Rico.

Mr. C. G. MacAvoy, for several years superintendent of the Bellefonte (Pa.) Electric Company, will sever his connection with the company on Feb. 1. During the time Mr. MacAvoy has been connected with the company a change-over from night service to twenty-four-hour service has been effected and the business of the company has been almost doubled.

Mr. Edward Hammett has been elected general manager of the Sheboygan (Wis.) Railway & Electric Company. Mr. Hammett was formerly superintendent of railways under Mr. E. Gonzenbach, president and general manager, who, as announced in these columns on Jan. 10, 1914, withdrew from the company following the sale of the property to the Reiss interests.

Mr. S. F. Hazelrigg, for many years vice-president and general manager of the Richmond Light & Railroad Company, New Brighton, N. Y., has tendered his resignation, effective Feb. 1, and will devote his time to the Atlantic Coast Electric Light Company and other properties on the Jersey coast of which he is president. Mr. Hazelrigg has been connected with the Staten Island company since 1902, and in addition to being vice-president and general manager of the Richmond Light & Railroad Company he is vice-president and director of the Asbury Park & Sea Girt Railway Company, president and director of the Atlantic Coast Electric Light Company, president and director of the Atlantic Coast Electric Railway Company, president and director of the New Jersey & Staten Island Ferry Company, director of the Sea Coast Traction Company of Asbury Park, N. J., director of the Seashore Electric Railway Company, president and director of the Southfield Beach Railroad Company, president and general manager and director of the Staten Island & Midland Railway Company, and secretary, treasurer and director of the West End & Long Branch Railway Company. He is also connected with a number of industrial and banking institutions.

Mr. Shiras Morris, who has been secretary and treasurer of the Hart & Hegeman Manufacturing Company, Hartford, Conn., was elected president and treasurer of the company, succeeding the late A. H. Pease. Mr. Morris was graduated from Trinity College, Hartford, in 1896 and for a time did reportorial work on the *Hartford Courant*. He afterward entered the cost department of the Pope Manufacturing Company, and prior to his connection with the Hart & Hegeman Manufacturing Company was advertising agent for the Pope company. Two years after his connection with the Hart & Hegeman Manufacturing Company he was chosen secretary and two years after that assumed the additional duties of treasurer. Mr. Morris is also secretary and treasurer of the Kinsler-Bennett Company, vice-president of the Hartford Chapter of the National Association of Credit Men, treasurer of the Manufacturers' Association of Connecticut, and a member of the directorates of the American Industrial Bank & Trust Company, the Industrial Realty & Title Guarantee Company, the New England Sherardizing Company and the New Haven Sherardizing Company. He is a member of the Hartford Board of Trade, Hartford Business Men's Association, Hartford Club, University Club, Hartford Golf Club, Republican Club of Hartford, Board of Fellows of Trinity College and of the Jovian Order.

E. F. SHERWOOD

Mr. E. F. Sherwood was appointed chief engineer of the Eastern group of Bell telephone companies on Jan. 1. Mr. Sherwood became an operator in the office of the Law Telegraph & Telephone Company in New York City in January, 1879. This was the year in which the agreement was made between the Bell interests and the Western Union by which the latter was to leave the telephone field. On Aug. 1, 1880, the Metropolitan Telegraph & Telephone Company was formed, which in 1884 acquired the Law system. During these five years (1879-1884) Mr. Sherwood had been made manager of a branch office and later manager of the entire Law system. When that business was taken over by the Metropolitan Telephone & Telegraph Company Mr. Sherwood was placed in charge of the traffic department of the telephone company, which position he has held for the past thirty years. Mr. Sherwood's career is therefore inseparably linked with the development of the telephone business in New York. Under his guidance every advance from the substitution of girls for boys as operators to the present speed and precision in rendering telephone service to the public has been made. Problems of organization, equipment and operation and giving the public the best telephone service possible have all been handled by Mr. Sherwood with an ability which, with his long experience in the business, has earned for him the title of the Nestor of the traffic department, although he is still in the prime of life.

Construction

New England

FORT KENT, MAINE.—The Fort Kent El. Co. is contemplating extending its transmission line to the village of Soldier's Pond, a distance of 2 miles, in the spring. The company has also carried its lines across the St. John River into St. Clair, where it will furnish electrical service. Power for operating the plant is obtained from the Wallagrass River, 6½ miles from town. M. T. Billings is superintendent.

KEZAR FALLS, MAINE.—The Cornish & Kezar Falls Lt. & Pwr. Co., of Kezar Falls, has erected within the last six months a new concrete power house and installed two units of 190 hp each. The company has on hand one 150-kw and one 100-kw generator to be installed; also all accessories. Allen Garner is manager.

ALTON, N. H.—Within the next six months the Alton El. Lt. & Pwr. Co. expects to purchase material for distribution and lighting systems, including poles, wire, transformers and line material, lamps, etc. Raymond C. Duncan is manager.

KEENE, N. H.—The Laconia Gas & El. Co., of Keene, has just completed the installation of a 340-hp Leffell waterwheel directly connected to a 250-kw Allis-Chalmers generator. F. T. Brockington is superintendent.

PORTSMOUTH, N. H.—Within the next three months the Rockingham County Lt. & Pwr. Co., of Portsmouth, expects to install a 3500-kw General Electric turbine. F. A. Belden is superintendent.

PITTSFORD, VT.—The Pittsford Pwr. Co., a subsidiary of the Rutland Ry., Lt. & Pwr. Co., has begun work on the construction of a 2000-hp hydroelectric power plant near Slab City in Chittenden County. The plant will be located between the Chittenden reservoir and the Rutland company's station at Mendon. A fall of 220 ft. will be utilized. A flume 7000 ft. long will be built in connection with this development. Electricity generated at the plant will be transmitted at 44,000 volts to Springfield, Vt., and Claremont, N. H. About one-third of the output will be sold to the Colonial Pwr. Co., and the remainder to the Rutland Pwr. Co.

SOUTH HADLEY FALLS, MASS.—At a special town meeting held Jan. 12 the citizens voted in favor of a municipal lighting system. It is proposed to take over the plant of the South Hadley Falls El. Lt. Co.

WESTFIELD, MASS.—Within the next three months the electric light committee expects to purchase one 500-kw turbine-driven alternator, one 300-hp boiler, economizer and condenser; also coal-handling machinery within the next six months. T. T. Logie is manager.

WORCESTER, MASS.—The Worcester El. Lt. Co., it is reported, will install another turbine, having a rating of 7800 kw, at its plant, to cost about $125,000. Plans are being prepared by Henry R. Kent and will include an addition to the building for the installation of the turbine and other machinery, which will include a new feed water pump. The company will soon ask for bids for the installation of nearly 400 luminous arc lamps, under the new agreement with the city.

MERIDEN, CONN.—The Board of Aldermen has granted the Meriden El. Lt. Co. permission to lay underground conduits in the business district. The present plans provide for laying about 1½ miles of conduits, at a cost of about $50,000.

Middle Atlantic

AFTON, N. Y.—The Public Service Commission has authorized the Afton-Windsor Lt., Ht. & Pwr. Co. to issue $60,000 in bonds, the proceeds to be used for the construction of a hydroelectric power plant. The company proposes to furnish electrical service in the towns of Afton, Colesville and Windsor.

AURORA, N. Y.—Within the next six months the Aurora El. Lt. Co. expects to purchase about 1000 incandescent lamps. N. L. Zabriskie is manager.

BUFFALO, N. Y.—Bids will be received at the office of the Department of Public Works, Room 5, Municipal Building, Buffalo, until Jan. 31 for an auxiliary 30-ton electric traveling crane at the Porter Avenue pumping station. Plans and specifications can be seen and printed forms of proposals obtained at the Bureau of Water. Francis G. Ward is commissioner.

DEERFIELD, N. Y.—The Town Board has accepted the proposal submitted by the Utica Gas & El. Co., of Utica, for lighting the streets of the town for a period of five years. The contract calls for about 50 street lamps.

DELHI, N. Y.—The Delaware El. Lt. & Pwr. Co., of Delhi, expects to purchase within the next eight months one 120-kw, single-phase, 60-cycle, 1150-volt generator. J. W. Hackney is manager.

EAST HAMPTON, N. Y.—Within the next six months the East Hampton El. Lt. Co. expects to erect 5 miles of transmission lines (probably subsurface) and to purchase 6 miles of underground conduit and wire. N. N. Tiffany is general manager.

FRANKLIN, N. Y.—The Delaware & Otsego Lt. & Pwr. Co., of Franklin, expects to purchase material for distribution system, including wire, meters, transformers, etc.; also incandescent lamps and electrical appliances and supplies. E. A. Mackey is manager.

GARDEN CITY, N. Y.—The Garden City El. Co. expects to purchase within the next two months cable, wire, meters, etc. (small amounts only to cover natural growth of system). Herbert L. Hatch is superintendent.

GENEVA, N. Y.—The Central New York Gas & El. Co., of Geneva, has applied to the Public Service Commission for permission to issue $50,000 in capital stock.

JAMESTOWN, N. Y.—The electric-light commission has accepted the recommendation of F. A. Shoemaker, of Buffalo, engineer, and will advertise for bids for the entire equipment recommended, which will include two stokers, two new steel stacks and a new 200-hp boiler.

MIDDLETOWN, N. Y.—Within the next two months the Orange County Ltg. Co., of Middletown, expects to erect a 1000-hp Cochrane feed-water heater, M. T. Davidson boiler-feed pump, with piping, etc., for which contracts have already been placed. Laurent Heaton is manager of the electrical department.

NEWARK VALLEY, N. Y.—Robert F. Chamberlain, of Cornell University, Ithaca, has been engaged to prepare plans for the municipal electric-light plant. It is proposed to install a steam-driven plant with an output of from 35 kw to 50 kw, 2200 volts, three-phase, 60 cycles.

ONEONTA, N. Y.—Within the next three months the Oneonta Lt. & Pwr. Co. expects to purchase a 250-hp engine and boiler. G. A. Lane is general manager.

POUGHKEEPSIE, N. Y.—Plans are being considered by the committee on municipal lighting for building an addition to the pumping station and installing additional dynamos and boilers, using this station as a municipal lighting plant to furnish electricity for lighting all the municipal offices and streets of the city. The cost of the plant is estimated at about $5,000.

RANDOLPH, N. Y.—Within the next six months the Randolph El. Lt. & Pwr. Co. expects to erect 13 miles of 6600-volt transmission line to furnish electricity in the villages of Rutledge, Conewango and Cherry Creek, and to farmers residing along the line; also to purchase 500 poles (from 30 ft. to 35 ft.) and fixtures for same, including 1500 6600-volt insulators, pole-top brackets and arms, constant-current, series street-lighting equipment for 50 to 75 5.5-amp, 60-cp tungsten lamps, and approximately 50 pole-type fixtures for same. The company will establish a 24-hour service about March 1 and now has contracts for approximately 75 hp in motors. Woodworth & Grace are proprietors.

SYRACUSE, N. Y.—The extension of the ornamental street-lighting system will be included in the contract awarded to the Syracuse Ltg. Co. for five years from July 1, 1913. The ordinance recently passed by the Council provides for 378 additional lamps.

WARSAW, N. Y.—Within the next six months the Warsaw Gas & El. Co. expects to purchase material for distribution system, including conduit, wire, arms and insulators. C. W. Torrey is manager.

WARWICK, N. Y.—The Warwick Valley Lt. & Pwr. Co. has applied to the Public Service Commission for permission to construct and operate an electric-light plant and for approval of franchise to supply electricity for lamps and motors in Warwick.

WEST WINFIELD, N. Y.—Application has been made to the Public Service Commission by L. B. & C. G. Seniff, of West Winfield, for permission to construct and operate an electric-light plant in West Winfield.

MEDIA, PA.—Specifications are now being prepared for an additional engine and generator for the municipal electric-light and water plant; also for a water pump of about 1,000,000-gal capacity. Patrick E. Ahern is superintendent.

PHILADELPHIA, PA.—The contract for the installation of engines, generators, switchboard and entire electric equipment in the addition to the Ritz-Carlton Hotel, Broad and Walnut Streets, Philadelphia, has been awarded to the United El. Construction Co., 1727 Sansome Street, Philadelphia. The work will involve an expenditure of more than $70,000. Horace Trumbauer is architect.

TULLYTOWN, PA.—The Borough Council has granted the East Pennsylvania Gas & El. Co., of Bristol, a franchise to erect transmission lines in Tullytown.

WASHINGTON, PA.—Bids, it is reported, are being asked by the Relief El. Lt., Ht. & Pwr. Co. for the construction of a brick and steel fireproof building (50 ft. by 90 ft.), plans for which may be obtained of Robert P. Reed, of Washington. The company proposes to furnish electricity in Washington and Canonsburg.

ALLENTOWN, N. J.—During the year 1914 the Water Department expects to build a retaining basin at the power house for use of the water department. Charles S. Joiner is superintendent of Municipal Electric Light Department.

CAMDEN, N. J.—The City Council has awarded the Public Service El. Co. a contract to furnish electric arc lamps and incandescent lamps and gas lamps for street-lighting in Camden for a period of five years.

ELIZABETH, N. J.—The Broad Street Improvement Association is negotiating with the street-lighting committee of the City Council for the installation of new street lamps on Broad Street, providing for an ornamental street-lighting system.

ELMER, N. J.—The Borough Council is considering the installation of an electric-street-lighting system in Elmer.

ORANGE, N. J.—Plans are being considered by the water and street lighting committee of the Common Council for extensions to the municipal electric-light plant and distributing system, to cost about $13,000. Henry Berg is chief engineer.

TRENTON, N. J.—The Ewing Township committee is planning for the installation of a street-lighting system on East Clinton Avenue and Hutchinson's Road. The installation will be made by the Pub. Ser. El. Co.

TUCKAHOE, N. J.—The Tuckahoe Lt. & Fuel Co. has been granted permission by the Board of Utility Commissioners for the installation of a new lighting system along certain highways of the county.

WILDWOOD, N. J.—An entire new lighting system will be installed on the boardwalk in the Second and Third Wards, replacing the incandescent lamps. Ornamental standards carrying five-lamp clusters will be erected.

LOGAN, W. VA.—Plans are being prepared by the Ohio Valley Co. for the installation of steam generating plant in Logan, to have an ultimate output of 20,000 hp. The initial installation will provide for 5000 hp. R. R. Livingston, 2 Rector Street, New York, N. Y., is engineer in charge.

WHEELING, W. VA.—The County Commissioners have granted the Brooke El. Co. of Brooke County a 30-year franchise to erect electric transmission lines over four roads of the county to furnish electricity for lamps and motors.

BROADWAY, VA.—At an election held recently the citizens voted to issue $5,000 in bonds to establish a municipal electric-light plant.

WILLIAMSBURG, VA.—The City Council is considering the question of establishing a municipal electric-light plant in Williamsburg.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 10, for furnishing at the various navy yards and naval station supplies as follows: Brooklyn, N. Y., Schedule 6285—1790 ft. single-conductor cable; Schedule 6290—200 angle-steel reflectors. East and West, Schedule 6290—300 desk lamps, type K. Lake Denmark, N. J., Schedule 6294—one duplex horizontal pump. Portsmouth, N. H., Schedule 6283—one motor-driven tumbling barrel, one motor-driven core cutting-off and coning machine, one motor-driven core wire straightening machine. Applications for proposals should designate the schedule desired by number. T. J. Cowie is paymaster general, U. S. N.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 17 for furnishing at the various navy yards and naval stations the following supplies: Brooklyn, N. Y., Schedule 6301—7510 ft. interior communication cable, four 2-kw transformers: Schedule 6296—furnishing and installing one storage battery car, complete. Annapolis, Md., Schedule 6298—four drawbridge brass lamps, red and green (fitted for electricity), eight brass lanterns with red lenses (fitted for electricity). Mare Island, Cal., Schedule 6292—75 electric flash lamps. Eastern yards, Schedule 6301—200 portable telephone testing sets. Norfolk, Va., Schedule 6302—switchboards and spare parts, miscellaneous telephones, etc.

North Central

BAY CITY, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 11, for conduits, etc., for the United States public building at Bay City, Mich. For further information see proposal pages. O. Wenderoth is supervising architect.

BELDING, MICH.—Bids will be received by the Spencer El. Co., of Belding, Mich., until March 5 for rebuilding its Smyrna water-power plant and penstocks in concrete, involving about 525 cu. yd. of reinforced concrete, 9 tons of structural steel and 8 tons of reinforcing steel. Plans may be seen at the office of the company at Belding, or at the office of the Fargo Engineering Co., Commonwealth Building, Jackson, engineer. Work will be started about May 15.

BIG RAPIDS, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 28, for the construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Big Rapids, Mich. Drawings and specifications may be obtained at the above office or from the custodian of site at Big Rapids. O. Wenderoth is supervising architect.

DURAND, MICH.—The board of electric light commissioners expects to purchase within the next 12 months one 125-kva to 177-kva, three-phase, 60-cycle, 1100/2200-volt generator, directly connected to a four-valve non-releasing Corliss engine, and from 18 to 22 lamp-posts for five-lamp clusters (center lamp vertical and four lamps inverted). H. F. Rosenkrans is superintendent.

EAST LANSING, MICH.—Plans are being considered for the installation of a new municipal street-lighting system.

GREENVILLE, MICH.—Bids will be received by the R. J. Tower El. Co., Greenville, until March 4, for furnishing labor and certain material for constructing concrete spillway and penstocks to remodel its present hydroelectric plant in Greenville. Concrete approximately as follows: In spillway, 800 cu. yd.; in penstocks, 1000 cu. yd. Company is to furnish structural steel; contractor to erect ready for riveting, which company will do, 68,000 lb. The company will furnish 35 tons of 6-in. U. S. 11-lb.-per-ft. sheet piling, which may be used for temporary work during construction. The company furnishes all structural steel, reinforcing steel, castings, turbines, electrical equipment and erection equipment. The Fargo Engineering Co., hydraulic engineer, Commonwealth Building, Jackson, Mich., has charge of the work.

MARQUETTE, MICH.—The Light and Power Commission expects to expend within the next 12 months about $25,000 for electrical supplies and appliances. C. Retallis is superintendent.

MUNISING, MICH.—The Munising Paper Co. is installing at its plant one 26-in. by 42-in. Allis-Chalmers horizontal simple Corliss engine directly connected to 400-kw alternating-current generator, together with all necessary auxiliary equipment to operate this unit with the present units in the plant. L. B. Steward is general manager.

OTSEGO, MICH.—The village of Otsego is considering the question of rebuilding the present lighting system or installing a complete new system. Electricity for operating the system is purchased from the Commonwealth Pwr. Co., of Jackson. W. G. Conlan is village clerk.

WHITEHALL, MICH.—The Board of Public Works expects to purchase within the next few months one feed pump and a carload of poles. E. Nelander is superintendent.

CLEVELAND, OHIO.—Legislation authorizing an issue of $800,000 in bonds for the completion of the municipal electric-light plant has been introduced into the City Council.

COLUMBUS, OHIO.—Extensive additions and improvements will be made to the plant of the Scioto Stone Co., work on which, it is said, will begin immediately. The company has closed contracts with the Columbus Ry. & Lt. Co. for electricity to operate its plant throughout.

COLUMBUS, OHIO.—Bids will be received by S. A. Kinnear, director of public service, Columbus, Ohio, until Jan. 28, for furnishing lamps as follows: 1800 40-watt, 118-volt gem lamps, 400 80-watt, 118-volt gem lamps, 200 25-watt, 118-volt Mazda lamps, 300 60-watt, 118-volt Mazda lamps, 700 40-watt, 118-volt Mazda lamps, 1600 100-watt, 112-volt Mazda lamps, 100 250-watt, 112-volt Mazda lamps, 200 100-watt, 118-volt Mazda lamps, 600 250-watt, 118-volt Mazda lamps, 25 150-watt, 118-volt Mazda lamps, 1800 60-cp, 6.9-amp Mazda series street lamps, 1100 100-sp, 6.9 amp Mazda series street lamps, 50 60-cp, 4-amp Mazda series street lamps, 15 80-cp, 5.5-amp Mazda series street lamps, 50 100-cp, 5.5-amp Mazda series street lamps, 15 80-cp, 4.2-amp Mazda series street lamps; 135 dozen 12-in. by 6-in. opal globes for cluster lamps, 45 dozen 16-in. by 8-in. opal globes for cluster lamps; 200 dozen Western Electric inner globes, 25 dozen Westinghouse Electric inner globes, 5 dozen Westinghouse Electric outer globes and 25 dozen Western Electric outer globes for arc lamps; 10 barrels of cylinder oil, 30 barrels of engine oil, 20 barrels of turbine oil and 1500 barrels of waste oil; 50,000 ½-in. by 12-in. cored carbons, 50,000 ½-in. by 12-in. solid carbons. Proposals to be made upon blank forms obtained from director of public service and the superintendent of the Department of Lighting, Dublin Avenue, Columbus, where copies of specifications may be obtained.

DAYTON, OHIO.—The Ottawa-Dayton Wtr. Pwr. Co., recently incorporated for the development of the water-power properties along the Fox River Valley, has made arrangements with the Illinois & Michigan Canal Commission relative to the development of power at Dayton. Simpson Brothers, who are among the incorporators of the company, have a developed water-power at Oswego and Yorkville and have negotiated for riparian rights on the Fox River between Wedron and Ottawa. It is proposed to erect a dam at Dayton and to utilize the power to generate electricity to furnish electrical service in the towns in the Fox River Valley.

ORRVILLE, OHIO.—Bids will be received at the office of the Board of Public Affairs, Orrville, until Jan. 28, for furnishing material and labor for the erection of an addition to the water-works station and the construction of a brick or concrete stack; also for furnishing steam and electrical machinery, electric street-lighting fixtures, material and supplies, etc. For details see proposal pages. W. R. Cook is clerk.

PIQUA, OHIO.—Wernette, Bradfield & Mead, architects and engineers, of Grand Rapids, have been awarded the contract to install a new power plant and heating system in the factory of the French Oil & Machinery Co. in Piqua.

PIQUA, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 27, for the construction, complete, including mechanical equipment and approaches, of the United States post office at Piqua. Drawings and specifications may be obtained from the above office or from the custodian of site at Piqua. O. Wenderoth is supervising architect.

SHERWOOD, OHIO.—The Board of Public Affairs expects to install a 72-in. by 16-ft. tubular boiler in the municipal electric-light plant this summer; also a Simms feed-water heater and boiler-feed pump. G. W. Woodworth is manager and engineer of the municipal electric-light plant.

ERLANGER, KY.—The Board of Trustees has closed a contract with the Union Lt., Ht. & Pwr. Co., Covington, Ky., to furnish electricity for lamps and motors in Erlanger. The transmission line is being extended from Fort Mitchell.

HARLAN, KY.—The mine owners, it is reported, are considering the establishment of a co-operative power plant. It is proposed to locate the plant in Harlan and transmit electricity to the mines in Harlan County and adjacent fields.

JEFFERSONTOWN, KY.—The installation of a street-lighting system is under consideration, bids for which will soon be asked for. Dr. D. A. Floore is chairman of board of trustees.

JENKINS,, KY.—The Consolidated Coal Co., of Baltimore, Md., will erect 150 miles of transmission line in eastern Kentucky and furnish electricity for lamps and motors within a radius of 60 miles of Jenkins. Owing to the increasing demand for electrical service it has become necessary to increase the output of the Jenkins power plant from 5000 kw to 10,000 kw. D. A. Maurer, of Jenkins, is construction engineer.

LA CENTER, KY.—The installation of a municipal electric-light plant in La Center is reported to be under consideration.

LEXINGTON, KY.—The City Council is considering an ordinance requiring public service companies to place their wires in underground conduits in the business district.

PADUCAH, KY.—The Board of Public Works has asked the City Council for an appropriation of $16,500 for the municipal electric-light plant.

PRINCETON, KY.—The Princeton Lt. & Pwr. Co. expects to purchase within the next two months one 150-hp horizontal tubular boiler and one 100-kw, three-phase, 60-cycle, 2300-volt alternator. W. J. Holman is manager.

HANOVER, ILL.—The contract for installing the municipal electric-light plant in Hanover has been awarded to the Joseph Chandler Co., of Rockford, Ill.

MELVIN, ILL.—We are informed that the Central Illinois Pub. Ser. Co., of Mattoon, has not been granted a franchise in Melvin, as reported in the issue of Jan. 10. E. Graham is assistant general superintendent.

TOWER HILL, ILL.—The installation of a municipal electric-light plant in Tower Hill is under consideration. The Central Illinois Public Service Co., of Mattoon, now furnishes electrical service here.

WAUKEGAN, ILL.—M. J. Douthitt, city engineer, writes that nothing definite has yet been decided upon in regard to the proposed ornamental street-lighting system. Probably 150 standards, carrying single or cluster lamps, maintained by underground wires, will be erected. Contracts for the work will probably be awarded in the spring.

ALTOONA, WIS.—The Chippewa Valley Ry., Lt. & Pwr. Co., of Eau Claire, is reported to have been granted a franchise to operate in Altoona.

MANITOWOC, WIS.—Contracts have been awarded by the Oslo Pwr. Co., of Manitowoc, for rebuilding its large dam in Oslo to Orbison & O'Keefe, of Appleton The capital stock of the company has been increased from $5,000 to $25,000. The company furnishes electricity for lamps to several villages, including Clarks Mills, Whitelaw, Valders, St. Nazianz; also for the county sanitorium at Whitelaw. The company will also furnish power in Manitowoc. A. O. Anderson is president and manager.

MILWAUKEE, WIS.—The City Council is considering the question of installing new street lamps in the outlying districts, which will involve an expenditure of $16,000. A resolution has been recommended to the Council finance committee which favors an appropriation of $5,000 to provide funds for a survey of the city for a new electric-lighting system.

ANNANDALE, MINN.—The Annandale El. Lt. & Pwr. Co. expects to purchase within the next six months a new generator and oil engine. G. G. Sawyer is manager and purchasing agent.

ANOKA, MINN.—Bids will be received by the board of armory supervisors, State of Minnesota, at the office of the secretary, 604 Pioneer Building, St. Paul, until Feb. 9, for construction of an armory building for Company B, Third Regiment Infantry, Minnesota National Guard. Separate bids to be submitted for general contract, heating, plumbing and electric work. Plans and specifications are on file at the Builders' Exchanges in St. Paul and Minneapolis and can be obtained at the office of Alden & Harris, architects, 809 Commerce Building, St. Paul, upon deposit of $10, which will be refunded upon return of same.

DULUTH, MINN.—The Great Northern Pwr. Co., of Duluth, within the next eight months expects to install a new generating unit, consisting of a 15,000-hp waterwheel (I. P. Morris Co.) and a 12,000-kva General Electric generator and transformer. This unit will have a vertical shaft and will give the station a total output of 45,000 kva. Contracts have also been placed for a new penstock. W. M. Ryeson is general manager.

HARDWICK, MINN.—Within the next three months the managers of the municipal electric-light plant expect to purchase lamps and other supplies needed for the plant. J. H. Mathison is superintendent of the municipal plant and J. B. Iversan is village recorder.

INTERNATIONAL FALLS, MINN.—Bids will be received by P. H. Fogarty, clerk of Board of Education, International Falls, until Jan. 29 for furnishing and installing electric-light fixtures for the high school building, in accordance with plans and specifications prepared by Tyrie & Chapman, architects, Auditorium Building, Minneapolis. Plans are on file at the office of the clerk of Board of Education and at the office of the architects.

KITZVILLE, MINN.—The Village Council has granted the Chisholm El. Co., of Chisholm, a franchise to furnish electricity for lamps and motors here; also a contract for street-lighting. Through error this was published under Kitzville, Mich., in the issue of Jan. 17. Kitzville has not a post office.

SHERBURN, MINN.—Within the next 30 days the Board of Public Works expects to purchase one second-hand Duncan 5-amp wattmeter; also within the next six months one boiler pump for 100-hp boiler; also to erect a cement block building for storage battery and to purchase a 50-amp, eight-hour storage battery with booster (118 cells) within the next 10 months. G. Fabianke is superintendent.

DE WITT, IA.—Within the next six months the De Witt El. Lt. & Pwr. Co. expects to purchase two 100-hp boilers, 150-lb. pressure, with stokers. John M. Reichart is proprietor and manager.

SIBLEY, IA.—Bonds to the amount of $18,000 have been voted for the establishment of a municipal electric-light plant. Steps, it is said, will be taken immediately for the installation of the plant.

VOLGA, IA.—O. Weisner, recently granted a franchise to furnish electricity in Volga, is now erecting a plant. The equipment of the plant will consist of a 30-hp Davis gasoline engine, one 35-hp McCormack waterwheel, Lombard governor (to be installed), one 50-kw Westinghouse three-phase, alternating-current generator, one switchboard with instruments, one 15-kva, one 10-kva and one 7½-kva transformer. About 70 white cedar poles and 2 miles of wire will be required for distribution system. Westinghouse meters will be used (none installed as yet).

WILLIAMSBURG, IA.—Frank Gue, of Keota, has purchased the street-lighting franchise voted to the local canning company; also part of the company's buildings and lot, on which he proposes to erect an electric power plant to furnish electricity in Williamsburg. Later the system will probably be extended to Conroy and Parnell.

ELDON, MO.—Within the next six months the Eldon Lt. & Pwr. Co. expects to purchase material for street-lighting system, consisting of 100 lamps. The company would like to receive estimates on this equipment. N. E. Harvey is president.

FESTUS, MO.—Within the next three months the board of electric light commissioners expect to purchase one 175-hp, 150-lb.-pressure, horizontal tubular boiler. C. J. Davidson is city clerk.

GLASGOW, MO.—The electric light commissioners expect to install within the next two months one 50-kva, three-phase, 60-cycle, 2300-volt generator directly connected to a 12-in. by 12-in. engine and switchboard panel, contracts for which have already been placed. R. L. Blacet is superintendent.

MOUNTAIN GROVE, MO.—Within the next six or eight months the Mountain Grove Ice & El. Co. expects to purchase about 2000 ft. of copper wire; also within the next few months to purchase one or two boilers. C. B. Walker is manager.

ST. CHARLES, MO.—The City Council has passed an ordinance granting permission to the St. Charles El. Lt. & Pwr. Co. to furnish electricity in St. Charles.

ST. JOSEPH, MO.—Within the next four months the city of St. Joseph expects to purchase about 2500 lb. of No. 8 weatherproof wire for extending arc lamp circuits. A. L. Utz is superintendent.

ST. LOUIS, MO.—The Board of Public Improvements has granted the Phœnix Lt. & Pwr. Co. (a subsidiary of the Laclede Gas Lt. Co.), and the St. Louis Lt. & Development Co. permits to place conduits and ducts on Washington Avenue between Fourth and Eighth Streets.

MINNEWAUKON, N. D.—Bids will be received by W. E. Paulson, county auditor, Minnewaukon, until Feb. 3, for installing an electric-light plant in the court house, also a set of storage batteries, chandeliers, switches, lamps, globes, etc.

SHERWOOD, N. D.—The installation of an electric-light plant in Sherwood next summer is reported to be under consideration. C. H. Budke is interested.

WILLISTON, N. D.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 9 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Williston, N. D. Drawings and specifications may be obtained from the above office or from the custodian of site at Williston. O. Wenderoth is supervising architect.

SALEM, S. D.—A movement has been started to have the transmission line of the Salem Milling, Lt. & Ht. Co. extended from Salem to Spencer to furnish electrical service there.

WINFRED, S. D.—The installation of an electric-light plant in Winfred is under consideration. M. A. Chapin and others are interested.

ADAMS, NEB.—Within the next 10 months the Adams El. Lt. Co. expects to erect 8 miles of transmission lines to supply electricity to another town; also to purchase an additional generator, one supply pump, poles, transformers, insulators, lightning arresters for 8 miles of transmission lines in addition to the needs of the town, and supplies for lighting system to meet ordinary demands. John Sheffler is proprietor.

ANSELMO, NEB.—Application has been made to the Village Board by David Christen for a franchise to construct and operate an electric-light plant in Anselmo.

AUBURN, NEB.—The city of Auburn is planning to install an ornamental street-lighting system in the spring. Present plans provide for 65 ornamental posts. G. E. Johnson, of Falls City, is engineer in charge.

BLOOMINGTON, NEB.—At an election held recently the proposal to issue $8,500 in bonds for the installation of an electric-lighting system was carried.

BRISTOW, NEB.—Bids will be received by Alvin Olson, city clerk, until Jan. 26 for the construction of an electric-light plant. Bruce & Standevin, Bee Building, Omaha, are engineers.

CENTRAL CITY, NEB.—Within the next three or four months the board of light commissioners expects to purchase a 200-kw, three-phase, 60-cycle, 2300-volt generator, with slow-speed engine, directly connected. Leonard Anderson is light commissioner.

FALLS CITY, NEB.—The city of Falls City expects to rewire the municipal electric-light system, at a cost of about $5,000. The city also is planning to extend its transmission lines to Roulo, Neb., and Mound City, Mo., where it will furnish electricity for lamps and motors. G. E. Johnson, manager of the municipal electric-light plant, has charge of wiring both towns for electrical service.

. HUMBOLDT, NEB.—Within the next six months O. A. Cooper & Son, owners of the local electric-light plant, expect to overhaul the entire distribution system (rebuild portions and improve the entire system), for which most of the material has been purchased. Also to purchase some heating and cooking devices, watthour meters and a general line of wiring supplies. H. P. Galliher is superintendent.

KEARNEY, NEB.—The City Council is considering two proposals for lighting the city—one to install a distribution system and secure electricity from the local company to operate it; the other to install an entire new municipal electric-light plant. The franchise of the local company ran out last spring and the Council refused to renew it.

OSCEOLA, NEB.—Within the next 12 months the managers of the Osceola & Shelby electric light, heat and power plant expect to purchase electrical appliances and supplies as demands require.

ARKANSAS CITY, KAN.—Plans are being prepared, it is reported, by Burns & McDonnell, Scarritt Building, Kansas City, Mo., for improvements to the electric-light and water-works systems, to cost approximately $75,000.

ARMA, KAN.—The contract for the construction of an electric-light plant and water-works system is reported to have been awarded to the Commercial Construction Co., Reliance Building, Kansas City, Mo. A. C. Moore, Barlett Building, Joplin, Mo., is engineer.

HERRINGTON, KAN.—At an election held Jan. 8 the proposal to issue $49,000 in bonds for extensions to the municipal electric-light plant and water-works system was carried. The City Council has engaged the Benham Engineering Co., of Oklahoma City, Okla., to prepare plans and specifications. The work will consist of development of a new water supply from springs, a 10-in. supply line, pumping machinery, extensions of mains in city, and an additional generating unit in the electric-light plant.

LE ROY, KAN.—Preparations are being made by the City Council for the sale of bonds ($13,000) which were recently voted for a municipal electric-light plant. As yet nothing definite has been done, but it is expected that work on construction of the plant will begin sometime in February. E. T. Archer & Co., New England Building, Kansas City, Mo., are engineers in charge Harry L. Covert is city clerk.

QUENEMO, KAN.—The municipal electric-light plant was recently destroyed by fire, causing a loss of about $6,000. It has not been decided as yet whether the plant will be rebuilt.

Southern States

CHARLOTTE, N. C.—The Southern Pwr. Co., ot Charlotte, is reported to have decided to develop Lookout Shoals water-power, the dam (fifth of the company) to be 80 ft. high.

LONG ISLAND, N. C.—Plans, it is reported, are being considered by the Long Island Cotton Mills for the construction of a hydroelectric power plant at Buffalo Shoals, above Long Island. The present plans provide for a concrete dam 10 ft. to 18 ft. high, to develop from 1500 hp to 2000 hp. The company has options on right-of-way for 2 miles of transmission line.

ST. GEORGE, S. C.—The City Council is reported to have awarded contract for the installation of an electric-light plant and water-works system to the Modern Equipment Co., of Savannah. The plant will be driven by oil engines.

COOLIDGE, GA.—The electric plant of the Coolidge El. Lt. Co. was destroyed by fire recently.

WAYCROSS, GA.—The Hebard Cypress Co., it is reported, is contemplating the construction of an electric light and power plant.

ARCADIA, FLA.—Bids will be received by board of public instruction of De Soto County, addressed to James O. Bickley, superintendent of public instruction, Court House, Arcadia, Fla., until Feb. 16, for construction of high school building, complete, including electrical work, plumbing, etc. Plans and specifications are on file at the office of the superintendent, Court House, Arcadia, and at the office of Francis J. Kennard, architect, American National Bank Building, Tampa, Fla., where copies of plans may be obtained upon deposit of $25, to be refunded upon return of same.

MARYVILLE, TENN.—The Aluminum Co. of America, which is establishing a plant at Maryville, it is reported, will secure electricity for operating its works from the plant of the Tennessee Pwr. Co., of Cleveland, Tenn., located on the Ocoee River. The Aluminum Co., it is understood, will install a power plant for emergency purposes.

BOONEVILLE, MISS.—Within the next six months the Booneville Water Works Co. expects to install a 10-ton ice plant in connection with its present light and water plants. A. W. Kearly is general manager.

CANTON, MISS.—Within the next two or three months the water and light commissioners expect to purchase one 160-hp high-speed automatic engine, one belt-driven centrifugal pump having a capacity of from 300 gal. to 400 gal. per minute, and one 350-cu. ft. air compressor (belt driven). John T. Sharp is superintendent.

WINONA, MISS.—Within the next two months the Winona Wtr., Sewerage, Ice & Lt. Co. expects to purchase a small quantity of electrical appliances and supplies (staples). W. H. Harvey is president and manager.

CAMDEN, ARK.—The property of the Camden Pwr. Co., consisting of electric-light and power plant and water-works system, has been purchased by the Arkansas Pwr. Co., recently incorporated. H. C. Couch, of Little Rock, is president of the Arkansas company.

SEARCY, ARK.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 28, for the construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Searcy, in accordance with drawings and specifications which may be obtained at the above office or from the custodian of site at Searcy. O. Wenderoth is supervising architect.

SINGER, LA.—Dr. J. W. Brown, it is reported, is contemplating the installation of an electric-light plant and ice factory.

PLEASANTON, TEX. — Improvements are being made to the plant of the Pleasanton Ice & El. Co., involving an expenditure of about $5,000. New machinery is being installed.

RUSK, TEX.—The capital stock of the Rusk Lt. & Pwr. Co. has been increased from $3,500 to $10,000.

SEGUIN, TEX.—We are informed that no definite action has yet been taken in regard to the proposed improvements to be made to the municipal electric-light and water-works plants as reported in the issue of Jan. 3. G. E. Smith is manager.

WACO, TEX.—Excavation work has been started on the new power plant of the Texas Pwr. & Lt. Co., in East Waco. The cost of the plant is estimated at $280,000.

Pacific States

BELLINGHAM, WASH. — The Skagit Pwr. Co., controlled by the Stone & Webster Corpn., of Boston, Mass., which is planning to develop water-power properties on the Skagit River, recently filed notices with the auditor of Whatcom County in Bellingham, for three locations as follows: One

19 miles above Marblemouth, one at Canyon Diablo and the other below the mouth of Ruby Creek. All are for 500 cu. ft. of water per second.

DAYTON, WASH. — Preliminary plans are being prepared by Jacob Weinhard, of Dayton, it is reported, for the installation of an electric-light and heating plant here.

OLYMPIA, WASH.—The Washington Pub. Ser. Co., of Olympia, is reported to have granted a franchise to erect transmission lines through Olympia to Tenino and Grand Mound to furnish electricity for lamps and motors.

OLYMPIA, WASH.—The commissioners of Thurston County have granted the Washington Pub. Ser. Co., of Olympia, permission to erect and operate electric transmission lines throughout the county. The franchise is for a period of 50 years. The system will extend from Olympia to Gate, via Tenino and Grand Mound; electricity will also be furnished to smaller towns and farmers along the route.

SEATTLE, WASH.—The contract for the installation of cluster lamps on Fifth Avenue has been awarded to Dicken & Rightmire, 2738 Thirty-third Avenue, Seattle, at $12,279.

SEATTLE, WASH.—The bid of Hunt, Mirk & Co., for $139,000, which was the lowest submitted, for the complete electrical equipment for the municipal power plant substation, will probably be thrown out, owing to the bid being unsigned. Charles C. Moore & Co., Hoge Building, Seattle, submitted the next lowest bid, at $149,000. It is understood that new bids will be called for. A. L. Valentine is chairman of board of public works.

SEDRO-WOOLLEY, WASH.—Plans for the installation of a cluster-lamp lighting system on Metcalf Street, from State Street to the Great Western crossing, to cost $25,000, have been approved by the City Council and steps will be taken at once to install same. Electricity for maintaining the lamps will be furnished by the Pacific Northwest Trac. Co., of Sedro-Woolley.

SUMAS, WASH.—The Public Service Commission, it is reported, has instructed the Sumas El. Co. to make considerable improvements and alterations to its system.

HOOD RIVER, ORE.—The Odell Development League is reported to be considering the construction of a co-operative electric light and power plant on Hood River, near Odell. A committee, consisting of Mark Cameron, George Sheppard, Harry Connoway, R. E. Miller and J. E. Ferguson, has been appointed to make a canvass to procure stock subscriptions and to engage a hydraulic engineer to prepare estimates of the cost of the proposed plant.

MARE ISLAND, CAL.—Improvements are contemplated at the navy yard electric-light plant at Mare Island within the next 12 months, including the rebuilding of 1000 ft. of 2300-volt, three-phase transmission line; the erection of 5000 ft. of No. 6 insulated wire and 4000 ft. No. 2 insulated wire; also the purchase of one 500-kw motor-generator, one motor-driven speed regulator for 1000-kw Westinghouse-Parsons turbo-generator, eight multiple inclosed 5-amp arc lamps, 20,000 ft. National Electric Code wire, 6000 ft. rubber-covered wire, 10,000 ft. No. 14 rubber-covered, iron-twisted pair wire, 5000 ft. 15 or 20 pair insulated, lead-covered telephone cable; also, within the next 24 months, 5000 ft. 750,000-circ. mil. paper-insulated cable and 2500 ft. 500,000-circ. mil. paper-insulated cable. Captain F. M. Bennett is commandant.

SAN JACINTO, CAL.—The Southern Sierras Pwr. Co., of San Jacinto, is now erecting about 3 miles of transmission lines on 35-ft. poles. The company is continually extending its lines to reach new customers. George R. Kempton is local superintendent for the San Jacinto and Hemit territory.

BOISE, IDAHO.—The contract for installing electric wires and fixtures in the Elks' Building in Boise has been awarded to the Brigger-Hetherington Co., of this city, at $2,116.

LAPWAI, IDAHO. — The Lewiston-Clarkston Imp. Co., of Lewiston, has petitioned the City Council for a franchise to supply electricity for lamps and motors in Lapwai. If granted a franchise, the company will extend its transmission lines to this city and install a complete lighting system.

LEWISTOWN, IDAHO.—Residents of the Normal Hill district have petitioned the City Council for the installation of a street-lighting system in that section of the city.

GLASGOW, MONT.—The city of Glasgow has awarded a contract for the installation of a municipal electric-light plant, the equipment to include one 80-hp compound, tandem engine, one 50-kw, three-phase, 60-cycle, three-phase generator, with exciter, directly connected; an entire new switchboard with all instruments for control and operation of both units. The city will also install an ornamental street-lighting system. E. S. Severance is city engineer and A. J. Melvin is superintendent of municipal electric plant.

GLENDIVE, MONT.—The City Council has recently passed an ordinance providing for the installation of an arc-lamp lighting system on Merrill Avenue, to cost about $5,000. For further information address Einar Rivenes.

LOVELOCKS, NEV.—Within the next six months the Lovelocks & Woolsey Lt. & Pwr. Co., of Lovelocks, expects to erect 4 miles of three-phase transmission line and to purchase one 150-kw, three-phase, 2400-volt generator, one 200-hp water turbine, water-wheel governors for two turbines (one 75-hp and the other 200-hp), 100 5-amp and 10-amp meters, (60-cycle, single-phase, 110-volt), one carload of 35-ft. poles; also material for street-lighting system for arc and tungsten lamps, and electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, switches, etc. C. L. Yung is manager.

Canada

HEDLEY, B. C.—Plans prepared by A. J. Matheson, of Cartwright, Matheson & Co., of Vancouver, for the construction of a dam across the Similkameen River at Hedley, it is reported, have been accepted by the Daly Reduction Co., of Hedley. The plans provide for a dam 200 ft. long, developing 18,000 hp; the flume will be 1500 ft. long with 60 ft. head of water. The total cost of the work is estimated at about $200,000.

KAMLOOPS, B. C.—The city of Kamloops, it is understood, will begin work on construction of the proposed municipal hydroelectric plant as soon as the weather will permit.

BRIGDEN, MAN.—A by-law has been passed by the ratepayers authorizing an expenditure of $4,000 for the installation of an electric-light plant.

LE PAS, MAN.—The ratepayers have passed a by-law authorizing an appropriation of the necessary funds for the installation of an electric-lighting system.

ROCKWOOD, MAN.—The Council has granted the Civic Light and Power Department of Winnipeg a franchise to furnish electricity for lamps and motors here. Rockford has not a post office.

CHIGNECTO, N. S.—Plans have been prepared by the Canada El. Co., of Amherst, for the installation of a 1000-kw turbo-generator set at its plant in Chignecto.

CREEMORE, ONT.—At an election held recently the ratepayers voted in favor of the by-law authorizing the town to contract with the Hydro-Electric Power Commission of Ontario for electricity.

HAMILTON, ONT.—At an election held recently the by-law authorizing an expenditure of $335,000 for extensions to the city's hydroelectric system was carried.

LARDER LAKE, ONT.—The D'Or Huronia Co., it is reported, is preparing plans for a water-power development in the vicinity of Larder Lake, which will enable them to operate its mine and mill on a larger scale.

PARK HILL, ONT.—The installation of an electrical distributing system in Park Hill is under consideration by the Council.

TORONTO, ONT.—Bids will be received by H. F. McNaughton, secretary of Public Works Department, Department of Public Works, Toronto, until Jan. 28, for steam heating, plumbing and electric wiring required in the following buildings: The reception hospital, Asylum for Insane, Brockville; court house at Fort Frances, court house at Haileybury, and for electric wiring only of the dining hall, Ontario Agricultural College, Guelph. Plans and specifications may be seen at this department, at the above institutions, Brockville and Guelph, and at the Sheriff's office in Fort Frances and Haileybury.

Miscellaneous

THORN ARM BAY, ALASKA.—Plans are being prepared for the construction of a 2000-hp hydroelectric station, 150-ton paper mill, 120-ton ground wood-pulp mill and 50-ton sulphite pulp mill at Thorn Arm Bay, Southeast Alaska, by W. C. Bigelow, architect and engineer, of Biddeford, Maine. Bids will be called for early in the spring.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Feb. 7 for electric welding outfit, tinsmith's plate-bending roll, steel locker cabinets, etc. Blanks and general information relating to this circular (No. 823) may be obtained from the above office or from the assisting purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

New Incorporations

BOSTON, MASS.—The Pittsfield Pwr. Co. has been granted a charter with a capital stock of $500,000. The directors are J. F. Moors, president; O. Clement Swenson, of New York, N. Y., treasurer; C. C. Davis, H. Nash, Jr., and F. E. Smith.

WALTHAM, MASS.—The Waltham El. Co. has been incorporated with a capital stock of $5,000 by Rufus B. Skinner, Grace B. Bowman and Lydia A. Brimmer.

ROSELAND, NEB.—The Roseland El. Lt. Co. has been incorporated with a capital stock of $10,000 by G. Boury and others.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 13, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,083,926. Microphone; L. Ericson, Chicago, Ill. App. filed Aug. 15, 1912. Combined receiver and transmitter.

1,083,937. Locomotive Side Frame; C. E. Lilley, Bluefield, W. Va. App. filed May 22, 1913. Electric locomotive side frame which may be readily adapted to various types of motor hangings.

1,083,941. Control System for Electric Motors; J. S. Peck, Manchester, Eng. App. filed Feb. 11, 1910. Connections effected by individual electromagnetically operated switches.

1,083,945. Cooling System for Transformers; K. C. Randall, Edgewood Park, Pa. App. filed Nov. 6, 1908. Cooling oil circulates through exterior cooling tubes which are surrounded by cooling medium.

1,083,950. Circuit Controller; H. A. Steen, Milwaukee, Wis. App. filed Jan. 3, 1911. Elevator controller with one set of contact members governing direction of rotation of elevator motor and another set controlling resistance sections.

1,083,956. Electric Seam-Welding; E. Thomson, Swampscott, Mass. App. filed May 10, 1913. Spot-welds an overlapping seam and then forms a continuous weld by rollers which constitute electrodes.

1,083,959. Automatic Weighing Apparatus; C. C. Voglesong, Oakland, Cal. App. filed Sept. 23, 1912. An electric motor reciprocates a feeding device.

1,083,964. Electric Spark-Producing Apparatus; G. W. Wacker, New York, N. Y. App. filed Aug. 10, 1908. Battery causes windings on the armature of the magneto to produce a starting spark independently of the interrupter.

1,083,965. Engine-Starting Spark-Producing Apparatus; G. W. Wacker, New York, N. Y. App. filed Nov. 18, 1908. Armature winding of magneto employed as induction coil at starting.

1,083,971. Air Brake; G. B. Wolf, Smithville, Tex. App. filed May 25, 1911. Electric controlling device causes brakes to be set simultaneously on all cars of a long train.

1,083,979. Method and Apparatus for Separating Ores or the Like; O. A. Zander, Guldsmedshyttan, Sweden, App. filed June 14, 1912. Employs traveling concentric shelves of successively varying diameters.

1,083,992. Apparatus for Cleaning Articles; E. L. Couch, Hartford, Conn. App. filed Nov. 19, 1912. Anode in the form of a plate made of aluminum, tin and lead.

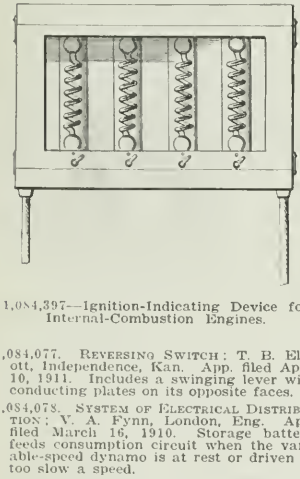
1,084,012. Device for Calling Cabs, Porters and the Like by Telephone; A. Hinzpeter, Munich, Germany. App. filed Aug. 12, 1912. Signaling apparatus remains locked until the call has been responded to.

1,084,040. Dynamo-Electric Machinery; A. L. J. Scherbius, Frankfort-on-the-Main, Germany. App. filed Sept. 7, 1906. Compensating winding for tri-phase commutating machines.

1,084,059. Signaling System; C. E. Beach, Binghamton, N. Y. App. filed April 9, 1912. Storage batteries included serially in the signaling circuit when the main source of current is operative so as to be kept fully charged for operation when main source is cut off.

1,084,060. Seal for Containing Cases; C. E. Beach, Binghamton, N. Y. App. filed June 4, 1912. Seals opening in the cover through which extends the operating handle for the fire alarm or other apparatus.

1,084,070. Loud-Speaking Telephone System; J. J. Comer, Chicago, Ill. App. filed Nov. 28, 1910. Heavy-current system in which provision is made for accurate adjustment.



1,084,397—Ignition-Indicating Device for Internal-Combustion Engines.

1,084,077. Reversing Switch; T. B. Elliott, Independence, Kan. App. filed April 10, 1911. Includes a swinging lever with conducting plates on its opposite faces.

1,084,078. System of Electrical Distribution; V. A. Fynn, London, Eng. App. filed March 16, 1910. Storage battery feeds consumption circuit when the variable-speed dynamo is at rest or driven at too slow a speed.

1,084,079. Dynamo-Electric Machine; V. A. Fynn, St. Louis, Mo. App. filed May 13, 1912. Machine has two shunt windings and a series winding for engine-starting and generator purposes.

1,084,083. Welding Machine; J. H. Gravell, Philadelphia, Pa. App. filed Feb. 24, 1913. Small-size portable device having terminals connected to the secondary coil and movable toward and away from each other.

1,084,100. Automatic Fire and Burglar Alarm; L. A. Meyers, Sauk Center, Minn. App. filed April 26, 1913. Telephone circuits and bells utilized for sounding an independent alarm in all the rooms of a hotel or other building.

1,084,104. Magnetic Break Switch; G. E. Palmer, Brookline, Mass. App. filed May 10, 1912. Multipolar switch with laminated contacts.

1,084,129. Method of Softening the Ends of Electrodes and Other Carbon Articles; J. W. Brown, Lakewood, Ohio. App. filed June 10, 1912. Graphitizes carbon with current of 5000 amp; for softening end of furnace electrode so that a threaded connection can be made.

1,084,147. Support for Electric Service Wires; G. Hopkins (deceased), Portland, Ore. App. filed Jan. 7, 1913. Semi-circular supports clamped on the insulator pin.

1,084,148. Device for Transmitting Force by Means of Magnetized Rings; A Huggenin, Zurich, Switzerland. App. filed Sept. 6, 1911. Blades on the driving and driven members arranged to coincide in the rotation of the members.

1,084,150. Process of Electrolytic Production of Copper; N. V. Hybinette, Christiania, Norway. App. filed March 29, 1913. Passes an electrolyte containing large quantities of ferric salts into cathode compartment of electrolytic cell and circulates the solution through a filter from cathode to anode.

1,084,155. Tracing Device for Copying or Duplicating Machines; Emil R. Lochman, Boston, Mass. App. filed May 21, 1910. An electric circuit is completed when the tracing tool contacts with a master pattern at any point.

1,084,172. Trolley-Pole Retriever; T. B. Shananhan, Manlius, N. Y. App. filed Sept. 2, 1909. Has means for locking one end of the retriever spring to the retriever casing.

1,084,189. Telephone System; F. M. Wolf and R. M. Austin, Monroe, Wis. App. filed April 23, 1912. Removal of receiver from hook notifies exchange and the other persons upon the line.

1,084,192. Internal-Combustion Engine Comprising Rotating Cylinders; E. Becker and F. Dinslage, Charlottenburg, Germany. App. filed July 1, 1912. "Gnome" revolving-cylinder type with special ignition control.

1,084,199. Fireproof Electrically Conducting Bodies and Process of Manufacturing the Same; G. Egly, Berlin, Germany. App. filed Sept. 12, 1910. Fashions mass containing free silicon into a body and then causes said body to absorb carbon and oxygen.

1,084,206. Attachment for Mouthpieces; A. C. Gaynor, Bridgeport, Conn. App. filed Dec. 17, 1912. Annular disinfectant holder supported in front of telephone mouthpiece.

1,084,220. Apparatus for the Electric Lighting of Motor Cars and for Other Purposes; M. Metz, Coventry, Eng. App. filed Feb. 9, 1912. Combined electric distributer, single-pole or double-pole switch and "change-over" switch.

1,084,250. Method of Making Chain Links; F. G. Breul, Bridgeport, Conn. App. filed May 17, 1913. Electric weld made upon the crossed and overlapped ends of chain link.

1,084,274. Apparatus for Graphitizing Carbon; P. L. T. Heroult, New York, N. Y. App. filed Feb. 16, 1912. Broken carbon subjected to blast of air under such conditions that it is considerably heated and is then heated to graphitizing temperature electrically.

1,084,317. Electric Locomotive; W. Dalton, Schenectady, N. Y. App. filed Aug. 19, 1913. Friction devices interposed between truck frame and unit frames modify and reduce lateral vibration to negligible point.

1,084,318. Electric Locomotive; W. Dalton, Schenectady, N. Y. App. filed Aug. 19, 1913. Has locking means for converting a non-swiveling or trailing truck into an effective swiveling or leading truck.

1,084,328. Telephone Attachment; E. Gransaull, New York, N. Y. App. filed Nov. 27, 1912. Sound amplifier attached to the receiver.

1,084,351. Apparatus for Extracting Metals from Their Ores; H. S. MacKay, Riverside, Cal. App. filed Jan. 20, 1910. For converting copper sulphides, carbonates, oxides, etc., into metallic copper.

1,084,362. Lamp Support; H. C. Reagan, Philadelphia, Pa. App. filed March 17, 1913. Has relatively fixed and movable socket-carrying arms which receive the opposite ends of the tubular lamp bodies.

1,084,364. Windings for Electrical Machines; E. Rosenberg, Berlin, Germany. App. filed Jan. 17, 1907. Dynamo for divided circuits.

1,084,365. Constant-Output Generator; E. Rosenberg, Berlin, Germany. App. filed May 17, 1907. Armature current, as it increases, produces a proportionately greater effect than the same current in the field winding.

1,084,371. Winding Machine; C. B. Snell, Brookline, Mass. App. filed Feb. 3, 1913. For winding continuous wire in flat spiral layers, one against another, in alternately increasing and decreasing spirals.

1,084,379. Screwless Carbon Holder; W. W. Wile, Bluffton, Ind. App. filed Oct. 10, 1912. Cam-operated wire and carbon clamps; particularly designed for use in lamps of moving-picture machines.

1,084,382. Circuit-Closing Device. W. W. Alexandar (deceased), Denver, Col. App. filed July 6, 1910. Highly sensitive circuit-closer operated by vibrations of the track rails.

1,084,384. Brush-Holder for Dynamo-Electric Machines, T. S. Allen, Milwaukee, Wis. App. filed Feb. 28, 1910. Vibration of brushes in high-speed machines is reduced by a weight arranged to increase the inertia of the pressure finger.

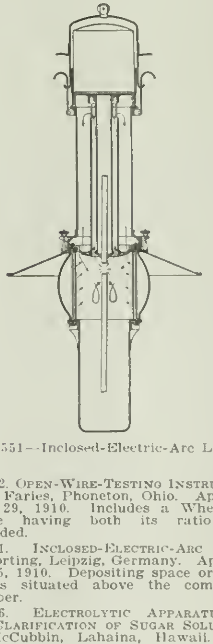
1,084,396. Electromagnetic Switch; E. R. Carichoff, Schenectady, N. Y. App. filed Sept. 11, 1912. Switch is magnetically opened as well as magnetically closed.

1,084,397. Ignition-Indicating Device for Internal-Combustion Engines; A. De Clairmont, Toledo, Ohio. App. filed Dec. 6, 1911. Geisler tubes included in the ignition circuits indicate by flashes of light the firing of the various cylinders.

1,084,466. Electric Furnace; G. Mettler, Berlin, Germany. App. filed Nov. 28, 1911. Resistance furnace which can be continuously charged and uniformly regulated up to temperatures of about 2400 deg. C.

1,084,469. Voltage-Regulating Means; H. Nehlsen, Niederschonhausen, Germany. App. filed Aug. 30, 1912. Employs an induction regulator and a regulating transformer.

1,084,506. Electrically Operated Air Brake; H. L. Tooker, Winslow, Ariz App. filed June 29, 1911. Electrical control analogous to the ordinary "triple valve."



1,084,551—Inclosed-Electric-Arc Lamp.

1,084,542. Open-Wire-Testing Instrument. C. L. Faries, Phoneton, Ohio. App. filed June 29, 1910. Includes a Wheatstone bridge having both its ratio arms grounded.

1,084,551. Inclosed-Electric-Arc Lamp; M. Korting, Leipzig, Germany. App. filed Dec. 5, 1910. Depositing space or chamber is situated above the combustion chamber.

1,084,556. Electrolytic Apparatus for the Clarification of Sugar Solutions; H. McCubbin, Lahaina, Hawaii. App. filed Sept. 16, 1911. Solution passed through container within which are electrodes.

1,084,560. Panelboard; R. H. Olley, Syracuse, N. Y. App. filed Feb. 18, 1911. Snap switch directly connected to conductor bars of panelboard.

1,084,589. Electric Meter; G. M. Willis, Chicago, Ill. App. filed Nov. 27, 1908. Wattmeter with special features of adjustment.

1,084,590. Electric Motor; H. L. Zabriskie, Westfield, N. J. App. filed July 15, 1911. Has interconnected brake device and contact member.

1,084,594. Induction Generator; F. E. Norton and F. A. Wilson, Nahant, Mass. App. filed Dec. 1, 1911. Development of the Thompson water-dropping collector or electrometer; has inductors, means for charging same, insulating walls forming a vapor channel and collectors exposed in said channel.

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Storing Coal for Strikes

For several months the consumers of large amounts of coal in the Middle West have been preparing themselves for the expected biennial April strike in the bituminous coal regions. Piles of coal along railroad rights-of-way, subaqueous coal pits of some central stations heaped to overflowing and the storage space of others filled to the fences attest the foresightedness with which many large utilities approach the periodic strife. Former experiences have shown the wisdom of preparation. The peculiar feature about the probable strike, however, is the fact that the miners are now working overtime to supply sufficient coal to tide the railroads, central stations, industrial plants and others over the period of disturbance. If a strike is declared, it will resolve itself into a test of the lasting qualities of the country's coal pile against the savings of the miner. Regardless of the outcome, a considerable saving may be effected by storing coal over what may have to be spent for fuel purchased during a strike period. If the strike, assuming that it comes at all, is of short duration, the depreciation in the heating value of the coal due to exposure will be nominal compared to what will have to be sacrificed if the utility is unprepared. Foresight is infinitely better than hindsight in such a case.

Bills for Anti-Trust Legislation

Bills designed to enact into specific law the general recommendations of President Wilson regarding anti-trust legislation have already been made public in Washington. The language of the bills and the concrete suggestions of the President are similar, and it is apparent that they are certainly an agreed part of a program made by the administration and its co-operators in Congress. The message contained many definite and hopeful reassurances to business. Necessarily the legal wording of the bills is entirely bare of any suggestion of heed for existing business practices. It is better that the President's message came first. If the bills had been made public first and the President's message had merely explained them after their introduction, the result would have been less effective. It is announced in Washington, apparently upon the best authority, that full opportunity will be offered to business men to present their ideas to the committees of Congress before action is taken. This is essential to business prosperity. It is especially needful in cases where the proposed legislation, as it now stands, threatens to disrupt or disarrange existing practices. Many of these practices have been built up in the belief that they were in conformity with law. If they were in clear conformity with the old law, but are of doubtful legality under the pending legislation, the government should not press for hasty changes at the expense of continuing trade or investment rights.

Playing to the Gallery

The controversy in progress in relation to the cost of electrical energy produced by the hydroelectric system of the Sanitary District of Chicago illustrates in a rather striking manner the unfortunate results which obtain when municipal politics is mixed with the operation of public utilities. The Sanitary District is a municipal corporation as well as the city of Chicago. The trustees of the one and the mayor and aldermen of the other are elected by direct vote of the citizens. It is difficult, apparently, for these municipal officers to consider industrial problems dispassionately and impartially. At all times the great majority of them seem to have in mind the condition of their political fences. Both the city and the Sanitary District have high-grade engineering advice. The engineers agree substantially that the price charged the city by the District for electrical energy for street lighting is too low under the existing contract. But the politicians find in the issue an excellent opportunity to pose as defenders of the rights of the people, and it is evident that many of them are doing so. The hue and cry indicates how difficult it is to conduct public service operations in a businesslike manner where the men in charge hold office for short terms and where their political future depends, or is thought to depend, on adroit appeal to popular prejudice rather than on industrial efficiency.

A Useful Consolidation

The merger of power plants in Lorain County, Ohio, of which we give an elaborate description this week, is an example of the gains which may come from wise consolidation. Enterprises of this sort are steadily growing more common as appreciation of their value is better realized. The particular instance before us combines electrically a group of towns west of Cleveland which have heretofore been served by isolated stations. Every consolidation of this kind involves special engineering problems in making the best use of the material on hand and in planning additions so as to fit the needs of growing communities. In this particular case a striking feature is the union of what now becomes the main generating station with a hydroelectric station situated fairly in the center of the city of Elyria. This station is on the Black River and operates under a 62-ft. head. Its four generators are arranged so that they can be connected either to two waterwheels or to a pair of 350-hp gas engines which serve as auxiliary. This plant is tied in, like the others of the system, on a 22,000-volt transmission line, and when the flow is sufficient the generators are driven from the waterwheels. At other times, when heavy load comes on or when the full capacity of the station is needed, the gas engines are thrown in. At still other times, when the load is light and the capacity of this plant is not required, the alternating-current generators are thrown upon the system and operated as synchronous condensers to improve the power-factor, at the same time serving as motors to drive the direct-current machines in the same station which supply a small network not yet shifted over to the alternating-current mains. Altogether the entire system has seven generating stations and six substations. The unification of this group has resulted through energetic management in a considerable increase of business and especially in the taking on of much motor load for the large industrial works in the vicinity.

Electrolysis in Concrete

The most salient change which has occurred in the last century of building construction, since the introduction of steel, has been the use of reinforced concrete. This wonderful change in structural material which has already come about, and is even now advancing so rapidly, is due not only to the great strength, economy and convenience of reinforced cement, but also to its apparent permanence. Some concrete buildings are more costly to destroy than to erect. Iron and steel, in the firm embrace of cement, sand and stone, forget the allurements of oxygen and remain passively unrusting in the heart of a mass of moist masonry. It is not surprising, then, that engineers and builders should have heard with misgivings of electrolytic destruction of reinforced-concrete beams and blocks by stray and vagrant electric currents.

The Bureau of Standards has given special attention to this question of electrolytic disintegration in concrete and has recently published a pamphlet on the subject, which we abstract elsewhere in this issue. The results of the investigation are of great importance and interest. Briefly stated, it appears that feeble electrolytic currents in reinforced concrete have negligibly small destructive influence, so that there is no cause for alarm unless the currents are sufficiently powerful to produce sensible heating in the mass. The non-oxidizing property of steel embedded in concrete seems to cease when the temperature rises above 45 deg. C. If the current can raise the steel to this temperature and flows from steel to concrete, so that the steel is the anode, the steel is likely to be steadily oxidized. As soon as oxidization occurs the structural strength of the embedded steel begins to be affected. At the same time the iron oxide occupies more space than the original iron, so that powerful expanding forces are initiated, which may lead to the bursting of the concrete block.

According, therefore, to the conclusions reached by the bureau, we have only to make sure that there are no powerful electric currents carried by concrete in order to calm our fears as to the dangers lurking in electrolysis. Such powerful currents might, however, readily occur in buildings containing electric generating plants with heavy current leaks to ground, so that wherever conductors carrying powerful electric currents pass through concrete structures it becomes necessary to see that they do not escape from the conductors into the concrete.

Electrical Pumping for Irrigation

For some years the transmission systems in the arid portions of the West, known to the ancient geographies as the "Great American Desert," have been taking on here and there a load of motor pumping for irrigation purposes. This Great American Desert turns to a garden if properly supplied with water, and while the irrigation companies and the government have done enormous work for betterment there are sections in which natural flow is difficult to find. In these cases cheap electrical energy comes to the rescue to the benefit of all concerned. By this means water can be pumped from the rivers at a low enough cost to make it economical for irrigation purposes, and the transmission companies obtain a very welcome type of load. In the first place, when in use at all pumping is a wonderfully steady load, and, in the second place, the induction motors almost universally used for pumping are very desirable on a big transmission system with much distributed capacity. By far the biggest single enterprise of this sort is that in the Snake River Valley described in our columns this week.

The two pumping stations already installed have a combined rating of about 200,000,000 gal. for twenty-four hours when driven at full load. The lift varies from 80 ft. to 177 ft., and four canals are fed from this supply, covering an aggregate of about 18,000 acres. Centrifugal pumps are used, driven by induction motors which are fed from the 40,000-volt transmission system of the Idaho Railway, Light & Power Company. The pumps show an efficiency slightly above 80 per cent. An interesting feature of the hydraulic arrangements is that the pumps feed the canal through wood-stave conduits, portions of which operate under as great a pressure as 75 lb. per sq. in. This type of construction is used largely and very successfully throughout the West, although it has never been a favorite with Eastern engineers. Not unlikely in certain districts pumping projects of this character will be installed on a large scale, for it seems to have been demonstrated that from the standpoint of the farmer such irrigation can be made economical, and if necessary the load could generally be so regulated as to give the transmission companies a heavy demand at periods when the load would otherwise be light. Economical operation in a hydroelectric system depends so much on the full utilization of the water that a pumping load may be desirable and worth taking on even at a very moderate price. Certainly the Snake River system should give encouragement to similar enterprises elsewhere.

The Prevention of Electrolysis

The study of methods of reducing the danger of electrolytic corrosion of pipes made by the Bureau of Standards is another evidence of the practical value of that institution to technology. Electrolysis is a condition well-nigh universal, which shows, at least here and there, unpleasant effects in the vicinity of nearly all electric-railway systems. Yet until now there has never been anything like a comprehensive study made of the methods of prevention, by reason of the fact that each place differs in its local conditions from every other place, and investigations made to remedy existing troubles necessarily have to be responsive to the local situation and cannot cover a wide scope. The Bureau of Standards, however, with the resources and skill there available, has been able to try out the fundamentals of the whole subject and consequently to present a much more comprehensive report than opportunity permits in studying the troubles of a single road.

When a grounded electric railway is paralleled by a pipe system it is perfectly certain that current will flow from one to the other and will set up electrolysis wherever it leaves either. Many attempts have been made to protect the pipes by coating them with asphalt, paint or even insulating paper, so as to prevent the access of electrical currents. Messrs. Rosa and McCollum have made an extended investigation of the reliability of such protection and, after trying out from forty to fifty kinds of paints, papers and similar protection, have found that in every single case there has been failure within a few months. Other lines of action studied by the bureau have been the use of insulating joints and "pipe drainage." These Messrs. Rosa and McCollum regard as mere palliatives, with considerable danger of local injury to the pipes in regions of high potential gradient. Methods of chemical protection appear likewise to be of dubious utility, and the researches of the bureau indicate that the real remedy should be found in preventive rather than curative measures. Investigating the economic side of the situation, however, Messrs. Rosa and McCollum find that the weak point of the uninsulated negative feeder system is irregularity of potential gradient, not to be remedied save by an excessive expenditure in copper. They find a much better condition results from an insulated negative feeder system with feeders run from the negative bus and tapped into the rail system at numerous points. By adjusting the resistance of these feeders, not only is the average potential drop in the rail greatly reduced, but it can be made remarkably uniform. Feeders of this kind have sometimes had, particularly in European practice, negative boosters connected to them. This, of course, gives the same reduction of potentials and diminution of current density in the rails, but the saving in feeder copper has to be set off against the cost of operating the boosting system.

During 1912, after these studies were well under way, the physicists of the bureau made a test on the United Railway of St. Louis with the installation of this insulated negative return feeder system. The net result of the work was to show clearly that the insulated negative feeder system gives for the same amount of copper very much less potential differences than the uninsulated feeder system as between pipes and rails, in the ratio of five or even ten to one, and in every respect is very much better adapted to the prevention of electrolysis. Of course, the particular design of such a negative feeder installation will vary greatly, according to the nature of the conditions, but from the present results it appears that it can be made without prohibitive expense to give remarkably good protection against the conditions which result in electrolysis.

The Inductance of Air-Cored Solenoids

Inductances, like taxes, are always with us. Whenever we deal with an alternating-current circuit, whatever the frequency may be, the question as to the amount of inductance present is sure to obtrude itself as soon as we commence to investigate what happens. Formulas for the inductance of air-cored coils are known, and they have been developed in recent years to a high degree of precision; but they are ordinarily complicated, from the standpoint of the engineer. The article by Mr. Leonard A. Doggett which we publish this week gives a very convenient, compact formula for determining quickly, to a moderate degree of precision, the inductance of any cylindrical coil, from a flat or pancake form to that of a long helix or tube. It depends upon three mechanical measurements of the coil —length, internal diameter and external diameter. From these, with the aid of a pair of curves, drawn on logarithm paper, the inductance of the coil can be speedily evaluated.

Although a high degree of numerical precision cannot be expected from so short a formula involving graphical estimation on a curve sheet, yet for a great many engineering purposes the degree of precision obtainable will be sufficient. Moreover, even if a measurement presents itself in which a higher degree of accuracy is required than such a formula can offer, it is ordinarily preferable to work out the inductance approximately with a short formula, and then to proceed, with further expenditure of time and effort, into refinements. Otherwise a direct calculation by means of a longer but more rigid formula may contain some arithmetical error that will render the result useless.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Society for Electrical Development

At a meeting of the directors of the Society for Electrical Development held at the society's headquarters, 29 West Thirty-ninth Street, New York City, Jan. 26, a number of important matters were thoroughly discussed by the fifteen directors present. Reports of Mr. J. M. Wakeman, general manager, and Mr. Stephen L. Coles, acting secretary-treasurer, covering the operations of the society to date were read and accepted. The society now has 1233 members, classified as follows: Manufacturers, 166; central stations, 258; jobbers and dealers, 250; contractors, 543; miscellaneous, 16. Mr. Coles, who has been the acting secretary-treasurer of the society for the past six months, was elected secretary-treasurer.

Meeting of Empire State Gas and Electric Association

The second of the midwinter meetings of the Empire State Gas and Electric Association will be held in conjunction with the Eastern New York Section of the National Electric Light Association at the Edison Club, Schenectady, Feb. 6 and 7. Dr. William McClellan will present a paper at the opening session on "Various Matters Affecting Public Opinion on Gas and Electric Companies," which will be discussed at some length by assigned speakers. Immediately after the session a buffet luncheon will be served at the Mohawk Club. A continuation of the discussion on Dr. McClellan's paper will occupy part of the afternoon session, and Mr. C. W. Stone, of the General Electric Company, will read a paper on "Commercial Aspects and New Lamp Development with a Retrospect as to the Effect of the Tungsten Lamp on Company Earnings." A dinner will be served at the Country Club in the evening, presided over by Mr. R. M. Searle, of the Rochester Railway & Light Company, past-president of the association. A trip of inspection to the General Electric Works, the American Locomotive Works and the new coal-gas plant of the Mohawk Gas Company will occupy the attention of the members on Feb. 7.

Revised Standard Specifications for Incandescent Lamps

Following increases in efficiency of tungsten lamps, the Bureau of Standards has issued the sixth edition of its Circular No. 13, containing its standard specifications for electric incandescent lamps. This supersedes the fifth edition, issued May 25, 1912. In the new edition the lamp schedules have been changed, the tungsten lamps being placed in Schedule A, the graphitized-filament lamps in B, carbon in C, and carbon series railway lamps in D. The tantalum schedule has been omitted. Life-test lamps must give 100 per cent of their specified life, except in the case of carbon lamps, which need give only 90 per cent of their specified life. This latter allowance is made because the present rating of carbon lamps in watts per candle is probably a limiting value. The efficiencies of all tungsten lamps have been raised and the limits on excepted voltages have been lowered. The tungsten schedule includes specifications for 200-260-volt lamps. In the metallized-filament schedule the 80-watt lamp has been omitted, and in both the graphitized and the tungsten schedules the sizes of bulbs for the different size lamps are designated.

Chicago Automobile Show

Practically the entire first floor of the First Regiment Armory, Chicago, which was one of the buildings used for the Chicago automobile show, Jan. 24 to 31, was occupied by the exhibits of electric pleasure-vehicle manufacturers. Storage-battery and accessory manufacturers filled the galleries of both the armory and the Coliseum. Among the "electrics" the prevailing tendency is in the direction of even more luxurious finish and lower and more graceful bodies, while the ingenuity with which the detailed difficulties of construction have been surmounted marks the electric vehicle as the car of maximum life. Although some of the makers are non-believers in new yearly models, others are presenting special 1914 designs.

On Jan. 27 the Chicago Section of the Electric Vehicle Association held a special passenger division meeting at the Lexington Hotel in connection with the show. The Electric Storage Battery Company gave a dinner at the Midday Club on the night of Jan. 28 for electric-vehicle manufacturers, dealers and others. This dinner seems to have become an annual feature of the Chicago show.

Annual Banquet of Lynn Section, A. I. E. E.

Two hundred and forty members and guests of the Lynn (Mass.) Section of the American Institute of Electrical Engineers assembled at the American House, Boston, on Jan. 24 for the annual banquet of the organization, which, with a total membership of 640, is the largest Institute section now in existence. Mr. Thomas D. Lockwood, manager of the patent department of the American Telephone & Telegraph Company, delivered the principal address of the evening on the subject "The Value of Minor Inventions." Mr. W. A. Hall, of Lynn, acted as toastmaster. The electrical decorations included miniature luminous-arc lamps carrying the Institute's name as a border along the front of the head table; a transparency of the new Lynn section button, 20 in. in diameter, and a rearrangement of the lighting of the banquet hall by the substitution of 100-watt amber-dipped lamps in the existing fixtures.

President C. O. Mailloux of the Institute was present and emphasized the spirit of solidarity illustrated by the growth of the Lynn Section, urging the full co-operation of all in making the San Francisco Electrical

Congress of 1915 a success. Mr. D. B. Rushmore voiced the need of more engineers in public life, particularly on state commissions, and Mr. W. C. Fish emphasized the importance of extending the engineering point of view throughout all walks of life. Mr. Lockwood discussed the humorous side of invention, also sketching the progress of electrical development in a philosophical vein and touching upon the relation of the telephone to the advance of civilization. Over 10,000 telephone patents have now been issued, and in 1913 there were about 25,500,000 daily telephone conversations in this country. It is estimated that the multiple switchboard saves at least ten seconds per connection, an economy of time that amounted to 928 years for American telephone users during the past twelve months.

The Electric Vehicle at Boston

At the regular meeting of the Electric Motor Car Club of Boston on Jan. 27 it was announced that in February an electric-vehicle meeting will be held at the American House, Boston, to which invitations will be sent by the Boston Edison Company to the Governor of Massachusetts, the Mayor of Boston, the Board of Street Commissioners of Boston, Massachusetts Highway Commission and other governmental authorities. Following a banquet, special efforts will be made to bring home to the public officials present the advances lately made in electric motor-car transportation. Other business includes the discussion of preliminary plans for the establishment of a down-town electric garage, giving special service during theater hours to owners of electric pleasure cars, and the consideration of organization against adverse bills before the Massachusetts Legislature bearing upon motor-vehicle service.

"Common Ground" in the Electric-Vehicle Industry

Mr. Hayden Eames, Cleveland, Ohio, speaking before the Chicago Section of the Electric Vehicle Association of America on Jan. 27, forcibly pointed out that the common ground upon which electric-vehicle manufacturers, garage owners, dealers and electric-car owners should stand is the question of public education. The average man of to-day takes no interest in an advertisement describing an electric car, said Mr. Eames, because he has not been educated to appreciate the advantages and economies derived from the use of electric vehicles. Hence work of an educational character must be done and this work will be of benefit to all concerned in the electric-vehicle industry.

Mr. Eames also stated that there was at present one electric car for each 300 inhabitants in Cleveland, Ohio. These figures give Cleveland a greater number of "electrics" per capita than any other city in the world. Although, said the speaker, a greater percentage of people in Cleveland than in any other city store and charge their cars on their own property, the garage men are prosperous. The garage man's business, maintained the speaker, should be the natural overflow from the home garages, it being a short-sighted and unwise policy for any one to discourage the tendency of an owner to keep his car at home.

In discussion near the close of the meeting Mr. H. J. Murphy, a Chicago garage owner, questioned the advisability of recent advertising of the Electric Vehicle Association, stating that the average cost of maintaining an electric vehicle in the United States was $23.50 a month. In Chicago, said Mr. Murphy, a garage owner would be unable to operate on such a price, and advertising of this type is producing dissatisfied customers.

"Tech" Research Laboratory to Study Store-Delivery Methods

R. H. Macy & Company, New York, have contributed largely to an investigation of department-store delivery methods to be carried on by the electrical research laboratory of the Massachusetts Institute of Technology, Boston, which has already made extended studies of trucking problems in that city. The Macy company employs 400 vehicles, horse-drawn, gasoline and electric, in its delivery service, the cost of which is more than $1,000,000 a year. A special staff of three research assistants will spend four or five months in New York studying the methods of the Macy store and determining the character of deliveries, zones and distances, speeds, loadings, running and standing times of wagons, etc.

The first of the present studies of the research division on the operation of delivery vehicles was undertaken at the initiation of President C. L. Edgar of the Edison Electric Illuminating Company of Boston. A paper giving the final results of this investigation will be delivered at the Electric Vehicle Association's meeting in New York Feb. 17.

Dr. Steinmetz on the Electric as the Ultimate Car

That the future of the automobile belongs to the electric vehicle was the prediction of Dr. C. P. Steinmetz in an address before the Electric Vehicle Association of America at its New York meeting, Jan. 28. Automobiling, said the speaker, is at present in very much the condition bicycling was eighteen years ago. Its attraction is chiefly that of a sport. The business or professional man drives a car because his associates have them, and despite his natural inclination in favor of some form of transportation in which the passenger is conveyed without effort. With the introduction of the cheaper gasoline automobiles the elements of "sport" and social prestige in connection with having a car are already beginning to disappear, leaving the automobile in its proper field as a utility conveyance. With the element of "sport" eliminated, the owner will no longer care to perform the labor of driving his car, and if he can afford it he will hire a chauffeur. On the other hand, the far larger class which must do its own driving will insist on having the car which is simplest and easiest to operate and maintain, and that car is, of course, the electric.

The greatest present need in the industry, declared Dr. Steinmetz, is a light, cheap electric vehicle corresponding to the Ford machine in the gasoline field. While there will always be a certain market for the present luxurious electric automobiles, a far larger opportunity exists for a plain, well-constructed, inexpensive vehicle to meet the uses of the average man. And for the broadest development of the electric vehicle the matter of charging should be handled by some central organization in each community, properly the local electric company. By off-peak early-morning charging the average passenger car could be supplied with energy at a cost as low as, say, $5 per month, or 17 cents per charge, said Dr. Steinmetz. Adding to this the cost of delivery service at, say, 10 cents per day, the expense of keeping an electric vehicle would not be excessive. Such low rates for electric-vehicle garaging would be possible, of course, only with a comparatively large number of cars in service, but the results of such co-operation on the part of the central station would secure for it profitable use of its off-peak early-morning energy, and for the vehicle industry the greatest possible expansion in the demand for electric automobiles.

Col. E. W. M. Bailey preceded Dr. Steinmetz with an account of the recent Boston-Chicago run of a Bailey electric roadster, reports of which appeared in the *Electrical World* of Nov. 1, Nov. 8 and Dec. 6, 1913.

Electric Trucks in Post Office Service Abroad

For postal delivery service in the city of Vienna the Austrian Post Office Department now makes use of thirty 2.5-ton electric trucks which are rented on a mileage basis by a local omnibus firm. The battery equipment of each truck consists of forty-two 300-amp-hour cells, assuring a radius of travel of at least 25 miles. Each front wheel contains a 15-hp motor with couple-gear transmission. The wheel-base measures 130 in., and the front wheels are 33.5 in. in diameter and the rear wheels 35.5 in.

In Vienna, just as in the case of several American cities, the choice of electric trucks for post office service followed careful tests of an experimental fleet, the records of which were carefully investigated. The first of the present Daimler electric trucks entered the service of the Vienna post office early in 1912, and during the following twelve months this car was driven 10,600 miles. After severe tests the general postmaster, Mr. von Uhl, found the electric truck to effect a saving of about 20 per cent in operating cost, besides its manifest advantages of safety, cleanliness, simplicity, noiselessness and absence of odor.

B. J. Arnold on Subways and Terminals

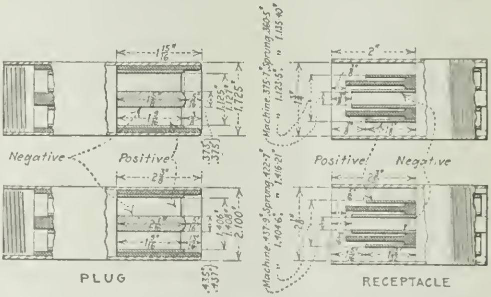
Before an exceptionally well-attended meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers on Jan. 26, Mr. Bion J. Arnold gave an illustrated talk on "Subways and Railroad Terminals." Mr. Arnold is well qualified to discuss these subjects, as he has made several engineering reports in relation to them dating back to 1902, and as he is also chairman of the Board of Supervising Engineers, Chicago Traction. Mr. R. F. Schuchardt, chairman of the electrical section of the Western Society, presided. Mr. Arnold described his 1911 plans with the aid of lantern-slide pictures and gave a lucid explanation of the general subway situation in Chicago. A vital question is the amount of rental, or interest, to be paid by the traction companies for the use of the subways. On that depends the amount of original expenditure, which probably ought not to be less than $30,000,000 or more than $50,000,000, considering the initial project. There should be no grade crossings in the subways, and this safety measure necessitates double-deck subways at intersecting points. The space between the crown of the concrete tunnels of the Chicago Tunnel Company and the street pavement is about 33 ft. To get a double-deck subway where necessary in this space has required close figuring, but Mr. Arnold feels confident that it can be done. Public-utility galleries should be provided in any system of subways adopted.

All subway schemes must, in the end, provide for a comprehensive service with high-speed, ten-car trains, each car to be as large as those used at present on the elevated railways. That does not mean that it would be wise to build more than the most needed portion first, for it seems clear that Chicago cannot support a comprehensive, city-wide subway system from the start. It is a fact, however, that a subway for surface cars can be justified only on the ground of relieving congestion. A subway for single-unit surface cars will not pay from a financial point of view. Ultimately such a subway must become part of a comprehensive high-speed system.

Mr. Arnold explained briefly the plan he has worked out for railroad terminals and his proposed system of through-routing of suburban traffic by the railroad companies. There was a brief discussion, in which Mr. James Lyman, Mr. E. N. Lake and others took part. In answer to a question Mr. Arnold said that the two-track "initial subway," recommended for Clark Street by the Board of Supervising Engineers, was not planned as a four-track subway at the beginning simply because the money was not in sight to build it. However, the subway has been planned so that it could be extended to accommodate four tracks later. Mr. Arnold expressed sympathy with the idea of defraying the cost of subways by special assessments on the property benefited. This plan has been adopted in San Francisco. The speaker mentioned the rise in the value of real estate along the line of the subways in New York north of 125th Street. This increase in values was equivalent to the cost of the subways. The special assessment plant is fundamentally just, but no doubt it would meet great opposition in Chicago.

Standard Charging Plugs for Electric Vehicles

Herewith are shown the standard forms of charging plugs and receptacles recently adopted by the Electric Vehicle Association of America. The committee which recommended these plugs comprised Messrs. E. R. Whitney, chairman; Alexander Churchward, J. R. C. Armstrong, H. H. Rice, W. E. Holland, E. J. Ross, Jr., E. Gruenfelt, Charles Blizard, J. H. Hertner and Louis Burr.



STANDARD FORMS OF 50-AMP AND 150-AMP CHARGING PLUGS AND RECEPTACLES

The outside contact, it will be noted, is of positive polarity while the inner contact is negative. Terminals should be marked with plus and minus signs to correspond with the polarity above given. The dimensions shown relate to plugs and receptacles for carrying 50 amp and 150 amp respectively, and the National Board of Fire Underwriters has approved plugs of these dimensions for overloads of 50 per cent beyond the current ratings given. In constructing the plugs it is desirable that the contacts be accurately concentric to insure interchangeability.

Exhibit Arrangements for Anglo-American Exposition

Celebrating the centenary of peace and progress in the arts, sciences and industries of the United States and the British Empire, the Anglo-American Exposition is to be held in London from May to October of this year. In order to interest American exhibitors special arrangements have been made for installing displays of absentee exhibitors at a fixed charge. For 100 sq. ft. of exhibit space, the booth fees for which are $2.50 per sq. ft., the committee offers, for example, to install booth and lighting, unpack and display articles, keep stands clean, furnish an attendant and supervise arrangements, all for a total charge of about $750.

The department of electricity of the exposition has been divided into the following sections: Plant, distribution of electrical energy, utilization, direct-current and alternating-current motors, heating, cooking and domestic appliances, electro-chemistry and metallurgy, telegraphy and telephony, and miscellaneous. Mr. W. H. Mordey is chairman of the electrical committee, Mr. Robert Hammond vice-chairman, and Mr. H. R. Kempe honorary secretary. The American executive offices are in the Woolworth Building, New York City, and Mr. Albert E. Kiralfy is commissioner-general.

Convention of Northwestern Cedarmen's Association

The eighteenth annual convention of the Northwestern Cedarmen's Association, held at Escanaba, Mich., Jan. 27 and 28, was well attended by the leading white-cedar producers of the Northern tier. In his opening address, Mr. M. C. Moss, president of the association, briefly reviewed the cedar industry during the last year, saying that there have been no unusual developments either in the amount of timber cut or in the number of sales. Stocks were also probably lower than in previous years. Business has been comparatively quiet, but indications now point to better conditions in both demand and price in the early future. Mr. N. E. Boucher, of Minneapolis, secretary of the association, reported that matters of reductions of freight rates have received constant attention during 1913.

The committee on changing the association's name next reported through its chairman, Mr. E. L. Clark, of the Valentine-Clark Company, who recommended that the name "The Northern White Cedar Association" be adopted by the association. This title, he said, would definitely specify the character of the cedar handled by the Northern producers as distinguished from the Western red cedar. After some good-natured opposition on the part of Mr. H. F. Partridge, this change of name was approved practically unanimously.

On Tuesday afternoon Mr. F. P. Vose, Chicago, secretary of the Electrical Credit Association of Chicago, explained the plan and scope of the latter's work. Mr. A. O. Kuehmsted, president of the credit association, also spoke. In the evening the eighteenth annual banquet was held in the large dining room of the New Delta Hotel, and at the close of the festivities the Escanaba men received a vote of thanks. A novel feature of the banquet entertainment was the impersonation by Mr. Charles Goodwin, a local cedar producer, of a French-Canadian lumberjack equipped with winter cutting kit, who forced his way into the dining room and insisted on sitting at the guests' table. After several recitations in dialect, the stranger removed his make-up and revealed his identity. Another feature was the singing of Mr. Joseph A. Naugle.

On the suggestion of Mr. E. L. Clark, a guarantee fund was subscribed to participate in the forest-products expositions at Chicago and New York, provided that the committee charged with the matter shall deem it expedient to establish an exhibit of Northern white-cedar products. The committee is composed of Messrs. E. L. Clark, L. A. Page, W. B. Thomas, J. C. Kirkpatrick, W. P. Browning and H. S. Gilke.

The following officers and directors were elected: President, Mr. J. W. Benham, Naugle Pole & Tie Company, Chicago; vice-president, Mr. L. A. Page, Jr., Page & Hill, Minneapolis, Minn.; secretary, Mr. N. E. Boucher, Minneapolis, Minn.; treasurer, Mr. W. B. Thomas; directors, Messrs. M. J. Bell, J. E. Gerich and L. A. Furlong.

Proposed Anti-Trust Legislation

Following closely the message of President Wilson to Congress in reference to anti-trust legislation, the full text of four of the bills which it is proposed to make the basis of Congressional action has been made public. The bills relate to an interstate trade commission, definitions under the Sherman law, interlocking directorates and trade relations. The fifth of the proposed bills will provide for regulation by the Interstate Commerce Commission of securities of interstate railroads.

The bill relating to the interstate trade commission provides for a commission of five members drawing a salary of $10,000 each, not more than three of whom shall be of the same political party. The Bureau of Corporations will be merged in the new commission.

All corporations engaged in interstate commerce or commerce with foreign nations, excepting common carriers, will be required to furnish information as prescribed by the commission. The commission or its agents will have complete access to all records of such corporations. Failure to comply with the act will constitute a misdemeanor and subject the corporation upon conviction to a fine of not more than $1,000 for every day of failure. The information so obtained will be a public record and may be made public by the commission. The commission will receive authority to institute an investigation to determine whether or not any corporation subject to the act was organized, or had established relations, or was conducting its business in whole or in part, in violation of the Sherman law. If the commission shall find violation, the matter will be submitted by it to the Attorney-General and proceedings will be begun. Upon request of the Attorney-General or any corporation affected, the commission shall at any time investigate any corporation subject to the act.

The section of the bill prohibiting interlocking directorates provides that after two years from date of approval of the act no person engaged as an individual, as a member of a partnership, or as a director or other officer of a corporation in the business, in whole or in part, of manufacturing or selling railroad cars or locomotives, rails, structural steel, or mining or selling coal, or in the conduct of a bank or trust company, shall act as a director or other officer or employee of any railroad or other public service corporation conducting an interstate business. After two years from date of approval of the act no person shall at the same time be a director or other officer or employee in two or more federal reserve banks, national banks or banking associations, or other banks or trust companies which are members of any reserve banks and are operating under the currency law of 1913; and a private banker and a person who is a director in any state bank or trust company not operating under the currency law shall not be eligible to be a director in any bank or banking association or trust company operating under the currency law. Violations shall constitute a misdemeanor, punishable by a fine of $100 a day or by imprisonment for not exceeding one year, or by both.

The bill defining the Sherman law is entitled "A bill to include within the meaning of every contract, combination in the form of trust or otherwise, conspiracy in restraint of trade or commerce among the several states or with foreign nations, and within the meaning of the word 'monopolize,' certain definite offenses, and to prohibit the same." Companies, combinations or agreements for the following purposes are definitely brought within the scope of the Sherman law:

"First—To create or carry out restrictions in trade or to acquire a monopoly in any interstate trade, business or commerce.

"Second—To limit or reduce the production or increase the price of merchandise or of any commodity.

"Third—To prevent competition in manufacturing, making, transporting, selling or purchasing of merchandise, produce or any commodity.

"Fourth—To make any agreement, enter into any arrangement or arrive at any understanding by which they, directly or indirectly, undertake to prevent a free and unrestricted competition among themselves or among any purchasers or consumers in the sale, production or transportation of any product, article or commodity."

Violation shall, upon conviction, be punishable by a fine of not exceeding $5,000 or imprisonment not exceeding one year, or by both. The offense of the corporation shall be deemed to be also that of the individual directors, officers and agents of the corporation authorizing, ordering or doing any of the proscribed acts, and upon conviction they shall be deemed guilty of a misdemeanor and punished by a fine not exceeding $5,000 or imprisonment not exceeding one year, or both. Nothing contained in the act shall be taken to limit or in any way curtail the effect of the Sherman law.

The trade relations bill as drafted definitely amends the Sherman act. It shall be deemed an attempt to monopolize trade or commerce among the several states or with foreign nations or a part thereof for any person in any state or foreign country to discriminate in price between different purchasers of commodities in the same or different sections or communities with the purpose or intent thereby to injure or destroy a competitor either of such purchaser or the seller; provided that nothing contained in the bill shall prevent discrimination in price between purchasers of commodities on account of differences in the grade, quality or quantity of the commodity sold or that makes only due allowance for difference in the cost of transportation. Nothing contained in the act shall prevent persons engaged in selling goods, wares or merchandise in interstate or foreign commerce from selecting their own customers, but this provision shall not authorize the owner or operator of any mine engaged in selling its product in interstate or foreign commerce to refuse arbitrarily to sell the same to a responsible person, firm or corporation who applies to purchase. It shall be deemed an attempt to monopolize trade or commerce for any person in interstate or foreign commerce to make a sale of goods, wares or merchandise, or fix a price charged therefor, or discount from or rebate upon such price, on the condition or understanding that the purchaser thereof shall not deal in the goods, wares or merchandise of a competitor or competitors of the seller. Other provisions relate to persons who have causes for action on account of practices involving infractions of the law.

Statements of the views of President Wilson on anti-trust legislation made public on Jan. 26 amplify his message to Congress. It is his idea that the proposed interstate trade commission shall not be an administrative body but an agency for publicity and information and an adviser to the Department of Justice and the courts. The commission's findings would not be binding on anybody. The Attorney-General and not the trade commission would determine whether or not there had been infraction of the law. The courts would be privileged to amend or to refuse to accept the decrees of the commission. It is also stated that the President is anxious to have the commission avoid unfairness by giving publicity to legitimate methods of business that would help the rivals of a corporation at its expense. It is his idea, however, that there should be entire publicity by the commission in regard to matters which concern the public, particularly the investing public. The statement of the President on one point has been that the proposed legislation is not intended to bar anything that is not in nature and spirit a monopoly.

Affairs of the Sanitary District of Chicago

In his annual report for the year 1913, recently published, Mr. Thomas A. Smyth, president of the board of trustees of the Sanitary District of Chicago, makes no direct reference to the politico-industrial dispute between trustees of the Sanitary District and municipal authorities of Chicago in relation to the cost of electrical energy supplied by the District for street lighting in Chicago. Mr. Smyth says that the value of material and labor so far used in the original contract for supplying and operating 10,000 flame-arc lamps for street lighting in Chicago is $2,568,960. He advises that some method be considered by which the peak load of the District's electrical plant may be provided for, either by installing an auxiliary steam plant or by increasing the rating of the present steam plants controlled by the District. He points out that the construction of the Chicago Drainage Canal is such that there is no opportunity to store water in reservoirs, as is done in the case of other hydroelectric plants. He recommends that have arisen in relation to the operation of the electrical department. These questions are enumerated as follows:

1. Should electrical energy be sold during the day to consumers that take such energy during the peak-load period?

2. Would it be better to sell the energy during the day to those consumers only who will not take the energy during the peak-load period? In this connection it should be determined whether there is a demand for electricity under those conditions.

3. How much rating should be retained at all times as spare to take care of emergencies?

4. Would it be better to sell the electricity to consumers who take it during the peak-load period and in order to do so provide an auxiliary plant to manufacture electricity during the peak-load period?

5. What is the rate that the District can properly demand for its commercial load that will accomplish the sale of the entire day load?

Mr. Smyth recommends that the Sanitary District employ an engineer of ability to consider these subjects in collaboration with the electrical engineer of the District.

Mr. E. B. Ellicott, electrical engineer of the Sanitary District, has written a letter addressed to Mr. Thomas M. Sullivan, chairman of the engineering committee of the District, in which he says that one thing to be kept in mind by all who discuss the subject of the cost of producing the electrical energy is that the cost of production of energy is the same for municipal and commercial purposes. The only variable is in the distribution of the energy. Mr. Ellicott says that there will be as many opinions as to the charges to be made for distributing energy as there are engineers consulted. Mr. Ellicott did not agree with Mr. Palmer, the city electrician, on all charges, but he says that he and Mr. Palmer finally adjusted their differences, and that all engineers will have to agree on the charges before an exact comparison of costs can be made. Mr. Ellicott concludes his letter by saying that unless practically all of the charges assessed against the total load by Mr. Palmer and himself are sustained, he cannot see his way clear to recommend investment of additional money to provide for the peak load caused by commercial users, "because such additional fixed charges and attendant expenses charged to commercial load might show the margin of profit so low that any considerable reduction in rates or quantity sold would show a loss on our commercial business."

Several civic organizations under the leadership of the City Club of Chicago have united in the appointment of a committee of fifty citizens to assist in making an investigation of the conduct of the electrical department of the Sanitary District. Mr. John F. Bass was elected chairman of the citizens' committee.

Annual Meeting Western Association of Electrical Inspectors

The ninth annual convention of the Western Association of Electrical Inspectors was called to order by the president, Mr. Benjamin W. Clark, of Detroit, on Jan. 27 in the convention hall of the new Hotel Gibson, Cincinnati.

Some twenty members came by special train from Chicago, where a preliminary program had been arranged at the Underwriters' Laboratories, Inc. Current break-down tests were made on tabular resistor units and voltage break-down tests on slate panels. The use of such tests in ordinary routine work of electrical fitting was explained in detail by Mr. W. H. Glover, electrical engineer of the laboratories. Further tests included demonstrations of sectional moving-picture-film cases and of the high electrical resistance along the cable of the metal sheath of armored conductors. Apparently the conductivity of such sheaths cannot be depended on to prevent burn-outs by chance leakages from contained conductors.

On the evening of Jan. 26 the delegates were entertained in Chicago at a theater party. The early registry of members at Cincinnati was unusually large, some seventy-five being present at the first session, representing municipalities and underwriters' inspection departments throughout the Central and Middle Western States, some Pacific points and Canada.

Mr. Frederick S. Spiegel, Mayor of Cincinnati, in his welcoming address briefly noted decisions made by him as a justice in the courts of his city, one of which awarded damages against a dry-goods firm for permitting wiring alterations in a display window to be made by an inexpert employee, the result being a disastrous fire and a death.

Mr. H. B. Long, of Kentucky, responding for the Western Association, spoke particularly of the growing tendency of state and municipal legislation to restrict the installation of wiring to qualified wiremen. This tendency, joined with the closer adherence to an unchanged National Electrical Code standard and wider use of the performance tests of the Underwriters' Laboratories, has been increasing the value of the inspectors' work.

Mr. Clark then made a short presidential address, in which he emphasized the necessity for concentrating attention rather on inspection methods and uniform interpretation than on uniform rules, which the National Electrical Code now so well supplies.

Mr. W. S. Boyd, secretary and treasurer, presented reports in both capacities. He stated the present membership to be 173 and spoke of the difficulty in maintaining constant progress in committee work, which has heretofore been the principal activity of this association and has resulted to an unprecedented degree in the desirable unanimity in the decisions of inspectors on inspection matters over a wide and diverse territory. Mr. Boyd suggested the advisability of collecting a reference library of electrical standards more or less supplementary to the National Electrical Code and of making such references readily available to all the members, as any individual may require such additional suggestions.

After receiving invitations from several cities, among them Minneapolis, St. Boniface (Manitoba), San Francisco and Indianapolis for next year's meeting and the reference of these invitations to the executive, the president appointed a nominating committee, a committee to report on the circulating or reference library matter, and a committee to revise the articles of association with a view to extending the territory from which active members may be admitted. The inclusion of Canadian and Pacific Coast members has been particularly urged by the representatives from many municipalities in those sections.

Overhead Wiring

The report of the committee on overhead wiring was next presented by Mr. Guy W. See, acting chairman. Mr. See referred only to the questions of insulation of wires and insulating guy wires. The committee recommended use of insulation for circuits up to nominal 2300 volts operating potential, both from the standpoint of continuity of service and from that of additional safeguard to linemen working among such wires. The recommendations of the National Electric Light Association's overhead-wiring committee were adopted in substance by the Western Association committee as its own for guy-wire insulation and grounding.

Somewhat in confirmation of the suggestions of the above committee were the conclusions stated by Mr. E. J. McGann in his paper on "Whether 2300-Volt Primaries Should Be Run Without Insulation on the Conductor Itself." Mr. McGann has conducted at the electrical laboratories of the city of Chicago a number of tests on various samples of weatherproof wire to determine the effectiveness of the insulation as a dielectric after different periods of use. These tests were made on dry and immersed samples, new and in service for three, five and ten years. While new wire with moisture repellant still in place withstood four times the normal voltage of the lines, wet samples barely withstood the line voltage to ground, but showed a good factor of safety for line crosses where the insulation of two wires is interposed. Samples taken out of lines which had been in service several years had lost very considerably in dielectric strength dry, but even more wet, and none but the new wire gave an insulation test indicating reliable protection for linemen on poles. The tests show that in general even wet insulation may for 2300 volts be depended on for ten years if the insulation remains intact to prevent break-down when wires of opposite polarity swing together. Mr. McGann drew the conclusions that present standards of weatherproof insulation give a distinct advantage over uninsulated wire by protecting against primary contacts to secondary, protecting continuity of service and protecting linemen in dry weather or with new insulation. Mr. McGann concluded with an earnest plea for a better insulation for overhead wires, asserting that dearer line construction would be repaid by greater safety to life and apparatus and by continuity of service, and suggested that the overhead-wiring committee bring in at the next meeting specifications for such an insulation.

While not intended as at all exhaustive, this series of tests marks a real advance in the present knowledge of the value of weatherproof insulation for 2300-volt construction. The question of 6600-volt construction was not touched on, and at least for present insulation Mr. McGann recommended use of insulating gloves by linemen working on live 2300-volt lines.

Show-Window Lighting

The report of the committee on show-window and display lighting was read by the secretary of the association in the absence of the chairman, Mr. F. P. McGough.

The report gave a summary of progress in show-window lighting and the part inspection has played in securing efficient as well as safe window illumination. Some recommendations were included as to means of avoiding certain hazards incident to the use of lamps near the displayed materials, and particular mention was made of the disadvantages of stem fixtures from their frailty and liability to grounds. Key sockets were condemned and lamps exposed to contact on side walls were shown to be ineffective as well as readily injured.

Temporary wiring and the use of low-hanging display fixtures were generally censured, and the analogy between good illumination and safe, permanent construction was clearly drawn.

Discussion was left to a later session, in the belief that it would be more valuable if it were all covered under the head of "Inspection Problems."

On the evening of Jan. 27 the members were entertained at a "smoker" given by the Cincinnati electrical interests.

Incandescent Lamps

Wednesday's session opened with a paper by Mr. R. H. Shenton, of the National Electric Lamp Works, who spoke on "The Incandescent Lamp and Its Circuit." The speaker remarked that just as the efficiency of light sources has increased, so has the demand for illumination, and while the incandescent lamp has now one-fourteenth the power consumption per candle that was demanded by its predecessors twenty years ago, the power consumption for illuminating a given area has risen. There is, however, a subdivision into smaller units, and Mr. Shenton questioned the necessity for so close a limitation of the number of lamps per circuit as the sixteen prescribed by the National Electric Code.

The discussion brought out the possible fire hazard caused by reason of the comparatively high bulb temperature of the gas-filled incandescent lamps of to-day, which the speaker explained was a result of convection taking the place, to some extent, of the radiation of heat from the incandescent filament.

Car Wiring

The report of Mr. F. Daniel for the committee on electric traction systems dealt solely with car wiring, and the committee proposed a complete set of rules for car wiring to cover the higher voltage systems as well as the 550-volt systems at present contemplated by the National Electrical Code rules. The proposed changes from the present requirements for car wiring at lower potentials consist of modifications which have been indicated by actual experience with car wiring installed in accordance with present rules. An interesting talk on car-wiring progress was given by Mr. M. C. Anderson, of the Cincinnati Car Works, at the afternoon session.

Theater Wiring

Mr. F. L. Lucas, chairman of the committee on theater wiring, reported in favor of requiring all permanent theater motors to be of the inclosed type, unless placed in fireproof rooms. He also urged a record by inspection departments of the defects noted in incoming show equipments as a safeguide to inherent defects of various types of devices and the sending of notices as to local inspection department requirements of the National Electrical Code. Standard construction was also recommended to each theatrical company booked a short time before the date of its arrival. The afternoon session was concluded with a discussion of various inspection problems, some of which will be touched upon in a later issue.

On Wednesday night a banquet provided by the electrical salesmen and contractors of Cincinnati was held in the ballroom of the Hotel Gibson. The growth in co-operation between the formerly antagonistic constructive electrical interests and inspection departments in Cincinnati was made the subject of much comment. Some of the early inspection problems were recalled with mutual interest to manufacturers, contractors and inspectors. Mr. W. E. Milnor, of Cincinnati, acted as toastmaster, and all but one of the past-presidents of the association were present and made addresses, a telegram being sent by Mr. Waldemar Michaelson, of Omaha.

The program for Thursday morning consisted of committee reports as follows: "Installation and Operation of Induction Motors," by Mr. K. W. Adkins; "Architects' Specifications," by Mr. F. H. Moore; "Signal Systems," by Mr. F. S. Anderson; "Rubber-Covered Wire," by Mr. B. H. Tousley. In the afternoon there was a tour of inspection which included the pumping station and filtration plants of the new Cincinnati water-works.

Public Service Commission News

Wisconsin Commission

A letter and data sheets have been sent out by the statistical department of the Railroad Commission of Wisconsin to the electric utilities of the State. It is the commission's plan to use the information received in the replies to formulate a set of rules or recommendations for the guidance of utilities seeking advice on the question of extensions or other allied matters.

A committee was appointed at the recent convention of the Wisconsin Electrical Association to make a similar investigation. It is probable that this committee will work in conjunction with the commission, with the result that the commission may issue a formal order in the matter or that the essence of the report may be incorporated in the rules for electric service.

The questions which the commission asked the utilities to answer are as follows:

"1. Have you a definite practice regarding the treatment of the expense of extending your lines to reach applicants for electric service?

"2. Is the expense of such extensions represented by a fixed amount per prospective consumer, or does it vary with the estimated revenue to be received from the applicant or group of applicants? State rule in full.

"3. (a) What is your rule in regard to extending lines beyond the point to which they will be extended without charge by the utility; that is, will you extend lines beyond the usual distance if the prospective consumer or consumers agree to meet a portion of the cost? (b) When consumers share in the cost of extensions, is the money advanced by them refunded? If so, under what conditions?

"4. Do you make a charge for connecting consumers where it is unnecessary to extend the lines? If so, what is the amount and basis of this charge?"

New Jersey Commission

The Board of Public Utility Commissioners has granted the Commonwealth Water & Light Company, of Summit, N. J., permission to issue $150,000 of 6 per cent five-year notes, subject to the specific understanding that it proceed at once to separate its properties into distinct corporations. With such provisions the water properties controlled by the company in the northern section of the State will be consolidated into one company, and the electric companies into a single electric company. In the Lakewood section the water and sewer properties will be brought under the control of the Lakewood Water Company, and all electric properties in both Lakewood and Point Pleasant sections will be under the jurisdiction of the Lakewood Electric Company.

The Jersey Power Company, of Boonton, has made application to the board for permission to issue $75,000 securities, the proceeds to be used for extensions.

Current News Notes

Ohio State University Electrical Show.—Members of the student branch of the American Institute of Electrical Engineers at Ohio State University, Columbus, Ohio, will hold an electrical show April 16, 17 and 18, similar to the one given several years ago. It is planned to have exhibits from several hundred manufacturers of all kinds of electrical machinery and apparatus.

* * *

Radio Stations.—Supplement No. 1 to the list of radio stations of the United States, edition of July 1, 1913, has been issued by the Department of Commerce, covering all additions and alterations to Oct. 1, 1913. The new supplement contains twenty-seven pages and can be secured from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents per copy.

* * *

An Obliging Street-Lighting Schedule.—From the Rolling Prairie (Ind.) *Record* is quoted the following self-explanatory notice: "Hereafter the street lamps will be turned off at 10 o'clock at night. If there is any person expected to return home by late train or any public gathering, the lights will be left burning until a later hour if such notice is given central at the telephone office."

* * *

Cleveland to Have an Electric Show in May.—The Electrical League of Cleveland is planning a large electrical exhibition to be held in that city in May. A committee consisting of Messrs. M. E. Turner, of the Cleveland Electric Illuminating Company; N. H. Boynton, of the National Electric Lamp Association, and T. P. Cagwin, of the Cleveland Telephone Company, has reported favorably. Many electrical concerns have signified their intention to take space.

* * *

Extension of Northwest Station.—Work on the extension of the Northwest generating station of the Commonwealth Edison Company of Chicago was begun last month. This station has two vertical 20,000-kw generating units, while a horizontal 30,000-kw unit, for which the present extension will provide, is on order. At the same time the addition to the Fisk Street station, housing the 25,000-kw and 20,000-kw units now under erection, is well advanced toward completion.

* * *

Electric Show for Salt Lake City.—The Electric Show Association of Utah will hold its third annual exhibit at Salt Lake City during the first week of April. A large downtown building has been arranged for the occasion and the show promises to be one of the most successful ever given by the association. The officers for 1914 have been elected as follows: Mr. B. W. Mendenhall, president; Mr. C. B. Hawley, vice-president; Mr. W. W. Torrence, secretary, and Mr. J. C. Gleeson, treasurer.

* * *

Navigability of Desplaines River.—In the pending suit before the United States Supreme Court Attorney-General P. J. Lucey of the State of Illinois has filed a brief contending that the Desplaines River is a navigable stream. His object is to defeat the attempt of the Economy Light & Power Company, of Joliet (now a part of the Public Service Company of Northern Illinois), to construct a dam across the Desplaines River at Dresden Heights. The company has contended that the river is not navigable.

* * *

Street-Lighting Survey for Milwaukee.—A thorough survey of Milwaukee's street-lighting equipment will be made under supervision of the Common Council, according to the newspapers of that city. The finance committee of the Council has recommended an appropriation of $5,000 for the purpose. The present street-lighting system is said to be inefficient and wasteful, owing to the practice of allowing aldermen to cause lamps to be placed indiscriminately to please individuals rather than to serve the needs of the community.

* * *

Hydraulic Work on Coon Rapids Plant Completed.—The hydraulic work on the Coon Rapids hydroelectric plant of H. M. Byllesby & Company on the Mississippi River, about 11 miles north of Minneapolis, is practically completed. Work will be begun at once on the generating station, and it is expected that before the end of the present year electrical energy will be transmitted to Minneapolis, where it will be used by the Minneapolis General Electric Company. The ultimate rating of the plant will be about 15,000 hp. An article in the *Electrical World* of Nov. 29, 1913, page 1094, gave an outline description of the enterprise.

* * *

Buffalo Electric Show.—Under the auspices of the Jovian League of Buffalo, N. Y., an electric show is to be held at the Elmwood Music Hall in that city March 9 to 14. An electric fountain will be the central feature of the 10,000-ft. exhibit space, the illumination effects for which have been designed by Mr. W. D'A. Ryan. Mr. E. D. McCarthy is general chairman of the Buffalo Electric Show, Mr. W. E. Robertson is in charge of exhibits, Mr. W. R. Huntley of finance, Mr. G. H. Calkins of concessions, Mr. L. F. Philo of advertising and publicity, Mr. H. I. Sackett of the program, Mr. J. J. O'Leary of decorations and illumination, Mr. F. A. Coupal of service, Mr. C. W. Underwood of entertainment, and Mr. L. W. Wipperman of tickets and admissions. Mr. Harry S. Hilliker is secretary of the show,, the general offices of which are in the Electric Building, Buffalo.

Suggests Legislation to Equalize Lighting Cost.—In a recent talk before the Cook County Real Estate Board, Mr. W. D. Wilcox, chief inspector of gas meters in Chicago, outlined a plan for providing a more equitable distribution of cost for supplemental lighting of business streets. Existing laws provide for the construction of paving and sidewalks by special assessment, but no similar legislation allows street lighting to be installed on that plan. Some of the improvement clubs and business associations in the city of Chicago are planning to take the question before the next meeting of the Legislature at Springfield, aiming to make all pay an equal share for lighting from which they benefit.

* * *

National Efficiency Exposition.—The first National Efficiency Exposition and Conference will be held at the Grand Central Palace, New York City, April 4 to 11, inclusive, under the auspices of the Efficiency Society. The plan and scope of the show will include displays of efficiency appliances, methods and products in the industrial, mechanical, governmental, educational and household fields. Mr. William R. Willcox, ex-chairman of the New York Public Service Commission, will preside over the exposition, which numbers among its advisory committee Messrs. F. H. Bethel, vice-president New York Telephone Company; Arthur Williams, general inspector New York Edison Company, and T. S. Williams, president Brooklyn Rapid Transit Company.

* * *

"Refreshing" the Parts of a Horse-Power.—A machine which, although not "perpetual motion," will run indefinitely, stopping "only when parts are worn out," is described by the Cleveland (Ohio) *Press* as being made ready for the market by Mr. August C. Rutzen, of Cleveland. "The secret of our machine is that while ninety-nine parts of a horse-power are working, the other one is being refreshed," the promoter is quoted as explaining. "It is a scheme mathematicians have overlooked. A machine can be set up anywhere. We guarantee one to run for a year at least. Our model machine generates 110 volts of electricity and lights twenty lamps. The cost of maintenance is only the wear and tear. No fuel—simply keep the parts oiled and let it run."

* * *

Half-Watt Lamps Under Consideration for Boston Street Lighting.—In a recent report upon appropriation matters, the Boston Finance Commission states that if the sum of $150,000 is transferred from lighting to other purposes, the remaining $150,000 of the yearly appropriation for street-lighting equipment will be insufficient to provide the necessary new apparatus if the existing contract with the Rising Sun Street Lighting Company is terminated and electric lamps are substituted for gas lamps. The commission indicates that in the not distant future it will consider the half-watt nitrogen-filled lamp in comparison with gas and inverted mantle lamps for the illumination of streets now lighted by the Rising Sun company, the thoroughfares involved being those of minor importance in many parts of Boston proper.

* * *

"Electrical and Lightning Engineering."—Our attention has been called to a seventy-seven-page booklet of the above title, written by a certain Mr. Henry W. Spang (but issued without publisher's imprint, address or sponsorship of any kind) which is likely to be very misinforming to non-technical laymen in its treatment of the topics of electrolysis in underground construction and of lightning protection. Free use is made of names and citations of well-known electrical authorities, and from these the author draws original conclusions in support of his novel theory concerning "the aversion of electricity for a metallic circuit," although not always taking pains to distinguish his own views from those of the defenseless authority quoted. In the words of the preface: "The object of this work is to explain why electric light, power and railway engineering is now in its most destructive state." College textbooks, "electric engineers," professors of electrical engineering, accepted rules for standard electrical construction, and electrical authorities in general, are assailed in language bristling with such words as "lies," "nonsense," "blunders," "ridiculous," etc. Coming to a frank mention of names, Mr. Spang adds that "Neither can the employees of the General Electric, Westinghouse and other electric manufacturing companies who design and develop electrical apparatus be regarded as expert electrical engineers. There is quite a difference between an electric developer and a practical electric engineer." Another interesting statement, which, like some favorite refrain, is repeated without any particular cause or context at intervals throughout the book, asserts "that the great electric heat generated in the New York subway is mainly due to the aversion of the power currents to flow in metallic circuits, and especially while starting the long and heavy-laden trains!" The pages abound in such disconnected discourse, although one wonders, on the other hand, whether some sympathetic electrical readers will not find method in the author's madness revealed by such occasional observations as: "The lightning-rod man is generally regarded as a charlatan, while the individual who loads up the electrical circuits with lightning arresters and choke coils poses as a consulting electrical engineer." We do not know how widely Mr. Spang's book has been circulated, but while its fallacies are self-evident to all persons of even the most elementary electrical understanding, it is to be feared that the author's plausible language may impress laymen having no technical knowledge, municipal officials, etc., at whom the work evidently has been directed.

* * *

SOCIETY MEETINGS

Rejuvenation of Detroit Jovians.—A rejuvenation of the Jovians of Detroit will take place at the Cadillac Hotel, Feb. 7, at which time 150 members will be initiated into the order.

* * *

National Fire Protection Association.—A Chicago chapter of the National Fire Protection Association has been organized, with Mr. Frank D. Chase as president and Mr. William S. Boyd, 76 West Monroe Street, as secretary-treasurer.

* * *

Editor Mehren to Speak in Chicago.—Mr. E. J. Mehren, editor of the *Engineering Record*, New York, will give an address on "The Making of a Technical Paper" before the Western Society of Engineers, Chicago, on the evening of Feb. 2.

* * *

Merit Test to Select Convention Delegate.—The Public Service Company of Northern Illinois section of the N. E. L. A. will conduct a merit test for the selection of a delegate to represent the section at the coming Philadelphia convention. Candidates will submit articles pertaining to the company's business or to topics of general electrical interest. Contestants will also be judged upon their discussions of these papers as they are read before the section. At the Dec. 23 meeting of the section a paper on "The Inspection Department's Test Work" was read by Mr. R. V. Ward, and another entitled "Service" was read by Mr. F. H. Scheel.

CONVENTION OF IDAHO SOCIETY OF ENGINEERS.—The annual convention of the Idaho Society of Engineers will be held at Boise, Feb. 5 to 7. Electrically cooked luncheons will be served to members. A Jovian rejuvenation is among the features of the program.

* * *

IOWA ELECTRICAL CONTRACTORS TO ORGANIZE.—On Feb. 2 a meeting will be held in Waterloo, Ia., at which the electrical contractors of the State will organize a state association. Mr. W. J. Collins, Mr. Ernest Freeman and others from Chicago have signified their intention to attend the meeting.

* * *

DOINGS OF THE PHILADELPHIA JOVIAN ELECTRICAL LEAGUE.—On Jan. 29 the Jovian Electrical League held a luncheon at the Bingham Hotel, Philadelphia, at which an address was made by Mr. G. C. Foley, of the Divinity School. A rejuvenation of the Sons of Jove was held on Jan. 30 on the roof garden of the Continental Hotel.

* * *

ADDRESS ON FELLOWSHIP AT CHICAGO ELECTRIC CLUB. —Mr. John D. Shoop, assistant superintendent of Chicago schools, addressed the Chicago Electric Club Jan. 15 on the subject of "Fellowship." Ministration to the needs of humanity not with charity from a dollars-and-cents standpoint but with the ideal of spiritual help was the theme of the address.

* * *

NEW YORK JOVIAN LEAGUE.—At the Jovian League luncheon, Hotel Martinique, New York, Jan. 28, Mr. Hugh T. Wreaks, of the Wire Inspection Bureau, discussed problems of electrical building inspection in New York City, suggesting remedies for the conditions existing with respect to the large number of buildings reported unsafe electrically.

* * *

CHICAGO SECTION, ILLUMINATING ENGINEERING SOCIETY.—On Feb. 11 Sears, Roebuck & Company, Chicago, will tender a dinner to the members of the Chicago Section, I. E. S., and their guests, following which Mr. S. E. Church, electrical engineer for the company, will describe the elaborate electrical installation in the great buildings of the mail-order house.

* * *

PANAMA SECTION OF THE INSTITUTE.—The board of directors of the American Institute of Electrical Engineers having authorized a section to be known as the "Panama Section," a meeting of thirty-eight members, applicants and prospective members was held at the Hotel Tivoli, Canal Zone, in December. Mr. Edward Schildhauer was elected chairman and Captain W. H. Rose secretary-treasurer of the new section.

* * *

INDIANA ENGINEERING SOCIETY.—An interesting three-day program was presented before the members of the Indiana Engineering Society at Indianapolis, Jan. 22 to 24. Officers were elected as follows: President, Prof. Albert Smith, Lafayette, Ind.; vice-president, Mr. J. G. B. Short, Hillsboro, Ind.; secretary, Mr. Charles Brossmann, 1616 Merchants' Bank Building, Indianapolis, Ind.

* * *

MEETING OF DUQUESNE LIGHT COMPANY SECTION, N. E. L. A.—At a meeting of the Duquesne Light Company Section of the National Electric Light Association at the Colonial Hotel, Pittsburgh, Jan. 23, Mr. F. B. Patterson spoke on "The Inside Meter Department of the Laboratory," Mr. H. S. Calderwood on "The Skilled and Schooled Workers," and W. A. Donkin on "Increase of the Sales Department."

CHICAGO JOVIAN LEAGUE.—Mr. C. R. Hunt, of the Chicago office of the General Electric Company, gave an illustrated talk on "Electrical Equipment for Theaters" at the Chicago Jovian League luncheon on Jan. 26. Mr. H. E. Niesz, the presiding statesman, announced the appointment of Mr. Victor H. Tousley as chairman of the membership committee. Mr. J. Bennett, of Montreal, made a few remarks as a visiting Jovian.

* * *

ORGANIZATION DINNER, INTERNATIONAL ELECTRICAL CONGRESS.—An organization dinner for the discussion of plans for the International Electrical Congress at San Francisco in September, 1915, is to be held at the Engineers' Club, New York City, Wednesday evening, Feb. 25. Invitations will be issued to members of the Congress General Committee of 150, to members of committees of the American Institute of Electrical Engineers and to officers of the Institute and its sections.

* * *

AWARD OF OCTAVE CHANUTE MEDALS. — Octave Chanute medals have been awarded by the Western Society of Engineers for the best three papers presented during the year 1913 as follows: Mechanical and Electrical engineering, Mr. W. L. Abbott on "The Northwest Station of the Commonwealth Edison Company"; general engineering, Mr. Onward Bates on "Arbitration"; civil engineering, Mr. D. W. Mead on "The Cause of Floods and the Factors That Influence Their Intensity."

* * *

OFFICERS OF NEW YORK STATE ELECTRICAL CONTRACTORS' ASSOCIATION.—At the convention of the Electrical Contractors' Association of the State of New York held in New York City recently the following officers were elected: President, Mr. H. N. Smith, of Syracuse; vice-president, Mr. L. W. Wood, of New York City; secretary, Mr. G. W. Russell, of New York City, and treasurer, Mr. J. F. Burns, of Schenectady. The next annual convention of the association will be held in Troy, N. Y. Mr. M. L. Barnes, of Troy, was elected for the fifteenth consecutive year to represent the State association in the Board of Directors of the National Electrical Contractors' Association.

* * *

OFFICERS OF UTAH ELECTRIC CLUB.—The Utah Electric Club of Salt Lake City, which now has a membership of 440 and holds weekly luncheon meetings, has elected officers for 1914 as follows: Mr. W. W. Torrence, of the General Electric Company, president; Mr. William M. Scott, of the Utah Light & Railway Company, vice-president; Mr. B. W. Mendenhall, of the Utah Light & Railway Company, secretary and treasurer. Other directors elected are: Messrs. C. C. Campbell, of the Mountain States Telephone & Telegraph Company; Leo Brandenberger, of the Utah Power & Light Company; E. H. Eardley, of the Eardley Brothers Company; R. S. Folland, of the Capital Electric Company; H. W. Kline, of the Mountain States Telephone & Telegraph Company, and C. B. Hawley, of the Intermountain Electric Company.

* * *

JOINT MEETING OF GARAGE OWNERS AND CHICAGO SECTION, E. V. A.—Members of the Chicago Garage Owners' Association and of the Chicago Section of the Electric Vehicle Association of America held a joint meeting and luncheon at the Lexington Hotel, Chicago, Jan. 13, at which Mr. F. H. T. Potter, attorney for the Garage Owners' Association, spoke on the value of coöperation between the two societies whose interests are so nearly the same. Speaking from the standpoint of a pleasure-car owner and a prospective purchaser of electric trucks, Mr. L. E. Hamburg, Chicago, said that he thought the excessive charges levied by the garage men on owners of pleasure cars for minor repairs produced an unfavorable impression in the minds of many business men who would otherwise buy electric cars for commercial purposes.

* * *

New York Section, A. E. S.—On Feb. 6, at the Chemists' Club, 52 East Forty-first Street, New York City, the New York Section of the American Electrochemical Society will hold a joint meeting with the local section of the American Chemical Society and the Society of Chemical Industry. Dr. Charles Baskerville will read a paper on "Opening Up the Field of Unused Elements," outlining uses for tellurium, selenium, cadmium, etc. Dr. H. T. Kalmus will present a paper on "Cobalt," and Dr. E. Weintraub, director of the Research Laboratory, General Electric Company, West Lynn, Mass., will read a paper entitled "The Present Status of Boron." Dr. R. W. Moore, of the same company's laboratory at Schenectady, N. Y., will close the program with an address on "The Present Status of Tungsten."

* * *

Delegate to Be Selected by Competition.—The Philadelphia convention delegate from the National Electric Light Association company section in Chicago and vicinity representing the Public Service Company of Northern Illinois will be selected as the result of a competition conducted on the merit basis. The member who receives the largest number of merit points will be adjudged the winner. Points will be awarded as follows: Two hundred for the best paper presented at each section meeting (all other papers being awarded points according to relative merit); fifty points for the best discussion (others getting a smaller number, according to merit); five points for each new member secured, and ten points for attendance at meetings. Provision was also made for thirty extra points to a member sending in a paper for the December (1913) meeting; fifteen extra points for a paper for the January meeting; ten extra points for a paper for the February meeting, and five extra points for a paper for the March meeting.

* * *

Pittsburgh Section, I. E. S.—The program prepared by the Pittsburgh Section of the Illuminating Engineering Society for the remainder of the season includes the following papers: Feb. 13, "Lighting of Railroad Yards," by Mr. A. C. Cotton, of the Pennsylvania Railroad, and Mr. Harold Kirschberg, of the Lighting Specialties Company; March 13, "Modern Gas Lighting," by Mr. S. B. Stewart, contract agent for the Consolidated Gas Company, Pittsburgh; April 17, "The Development of Flame Carbon Arc Lamps," by Mr. C. E. Stephens, of the Westinghouse Electric & Manufacturing Company; May 15, "The Illumination of Building Exteriors," by Mr. Ward Harrison, and "Engineering Features of Electric Sign Advertising," by a representative of the engineering department of the National Lamp Works of the General Electric Company; June 12, a lecture by Dr. John A. Brashear. The meetings will be held in the Oliver Building, Pittsburgh, at 8 p. m.

* * *

Convention of Western Pennsylvania Telephone Association.—The fifth annual convention of the Western Pennsylvania Telephone Association was held in Pittsburgh Jan. 23 and 24. Mr. J. Walter Barnes, president of the association, presided. At the opening session speeches were made by Mr. H. E. Webb, of Pittsburgh, and Mr. C. Phillips Hall, of the Doubleday-Hill Electric Company of Pittsburgh. Delegates to the recent national convention of independent companies read reports. A number of girl operators invited to the convention led in the discussion of "Handling the Service." Other speakers during the two days' sessions were: Mr. H. L. Lamb, California, Pa., on "The Value of Publicity"; Mr. J. C. Core, Jr., of Uniontown, on "The Toll Business"; Mr. T. J. Shuflin, of Butler, on "Building Good Toll Lines"; Mr. H. H. Bradley, of Philadelphia, on "The Female Labor Law"; Mr. W. S. Paca, of Oil City, on "Proper Maintenance"; Mr. W. H. Wilson, of Erie, on "Rural Lines," and Mr. E. D. Schade, of Johnstown, Pa., on "The Pennsylvania Public Service Commission."

* * *

Safety First.—At the meeting of the Chicago Section of the Electric Vehicle Association on Jan. 20 Mr. G. H. Whittle, president of the Public Safety Commission of Cook County, and Mr. Peter M. Hoffman, the coroner of Cook County, addressed the members on the subject of public safety. Mr. Whittle gave a statistical review of the "safety-first" movement and said that both legislation and education are needed to lessen the number of accidents. In relation to automobiles he said that traffic should be speeded up rather than slowed down. To do this pedestrians must be excluded from the roadways except at street intersections. The problem must be dealt with sanely, but it is true that the proportion of accidents due to automobiles is increasing, and the persistent speeder must be brought to justice. The coroner said that 70 per cent of accidents are due to carelessness of the public and 30 per cent to the recklessness of drivers, operators or owners. For automobile drivers who are confirmed "speed maniacs" jail sentences were recommended. Those interested in automobiles should see to it, in self-defense, that the reckless driver is put out of business.

* * *

New Officers of St. Louis League of Electrical Interests.—At the recent annual dinner of the St. Louis League of Electrical Interests, Jovian Chapter, there was an attendance of 225. Officers were elected as follows: President, Mr. H. J. Pettengill, president Southwestern Telephone & Telegraph Company; vice-presidents, Messrs. Frank D. Beardslee, sales manager Union Electric Light & Power Company, and Fred B. Adam, general manager Frank Adam Electric Company; secretary, Mr. Fred Johnson, district sales manager Wagner Electric & Manufacturing Company. Mr. W. N. Matthews, Jupiter of the Jovian Order, presided at the meeting until the election of officers, when Mr. Pettengill took charge and acted as toastmaster at the dinner. Mr. J. Von Mar, superintendent of the Laclede Gas Light Company, in a humorous speech presented to the retiring president, Mr. A C. Einstein, president of the Union Electric Light & Power Company, a badge of membership in a new order which seems to be exciting considerable attention in St. Louis. Other speeches were made by Mr. W. A. Layman, president of the Wagner Electric & Manufacturing Company; Gen. E. J. Spencer, of the National Guard of Missouri; Messrs. Sam A. Hobson, Western manager *Electrical World;* T. M. Meston, vice-president Emerson Electric Manufacturing Company; H. H. Humphrey, consulting engineer; F. N. Boyer, district manager of the General Electric Company, and Ell C. Bennett, Mercury of the Jovian Order. There was excellent music by the Union Electric orchestra, and motion pictures were shown. The league now has a membership of 763. Plans are already under way for the entertainment of the Jovian Order at the time of the annual convention in St. Louis next October.

Unified Electric Service in Lorain County, Ohio

Power plants, modern substations, 22,000-volt transmission lines and commercial methods of the central-station system serving Lorain and Elyria, Ohio

SEVERAL scattered electric-service properties in Lorain County, Ohio, on the southern shore of Lake Erie, west of Cleveland, have been consolidated during the past year and are now being operated as a modern interconnected central-station system. Formerly the various parts of the territory now served by this unified system received electrical energy from the Ore Dock power plant of the Baltimore & Ohio Railroad in Lorain, from the Citizens' Gas & Electric Company, Lorain and Elyria, from the Ely Realty Company, Elyria, and from the Elyria Milling & Power Company. The present organization, operating for the time being under the name of "R. E. Burger, Agent," is furnishing energy to the towns of Amherst, North Amherst, Berea and Olmstead Falls in addition to Elyria and Lorain. Since the reorganization some of the former generating stations have been rehabilitated while the operation of others has been discontinued, new substations and transmission lines have been erected, and every effort has been made to deliver efficient and reliable service to the company's patrons. Although the organization has yet to complete the first year of its existence, rapid strides have already been made in building up an industrial motor load on the system.

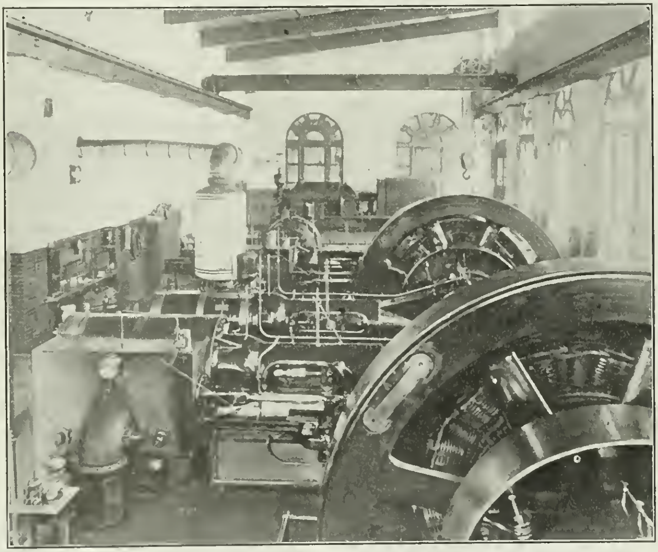


FIG. 1—INTERIOR OF ENGINE ROOM, ORE DOCK PLANT, LORAIN, OHIO

The property is owned by Henry L. Doherty & Company, New York, and pending the completion of the plans for re-incorporation now being prepared, the system, as above noted, is being operated under the name of "R. E. Burger, Agent," under which style all transactions have been carried on since the sudden death recently of Mr. George E. Milligan. Later it is expected that the name "The Lorain County Power Company" will be adopted.

The Ore Dock plant's equipment includes two 500-kw engine-driven direct-current units and one 2500-kva turbo-generator set. Each of the direct-current units is made up of a 500-kw, 250-volt interpole Westinghouse generator directly connected to a cross-compound Buckeye engine, the cylinder dimensions of which are 24 in. and 42 in. by 36 in. Both of these engines operate non-condensing and are provided with sliding cut-off piston valves. On acceptance test 125 per cent overload was carried on the generators and the engines developed 1562 hp. Their normal rating, however, is only 1040 hp. Since the energy furnished by these direct-current generators is used in driving the large ore unloaders on the dock, the demand for power sometimes fluctuates from zero to 125 per cent overload in a period of fifteen seconds. It will thus be seen that the additional specification which required the engines to maintain a regulation of 2 per cent from no load to full load and full load to no load was not without cause.

Practically all of the alternating-current load of the station is carried by the Westinghouse Parsons double-flow 2500-kva, 2400-volt, sixty-cycle turbo-generator, which operates at 3600 r.p.m. The steam end of this unit has been designed for 175 lb. pressure at 100 deg. superheat with 28-in. or 20-in. vacuum.

On the same platform with the turbine are mounted two direct-current units furnishing excitation energy. One of these sets consists of a Terry steam turbine driving a compound-wound 25-kw direct-current generator at 3000 r.p.m., while the other is an induction-motor-generator set operating at 2400 r.p.m. The latter exciter is also rated at 25 kw and 125 volts and was furnished by the Westinghouse Electric & Manufacturing Company. The vacuum for the turbine is carried by a Westinghouse Leblanc condenser of the latest type mounted in the basement just below the turbine. A 40-hp Westinghouse steam turbine operating at 1600 r.p.m. drives both the water pump and the air pump serving the condenser. Oil at 4-lb. pressure is delivered to the bottom of the turbine bearings by a rotary pump and on passing through the bearings is filtered, cooled and reused. An auxiliary steam reciprocating oil pump is used for emergencies and during periods of low speed at starting and stopping.

Near the east end of the station between the turbine units and the engine-driven units two motor-generator sets have been placed. One of these is a 300-kw Allis-Chalmers machine, the direct-current end of which consists of a 300-kw, 250-volt, compound-wound dynamo designed to operate either as a motor or a generator. The alternating-current end consists of a synchronous motor or generator designed for 440-volt operation. A 25-kw exciter unit is mounted on the same shaft and the whole set operates at 600 r.p.m. At times when the ore docks are not unloading or loading a vessel but the operators at the docks desire small amounts of energy for testing purposes, this unit is operated as a synchronous motor and direct-current generator to supply the 250-volt energy. At other times, when the turbine needs overhauling and cleaning or at times of light load, 250-volt direct-current energy is taken from the engine-driven unit through the direct-current end of this motor-generator set and delivered to a bank of transformers at 440 volts. Here it is stepped up to 2300 volts for distribution about the city of Lorain. Thus, at periods of light load, this unit equipped for duplex duty supplies the demands of the system, relieving the larger units and effecting a saving in efficiency over that of the large machines at light load. Near by is a 500-kw Crocker-Wheeler motor-generator set converting 250-volt direct current into 2300-volt alternating current.

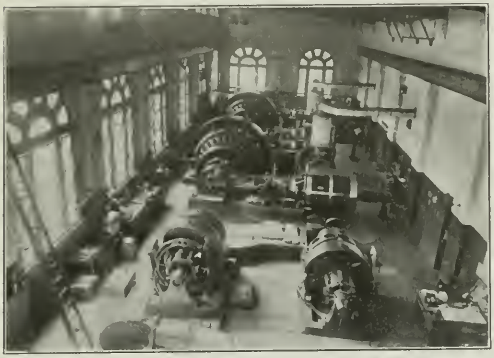


FIG. 2—MOTOR-GENERATOR SETS AND ENGINE UNITS, LORAIN PLANT

FIG. 3—HYDROELECTRIC STATION, DAM AND FALLS AT ELYRIA

The switchboard in the west end of the station consists of fourteen panels of blue Vermont marble and with its instruments was furnished by the General Electric Company, Schenectady, N. Y. Thompson astatic ammeters with 4000-amp scales and illuminated dials indicate the individual output of the generators. All of the direct-current panels are provided with double-throw switches so that the buses may be sectionalized and the fluctuating load carried separately from the other direct-current output. Thompson watt-hour meters rated at 250 volts and 3000 amp record the outgoing energy. Carbon-break equalizer switches for the direct-current units are placed on pedestals near the machine for handier operation. A speed-limiting device on the motor-generating set is arranged to trip the latter's breaker. Since this machine is designed to operate either as a direct-current or as an alternating-current set, a double-throw switch has been provided to maintain correct polarity at the wattmeter.

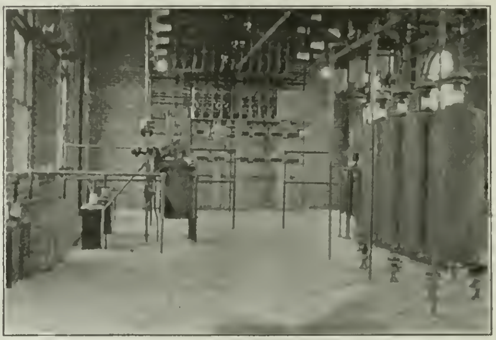


FIG. 4—LIGHTNING-ARRESTER GALLERY, ELYRIA SUBSTATION

Both exciters serving the 2500-kva turbine are controlled from one panel carrying three instruments at the top. Only one voltmeter is needed, since a double-throw switch has been installed which allows the potential of either machine to be read from this instrument.

The swinging panel shown supports a synchroscope, sychronizing lamps, a frequency indicator and a voltmeter. Below this swinging bracket on a small auxiliary panel is the Tirrill regulator for the main alternating-current circuit. A ground detector lamp is mounted above each instrument. The framework of the board is constructed of iron pipe spaced about 6 ft. from the wall so that there is ample room for wiring and other work behind the board.

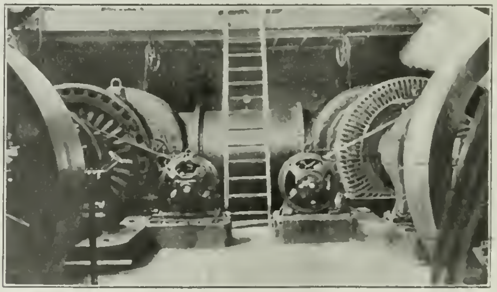


FIG. 5—WATERWHEELS, ALTERNATING-CURRENT AND DIRECT-CURRENT GENERATORS

As a feature of economical operation, the oiling system used in connection with the two 500-kw direct-current engine-driven units is of interest. By means of this home-made system devised by Mr. W. C. Worley, chief engineer of the plant, oil from these engines is used over again many times. From the bearings of the machines the oil is taken to a separator where, after the water is removed, the lubricant is conducted through a filter to receiving tanks. From these tanks pumps lift the oil to overhead closed tubular tanks, which deliver the oil to the bearings at about 8 lb. per sq. in. When filled this oiling system contains about eleven barrels of oil, and about two barrels per year are needed for replenishing. Before the present filtering scheme was installed the two engines, it is said, used approximately fifteen barrels of oil per year.

Steaming Equipment

The steam generating equipment of the station consists of five 260-hp Babcock & Wilcox boilers and three 400-hp units built by the same manufacturers. The five smaller boilers made up the original Baltimore & Ohio installation and they now carry steam pressure at 175 lb. per sq. in. Steam pressures of 175 lb. per sq. in. with 100 deg. superheat are carried on the three newer units. All boilers are hand-fired and are equipped with McClave shaking grates. The firing doors on the entire bank of boilers face the side of the power house nearest the lake. Coal is brought in hopper-bottom cars to this side of the plant on a coal tipple track elevated 9 ft. above the boiler-room floor. These cars are dumped into 350-ton bunkers and the fuel travels by gravity to the furnace room, where it is shoveled directly into the furnace doors.

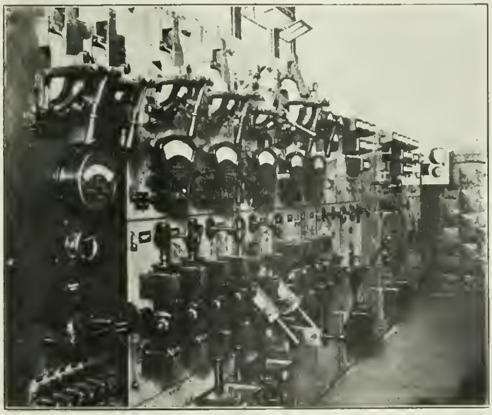


FIG. 6—SWITCHBOARD IN LORAIN STATION

In order that the feed-water pumps may be independent of all other steam-driven equipment in the station, non-return stop valves have been installed on the lines serving these pumps. The high-pressure steam-pipe work has all been built for 200-lb. steam pressure, and where practicable long sweeps have been employed in the pipes instead of short bends or elbows. All boilers are connected to a common header. The blow-off equipment consists of Simplex blow-off valves used in conjunction with quick-opening valves.

Feed water is brought to the boiler by a loop system which is so arranged with valves and by-passes that any boiler may be cut out of the line in case of trouble or for cleaning while the other units are still in operation. At present feed water is secured from the city mains, but later arrangements will be made to take water from Lake Erie through a still-well and open feed-water heater. With the present arrangement water is delivered through a turbine-driven Platte centrifugal boiler-feed pump operating at 3000 r. p. m. to a Platte feed-water heater of 3000-hp rating, where it is raised to a temperature of 212 deg. Fahr. The feed-water heater is situated above the boiler and gives a 16-ft. head on the pumps. As an emergency unit a Worthington reciprocating duplex pump is kept at hand which is large enough to handle water for the entire plant. The depth of water in the boilers is made known to the firemen through Reliance water columns. High-water and low-water alarms used in connection with these devices serve to warn the operator against dangerous conditions existing in the boilers. All live-steam, feed-water and drip pipes are lagged with 1.5 in. of heat-insulating material consisting of 95 per cent magnesia. Although the normal rating of the boilers in this plant is but 2500 hp, it is said that under overload conditions they will develop 3500 hp.

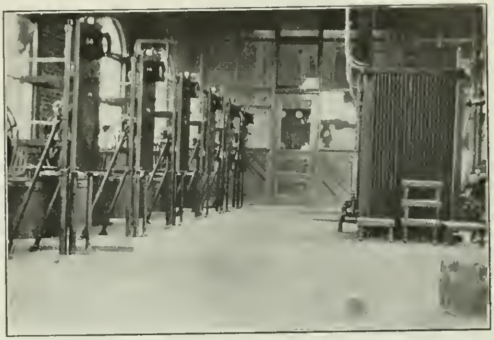


FIG. 7—FIRST FLOOR, ELYRIA SUBSTATION

The entire bank of eight boiler units is connected to a common breeching which conducts the gases to a Custodis brick stack. This stack is 7.5 ft. in diameter, stands 187 ft. above the grates of the furnaces and has been designed to furnish draft for 2500 hp in boiler rating.

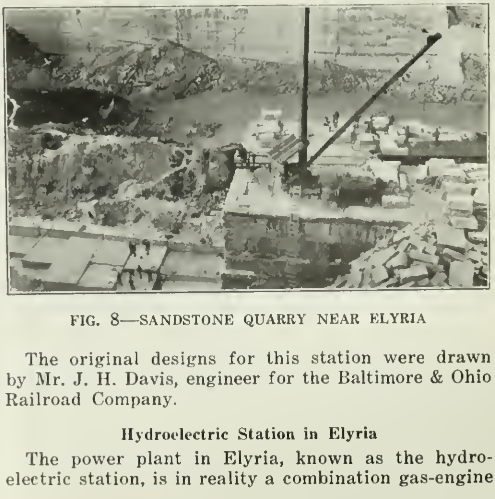


FIG. 8—SANDSTONE QUARRY NEAR ELYRIA

The original designs for this station were drawn by Mr. J. H. Davis, engineer for the Baltimore & Ohio Railroad Company.

Hydroelectric Station in Elyria

The power plant in Elyria, known as the hydroelectric station, is in reality a combination gas-engine and water-power plant. Here two alternating-current 200-kw, 2300-volt, three-phase, sixty-cycle Westinghouse alternators and two direct-current 50-kw, 110-volt Westinghouse generators are connected by shafting so that they may be driven by either two Triumph waterwheels or by two Rathbun-Jones 350-hp gas engines.

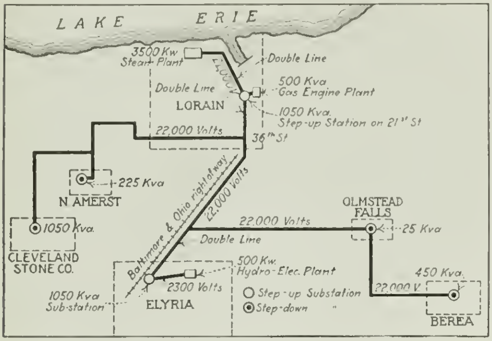


FIG. 9—MAP SHOWING LINES AND STATIONS

Although not of very large rating, this station has many interesting features. First among these may be noted the construction of the building itself, for two of its walls are formed from the natural unhewn rock of the cliff. The location of the station in relation to the city is also unique, for the waterfall, the dam and the power site are within one square of the heart of the city of Elyria. The plant operates on a 62-ft. head, 50 ft. of which is produced by the natural fall shown in the illustration.

At the time of the Ohio floods in March, 1913, water poured over these falls in torrents and at its highest stage was rushing over the roof of the power house. A dam which formerly stood nearer the falls and a bridge on one of the main streets of Elyria, just back of the present dam, were both carried away. At this time new generators were shipped by express from the Westinghouse works at East Pittsburgh, Pa., and service was resumed in a remarkably short time. Even while the water was still standing in the power house, tub transformers for street lighting had been shipped and were put into operation in a shed not far from the hydroelectric plant.

When the flow of Black River is sufficient, the alternators and the direct-current generators are connected to the Triumph waterwheels. At other times, when the generating equipment is needed and insufficient water is at hand for its operation, the gas engines at the opposite end of the line shafting from the waterwheel are connected to the generating equipment to carry the load. Again, there are other periods when the operation of this plant is not required for carrying alternating-current loads, and then the alternating-current generators are connected to the mains of the system and operated as synchronous motors. This expedient has been found very successful in improving the general power-factor of the system. The direct-current output supplied at such times furnishes energy to direct-current customers who were formerly on the old circuits and have never been changed over to the alternating-current mains.

Substation in Elyria

One of the newest additions to the company's property is the modern 1050-kva substation in the outskirts of Elyria. Here three 350-kw, 2200 22,000-volt transformers connected in delta on tubular busbars are provided for handling commercial load. The station has been designed and wired so that at any time the system may be changed to 33,000-volt operation. In addition to transformers carrying commercial loads there are seven tub transformers with individual panels each supplying fifty series arc lamps taking 4 amp apiece.

On the second floor of the substation are the lightning arresters and the high-tension switches supported upon iron-pipe framing. White-asbestos wiring has been used throughout the entire substation, with the result that circuits stand out clearly and present a pleasing appearance to the eye. The lightning arrester and machine-switch equipment are also arranged so that they may be transferred at any time to 33,000-volt operation. For both the high-tension and distribution circuits entering and leaving the building neat racks constructed of wood substantially braced and anchored have been provided.

At the power house in Lorain there has just been erected a step-up transforming substation containing three 1500-kw, 2400/22,000-volt water-cooled Westinghouse transformers with duplicate switching and lightning-protective apparatus. The building is of brick and steel and has been made to conform with the architecture of the main station. From this substation to the Lorain city limits a 23,000-volt steel-tower transmission line has been erected, with duplicate conductors, lightning protection and telephone circuit.

Other Substations

Connected to the transmission lines of the company, there are altogether seven generating stations, one step-up transformer station and six substations in which energy is stepped down from high voltage to distribution pressure. Eventually, the 500-kw gas-engine-driven plant in the outskirts of Lorain will be discontinued. At present the six step-down substations are rated as follows: Cleveland Stone Company (Amherst), 1050 kva; North Amherst, 225 kva; Olmstead Falls, 50 kva; Berea, 450 kva; Elyria, 1050 kva, and Lorain, 1050 kva.

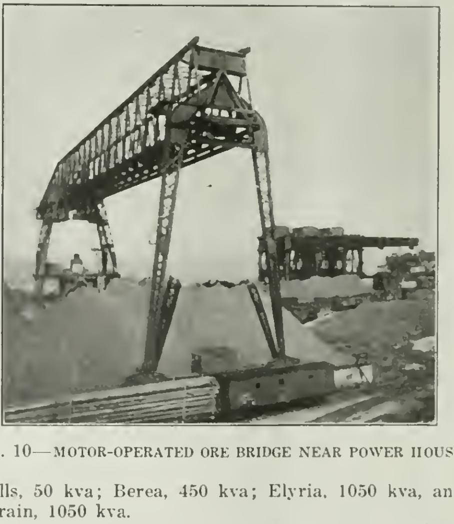


FIG. 10—MOTOR-OPERATED ORE BRIDGE NEAR POWER HOUSE

Both the substation at the works of the Cleveland Stone Company and the one at Berea supply energy for motor service alone. What are said to be the largest sandstone quarries in the world are situated in the vicinity of Lorain, and the local electric-service company has found the quarry owners ready users of electrical energy. The Cleveland Stone Company not only quarries its own stone, but is also engaged in the manufacture of grindstones and grindstone frames, so that the motor applications on their properties cover a varied field. Substations at North Amherst and Olmstead Falls supply energy for lighting and for motor service to the suburban and rural communities thereabouts.

Transmission Lines

An excellent idea of the typical 22,000-volt transmission structures of the company may be gained from the accompanying illustration taken near the three-way junction along the right-of-way of the Baltimore & Ohio Railroad between Elyria and Lorain. In all cases the lines are carried on 40-ft. cedar poles with 8-in. tops.

The sectionalizing switch rack is built of poles of the same height and is braced with pine timbers measuring 4 in. by 4 in. Steel messenger wire is also liberally used in bracing this structure. As will be noted from the illustrations, ground wires are carried on brackets above and below the high-tension circuits, and on the small arm about 6 ft. beneath the lower high-tension arms an emergency telephone line has been strung. A booth beneath the sectionalizing switches contains a telephone for signaling substations and generating plants.

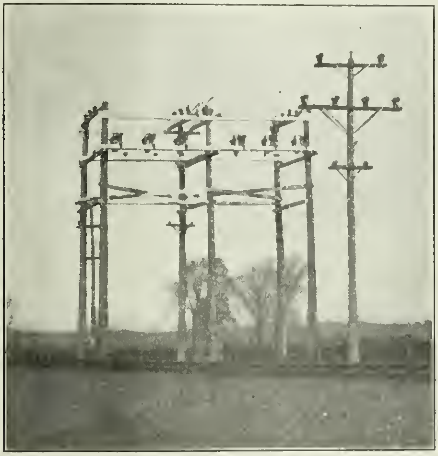


FIG. 11—TRANSMISSION-LINE CONSTRUCTION, SHOWING SWITCH RACK

New-Business Methods and Results

Although only a short time has elapsed since the consolidation of the electric-service companies under the present organization, the new-business department has been actively at work. Within the last three months nearly 200 residences in and about Lorain and Elyria have been wired for electric service. In securing house-wiring business the company's solicitors call on citizens and, if possible, induce them to sign contracts for wiring. The prices set down in these contracts are based upon estimates made from a set schedule agreed to by the company and all the contractors in the city. Contractors do the wiring, receiving payment from the company immediately upon the completion of the job. The company is paid 20 per cent of the cost of installation by the customer immediately after the job is finished, while the remainder is paid in ten equal monthly payments. Should the householder wish to take advantage of a discount for cash payment, 10 per cent is allowed if the full cost of installation is paid within ten days after completion of the work. Thus far this scheme of financing customers unable to pay for an extra wiring installation has proved very satisfactory.

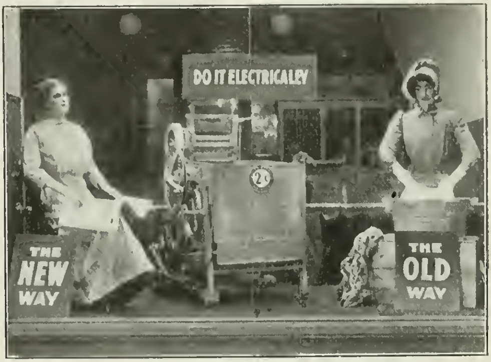


FIG. 12—WINDOW DISPLAY, ELYRIA, OHIO

In the company's office and display room, facing the public square, attractive window displays advertising electric appliances and motor-driven devices are kept continuously before the public. One of these displays exploiting "the new way" and "the old way" of doing a Monday's washing is shown in an accompanying illustration. Prominent place is given to the statement that the washing machine may be operated one hour at a cost of only 2 cents.

Thus far the efforts of the motor salesmen in the commercial department have been confined largely to connecting up stone quarries and manufacturing auxiliaries. How well they have succeeded may be judged from the statement that at present one of these companies has a connected load of nearly 3000 hp. A view of a portion of one of these quarries which conveys some idea of the scale of the works is reproduced herewith. Besides the sandstone quarries there are in the territory served a large steel plant, ship-building yards, several automobile factories and the ore docks already mentioned.

The present organization is under the direction of the general manager, Mr. R. E. Burger, who in his work is assisted by Mr. M. L. Derge, general superintendent; Mr. H. N. Becket, secretary; Mr. H. G. Bonner, commercial manager; Mr. L. Bartlett, construction engineer; Mr. R. W. Curran, superintendent of distribution, and Mr. C. G. Kiefer, superintendent of transmission lines. At the main steam plant Mr. W. C. Worley is chief engineer and Mr. C. B. Pierce is foreman of construction.

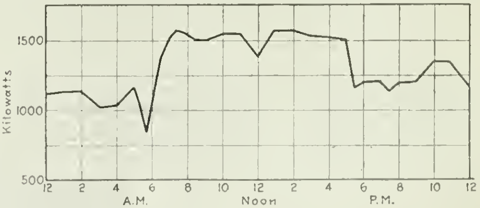


FIG. 13—TYPICAL LOAD CURVE AT THE LORAIN PLANT

Largest Motor-Driven Irrigation Pumping Plant

Nine centrifugal-pump units, aggregating 5685 hp. which can deliver 200,000,000 gal. per day to the 30,000-acre Gem irrigation district in western Idaho

THE Gem irrigation district in western Idaho comprises an area of 30,000 acres occupying one of the higher coves in the valley of the Snake River and having an altitude of approximately 2300 ft. above sea level. Its westerly edge is at the Oregon boundary, from which it stretches eastward into Idaho for a distance of 18 miles, skirting the south bank of the Snake River.

Since May of last year the lands of the Gem district have been made usable and fruitful with water from the Snake River, lifted electrically into the canals of the elevated plateau by the two pumping stations of the Crane Falls Power & Irrigation Company. The Gem installation, which includes the largest motor-driven irrigation pumping plant in the world, consists of nine motor-driven pumps arranged in four batteries. Three pumps lift the water to an elevation of 175 ft., two to an elevation of 100 ft., and two to 60 ft. The two pumps installed in the smaller station lift the water 104 ft.

When all of the foregoing pumps are in operation they will absorb 5685 hp, which is equivalent to the output of the largest of the water-power electric generating stations in this part of Idaho. The immediate needs of the district, however, require something less than 1500 hp even when sufficient head of water is running in each of the four canals. The entire output of all the pumps is approximately 200,000,000 gal. per twenty-four hours, a supply so large it is of interest to note that, allowing a per capita consumption of 75 gal., this installation would care for the needs of a city of 3,000,000 people.

The soils of the district are of five varieties, although the greater part of the land consists of volcanic ash. Several watercourses traverse the district and have deposited in their beds considerable alluvia. The greater portion of the remainder of the tract may be classed as wind-blown or eolian, and the fertility of the entire area is well shown by its present vegetation.

History of the Project

The Gem project was organized under the state law providing for the formation of irrigation districts, the development being financed by a bond issue which, when all phases of the project shall have been taken care of, will not exceed $28 per acre. For three years, moreover, enough electric energy has been guaranteed to the district free of all cost to permit operation of the pumps for the estimated requirements, while for the same period the interest charges are also exceedingly moderate, averaging only 20 cents per acre.

The present project was first undertaken in August, 1911, by Canadian interests acting through the Crane Falls Power & Irrigation Company, Ltd., whose engineers, Smith, Kerry & Chace, of Toronto, have been in charge of the design and construction of the works now built and in operation in the district.

In 1912 the canals were excavated and the pumping stations built. In the latter 40,000-volt energy taken from the lines of the Idaho Railway, Light & Power Company is transformed into mechanical energy to drive the nine huge centrifugal pumps which were supplied by Henry R. Worthington, Harrison, N. J. Leading from the pumps to the four canals are great wood-stave conduits, the largest being 4 ft. 6 in. in diameter and the smallest 3 ft. in inside diameter. These conduits contain 9662 linear ft. of pipe, some of which operates under pressures as high as 75 lb. per sq. in.

The two Gem pumping stations have a combined

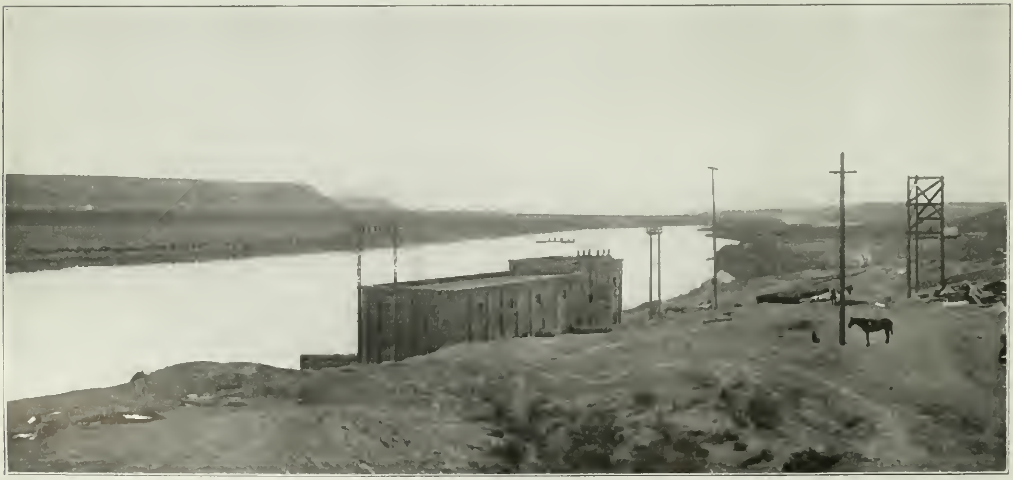


FIG. 1—MAIN PUMPING STATION, GEM IRRIGATION DISTRICT, WESTERN IDAHO

pumping output of 292 cu. ft. per second, which, as already noted, is equivalent to approximately 200,000,000 gal, per twenty-four hours. These pumps take their water supply from the Snake River and discharge into four different lifts. The A canal covers a territory of 1176 acres and has 1225 stations 100 ft. apart; the B canal covers 7916 acres and has 693 stations 100 ft. apart; the C canal covers 6244 acres and has 596 stations 100 ft. apart; the D canal has 176 stations 100 ft. apart and empties into a patch canal 1¼ miles long, covering an area of 2805 acres.

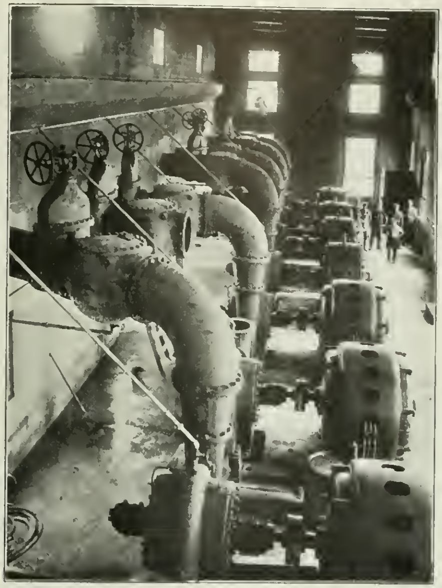


FIG. 2—INTERIOR OF MAIN PUMPING STATION, SHOWING LARGE CENTRIFUGAL PUMP UNITS

Station No. 1, the larger of the two pumping plants, contains seven pumping units—the A pumps, of which there are three 18-in. sets, each discharging 38 cu. ft. per second against 177-ft. head and driven by a 1100-hp motor; the B pumps, of which there are two 20-in. sets, each delivering 43 cu. ft. per second against 108-ft. head and driven by a 750-hp motor, and the C pumps, of which there are two 20-in. units, each discharging 30 cu. ft. per second against 70-ft. head and connected to a 350-hp motor. The D units are located in Station No. 2 and consist of two 14-in. pumps, each discharging 16 cu. ft. per second against 110-ft. head.

TABLE I—RESULTS OF TEST OF 20-IN. "B2" PUMPING SET

Weir reading....	19.85	19.8	19 8	19.8	19.2	19.15	18.19	17.75	17.65	0
Correctedreading	12.55	12.5	12.5	12.5	11.9	11.85	11.6	10.45	10.35	0
Gal. per minute..	19,460	19,380	19,380	19,380	18,100	17,900	17,300	14,830	14,550	0
Corrected gal. per minute.......	20,100	20,000	20,000	20,000	18,700	18,500	17,850	14,830	14,550	0
Cu. ft. per second	44.7	44.5	44.6	44.5	41.6	41.2	39.7	33	32.35	0
Amperes	153	157	157	153	152	150	151	138	141	60
Volts..........	2,050	2,040	2,080	2,080	2,180	2,200	2,190	2,120	2,100	2,140
Power-factor....	85	85½	85	85	86	86	87	83	84	85
Electrical hp....	618	635	644	628	600	610	650	565	575	253
Mechanical efficiency... ...	92	92	92	92	92	92	92	91	91	87
Brake hp.......	569	584	592	578	552	562	598	515	523	221
R.p.m..........	673	675	676	676	665	664	685	667	665	705
Discharge pressure, lb......	39	39	39	39	45	45	45	48	48	51
Discharge pressure, ft........	90	90	90	90	104	104	104	111	111	117½
Total head......	96	96	96	96	110	110	110	117	117	123½
Water hp........	487	485	485	485	...	515	495	....	....	....
Efficiency.......	85.5	83	82	83.8	....	82.8	. .	82	....	....

FIG. 3—HIGH-TENSION ENTRY AND PUMPING STATION NO. 2

The official tests on the pumping equipment of the Gem project were run off between May 30 and June 6, 1913. The water was measured over Cippoletti weirs, which are of the trapezoidal type, levels being determined by means of hook gages. Corrections were made for velocity of approach. The formula used to measure the discharge over the weirs is: $D = 3.33\ LH^{3}/_{2}$.

TABLE II—RESULTS OF TEST ON 18-IN. "A3" PUMPING SET

Weir reading........	16.5	16.6	16.5	16.5	16.5	16.25	14.95	14.9	....
Corrected reading......	11.4	11.4	11.4	11.4	11.4	11.15	9.85	9.8	0
Gal. per minute........	16,800	16,800	16,800	16,800	16,800	16,280	13,640	13,380	0
Corrected gal. per min...	17,250	17,250	17,250	17,250	17,250	16,600	13,640	13,380	0
Cu. ft. per second.	38.3	38.3	38.3	38.3	38.3	36.95	....	29.75	0
Amperes	233	233	233	233	233	231½	208	213	120
Volts..............	2,120	2,120	2,120	2,190	2,180	2,200	2,190	2,190	2,330
Power-factor..........	87	87	87	85	86	83	86	86	79
Electrical hp	995	995	995	1,015	1,010	....	900	918	...
Mechanical efficiency....	92	92	92	92	92	92	91	91	...
Brake hp.............	916	916	916	934	930	905	825	845	....
R.p.m...............	872	873	865	870	871	872	874	870	900
Discharge pressure, lb...	70	70	70	70	70	75½	86	86	90½
Discharge pressure, ft...	161½	161½	161½	161½	161½	172½	199	199	209
Total head............	168	168	168	168	168	180½	205	205	215
Water hp............	729	729	729	729	729	757	705	692	0
Efficiency............	79.7	79.7	79.7	78.2	78.5	83.7	86	82.7	....

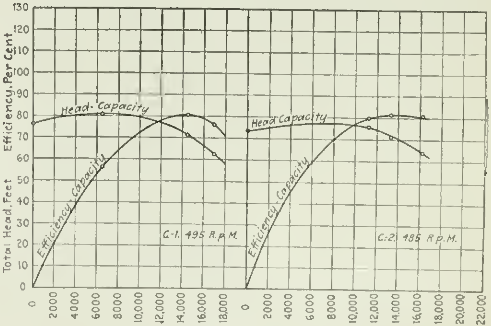


FIG. 4—CHARACTERISTIC CURVES, 20-IN. DOUBLE VOLUTE PUMPS

The discharge pressure on the pump was taken by means of a pressure gage, and the electrical input was measured by the station instruments, consisting of a voltmeter, an ammeter and a power-factor meter.

The power conditions during the test were not altogether satisfactory, as there was considerable variation in both voltage and frequency.

The accompanying tables and curves of average results show that the pumps exceeded their guarantees in both efficiency and capacity in all cases except that of one of the A pumps, which was 600 gal. short, possibly owing to unsteady power conditions. The excess capacity given by the whole installation totals, however, approximately 4500 gal. per minute. On the A and B pumps the efficiency guarantee was 80 per cent, while on the C and D sets it was 79 per cent. These guarantees were exceeded in all cases.

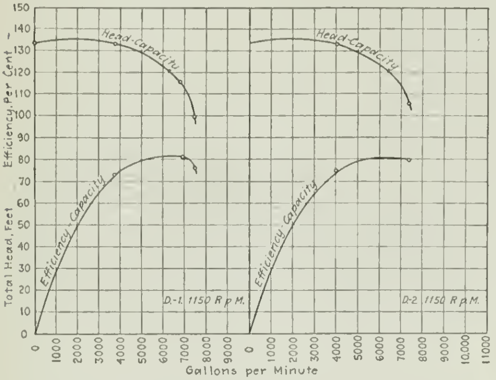


FIG. 5—CHARACTERISTIC CURVES, 14-IN. DOUBLE VOLUTE PUMPS

Rock River Hydroelectric Station Being Built on Government Dam

When the United States government constructed its new 1335-ft. dam across the Rock River at a point 0.75 mile above the city of Sterling, Ill., to divert water into a feeder for the "Hennepin," or Illinois & Mississippi Canal, it was generally conceded that injury would be done to the water rights of the Sterling Hydraulic Company, which owned a dam on the same stream at Sterling. As a recompense for the damage to the existing water rights the government granted the Sterling Hydraulic Company permission to erect a power station at the north end of the new dam, as shown in Fig. 1. These rights have now been leased for a period of twenty-five years, with the option of twenty-five years additional, to the Rock River Light & Power Company, and a station is in process of erection on the government dam site.

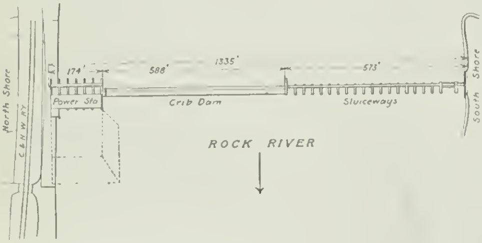


FIG. 1—POWER STATION IN GOVERNMENT DAM ACROSS ROCK RIVER

The river at this point measures 1335 ft. in width, and of this distance the eighteen sluiceways and lock occupy 573 ft., the spillway 588 ft., and the power house itself 174 ft. The contour of the riverbed here is such that both the wheel pits and the tailrace have had to be blasted from solid rock. Flowage through the sluiceways at the south side of the dam is controlled by means of counterweighted Tainter gates. The erection of this dam has created a pondage of 2230 acres over which the average depth of water is 8 ft. Inside dimensions of the station proper are 50 ft. by 168 ft.

On an 80 per cent power-factor basis the ultimate rating of the station will be 2250 kw. The equipment will be installed in six star-connected units rated at 375 kw, 2300/4000 volts and sixty cycles, operating at 60 r.p.m. All units will be of the vertical type with the 60-ton rotating elements supported from cast-iron hung-bearings. One governor will be installed for each two units. Electrical and waterwheel equipment is to be supplied by the Allis-Chalmers Company, Milwaukee.

Mr. H. S. Green, Sterling, Ill., general manager of the Rock River Light & Power Company, is in charge of the construction work on the power house. Jacobson & Ackerman, architects and engineers, Minneapolis, Minn., are the contractors for making the excavations; A. Bolter's Sons, Chicago, for the structural steel work, and the H. A. Peter Company, Chicago, for the erection of the station building.

FIG. 2—WATER-POWER PLANT UNDER CONSTRUCTION AT STERLING, ILL.

A 425-Mile Transmission Project in California

Mr. William E. Groff, manager of the Coachella (Cal.) Valley Ice & Electric Company, announces that his company has completed negotiations for the wholesale purchase of electrical energy from the Bishop station of the Southern Sierras Power Company. A 35-mile transmission line will be built from Banning to San Bernardino, connecting the existing lines of the Coachella and the Southern Sierras system. From Coachella the transmission line will also be extended 150 miles to the south, where it will connect with the present system of the Holton Power Company, operating in and about El Centro. From the water-power station at Bishop to El Centro is a distance of about 425 miles, so that the connecting links about to be built will complete one of the longest transmission lines in the world. Although no definite decision has yet been reached, it is thought that the line from Banning to El Centro will be carried on wooden poles. The transmission potential will be 55,000 volts.

Calculations for Alternating-Current Coils

Development of a formula for the inductance of a coreless solenoid, and description of tests to determine pull of alternating-current electromagnets

The Inductance of Air-Cored Solenoids

By Leonard A. Doggett

In what follows the author aims to present in the least possible space a universal formula for the inductance of an air-cored solenoid. Owing to the excellent work of the Bureau of Standards, much of the necessary information has already been gathered into one place.[1] The demand for a condensed summary of this work is evidenced by the work of Prof. Morgan Brooks.[2] At the present time air-cored solenoids find application as current-limiting reactances in central-station work and as tuning coils in wireless telegraphy.

Formula

The formula offered for the inductance of an air-cored solenoid is

$$L = N^2a(A - B) \times 10^{-9} \text{ henries}$$

where

N = total number of turns

a = mean radius of coil in centimeters

A = a function of the ratio

$$\frac{\text{Mean radius}}{\text{Length}} = \frac{a}{l} \text{ and is given by curve A}$$

B = a function of the ratio

$$\frac{\text{Winding depth}}{\text{Length}} = \frac{c}{l} \text{ and is given by curve B.}$$

The accompanying curve sheet is self-explanatory and contains a sample calculation.

Experimental Comparison

In order to test the accuracy of the formula, comparisons were made between the calculated and measured values of inductance for fifty coils. The data on fourteen of these are shown in Tables I and II, the aim having been to select values of $\frac{a}{l}$ and $\frac{c}{l}$, not those that happened to yield the most accurate result, but those that covered as wide a range of these ratios as possible. The average inaccuracy for the fifty coils was about ± 2 per cent.

TABLE I—CALCULATED AND MEASURED VALUES

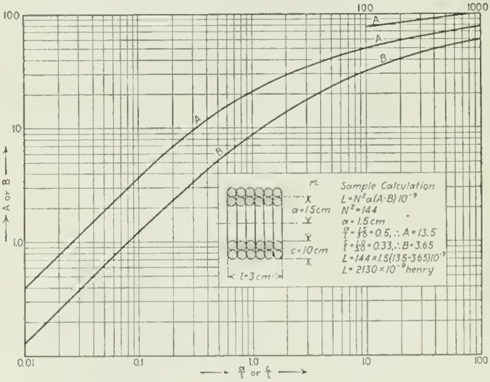
Reference No.*	Number of Turns	Mean Rad. a, in Cm.	$\frac{a}{l}$	$\frac{c}{l}$	Calculated L, in Henries	Measured L
1	144	45.1	0.987	0.583	1.39 x10-2	1.481 x10-2
1	126	43.18	0.945	0.556	1 012x10-2	1.074 x10-2
3	2	4.97	22.25	0.425	0.115x10-5	0.1092x10-5
2	784	6.19	1.932	1.00	7 57 x10-2	7 574 x10-2
3	8	1.505	1.545	0.098	0 243x10-5	0 2479x10-5
2	594	3.25	1.0833	0.53	1 865x10-2	1.8476x10-2
4	30	6.5	0.507	0.0162	0.795x10-4	0.82 x10-4
3	20	0.98	0 227	0.0221	0.287x10-5	0 2867x10-5
3	24	0.98	0.1885	0.0181	0.348x10-5	0.3458x10-5

TABLE II—CALCULATED AND MEASURED VALUES

Reference No.*	Number of Turns	Mean Rad. a, in Cm.	$\frac{a}{l}$	$\frac{c}{l}$	Calculated L, in Henries	L, Calculated by Brooks Form
2	80	3.18	2.5	3.2	2.79 x10-4	2.89x10-4
2	50	5.08	4.0	2.0	3.01 x10-4	3.01x10-4
2	8	31.8	62.5	2.0	1.18 x10-4	1.19x10-4
2	4	63.5	250.	4.0	0.666x10-4	0.69x10-4
2	2	127.0	500.	2.0	0.404x10-4	0.42x10-4

Space Factor

The foregoing formula will serve for most ordinary cases where the space factor, defined as the ratio of the copper area to the product of the length times the winding depth, is above 35 per cent. For lower values a correction factor needs to be applied which is 1.01 for a space factor of 1/3, 1.04 for 1/4, 1.08 for 1/5, 1.12 for 1/6, 1.21 for 1/8, 1.28 for 1/10, 1.47 for 1/15, and 1.62 for 1/20. To illustrate the application of this point, the inductance of a current-limiting reactance, described in the *Electrical World* for Dec. 21, 1912, page 1333, was calculated. The constants of the coil are: $N = 34$, $a = 42.6$, $\frac{a}{l} = 0.58$, $\frac{c}{l} = 0.36$, space factor = 21 per cent. The calculated value of the inductance was 5.54×10^{-4}, compared with 5.83×10^{-4}, the measured value.



CURVES GIVING RATIOS OF MEAN RADIUS AND WINDING DEPTH TO LENGTH

Discussion

In explanation of the derivation of curves A and B, it is to be noted that the A curve corresponds to the assumption of a current sheet of radius a and length

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[1] *Bulletin* of the Bureau of Standards, Vol. 8, No. 1.

[2] *Bulletin* 53 of the University of Illinois.

*References: (1) *Transactions* N. E. L. A., 1909, Vol. II, page 144, "Current-Limiting Reactances"; (2) *Bulletin* 53, University of Illinois, Brooks and Turner; (3) *Wied. Annalen*, 1905, page 763, B. Strasser; (4) *Physical Review*, Vol. XXIV, page 153, G. W. Pierce, "Wireless Coil."

In Vol. 8, No. 1, of the *Bulletin* of the Bureau of Standards, this curve has been calculated for a range of $\frac{a}{l}$ from $\frac{1}{10}$ to 2, while in the accompanying curve sheet the range has been extended from $\frac{1}{100}$ to 1000. Similarly, the B curve, which was obtainable from this same *Bulletin* in the range of $\frac{c}{l}$ from $\frac{1}{30}$ to 1, has been extended in range from $\frac{1}{100}$ to 100. These extensions of the above curves have made the formula universal and rendered it possible to include the solution of the inductance of any air-cored solenoid on one page, as shown on the curve sheet.

Alternating-Current Electromagnets

BY CHARLES R. UNDERHILL

The laws of the static pull due to alternating-current electromagnets can be shown to be identical with those for direct-current electromagnets by taking the mean effective pull and making allowances for core losses. Since the power component of the pressure or voltage is directly proportional to the total effective current, there is a proportionality between the total alternating-current ampere-turns and the direct-current ampere-turns required to produce the same pull under similar conditions. The same principle applies to the active volt-turns.

If there were no core losses the alternating current would be of the same value as the direct current, for the same active voltage and pull, not instantaneously but effectively, because the static pull is due to the flux in either case. No mechanical work is performed by the electromagnet in either case, and the same flux which produces the pull also generates the emf of self-induction in the case of alternating current. Therefore, the writer believes that the ampere-turns of direct current which will produce a certain pull with an alternating-current electromagnet represent the true value of effective alternating-current ampere-turns which will be required to produce the same mean effective pull as with direct current.

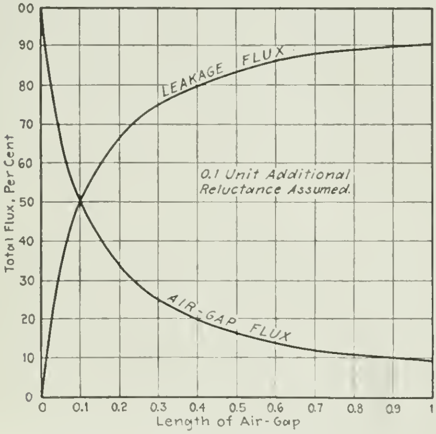


FIG 1—RELATIVE VALUES OF FLUX

In the tests to be described a spring balance was used for measuring the pull. A spacer was inserted between the plunger and the stop to represent an air-gap. When the spring of the balance was extended in measuring the pull, the pointer showed very little evidence of vibration, and since the mass of the spring was very small, as compared with the mass of the plunger, and the vibration of the plunger was slightly damped by friction, it would seem that a mean effective pull was being obtained. A brief résumé of the general laws of electromagnets will here be given. The plunger type with stop and frame is selected.

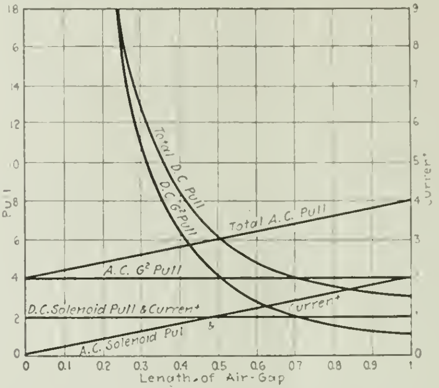


FIG. 2—CHARACTERISTICS WHEN THE ALTERNATING CURRENT FALLS TO ZERO

After eliminating all constants, the law of Maxwell for the pull between the plunger and stop at the middle of the coil, when there is no air-gap, is

$$P = B^2 \tag{1}$$

In this it is assumed that the coil is also divided at the point of division of the core. But

$$B = 4\,\pi I + H \tag{2}$$

Allowing G to represent $4\,\pi\,I$

$$B = G + H \tag{3}$$

and

$$P = B^2 = G^2 + 2\,GH + H^2 \tag{4}$$

Conventionally stated, G^2 is the pull between the plunger and the stop; $2\,GH$ is the pull between the coil and plunger and coil and stop; H^2 is the pull between the two half-coils and is not available in the practical type. Therefore, the law for the pull between the flat-faced plunger and stop, when they are in perfect magnectic contact and there is no leakage from the abutting ends back to the frame or their opposite ends, is

$$P = G^2 + 2\,GH. \tag{5}$$

Now as soon as the plunger and stop are separated and an air-gap is introduced, these conditions are changed, because a new factor is introduced, namely, the leakage of the flux from the inner ends of the plunger and the stop back to their opposite ends, which causes them to become much more highly magnetized than if the flux passed only through the air-gap. This leakage flux is exceedingly important in alternating-current magnets, especially, and grave errors result when it is not considered. The stop is assumed to be fixed in position and cannot move, but its reluctance will be higher than if the flux were confined to the air-gap. This leakage effect is so great that a strong pull is obtained between the plunger and coil even when there is no other iron present.

The pull due to a plunger electromagnet with an air-gap becomes, therefore,

$$P = G^2 + 2\,GH + 2\,G_1H, \tag{6}$$

wherein G is the flux density in the air-gap, $(B_a - H)$, and G_1 is the density $(B_l - H)$ of the leakage flux in the plunger. There are now two active magnetic circuits in shunt with one another instead of only one circuit, as when the air-gap was completely closed. Therefore, $G^2 + 2\,GH$ is the total air-gap pull and $2\,G_1H$ is the leakage pull.

Generally speaking, the leakage pull is a maximum when the length of the air-gap is maximum, but when the length of the air-gap of a plunger electromagnet is reduced to zero there can be no leakage whatsoever, and the law of the total pull is then expressed by equation (5). On the other hand, the air-gap flux will vary inversely as the length of the air-gap, so that the general conditions, for a direct-current plunger electromagnet, so far as the air-gap and leakage fluxes are concerned, are graphically represented in Fig. 1. It is to be observed that the sum of the two fluxes is assumed to be of constant value, to illustrate the general principle.

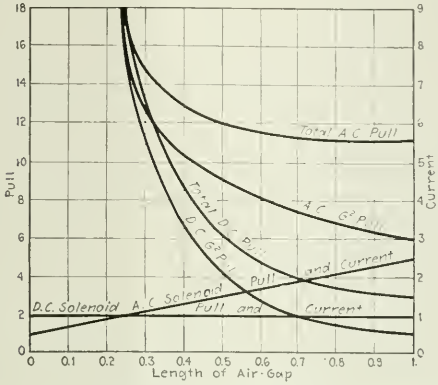


FIG. 3—CHARACTERISTICS WHEN THE ALTERNATING CURRENT DOES NOT FALL TO ZERO

It will now be readily seen that Maxwell's law is true for a closed air-gap, under the ideal conditions previously mentioned, but that it does not hold for tractive electromagnets unless modified to allow for the extra pull due to leakage.

Perhaps the relations may be better understood by writing equation (6) in the form

$$P = G^2 + 2H(G + G_1). \qquad (7)$$

Since G is proportional to the part of the flux from the plunger which passes through the air-gap and G_1 is proportional to that part of the flux which does not pass through the air-gap, it is evident that the total pull between the coil and the plunger, which may be called the "solenoid pull," will be $2\,H(G + G_1)$, and the pull due to the contraction of the flux in the air-gap, proportional to $B_a - H$, is simply G^2. This will be called the "G^2 pull." The total pull is the sum of these two pulls.

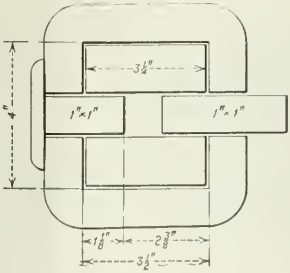


FIG. 4—TESTING ELECTROMAGNET

Fig. 2 shows the theoretical conditions with the air-gap in that part of a plunger electromagnet where the magnetizing force due to continuous current is assumed to be of constant value. It is also assumed that there is no reluctance in the plunger, stop and frame, and that there are no hysteresis or eddy-current losses, so that the alternating current will fall to zero when the plunger is in perfect magnetic contact with the stop. The G^2 pull, varying as $\frac{i^2}{l^2}$, wherein i is the direct-current value of the alternating current and l is the length of the air-gap, will be of constant value for all lengths of air-gap, and the total alternating-current pull will be the sum of the G^2 and solenoid pulls.

The direct-current G^2 pull will, however, be in the form of a hyperbola, while the total direct-current pull will be equal to the sum of the solenoid and G^2 pulls.

In Fig. 3 are shown the same characteristics for direct current as in Fig. 2. The alternating current and consequent alternating-current solenoid pull do not fall to zero in this case. A comparison of the alternating-current characteristics in Figs. 2 and 3 shows that in the latter case the total pull is not only greatly increased at the beginning of the stroke but that it increases as the air-gap diminishes, somewhat after the manner of the direct-current pull. Practical alternating-current electromagnets have losses due to reluctance, hysteresis and eddy currents, and the alternating-current solenoid pull does not fall to zero.

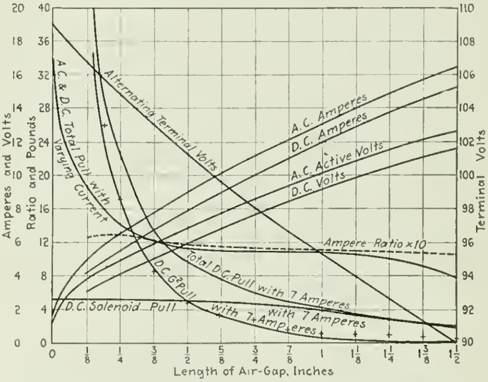


FIG. 5—TEST CHARACTERISTICS WITH BOTH ALTERNATING AND DIRECT CURRENT

In Fig. 4 are shown the general form and dimensions of a standard alternating-current plunger electromagnet which was kindly loaned to the writer by a well-known manufacturing company. Fig. 5 shows the general characteristics. Tests were first made with alternating current to determine the pull and current for various lengths of air-gap. Energy for testing the electromagnet was taken from a sixty-cycle lighting circuit and, consequently, there was a considerable drop in the line. Next tests were made with direct currents of such values that the pull was the same for direct current as with alternating current. The stop was then removed and the solenoid pull found for all points, through the former air-gap, with direct current. A test was also made with direct current, with the stop in place, in order to find the total direct-current pull. In Fig. 6 are shown the characteristics obtained by first calculating the solenoid pull for alternating current from the direct-current solenoid pull data. The alternating-current G_2 pull is found by subtracting the alternating-current solenoid pull from the total alternating-current pull.

Now the G^2 pull is proportional to $\frac{i^2}{l^2}$. By allowing an additional reluctance for the ferric parts corresponding to one-sixteenth unit of length of air-gap and dividing by 30 to bring the $\frac{i^2}{l^2}$ values to the same scale as the G^2 pull values in both Figs. 5 and 6, and using the direct-current values, the calculated G^2 pulls coincide favorably with the actual G^2 pull curves, as indicated by the crosses which represent the calculated points. By using different lengths of stops, pull curves of various forms are obtained. The solenoid pull, due to the varying values of the magnetizing force for constant direct-current value of ampere-turns, at different positions inside the coil, is the cause. The use of shading coils, to prevent chattering, in no wise affects the principles above outlined.

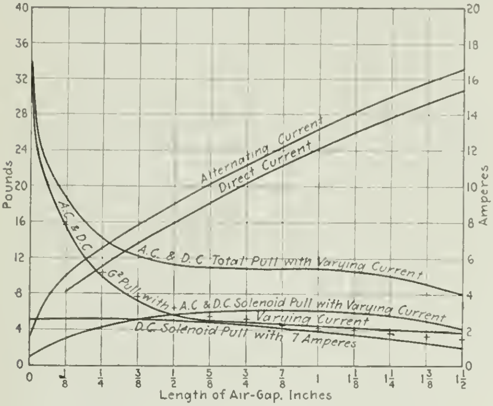
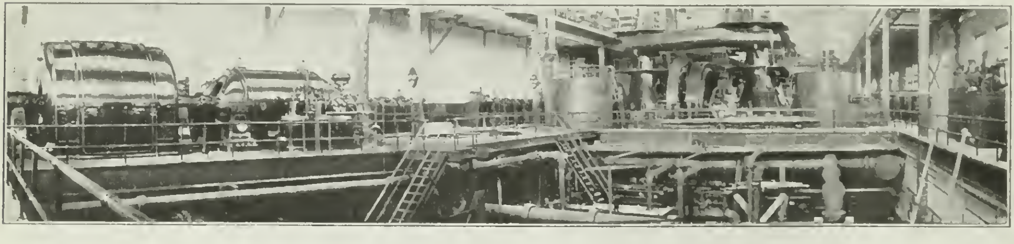


FIG. 6—ANALYSIS OF THE TEST CHARACTERISTICS

Recent Improvements in the Metropolitan Plant at Kansas City, Mo.

With the rapid extension of transmission and distribution lines and with additional loads coming on the existing city railway and lighting feeders of the Kansas City Railway & Light Company, additional generating equipment in the station has been found necessary. Within the last year a second 15,000-kw turbine has been installed, replacing a vertical turbine unit of 5000-kw rating, so that now the main generating equipment of the station consists of two vertical General Electric 15,000-kw, 6600-volt, twenty-five-cycle, three-phase turbines; one horizontal Westinghouse 7000-kw, 6600-volt, twenty-five-cycle, three-phase turbine, and two vertical reciprocating engines driving 6600-volt, twenty-five-cycle, three-phase alternators, all direct-connected. This equipment is operated on a single set of buses, and, owing to the fact that all equipment can be connected in parallel, the station power-factor ranges near 98 per cent continuously. Protection for the 15,000-kw units against heavy short-circuits on the twenty-five-cycle mains near the station is to be provided by two sets of reactors now being installed between the station bus and the terminals of the machines.



PLANT OF KANSAS CITY (MO.) RAILWAY & LIGHT COMPANY

Recently two banks of three single-phase 6600/33,000-volt transformers were installed on the third gallery of the station to step up the voltage for transmission to Cement City and way points. To insure continuity of service the transmission lines serving these customers have been erected in duplicate and a double equipment of lightning arresters and switches has been placed in the station. At Cement City, 12 miles distant from the plant, a single customer is served. This patron is a cement-mill owner with an installation of 3000 kw in motors. Some of these units operate throughout the entire twenty-four hours of the day. This plant is the company's largest motor-service customer. According to the contract under which the motors in this mill are operated, the load curve of the cement mill is adjusted to vary inversely with that of the electric-service company's generating plant, an arrangement which, of course, conduces greatly to economy of operation.

The control of the mill's load curve to avoid heavy demands during the system's peak is accomplished by having grinding operations and other heavy work performed early in the day and keeping these motors off the line from 5 p. m. till 7 p. m. Among the other customers served along the route of this 33,000-volt line are the Kansas City Nut & Bolt Works and the American Radiator Company, each operating installations ranging from 500 hp to 1000 hp.

New York's Oldest Private Plant

The oldest private electric generating plant in New York City, according to Mr. C. M. Ripley in a paper presented before the recent meeting of the Society of Heating and Ventilating Engineers, is the installation of Edison dynamos driven by "Safety Steam" engines in the Mills Building opposite the Stock Exchange on Broad Street. This plant, which is still in daily operation, was installed in 1883, only four years after Edison's invention of the incandescent electric lamp. The three 25-kw Edison generators have been in continuous daily service for thirty-one years, although the plant has since been supplemented by the addition of a 75-kw, a 100-kw and a 160-kw unit made necessary by the increased demand for artificial illumination in the Mills Building as the height of surrounding structures has increased.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Electric Trucks in Central-Station Service at Atlanta, Ga.

For the last three years the Georgia Railway & Power Company, Atlanta, Ga., has had in service a 750-lb. electric wagon, which during that time has completed a total travel of over 30,000 miles, 25,000 miles of which was made on a single battery. There was one renewal of tires, and with the exception of the second battery the only repairs amounted to one hub cap and one chain.

In its gas-installation division the same company has another 1000-lb. General Vehicle wagon which made 16,500 miles in three years. The repairs for a period of more than two years ran less than $400. Another 2-ton truck in service two years has made 10,000 miles and is still using the original battery.

Central-Station Service Practically Universal in Denver

Ten years ago several isolated plants were operating in Denver, Col., but since then the Denver Gas & Electric Company has made central-station service so attractive that most of these private installations have been discarded and the company's service has been adopted in their place. Not a private plant has been installed in the last three years, and only three have been erected in the last ten years.

The automobile-assembling factory recently erected at Denver by the Ford Motor Company will likewise use central-station energy. All of the vehicles for the company's Rocky Mountain trade will be assembled in this factory, which is a four-story reinforced-concrete building. About 200 hp in motors is installed, and the total monthly energy consumption will be about 30,000 kw-hr.

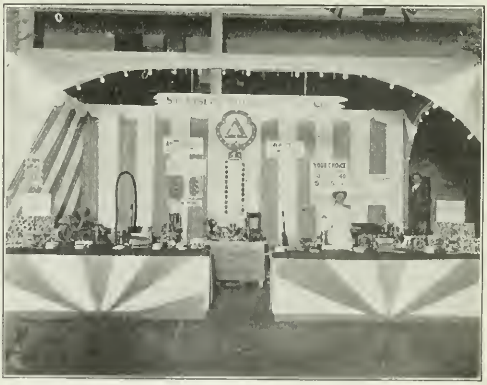
Remarkable Expansion of Electric and Gas Service in San Diego

San Diego, Cal., is increasing rapidly in population, but the expansion of the public-utility interests has proceeded at even a greater rate. The city's inhabitants in 1910 numbered not quite 40,000. While it is difficult to estimate the population to-day, the local authorities agree that the figure is in the neighborhood of 80,000. In 1905, when the San Diego Consolidated Gas & Electric Company came under the management of H. M. Byllesby & Company, the city had an estimated population of 25,000. Since 1905, however, the gas and electric distributing systems have been extended to suburbs and adjacent towns, and the population served with gas is now estimated as about 95,000, although the population served electrically is not quite so large. The electric output of the company named for the year previous to the advent of the Byllesby management was 1,166,817 kw-hr. For the calendar year 1913 the kilowatt-hour output was 14,404,741, an increase of 1130 per cent, while the population served increased less than 400 per cent. Between April 1, 1905, and Jan. 1, 1914, the rating of the company's electric generators increased from 1220 kw to 8470 kw. There is now one electricity meter to every 5.6 of population, as compared with one to every 20.9 in May, 1905. The number of customers of the electric department of the company increased from 1181 to 17,054 and the total connected load from 1128 kw to 28,384 kw, the increase here being 2410 per cent. The increase in number of customers in the gas department was 870 per cent, comparing May, 1905, with November, 1913.

Teaching Customers the Cost

To demonstrate to users of electricity in St. Joseph, Mo., the low cost of operating electric household devices, the St. Joseph Railway, Light, Heat & Power Company made good use of an electric sign flasher in its booth at the recent "Fos Festival" exhibit. Connected to the flasher were a number of household appliances, including a flatiron, electric heater, chafing-dish, hot-water cups, a sewing machine, luminous radiator, coffee percolator, fan, electric samovar, disk stove, washing machine, tailor's iron, curling iron, warming pad, vacuum cleaner, and groups of carbon and tungsten lamps.

The flasher switched these devices successively into circuit, at the same time lighting a pilot lamp on a central board, opposite the name of the device in service at the moment. A wattmeter connected in circuit with the appliances had its scale specially graduated to read in cents per hour the cost of operating each device, so that the spectator who lingered in front of the display for a few minutes had an automatic demonstration of the expense of running the various appliances scattered throughout the booth. The attractively fitted-up display room and the flashing of the colored pilot lamps made the company's booth one of the most popular during the auditorium exhibit.


CENTRAL-STATION BOOTH AT ST. JOSEPH'S "FOS FESTIVAL"

Loading Sand Electrically Along the Mississippi

On the Mississippi River at Davenport, Ia., barges ply between the sandbanks in the river and the spur tracks of the railroad which reach down to the waterfront conveying to the cars for shipment sand that accumulates in times of high water. To save time in loading the sand from the barges onto the cars the motor-driven belt conveyor shown in the accompanying illustration has been erected. Sand unloaded from the boats is dumped into a pit at the lower end of the runway, where it is picked up by the concave belt and carried to the chute above the cars. The belt travels at approximately 80 ft. per minute, the power being supplied by a 7.5-hp, 440-volt, two-phase motor operated from the circuits of the People's Light Company. It is stated that the time and money saved over the old method in which the sand had to be shoveled out of the barges into wagons and then up into the cars repays many times the cost of energy for driving the motor.

MOTOR-DRIVEN SAND LOADER

Welfare Work in St. Louis

Mr. A. C. Einstein, general manager of the United Electric Light & Power Company, of St. Louis, has announced that the company plans to establish a welfare club during the present year. The building at Vandeventer Avenue and Morgan Street is to be transformed into an employees' club house, equipped with bowling alleys, gymnasium, billiard and pool tables, library, etc. A separate gymnasium and quarters in the club are planned for the women employees of the company. Possible additional features are a ballroom and a swimming pool. The membership in the welfare club will be restricted to employees of the company, who will be divided into two classes, major and minor. Major members must be twenty-one years old, and their dues shall be proportionate to salaries earned, ranging from $3 a year for those whose salaries are under $50 a month to $12 a year for those whose salaries exceed $150 a month. The annual dues of the minor members and women shall be $3. From the annual dues an allowance of 25 per cent shall accrue to those members of the welfare club who are also members in good standing of either the Employees' Mutual Benefit Association or the Union Electric Light & Power Company Section of the National Electric Light Association. Those who are members of both of these associations shall be entitled to apply 50 per cent of their club dues toward the dues of those societies.

Mr. Einstein also announced that the company has under consideration the establishment of a pension plan by which employees who have reached a certain age and have been in continuous service with the company or its predecessors for a period of years may be retired with a life pension. In committing itself to this pension system the company will reserve certain privileges, which will be set forth fully in the rules and regulations now being compiled. The company is active in welfare work, maintaining or assisting a mutual benefit association among employees, a company section of the N. E. L. A., a loan fund, an orchestra and a glee club, as well as a free educational course for salesmen.

Small Versus Large Quantity Purchases of Electrical Supplies

The central-station manager in the small city or town is often in a quandary as to the quantities in which he should purchase his supplies. The large-quantity discounts are alluring, but, on the other hand, he does not want to tie up money in slow-moving stock. The governing feature, of course, should be the return on the increased investment. If one has not given more than the usual amount of thought to the subject, the additional discounts for large purchases are likely to cause him to underestimate the actual return on the increased investment.

As a concrete example, consider the purchase of sockets by a company using, say, 1000 sockets per year. The present list price on these is 33 cents, with discounts of "50 and 15" for 500 lots, and "50, 15 and 10" for 1000 lots. At first glance this might appear to be a return of only 10 per cent on the additional money invested when the larger quantity is purchased, and as there may be other uses for money where the return will be greater, the manager is very likely to buy the sockets in 500 lots twice each year. A little calculation, however, will show the return to be much greater if 1000-lot purchases are made each year.

With all discounts considered the problem works out as follows, assuming that in one case 1000 sockets are purchased at the beginning of the year and that in another instance 500 sockets are bought at the beginning of the year and six months later another 500 lot is purchased:

1000 sockets	$126.13	
Interest, one year, at 6 per cent	7.56	
Total		$133.69
First purchase, 500 sockets	$70.13	
Interest, one year, at 6 per cent	4.20	
		$74.32
Second purchase, 500 sockets	$70.12	
Interest, six months, at 6 per cent	2.10	
		72.22
Total		$146.54

The purchaser therefore actually saves $12.85. The difference between the interest on the two investments at 6 per cent is $7.56 less $6.30, or $1.26. If $1.26 is the difference in interest at 6 per cent on the two investments, then one may think of the $12.85 saved as representing 66 per cent return on the increased investment necessary to purchase and carry the larger quantity.

Some plants are so small that they may not require 1000 sockets in several years, and in such cases it may be best to purchase in smaller quantities notwithstanding the results obtained by the other method. The managers of these may claim that small-quantity purchases are best for them. There are, however, very few plants that do not use 250 rosettes in the course of two years, yet many managers of such plants prefer to buy these and other standard supplies in one-fifth standard packages.

One example will show the fallacy of this plan. Assume rosettes listed at 26 cents each, with 40 per cent discount in one-fifth package lots, or 60 per cent discount in standard packages of 250 pieces. This problem may be worked out in the same manner as the socket transaction, assuming that in one instance the standard package is purchased at the beginning of the two-year period, and that in the other purchases of one-fifth standard packages are made at the beginning of this period and at intervals of four and four-fifth months thereafter. The results show an ultimate saving of $10.53 at the end of the two years, an amount which many in the same way be viewed as 132 per cent on the excess investment.

A few hours spent with a standard supply catalog and discount sheet in working out similar problems will doubtless convince any follower of the small-quantity purchasing method that he has been losing money in a manner almost as mysterious as a magician's tricks.

Electric Motors in a Modern Warehouse

An aggregate of 350 hp is usel for motor drive in the new warehouses of Park & Tilford, West Forty-second and Forty-third Streets, New York. Of this total rating, 175 hp is used for driving one passenger and six freight elevators, each of the latter having a capacity of 4500 lb.

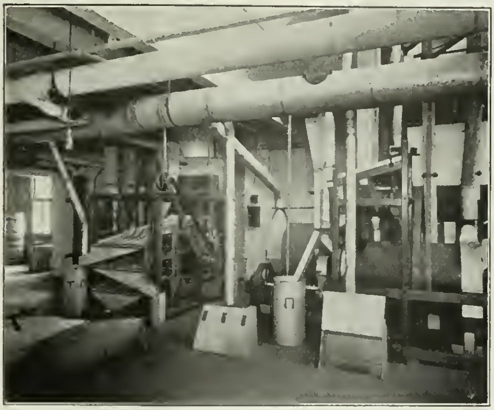


FIG. 1—GREEN-COFFEE MIXER, MILLING MACHINE AND SEPARATOR

Of the several departments into which the building is divided, that devoted to the preparation of coffee is perhaps the most completely equipped. The coffee, which arrives in the bean, passes from one to another of the various machines through strong galvanized-iron chutes. Six roasters are operated by shaft drive, power being obtained from a 7.5-hp motor. Separate motor drive is used for each of three grinders, a pulverizer, a mixer for roasted coffee, a green-coffee mixer, a green-coffee cleaner and a green-coffee separator. A 50-in. Stuyvesant suction fan, operating at 1500 r.p.m. and driven by a 15-hp motor, cools the product as it emerges from the roasters. Another fan disposes of the smoke that rises from the coffee during the roasting process.

The work done in the spice rooms consists chiefly of grinding and sifting. Two large grinders, driven by 20-hp motors, are used in the preparation of the pepper and ginger, and a pulverizer working at 2775 r.p.m. takes care of the cinnamon, cloves and allspice. Nutmegs are broken up by a motor-driven cracker. The spices are sifted by means of electrically operated machines. Of the latter one device of new design distributes both the product and the waste automatically into their proper receptacles. Sifters of a somewhat older type, having bucket-shaped receptacles with bottoms of fine silk, are also employed.

In the liquor and wine vaults are several electrically driven appliances. Among these is a bottle-corking machine to which the bottles are conveyed from the automatic fillers. The corking machine can be adjusted to handle various sizes of bottles. Long bottle-washing sinks are equipped with self-adjusting rubber-coated instruments which are inserted into bottles and revolved rapidly while a stream of water delivered at a pressure of 60 lb. per sq. in. circulates about them. Two electric disk stoves or hot plates heat the wax which is used to seal the liquor flasks.

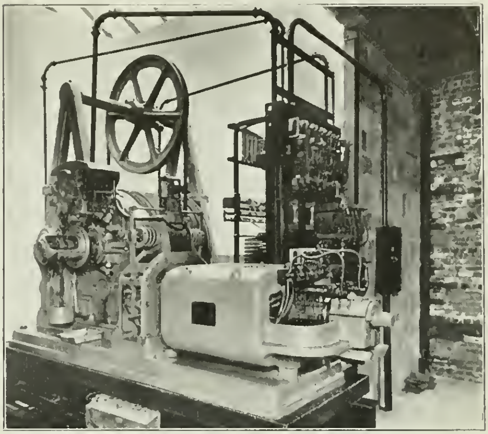


FIG. 2—PASSENGER-ELEVATOR MOTOR

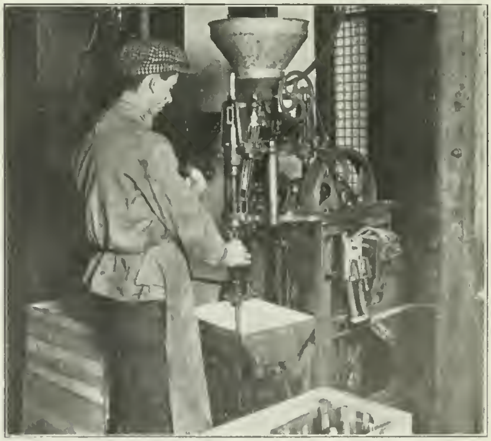


FIG. 3—BOTTLE-CORKING MACHINE

The principal rooms in which cigars are handled are ventilated by means of pipes radiating from an electrically operated humidor. Air is forced through a veil of running water into these pipes by a 3.5-hp fan.

The pumping equipment is in the basement and consists of three house pumps and a sump pump, each driven by a 7.5-hp motor, a well pump and a small boiler pump. The sump pump handles 400 gal. per minute. The building is supplied from an artesian well 325 ft. deep. An ice machine, in the basement, is operated by a 12-hp motor.

One of the main features of the building is a thoroughfare and driveway, 83 ft. wide, running from Forty-second to Forty-third Street, and containing 14,000 sq. ft. of space, which enables thirty-six trucks to load or unload at the same time. The driveway is equipped with charging posts for electric vehicles, twenty-six of which can be charged here at one time.

The lighting installation of these warehouses aggregates the equivalent of 4000 16-cp lamps.

Proposed Street-Lighting Contract for Milwaukee

The City Club of Milwaukee recently appointed a committee to investigate the question of street lighting for that city, which has been before the public for some time. This committee has made recommendations to the Common Council which gives evidence of considerable thought on the part of the members of the committee and an appreciation of some of the economic and technical problems involved in street-lighting contracts. The committee points out that there is considerable difference of opinion among citizens of Milwaukee at present as to the desirability of the city installing and operating a municipal lighting plant. It finds, however, that citizens appreciate that present conditions of inadequate street lighting are well-nigh intolerable and that Milwaukee is paying tens of thousands of dollars in commercial and economic losses annually. The committee believes it is practicable to arrange at once for the installation of an adequate street-lighting system without prejudicing either favorably or unfavorably any action which the city may wish to take in the future in the matter of a municipal lighting plant.

The first question discussed is whether a contract for street lighting should be signed at this time with a private company. The report shows that in view of the differences of opinion as to the advisability of installing a municipal plant it would be unreasonable to assume that Milwaukee would be in a position to obtain energy for street lighting from a municipal plant in less than three years, and probably it would be four or five years. It is unthinkable, the committee says, that the present grossly inadequate street lighting should be endured for from three to five years longer. On the other hand, no new lamps, even of the present inefficient type, can be obtained or expected under the present no-contract condition with the central-station company. The committee thinks the city should enter into a contract with a private company for lighting the streets under the rather unusual terms which are given later.

The usual form of street-lighting contract is on the lamp-year basis, under which the city pays a fixed sum per year for each lamp installed. This is seriously objected to by the committee. At least 60 per cent of the cost to a private company in furnishing street lighting is the interest and depreciation on the investment. These figures apply to a ten-year contract. For shorter contracts the interest and depreciation factor represents a still larger proportion of the total. The signing of such a contract usually finds a city with a more or less inadequate street-lighting system. Generally a new contract provides for the adoption of an improved type of street lamp. Upon the signing of such a contract the lighting company proceeds to install a very large number of the new type of lamp. It is to the interest of the lighting company to furnish just as much street lighting as the city is willing to authorize and to have the lamps installed at once so as to receive interest and depreciation on the investment throughout the entire period of the contract. At the end of the first year or two of such a contract a considerable investment in new lamps has been made. By this time it generally happens that there have been improvements in street lamps and the existing type is no longer the most satisfactory. Nevertheless, it is not to the interest of the lighting company to make a change, because such change would open anew for discussion the question of rates and cost, or the adoption of a new and more satisfactory type of lamps might tend to create a demand for investment in new distributing circuits of lamps before the investment in old circuit lamps had been covered by the interest and depreciation charges.

The lamp-year basis of contract, therefore, involves an unwisely large investment in one type of lamp during the earlier period of the contract and an unwisely small investment in any type of lamp during the later years of the contract. Moreover, the lamp-year basis of contract involves such practical difficulties in making any change in the type of lamp that such changes are very unlikely to be made. The lighting company naturally and properly figures so that it will be repaid during the contract term for its investment in lamps. At the end of the contract the city is in the position of having paid for the lamps without having any title to them.

No such difficulties exist in the case of private lighting contracts. A department store for example purchasing electric service owns its own lamps, reflectors, fixtures and motors. As improved lamps, etc., are placed on the market the store brings its equipment up to date. It purchases energy on the kilowatt-hour basis. At the end of any contract it owns the lamps for which it has paid.

If the kilowatt-hour basis were used for the city's street-lighting contract, it would involve the ownership by the city of the wires, lamps and lamp-poles devoted to street lighting only. There would be no incentive to install a large number during the early period of a contract and an insufficient number during the latter period. The question of financing such a purchase would discourage the city from making an excessive purchase of lamps at one time. This would be a desirable result in view of the improvements that are constantly being made in street lamps. As improved lamps were introduced self-interest would not stand in the way of the city promptly availing itself of them. The city would pay the actual cost of the lamps only and would then own them instead of paying twice over, as happens with the lamp-year contract when the same lamps are employed for two different contract purposes.

To carry out the last-mentioned contract it is suggested that the present street lamps in Milwaukee be rented from the Milwaukee Electric Railway & Light Company on a per month basis. The city would then devote a certain amount to the purchase of new lamps each year to replace the antiquated lamps.

The city is not organized at present to assume properly and economically the responsibility for the purchase, installation and maintenance of lamps and poles under such a contract. A proper organization could be made, but a simpler plan is recommended, that the city pay for the purchase, installation and maintenance of the street lamps by the lighting company, the city paying the actual cost of labor and material plus a percentage to cover the overhead expense; the final power to specify type of equipment rests with the city.

The city would pay for its street lighting month by month on the kilowatt-hour basis, and for installing lamps and for maintenance like private consumers.

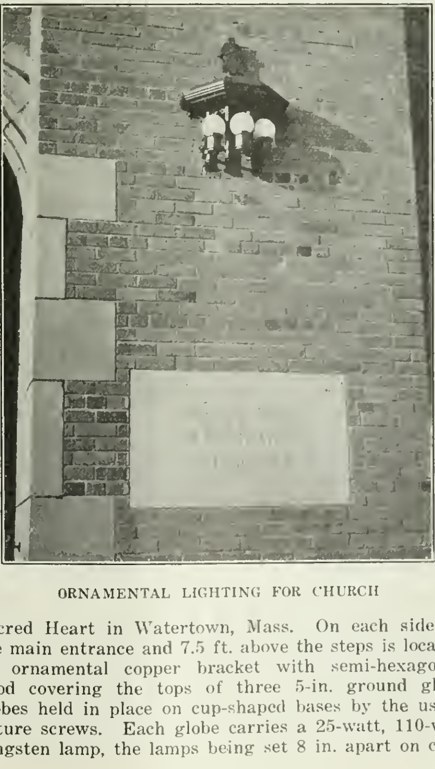
Illumination and Wiring

Improving "Island of Safety" Lamps

Accidents have happened by reason of the elevated "islands of safety" in city streets not being clearly visible either because the red signal lamp failed to burn or because of exceptional darkness during the period when the lamp is unlighted. The islands of safety, with their red lamps, have been placed in Minneapolis streets recently to the number of about a dozen. The Minneapolis General Electric Company furnishes the electricity for the 60-watt tungsten lamps in the red globes. But Mr. R. F. Pack, the general manager of the company, thought there should be some protection besides the large lamp. So he had his construction men connect a tiny 2-cp lamp in the main lamp circuit. This lamp is placed in the big red globe beside the principal lamp. It is, however, wired to the supply circuit at a point beyond the switch controlling the 60-watt lamp, this switch being operated by a watchman. The little lamp is thus burning constantly, and it affords enough light to make the red globe dimly visible in the dusk or dark should the main lamp for any reason be unlighted. This added "safety first" precaution has been introduced by the company entirely at its own expense.

Attractive Entrance Lighting for Church

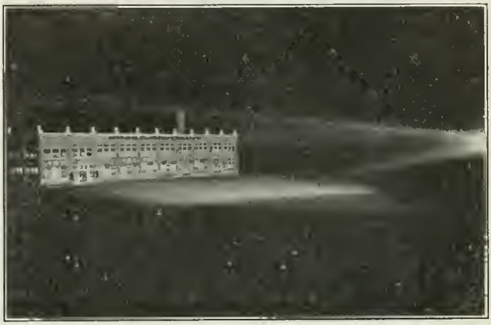
The architectural possibilities of modern exterior electric lighting for church entrances are illustrated in the halftone accompanying this note, the view having been taken at the recently completed Church of the Sacred Heart in Watertown, Mass. On each side of the main entrance and 7.5 ft. above the steps is located an ornamental copper bracket with semi-hexagonal hood covering the tops of three 5-in. ground glass globes held in place on cup-shaped bases by the usual fixture screws. Each globe carries a 25-watt, 110-volt tungsten lamp, the lamps being set 8 in. apart on centers. The lighting effect secured is dignified and the fixtures and canopies are thoroughly ecclesiastical in appearance without losing practical usefulness in illuminating the steps. Energy is supplied from the local central-station lines.



ORNAMENTAL LIGHTING FOR CHURCH

Searchlamp Illumination of Building Front

The Philadelphia plant of the Hess-Bright Manufacturing Company is situated near the main-line tracks of the Pennsylvania Railroad, and advantage has been taken of this fact to attract the attention of passengers on night trains by illuminating the entire front of the office building by a projector lamp concealed from view.



BUILDING FRONT LIGHTED FROM SEARCHLAMP

Mounted on a 25-ft. steel tower at a distance of 250 ft. in front of the building wall is a 50-amp, 10,000-cp, 24-in. searchlamp using 110-volt direct current. The building front itself is 200 ft. long and 34 ft. high, and after nightfall, as shown in the illustration, it is bathed in an intense illumination which one observer describes as "sunlight at night." The searchlamp consumes 5.5 kw-hr. per hour and costs about 27 cents per hour to operate. It is used from five to six hours nightly. Installed complete, this spectacular lighting scheme cost about $1,000.

Complying with Wisconsin's Voltage-Regulation Law

For the past three months Mr. C. R. Phenicie, general superintendent of the Green Bay (Wis.) Gas & Electric Company, has been making a study of the voltage conditions existing on the feeder circuits of his company, in order to determine the changes necessary to comply with the voltage-regulation order recently issued by the Wisconsin Railroad Commission. The rule specifies that the voltage on all circuits shall be regulated within 3 per cent of the normal potential.

To the small utility, where the common practice of the operators has been to boost the station voltage at times of peak load in order to compensate for the line drop, compliance with the ruling often means a large expenditure from which the company derives no direct revenue. Mr. Phenicie, after three months' study, declares that some form of induction regulator seems to be the only device which will control his standard 75-amp feeders satisfactorily.

The subject of voltage regulation was brought up for discussion at the January meeting of the Wisconsin Electrical Association, following a paper by Mr. G. G. Post, of the Milwaukee Electric Railway & Light Company, as reported on page 193 of last week's *Electrical World*.

Street Lighting from Private Plant in Hospital

The private electric-service and heating plant of the Kansas City (Mo.) General Hospital is equipped with three 150-hp Erie City water-tube boilers supplying steam to reciprocating engines which drive two Westinghouse 110-volt generators rated at 100 hp and 75 hp respectively. Since at no time does the electrical load of the hospital demand the full output of the machines the authorities of the institution have combined forces with the local health and park boards to light the hospital grounds and part of Gilham Road leading from the new union depot. To avoid the need for excessive copper conductors two 20-kw motor-generator sets were installed, which raise the potential from 110 volts to 220 volts. At the latter pressure the energy is conducted through underground wiring to the eighty lighting standards, all of which are of the type shown in Fig. 1.

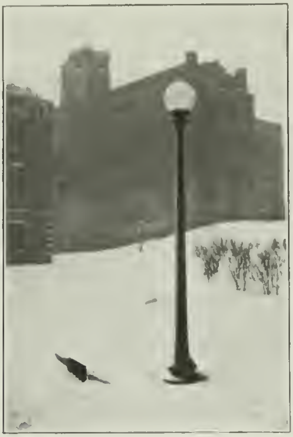


FIG. 1—LIGHTING UNITS ON HOSPITAL GROUNDS

One-hundred-watt tungsten lamps are used in all units, the eighty lamps being connected on six circuits. The small switches for controlling these circuits are shown at the base of the panelboards (Fig. 2). Motor-generator and switchboard equipments have been installed in duplicate, either machine having sufficient rating to supply the eighty lamps. As compared with the gas lighting formerly used there and still used on the neighboring streets, the new installation, declares Mr. John M. Coughlin, chief engineer of the hospital, is a marked improvement. Mr. A. R. Winnie is chief electrician for the plant.

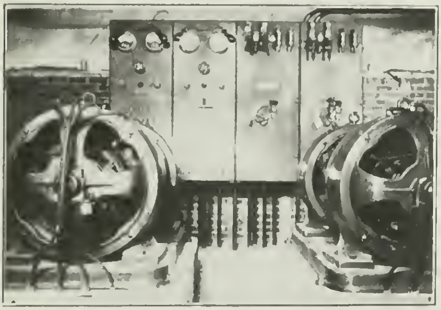


FIG. 2—MOTOR-GENERATOR SETS IN KANSAS CITY GENERAL HOSPITAL

Carrying Out the Color Scheme

When the ground floor of an old building at Milwaukee, Wis., was remodeled recently the exterior lighting units were included in the general scheme of improvement. As will be seen from the illustration, the fronts of the new store were finished in white tile, and to aid in extending the air of cleanliness to the exterior the entire installation of ornamental posts was painted pure white with the exception of their bases, to which a coat of bronze was given.

ORNAMENTAL STANDARDS PAINTED WHITE

The posts are thus attractive in appearance both by night and by day and have created much favorable comment on the neatness of their appearance and the way they harmonize with the white store fronts.

Cable Burn-Out Caused by Mice

By J. J. Skelly

An interruption occurred recently in a 2200-volt feeder supplying energy for the operation of a railroad signal system.

The oil switch on the circuit opened on a short-circuit and when restored tripped out again. Smoke was noticed issuing from an iron conduit carrying the feeder and a test showed that the feeder was grounded therein.

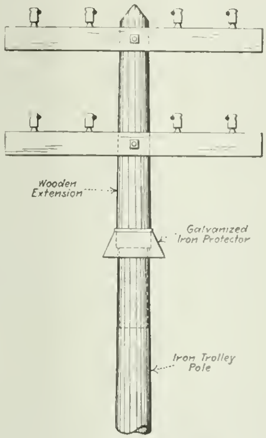
BURN-OUT IN 2200-VOLT CABLE, AND CHARRED BODIES OF MICE

The cable when pulled out revealed the charred bodies of two mice at the point where the cable broke down. They had evidently gnawed into the insulation, causing a short-circuit when the wire was reached.

After pulling in new cable and re-establishing service the ends of the conduit were sealed with a mixture of plaster of paris and mineral wool, with a view to the avoidance of any further trouble of the kind.

Protecting Wooden Trolley-Pole Extensions

In Kansas City, Mo., as in many other places, it has been found convenient to add wooden extensions to the tops of iron trolley poles for the purpose of suspending overhead feeders. Usually such construction is considered more or less temporary, but as is the case with much temporary construction, it has a way of remaining in service until necessity forces a change. Here, however, an effort has been made to provide something more than a piece of temporary construction, so that galvanized-iron rain shields have been provided for the joint of the wood and the iron pole. Just as the wooden pole fails at the ground line, so the extensions when placed as shown in the accompanying sketch weaken first at the top of the iron pole. When the poles are carrying several heavy trolley feeders and lighting circuits even a very little rot is likely to produce a dangerous condition in case a bending strain is imposed. Hence the precaution of protecting as far as practicable against the entrance of moisture from the pole joint reduces liability of failure.



PROTECTOR FOR JOINT OF WOODEN-POLE EXTENSION

Recent Telephone Patents

Two different methods of designing call-distributing systems of telephone apparatus were recently made the subjects of patents. In one of these, granted to Mr. S. H. Brown, of Pittsburgh, Pa., the signal-control switches are associated with the individual lines. When a call is made on any line the distributing switch belonging to that line hunts out an idle set of line-lamp and answering-line contacts, and thereby extends the calling line to an idle exchange operator. The usual jack multiple is placed before this operator. The answering lines end in plugs and cords, and each is provided with a listening key. A disconnecting signal is also provided for each trunk for signaling the operator to clear the line called. The calling line is automatically cleared by the restoration of the selecting switch when the receiver at the calling station is hung up.

The other system is described in a patent granted jointly to Messrs. H. J. W. Fay, of Westboro, Mass., and E. C. Molina, of East Orange, N. J. In this system the selecting switches for distributing the calls are associated primarily with the operators' positions. The subscribers' lines are grouped in proper lots and each group has access to a selective switch upon a sufficient number of different operators' positions. In this system a call from any one of a group is picked up by the first idle switch of that group and signaled to the corresponding operator. By properly arranging the sequence of switches and signals for various groups the calls are evenly distributed. Both these patents are assigned to the American Telephone & Telegraph Company.

Letters to the Editors

Electric Trucks for Parcel Post Service

To the Editors of the Electrical World:

SIRS: On page 1345 of your issue of Dec. 27 appears an article entitled "Electric Trucks for Parcel Post Service," in which comparison is made between the performance of gasoline cars and electric vehicles, and it is stated that as a result of the data shown the use of gasoline cars was discontinued in parcel-post deliveries at Indianapolis.

The data indicate that the cost per parcel-mile with the gasoline cars was 25 per cent higher than with the electric vehicles, but examination of the figures shows that the gasoline cars made far longer runs, with fewer stops and fewer parcels. They were thus used in their proper place, that is, outside the radius of operation of the electric trucks, so that the comparisons made are not by any means based upon identical conditions.

Had the gasoline trucks been operating on the same service as the electric trucks, the difference in favor of the latter would probably have been much greater than the 25 per cent shown. On the other hand, had the electric trucks been operating on the same service as the "gas" cars, the latter would probably have made a far better showing. J. V. ROCKWELL,

Bureau of Yards and Docks, Navy Department.

Washington, D. C.

"Combined Synchronous and Induction Motor Loads"

To the Editors of the Electrical World:

SIRS:—Readers of the discussion on "Combined Synchronous and Induction Motor Loads," by Mr. H. L. Wallau, in the *Electrical World* for Nov. 22, 1913, will doubtless find further facts of interest reported in an article of mine in your issue of Feb. 3, 1912, entitled "Comparison of Commercial Economy of Gas Engines and Steam Turbines." In this article the topic enlarged upon by Mr. Wallau was discussed in a general way. In the steel works mentioned in my article a new electric motor-driven merchant mill had been projected, and the matter of all-alternating-current drive or mixed alternating-current and direct-current drive was under discussion. The project was a big one, requiring an addition to the power station, and, anticipating that the effect of low power-factor would be important, I made estimates on the entire arrangement with both types of drive. The comparison resulted in favor of the mixed drive. The saving in investment and in operating cost effected by the mixed drive using alternating-current and direct-current synchronous motor-generator sets to correct the power-factor more than balanced the loss from the smaller efficiency of the motor-generator sets compared with transformers. This case was, of course, special, but there are likely many others that would show a similar result.

In the same steel works it had been the custom to correct for "lagging power-factor" with synchronous motors under load, the load carried usually being from 75 per cent to 80 per cent of normal with the motor field set to give about 95 per cent "leading power-factor" at normal load on the motor. Where direct current was to be supplied, synchronous motor-generators were used in the substations. Wherever large motors were to be used and the load conditions would justify it, synchronous motors were put in. The transformer stations were separate, but in each case they were fed with energy from the same line as a motor-generator substation. Correction of the power-factor at the generating station was all that was attempted, however.

The induction-motor load was usually about two-thirds the synchronous-motor load, and the electric-furnace load was about double the synchronous-motor load. With the induction-motor load alone the station power-factor would be from 65 per cent to 70 per cent; with the addition of the electric furnace it would go up to from 75 per cent to 80 per cent; with the further addition of the synchonous-motor load, the power-factor would rise to 92 per cent or 93 per cent, and when the electric furnace was dropped it reached approximately unity.

Hudson, Ohio. FRANKLIN M. FARWELL.

An Alliance for Learning

To the Editors of the Electrical World:

SIRS:—Every friend of technical education will rejoice at the recent announcement that the engineering faculties of the Massachusetts Institute of Technology and Harvard University are to get together in a close union for the advancement of learning and on terms which indicate effectual work for their common end. When a few years ago a merger of the institutions was planned and all but carried through, the project was of a kind which aroused serious and well-grounded opposition among the alumni of both institutions. From the viewpoint of the outsider it involved, on the one hand, the wiping out of the identity and spirit of the country's first technological school, and, on the other, the attempted assimilation of a student body and ideals absolutely foreign to the old leisurely Harvard of the humanities. Educationally, it would have meant an irritating struggle between the new and the old, and, socially, civil war.

The plan of action to-day is radically different, far richer in promise of good, and infinitely broader in spirit, springing from mutual interest instead of mere passion for impressive amalgamation. In brief, the engineering faculties of the two institutions are to join hands and resources, working together under the hospitable roof of the new "Tech," now being equipped on a scale to command the respect of even the most blatant materialist who ever mistook brick and concrete for scholarship. But, though the president of the Institute of Technology is to guide the whole and the bursar of the Institute is to handle the funds, the two high contracting parties retain their individual rights and identities, give their own degrees and guide the courses that lead to them. Each professor who comes over from Harvard holds his chair and title, although *ex officio* holding rank in "Tech," and likewise every "Tech" professor in engineering becomes *ex officio* attached to the staff of Harvard. Thus, howsoever the courses of instruction may be worked out, they can readily be made *de jure* and *de facto* interchangeable as leading to a degree from either institution. Just how these mutual interrelations can be worked out to the best advantage remains to be seen. There will be many complications requiring the wisdom of the serpent to untangle. For it must be remembered that from the engineering standpoint the two institutions have had courses of instruction far from parallel, so far, indeed, that they are difficult to set into equivalency. All the regular engineering work in "Tech" is essentially undergraduate, while much of that in Harvard is essentially post-graduate, although not more advanced in fact, owing to the different requirements for the undergraduate degree. To express the matter with frankness, the Technology course, by ruthless cutting out of non-essentials, by stern enforcement of a defined regimen of study, and by a rigor of persistent instruction that smacks of slave-driving or the finest efforts of the efficiency engineer, has jammed into four years as much of engineering as would ordinarily go into an undergraduate course in science plus a couple of years of post-graduate work. The Harvard engineering courses take these extra two years and start from an entirely less strenuous beginning. How these two different lines of action can be harmonized is no easy matter to predict, but one can easily see that two student bodies of which one is trying to compress into four years about what the other is finishing comfortably in six may not be distinguished by mutual sympathy. It is earnestly to be hoped that things will so turn out that the courses may be made parallel, for it would be better for both if a compromise could be arranged. The outsider can perhaps realize the situation better than those upon whom it has grown by almost imperceptible degrees. The fact is that the "Tech" work has grown to a point of intensiveness which to a certain extent defeats its own ends. Year by year hours and courses have been added at the instance of one department or another, loath to yield one jot or tittle of its influence, until the student is loaded with requirements that he must fulfil superficially or not at all. He is stuffed like a Strassburg goose, with facts forced upon him through tubes leading from divers departments, each jealous lest he escape with too little of its particular sort of pabulum.

When the new alliance is put in force it is devoutly to be hoped that a neutral ground may be discovered on which both institutions may meet for the adjustment of requirements—a calm and peaceful spot where the insatiate desire to have every student specialize in everything may be laid aside in favor of giving him time to think about something. The soothing aid of a curriculum arranged along more leisurely lines should bring balm to the harassed and weary. On the other hand, the party of the second part may not suffer from a little high pressure in the educational engine.

Seriously, the proposed alliance ought not only to conserve energy and better utilize equipment, but it should end in the working out of incomparably the finest technological school in the world. The two faculties now to be united are both strong and can be made even stronger in co-operation. It would have been lamentable to have two schools in the same city trying to compete when they should be helping each other. United, there should be sufficient endowment and instructing force to build up beyond the present a post-graduate engineering course such as neither institution has yet been able to compass, the one from lack of students, the other from too many. And this may furnish the solution of the main problem in technical education—how to put a quart into a pint bottle—by providing a place for the spill-over.

Boston, Mass. BARRETT LEE.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Causes of Transmission-Line Interruptions

Communities depending upon energy transmitted from a distance oftentimes suffer from interrupted service due to no fault at the generating station nor in the substation or local distribution system. The fault is in the high-voltage transmission system, which, however excellently built, is subject to mishaps over which the company has no control. The wonder is that transmission lines traversing open or wooded country for more than 100 miles are not subject to more mishaps than actually occur. Human beings have an unbounded respect for transmission lines carrying high potentials, and to this may be attributed the rapidly decreasing number of service interruptions due to persons with mischievous intentions. However, no one has yet evolved a system which is proof against birds of the air and the smaller animals that can climb with agility.

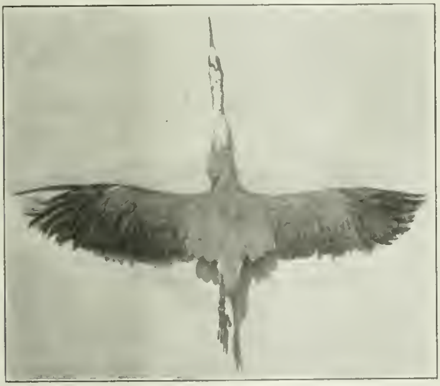


FIG. 1—CRANE THAT GROUNDED 104,000-VOLT LINE

Almost any transmission company can furnish instances of outages due to birds or animals, and four causes for interrupted service in different parts of the country are illustrated herewith.

Fig. 1 shows the crane that grounded the 104,000-volt line of the Sierra & San Francisco Power Company not very long ago. The crane alighted on a tower near the San Joaquin River. It measured 6 ft. 2 in. across from wing to wing.

Fig. 2 shows a small screech owl which placed itself between a grounded pin and a No. 4 three-strand high-tension line carrying 35,000 volts on the system of the Indiana General Service Company between Elwood and Alexandria, Ind. It will be noted that the left wing is badly burned and also the left leg.

Fig. 3 shows a heron which recently caused the electric lighting and railway service of the British Columbia Electric Railways Company, Ltd., Vancouver, B. C., to go out of commission. The heron was flying over the peninsula between the Fraser River and False Creek one night and came in contact with the three high-tension wires of the company along the line of the Lulu Island railway. A short-circuit resulted, about a foot of each of the three wires at the point being burned away. The resulting surge put the substation supplying energy for Vancouver out of business. The cause of the short-circuit was not known until the following morning when the linemen discovered the dead heron lying at the side of the track. The company made good use of the dead bird from a publicity point of view. It was roughly mounted and displayed in the window of a newspaper office on the principal street of the city with a placard hanging from its bill on which was printed, "Why the Lights Went Out Last Night." This exhibit was seen by thousands during the afternoon and evening, the burned leg and body of the bird telling at a glance the cause of the interruption of the company's street-car system, and thereby showing without further explanation the difficulties of the company in maintaining uninterrupted service over a large territory. Pictures of the bird were also printed in the daily newspapers of Vancouver, accompanied by explanations of the accident.

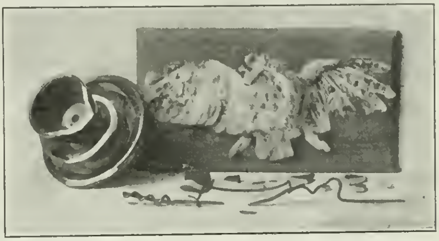


FIG. 2—SCREECH OWL THAT CAUSED TROUBLE ON 35,000-VOLT LINE

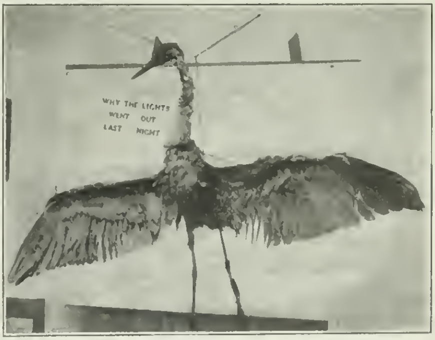


FIG. 3—HERON THAT PUT LINE OUT OF SERVICE IN BRITISH COLUMBIA

Fig. 4 shows the picture of a squirrel which short-circuited and rendered useless a 2000-kw transmission line of the Public Service Company of St. Cloud, Minn. This company has a sixty-cycle, 16,500-volt line which is 26 miles long and supplies five substations. About 2 o'clock one afternoon the circuit-breaker was thrown out and the switchboard attendant expected to hear that one of the substations had trouble. No complaint was received, but during the night the circuit-breaker was thrown open again. The next day the linemen were sent over the line and found a dead squirrel at the bottom of one of the poles. By that time the circuit-breaker would not stay in at all, and it was of course necessary to look for a punctured insulator. This was found two miles from the spot where the linemen picked up the squirrel. Upon an examination the insulator was found to be punctured through to the thimble which in turn went to the ground. The company employs the "wishbone" type of construction, every other pole being thoroughly grounded to an overhead ground wire. It will be noted that the squirrel's hip was quite badly punctured also and that his ears and whiskers were burned off.

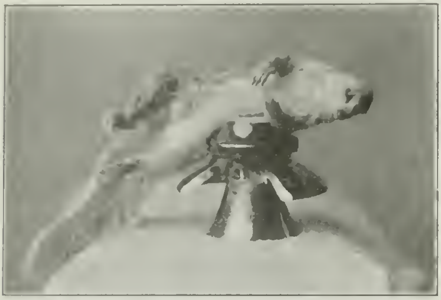


FIG. 4—SQUIRREL THAT CAUSED TROUBLE ON A 16,500-VOLT LINE

Combustion of Oil Fuel

By R. T. Strohm

The efficiency of combustion of oil fuel is dependent upon the furnace in which the burning takes place. The burner should give a finely atomized spray of oil, but the furnace must be of such size and shape as to enable the oil to be vaporized, mixed with the required quantity of air and burned to carbon dioxide before the resulting products of combustion are allowed to come in contact with the boiler surfaces.

Size of Furnace Required

The effect of too small a furnace is to cause incomplete combustion. The oil is sprayed into the furnace in the form of minute globules, each of which must be converted into vapor before it can burn. The heat required for this vaporization is derived from the highly heated firebrick with which the furnace is lined. Each globule of oil, on being converted into vapor, expands to many times its original volume, and this sudden increase of the volume of the oil makes it necessary to have a furnace that will accommodate the expansion. When the furnace is too small the expansion at the moment of vaporization increases the volume so greatly that the gases must travel very rapidly, and the result is that they pass out and come in contact with the boiler tubes or surfaces before the air has been thoroughly mixed with them and before combustion is complete.

The burner also affects the furnace efficiency; for the greater the size of the oil globules the longer will be the time required to convert them into vapor. Their expansion produces a pressure in the furnace, and this pressure, aided by the steam blast, quickly drives them on into the boiler passages. As a result, only the smallest globules are vaporized and burned in the furnace and the others are carried into the boiler passages, where their temperature is lowered and they are only partly burned. Even the carbon dioxide formed by combustion in the furnace may be converted to monoxide by taking up carbon from the unburned gases beyond the furnace.

If there is a very large percentage of carbon monoxide in the gases, secondary combustion may occur; that is, the monoxide may burn on its way through the passages of the boiler, or even in the uptake or the chimney. Although some heat may thus be recovered, the combustion takes place under poor conditions and is not nearly so efficient as when it takes place in the furnace. So, whether secondary combustion occurs or not, heat is lost.

The final effect of too small a furnace, therefore, is to give too rapid a travel of the gases through the furnace, with the subsequent formation of carbon monoxide and waste of heat. For these reasons the oil should be broken up into a spray almost too fine to be seen, and the furnace should have sufficient volume to allow combustion to be completed before the gases leave it. In this way the maximum temperature will be obtained and the loss due to carbon monoxide will be obviated.

Slight Excess of Air Desirable

The amount of air required for the complete combustion of a pound of oil fuel of known composition may be calculated approximately by the formula

$$W = 11.6\,C + 34.8\,H$$

in which

W = pounds of air per pound of oil;

C = percentage of carbon, expressed decimally;

H = percentage of hydrogen, expressed decimally.

For example, suppose that a certain grade of crude oil is found to contain 85 per cent of carbon and 12 per cent of hydrogen. The least amount of air that will burn a pound of this oil completely is

$W = 11.6 \times 0.85 + 34.8 \times 0.12 = 14$ lb., very nearly.

Slight differences in the relative amounts of carbon and hydrogen in oils, together with the presence of such elements as oxygen, nitrogen and sulphur, will cause the minimum amount of air per pound of oil to be greater or less than that just calculated; but with the oils ordinarily used as fuels in steam-boiler work, from 13 lb. to 14 lb. of air would be required per pound of oil if the combustion were ideal and complete.

Just as in the combustion of coal, so in the combustion of oil fuel it is necessary to admit an excess of air to the furnace. The reason is the same, namely, to insure a sufficient supply of oxygen to enable each particle of combustible matter to be burned completely. But there is a great difference between the excess required for solid fuel and that required for liquid fuel. The average coal-burning furnace seldom uses less than one and one-half times the minimum amount of air required for complete combustion, and usually it requires twice the amount or even more; that is, the excess of air ordinarily ranges from 50 per cent to 100 per cent and frequently exceeds the latter value. With oil fuel, the excess of air may be kept as low as 10 per cent by efficient furnace arrangement and careful regulation, and it is not uncommon to find oil-burning plants in which the excess of air is not over 20 per cent.

The reason for the smaller supply of air required lies in the fact that the conditions in the oil-burning furnace are much more favorable to the thorough mixing of the air and the fuel than is the case in a coal-burning furnace. The oil is sprayed, and the air is admitted in such a way as to mingle intimately and uniformly with it. In the case of coal the air must pass up through the fuel bed, which is of varying thickness, with the result that the resistance is highest and the flow least where the supply should be greatest; that is, at the thickest part of the bed. The use of a small excess of air conduces to greater boiler efficiency because it results in a higher temperature of the products of combustion. For the heat generated is contained in a much smaller weight of gases than in the case of a coal fire.

Causes of Smoke and Soot

The formation of soot or smoke is due to the presence of unburned carbon in the gases, and it may occur even when a sufficient amount of air is being admitted to the furnace. The point to be observed is that the combustible matter shall not only be surrounded with an ample supply of oxygen, but that the temperature of ignition shall be maintained until combustion is complete. In the case of oil fuel the spray is first converted into gaseous hydrocarbons, and these hydrocarbons are broken up into free hydrogen and free carbon. If there is enough oxygen present and the temperature is sufficiently high, the hydrogen will burn to steam and the carbon to carbon dioxide; but if the temperature of the mixed gases is lowered by admitting an excessive amount of cold air, or by allowing the gases to impinge on cold boiler surfaces, combustion will be prevented and the unburned combustible will be carried along with the gases and go to waste.

The free unburned carbon is in the form of fine particles that, on cooling, assume the characteristic black color and appear as smoke or collect as soot on the boiler surfaces. This explains the use of firebrick linings and baffles in furnaces and combustion chambers in which oil is burned. The brickwork becomes incandescent and maintains the temperature necessary to insure the union of the carbon and the oxygen.

Although the condition of the fire in an oil-burning furnace can be judged by observing the flame and noting the roaring sound made by the burners, it is well if the fireman can keep an eye on the gases issuing from the top of the chimney. The smoke, if there is any, should be very light and uniform in color. If it becomes dense, it is a sign that the burners need to be regulated or the air supply readjusted.

Absence of smoke is not necessarily a sign of perfect combustion, and no fireman should assume that he is obtaining the best results in the furnace merely because there is no smoke issuing from the chimney; for the supply of air may be greatly in excess of that required for economy. On this account it is wise to analyze the flue gases, or to install a continuous CO_2 recorder, so that the efficiency of combustion may be under the observation of the management. Particularly is this true of the plant that has been altered from the burning of coal to the burning of oil; for it is found that a fireman accustomed to fire coal is very apt to admit entirely too much air when he takes up the management of oil burners.

Effect of Steam

The idea that the admission of steam to the furnace increases the amount of heat generated is an error that is apparently based on a misunderstanding of the action of the steam during combustion. The steam that enters with the oil is heated to the temperature of the furnace, which is so high that the steam is decomposed, or broken up, into its constituents, hydrogen and oxygen. In the presence of the carbon and oxygen in the gases, however, the hydrogen and oxygen thus liberated are taken into combination again, forming steam and carbon dioxide. Moreover, the amount of heat resulting from the burning of the hydrogen is precisely equal to the amount that was required to set that hydrogen free during the decomposition of the steam. This is directly in compliance with the law of conservation of energy. The net gain, therefore, is nothing, and the final result is the same as though the steam had passed through the furnace without being decomposed. In other words, the steam not only does not add to the heat generated but actually carries away a part of the heat because it escapes to the chimney in a highly superheated condition.

Resistance Grid for Spot Lamp

What size quality and length of wire should be used in a non-adjustable rheostat for a spot lamp operating on a 110-volt alternating-current circuit? The current required is about 25 amp. J. R. W.

To operate your spot lamp satisfactorily the potential across the carbon electrodes should lie between 45 volts and 60 volts, otherwise the arc will hiss or sputter. Since the lamp is to operate on a 110-volt circuit, the remaining potential drop must occur in the series resistance. Assuming 50 volts as an average drop across the carbon electrodes, the effective resistance required to allow 25 amp to flow must be about 2.4 ohms (disregarding the reactance drop, which is negligible if the resistance coil contains an air core and the turns are separated). Thirteen feet of No. 18 Iala resistance wire is a good wire to use as it is inexpensive, does not oxidize readily, will not break easily, and has sufficient radiating surface to dissipate the energy absorbed by it. This wire can be wound on an open frame consisting of four insulated, equidistant, parallel spindles fastened between two sheet-metal headers. The spindles should be wrapped with sheet asbestos.

Losses in Metallic Conduits

To distribute energy from a polyphase system we have decided to inclose each conductor in a separate iron conduit. Usually two and even three conductors are run in the same conduit. How do the losses in the conduits compare in these two cases? Are the losses caused by hysteresis or eddy currents or both? E. R. S.

If all three wires of a three-phase circuit are inclosed in the same conduit and the load on the system is balanced, there is no loss in the conduit, the instantaneous sum of the currents in the three wires being always zero. When only one or two conductors of a three-phase system are inclosed in the same conduit the sum of the currents is no longer zero, and hysteresis and eddy current losses may become large. These losses are caused by the cutting of the conduit by the rapidly expanding and contracting rings of magnetic flux which surround each conductor carrying current. When the conduit is made of iron the density of these concentric rings of flux is increased and the losses in the conduit are correspondingly increased. The drop of potential in single alternating-current wires carrying 50 amp or over, inclosed in iron conduit, may be more than ten times as great as for the same wires carrying direct current, while the rise in temperature may be increased several-fold. Serious trouble may be caused with even lower currents due to temperature rise, voltage drop and energy loss. On the other hand, the losses in brass-coated paper conduits are small. Some experiments conducted recently in this country showed that with a 6.6-amp series circuit operating at 2200 volts there was a drop of only 6.07 volts in 1000 ft. of steel-taped, lead-covered No. 6 cable. Of this drop 2.7 volts was caused by ordinary ohmic resistance.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Ratio, Regulation and Phase-Angle Transformers.—P. S. Agnew and F. B. Silsbee.—A note on an investigation carried out in the Bureau of Standards. A detailed study of all the approximations involved in the derivation of the following formulas for ratio, regulation and phase-angle shows that they are as accurate as are required by the precision with which the quantities involved may be experimentally determined:

N = ratio of turns, primary to secondary.
E_1, E_2 = primary and secondary terminal voltages.
$R = R_1 + N^2R_2$ = equivalent total resistance referred to the primary.
$X = X_1 + N^2X_2$ = equivalent total reactance referred to the primary.
I, I_0 = load current and exciting current referred to the primary.
$\cos\theta$ = power-factor of load.
$\cos\gamma$ = power-factor of exciting current.

When ± signs occur the upper sign should be used for lagging and the lower sign for leading current. A positive phase angle means that the reversed secondary leads the primary.

$$\text{Ratio} = N\left[1 + \frac{IR\cos\theta \pm IX\sin\theta}{NE_2} + \frac{(IR\sin\theta \mp IX\cos\theta)}{2\,NE_2^2} + \frac{I_0R_1\cos\gamma + I_0X_1\sin\gamma}{NE_2}\right]$$

$$\text{Per cent regulation} = 100\left[\frac{IR\sin\theta \pm IX\cos\theta}{NE_2} + \frac{(IR\sin\theta \mp IX\cos\theta)^2}{2\,NE_2^2}\right]$$

$$\text{Phase angle} = \frac{1}{E_1}\left[IR\sin\theta - IX\cos\theta + I_0R_1\sin\gamma - I_0X_1\cos\gamma\right]$$

For most practical work the squared terms in the formulas for ratio and regulation may well be omitted. To test the formula, direct measurements were carried out on two types of lighting transformers by means of the potentiometer method, and covering the whole range of power-factors from zero power-factor, current leading, to zero power-factor, current lagging. The results checked with the values computed by means of the formula from short-circuit and open-circuit data well within the experimental errors.—*Journal Franklin Inst.*, January, 1914.

Commutator Machines.—A note on a recent British patent (No. 29,409, 1912) of A. Heyland. To diminish the emfs induced in the commutation zones of commutator machines for direct-current or alternating-current circuits a portion of all the zones is provided with auxiliary poles or coils, and another portion with recesses, open slots or tunnels, which increases the magnetic reluctance and superposes the effects on those of the remaining commutating poles. As an example, in converters fixed points on an armature winding are connected to one circuit through slip rings and to another circuit through the commutator brushes. The points on the winding from which connection is made are not distributed evenly.—London *Elec. Eng'ing*, Jan. 8, 1914.

Mercury-Vapor Rectifier for Speed Regulation.—F. W. Meyer.—The first part of an article in which the author discusses how recent progress in the construction of mercury-vapor rectifiers may affect the problem of speed regulation of motors. Simplifications are obtained especially for the commutation problem. While for many cases, like traction, it is necessary to investigate how far alternating-current commutator-motors can be advantageously replaced by direct-current motors, there is for many systems with speed regulation a distinct possibility of extending the limits of regulation with the aid of mercury-vapor rectifiers. Simple induction motors can be operated in such a way that with one central rectifier, common to a large number of motors, only one central direct-current commutation is required for the common converter, without commutation for all the motors. The article is to be continued.—*Elek. Zeit.*, Jan. 1, 1914.

Polyphase Synchronous Motors.—A note on a recent British patent (No. 15,523, 1913) of Crompton & Company and H. Burge. To start up and synchronize underload synchronous motors in which the armature has a main alternating-current winding and a small direct-current exciting winding, a distributed closed-circuit winding of the direct-current type is arranged on the field magnet so that it can act as an induction-motor secondary at starting and as a field winding when the machine is up to speed. This is effected by providing two phase tappings, one for the direct-current excitation, which is applied through an adjustable resistance after the motor is run up to speed, and the other for a similar adjustable resistance, which is used at starting. —London *Elec. Eng'ing*, Jan. 8, 1914.

Lamps and Lighting

Combined Neon and Mercury-Vapor Tubes.—A note on a recent British patent (No. 19,439, 1913) of G. Claude. Neon and mercury-vapor tubes are successively lighted and extinguished, so that, owing to the condensation of the mercury vapor by cooling, lights of red, blue and other colors are obtained.—London *Elec. Eng'ing*, Jan. 8, 1914.

Generation, Transmission and Distribution

Bordeaux Transmission System.—An article on the system of the Société d'Eclairage Electrique de Bordeaux et du Midi, which has completed a transmission line of 100 km (60 miles) from its water-power plant to Bordeaux. The water-power plant is located at Tuilière and is rated at 12,000 kw. The company has also two steam stations in the city of Bordeaux, each rated at 3000 kw, while the steam station of the railway company is rated at 2500 kw. The water-power station contains nine 2000-kw, 5500-volt, fifty-cycle, three-phase alternators. There are five transmission lines operating at 13,500 volts and three transmission lines of 50,000 volts.—*Elek. Zeit.*, Jan. 8, 1914.

British Practice in Construction of High-Tension Transmission Lines.—B. Welbourn.—A paper read before the (British) Institution of Electrical Engineers. The subject of regulations for overhead transmission lines is dealt with first, and the author then describes and discusses the poles used, the method of fixing and spacing conductors, selection of insulators, grounding arrangements, and the subject of telephones and telephone cables used with high-tension lines. He concludes by describing safety devices and the guarding of conductors.—London *Electrician*, Jan. 4, 1914.

Traction

Electrolysis of Gas and Water Pipes.—E. B. Rosa and Burton McCollum.—An account of special studies of electrolysis mitigation with particular reference to the conditions in Springfield, Ohio. The authors first discuss methods of electrolysis mitigation. The three methods applicable to pipes are surface insulation of pipes, use of insulating joints in pipes, and pipe drainage systems (direct taps between pipes and rails, or negative feeders to pipes). The authors next treat of methods to be applied to the railway system. They describe both the uninsulated negative feeder system and the insulated negative feeder system (*a* boosters in separate feeders, *b* insulated negative feeders without boosters, *c* single booster system, *d* inverted booster systems). They then make recommendations for electrolysis mitigation in Springfield, Ohio. Those methods which are intended to be applied to the pipe system are regarded as unsatisfactory in general, and particularly so for conditions as they exist in Springfield. This is the more emphasized by the fact that there are in the pipe systems at Springfield, especially the gas system, a considerable number of insulating joints. So long as these insulated couplings are in place, the application of negative feeders to either the gas pipes or to the water pipes, or to both, would prove disastrous to the gas system in the vicinity of these insulating couplings. On the other hand, if the system of insulated negative feeders be applied to the tracks as recommended in the report so that the potential differences between different parts of the network are reduced to a comparatively low value, the presence of these insulating joints would be decidedly beneficial since they would tend still further to reduce the current flow in the pipes, while the potential gradients would be so small that dangerous potential drops across the insulating joints could not arise. The life and property hazard would also be increased by the installation of a system of feeders connected to the pipes because of the dangers from fires and explosions. The insulated negative feeder system applied to tracks should therefore be adopted as the primary means of electrolysis mitigation in the city of Springfield. It is further recommended that the joints in all the railway systems operating in the city of Springfield be tested at intervals not exceeding six months or a year, and all joints showing resistances exceeding that of 3 ft. of rail should be immediately rebonded so as to maintain perfect continuity of the tracks throughout the city. It is also of very great importance to have the railway tracks of the Ohio Electric Company and the Springfield Railway Company interconnected electrically at all crossings, both for the sake of economy of operation and for the safety of the pipe systems. To neglect this interconnection, or to deliberately insulate the two systems from each other, would invite certain disaster to the underground pipes. The proposed system of insulated track feeders will not only greatly improve voltage conditions throughout the entire negative return, but will also bring about large economies in power which will pay large returns on the small investment required for putting the proposed plan into effect. As compared with the arrangement of insulated track feeders now in service, the proposed arrangement would give considerably smaller drop on the negative return, which in turn would give a higher average voltage on the cars with consequent improvement in the car service and car lighting.—*Technologic Papers,* Bureau of Standards, No. 27, June 19, 1913.

Subway in Christiania, Norway.—A. Braarud.—An illustrated article on the new subway in Christiania, Norway, which has a length of 2 km (½ mile) and connects the center of the city with the Holmenkol railroad. Direct current at 600 volts is used, a third-rail being employed in the tunnel and an overhead trolley wire outside of the tunnel.—*Elek. Zeit.*, Jan. 8, 1914.

Installations, Systems and Appliances

Electricity in Mines.—Extracts from the annual reports of the chief inspector of mines of Great Britain, giving data on electric power used in mines, electric accidents, etc.—London *Electrician,* Jan. 2, 1914.

Safety Device for Wet Rooms.—O. Heinisch.—The author points out the dangers to cattle in electrically equipped stables in the event of grounded conductors. To overcome this danger the Rhenish-Westphalian Electricity Works has developed a safety device which has proved satisfactory in practice. In the case of ground troubles this device disconnects the circuit containing the fault, at the same time short-circuiting it. —*Elek. Zeit.*, Jan. 8, 1914.

Wires, Wiring and Conduits

Wiring Rules.—The new proposed wiring rules of the German Association of Electrical Engineers are printed in the *Elek. Zeit.*, Jan. 8, 1914.

Electrophysics and Magnetism

Principle of Relativity.—Kajuro Tamaki.—A mathematical paper on the Dobbler principle and the principle of relativity.—*Memoirs* of the College of Science and Engineering, Kyoto Imperial University, Vol. V, No. 6.

Units, Measurements and Instruments

Plugs for Resistance Boxes.—At a recent exhibition of the British Physical Society a new form of resistance-box plug was shown as illustrated in Fig. 1. The usual blocks terminate in vertical portions forming a split cone. These are seen at *b*, *c*, and when the cap is removed these are separated by an air space so that the coil is in circuit. When, however, the cap *h* is pushed into position the pin *k* forces the two half cones apart, the coned cap bringing them into contact with the pin, which in itself gives a further contact. The contact resistance is thus reduced to a minimum, even if the surfaces are not very carefully fitted. One great advantage of this method is that each plug is independent of its neighbors (when plugging in or out) as regards constancy of the contact resistance. Thus there is a saving of time in use. The vertical portions are cut

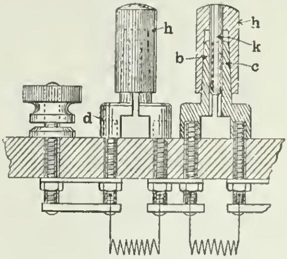


FIG. 1—RESISTANCE-BOX PLUGS

away as shown at the base, so that dust can be easily removed. A resistance box fitted with this type of contact occupies much less space owing to the fact that the brass strips do not require to be so rigid and may, therefore, be shorter; also a larger area of contact per plug is obtained than with the ordinary type.—London *Electrician*, Jan. 9, 1914.

Electro-Dynamic Frequency Meter. — KONRAD GRUHN.—An illustrated description of a new frequency meter of Hartmann & Braun. As shown in Fig. 2, four coils f_1, f_2, f_3, f_4 symmetrically arranged produce four alternating fields which are combined in two resulting fields F_1 and F_2 as shown in Fig. 3. In the center there is a movable coil *S*. Its peculiar form shown in the illustration has been chosen in order to get as uniform a scale as possible. The coils f_1 and f_2 are in series with the condenser *C* and the movable coil *S*. The two coils f_3 and f_4 are in series with the inductance coil *D*. The two coils f_1 and f_2 form together the flux F_1 and the two fluxes f_3 and f_4 form the flux F_2 as shown in Fig. 3. There are, therefore, two branches of the circuit between the points *a* and *b*, one branch containing the condenser *C* and the other the inductance *D*. The two points *a* and *b* are connected to the circuit in which the frequency is to be measured. The author calculates the two electric torques which, while counteracting each other, determine the position of the movable coil *S*. If the frequency is increased, the current i_1 increases while i_2 decreases and the position of the coil is changed. The scale of the instrument is nearly uniform. It consumes about 60 milliamp.—*Elek. Zeit.*, Jan. 8, 1914.

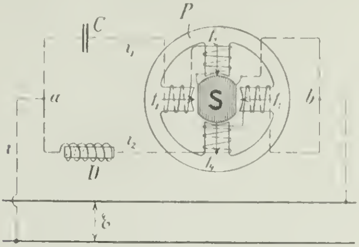


FIG. 2—FREQUENCY METER

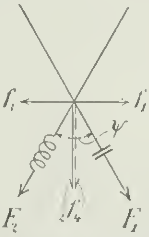


FIG. 3—DIAGRAM SHOWING RESULTING FIELDS

Analysis of Alternating-Current Waves.—FREDERICK W. GROVER.—A long paper on the analysis of alternating-current waves by the method of Fourier with special reference to methods of facilitating the computations. The equations of Fourier for the resolution of a periodic curve into a series of component sine curves, although furnishing a complete solution of the problem, suffer under the disadvantage that, in making numerical calculations, a large number of products have to be formed. Consequently other less satisfactory methods have been employed to shorten the calculation. By grouping similar terms Runge has so simplified the use of the Fourier equations as to greatly reduce the labor of calculation. The object of the present paper is to stimulate a more general employment of Runge's method by the systematic arrangement of the calculations and the use of multiplication tables such as to render inconsiderable the time and labor necessary for the precise analysis of alternating-current curves. The derivation of Fourier's equations for the case of a finite number of odd harmonics is sketched briefly, using the treatment in Byerly's "Fourier's series and spherical harmonics," and this is followed by a development of the simplifications introduced by Runge. The arrangement of the calculation is given in detail for three special cases, namely, for six, twelve and eighteen measured ordinates per half cycle, together with verifying equations which facilitate the location of numerical errors. The considerations which determine the choice of the proper schedule of analysis in any given case are treated at some length. The complete calculation of the amplitude and phases of the component waves of experimentally determined alternating-current curves is carried through, using each of the three schemes of analysis. Further examples are given in connection with what has been previously enunciated with respect to the choice of schedule and to illustrate the accuracy of the results. The latter part of the paper is devoted to the consideration of a few practical applications, such as the calculation of average and effective values, average power, and equations of power curves, together with a full illustration of the principles involved in numerical examples. — *Bulletin* Bureau of Standards, Vol. IX, No. 4, Dec. 15, 1913.

Micropyrometer.—G. K. BURGESS.—An illustrated description of a micropyrometer for the rapid estimation of the melting points of minute specimens as fine as 0.001 mg or less. Within the Huyghens eyepiece of an ordinary microscope a small incandescent lamp is mounted, which is in series with a rheostat and ammeter. The tip of the filament of the lamp is set to the brightness of the platinum strip viewed from above at the instant of melting of the metallic or other specimen on which the microscope is focused. The eye of the observer, therefore, sees the specimen, the platinum strip and the lamp filament all in focus at once, and the current through the lamp is taken as a measure of the temperature of the strip, as in the Morse or Holborn-Kurlbaum pyrometer.—*Bulletin* Bureau of Standards, Vol. IX, No. 4, Dec. 15, 1913.

Meter.—A communication from the Reichanstalt admitting for calibration a direct-current-motor meter of the Siemens-Schuckert Company for two-wire and three-wire systems from 200 amp to 750 amp and for 65 volts to 750 volts. The construction and operation of the meter is described.—*Elek. Zeit.*, Jan. 8, 1914.

Calorimetric Resistance Thermometer.—H. C. DICKINSON AND E. F. MÜLLER.—An illustrated description of an improved form of calorimetric platinum-resistance thermometer. A difference formula for simplifying calorimetric computations is given and its applicability is shown.—*Bulletin* Bureau of Standards, Vol. IX, No. 4, Dec. 15, 1913.

Telegraphy, Telephony and Signals

Duplex Telegraphy.—RICARDO LOPEZ.—An illustrated article in which the author describes the ordinary methods of duplex telegraphy and then describes a new duplex system of his own. Translated in abstract from *Revista Telegrafico* (Buenos Aires) in London *Electrician*, Jan. 9, 1914.

Magnifier.—At the recent exhibition of the British Physical Society there was an exhibit of Huertley's magnifier, for use in cable telegraphy or wireless telegraphy, or wherever it is required to magnify the effect of very small mechanical movements. The principle of the instrument is as follows: Two very fine wires with a high electrical temperature coefficient are mechanically connected to a recorder coil which is acted upon by the incoming current. These wires form the two arms of a Wheatstone bridge circuit, the other two arms being fixed resistances. In place of the galvanometer in the circuit is placed the recording instrument, which, for the present purpose, is the ordinary siphon recorder. This Wheatstone bridge or local circuit is supplied with a current from a local battery which is of sufficient intensity to heat the fine wires considerably above the temperature of the surrounding atmosphere. These wires are so positioned that when there are no signals being received they lie theoretically half in and half out of the blasts of air which blow continuously in a plane at right angles to the plane of movement of the wires. The blasts of air are so positioned relatively to these heated wires that, on these latter being moved in one direction or the other by the incoming current, one is inserted more into its blast of air and the other is inserted less. The physical effect of this relative change of position is that whereas one wire as a whole becomes more cooled owing to a greater part of its length being inserted in the blast, the average temperature of the other wire is increasing owing to the cooling effect of the blast of air being removed from an additional portion of its length. The effect of these changes of temperature on the electrical properties of these wires is that the total resistance of the cooled wire is reduced and that of the other increased. As these two wires are arranged on the adjacent sides of the Wheatstone-bridge local circuit, these changes in the balance are additive. The result is that a current passes through the siphon-recorder coil, reproducing in this coil the movement of the primary coil, but in magnified form, the degree of magnification depending upon the strength of the blast and the intensity of the current passing through the wires. There is a slit along the whole length of each tube of the blowers. This is adjustable in breadth, the position of the slit being so adjusted by moving the tube by means of an adjusting screw that the blast is projected in a vertical direction. These "blowers" are mounted on platforms which enable any required position of the tubes relative to the wires to be obtained. Air is supplied to the blowers from a reservoir by two rubber tubes, and a small electrically driven fan supplies the current of air to the reservoir. The wires used are drawn by the Wollaston method—that is, about 3 mils or 4 mils platinum wire is coated with a shell of silver until the total diameter is between 20 mils and 30 mils. The whole is then drawn down to 3 mils or 4 mils in diameter, which results in the platinum core being of the order of 0.5-mil diameter. The wire is supplied with the silver coating intact and is mounted on the suspension in this condition, the silver coating being finally removed with nitric acid. The magnifier produces an increase of speed on duplex cable working of from 40 per cent to 50 per cent and has been adopted by many of the cable companies and found to work satisfactorily.—London *Electrician*, Jan. 9, 1914.

Portable Wireless-Telegraph Transmitter.—At the recent exhibition of the British Physical Society there was shown a portable Leslie Miller condenser radio-telegraphic transmitter. This apparatus can be worked from a 100-volt or 200-volt continuous-current supply and has a range of about 15 miles. The method of operation is shown in Fig. 4 and employs a high-speed platinum-pointed interrupter, across which is shunted a condenser *C* in series with an inductance, which forms the primary winding of a step-up transformer *T*. The inductance is shunted with a small steadying condenser *c*. The magnet coil *u* of the interrupter also acts as a choking coil, so that on a 100-volt circuit the interrupter can be put straight across the mains. With a 200-volt circuit, however, a non-inductive resistance *R* (about 25 ohms) is inserted in series with the interrupter. The secondary winding of the transformer operates an ordinary oscillation circuit, the only peculiarity of which is the spark-gap *S*. This consists of four copper plates fixed close together and separated at the ends, which are beveled by small glass tubes. The transmitter takes from 1.5 amp to 2 amp, and very little sparking occurs at the interrupter, owing to the arrangement of the primary circuit.—London *Electrician*, Jan. 9, 1914.

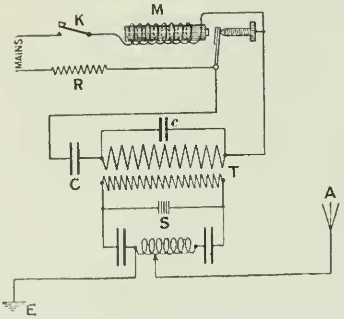


FIG. 4—PORTABLE RADIO-TELEGRAPHIC TRANSMITTER

Quenched-Spark Wireless Telephony. — W. T. DITCHAM.—A general description is given of experiments in wireless telephony on a commercial basis between stations situated at Letchworth and Northampton, covering a distance of about 50 km. Satisfactory results have been obtained, and speech has been received up to a distance of 155 km. An alarm apparatus in conjunction with a Brown relay was used with good results in carrying out these experiments.—London *Electrician*, Jan. 1, 1914.

Miscellaneous

Electrolysis in Concrete.—E. B. ROSA, BURTON MCCOLLUM AND O. S. PETERS.—An article giving an account of investigations relating to the nature and causes of the phenomena resulting from the passage of electric current through concrete, with a discussion of the possibilities of trouble from electrolysis in concrete structures under practical conditions. The observations of previous investigators that the passage of current from an iron anode into normal wet concrete caused the destruction of the test specimen by cracking the concrete were only partly confirmed. This effect was found not to occur in most of the specimens tested when the potential gradient was less than about 15 volts through a distance of 3 in., or about 60 volts per foot. These figures must be considered as but roughly approximate, as they depend much on conditions. Of the numerous theories that have been advanced for the cracking of reinforced concrete owing to electric current, that one which attributes it to oxidation of the iron anode following electrolytic corrosion has been fully established. The oxides formed occupy two and one-fifth times as great a volume as the original iron, and the pressure resulting from this increase of volume causes the block to crack open. Corrosion of iron anodes even in wet concrete is very slight at temperatures below about 45 deg. C. (113 deg. Fahr.). The lack of corrosion of the iron at temperatures below 45 deg. C. is due to the inhibiting effect of $Ca(OH)_2$ and possibly other alkalis in the concrete. The rapid destruction of anode specimens of moist concrete at high voltages (60 volts to 110 volts or more) is made possible mainly by the heating effect of the current, which raises the temperature above the limit mentioned above. Salt, as a small addition to concrete, should never be used in structures that may be subjected to electrolytic action. Reinforced-concrete structures built in contact with sea water, or in salt marshes, are more susceptible to electrolysis troubles than concrete not subjected to such influences. Contrary to the observations of previous investigators, there was a distinct softening of the concrete near the cathode. This begins at the cathode surface and slowly spreads outward, in some cases as far as 0.25 in. or more. After exposure to the air this softened layer becomes very hard again but remains brittle and friable. The softening effect at the cathode noted above under the conditions of the experiments caused practically complete destruction of the bond between the reinforced material and the concrete, reducing the strength of the bond to a few per cent of its normal value. Unlike the anode effect, which becomes serious in normal concrete only at comparatively high voltages, the cathode effect was found to develop at all voltages used in the experiments, the rate being roughly proportional to the voltage in a given specimen. Because of this cathode effect, the proposal to protect reinforced-concrete buildings by maintaining the reinforcing material at cathode polarity as by a battery or booster would be much more dangerous than no protection at all. In order to insure safety or reinforced concrete from electrolysis, the investigation shows that potential gradients must be kept much lower in structures exposed to the action of salt waters, pickling baths and all solutions which tend to destroy the passive state of iron. All direct-current electric-power circuits within the concrete building should be kept free from grounds. If the energy supply comes from a central station, the local sections should be periodically disconnected and tested for grounds and incipient defects in the insulation. In the case of isolated plants ground detectors should be installed and the system kept free from grounds at all times. All pipe lines entering concrete buildings should, if possible, be provided with insulating joints outside the building. If a pipe line passes through a building and continues beyond, one or more insulating joints should be placed on each side of the building. If the potential drop around the isolated section is large—say, 8 volts or 10 volts or more —the isolated portion should be shunted by means of a copper cable. Lead-covered cables entering such buildings should be isolated from the concrete. Wooden or other non-metallic supports which prevent actual contact between the cable and the concrete will give sufficient isolation for this purpose. Such isolation of the lead-covered cable is desirable for the protection of the cable as well as the building. The interconnection of all metallic work within a building is an advantage where practicable, provided that all pipe lines entering the building are equipped with insulating joints and lead cables are taken care of as just indicated. but the grounding of such interconnected metal work or any part of it to ground plates or to pipe lines outside of the insulating joints is in every case to be strictly avoided.—*Technologic Papers*, Bureau of Standards, No. 18, 1913.

Effects of Electricity on Reinforced Concrete.—KURT LUBOWSKY.—The conclusion of his article. The author describes laboratory tests on the behavior of reinforced concrete when subjected to direct current or alternating current and states the conclusions at which he arrived. —*Elek. Zeit.*, Jan. 8, 1914.

Book Reviews

ELECTRIC INTERLOCKING HANDBOOK. By the engineering staff of the General Railway Signal Company. Rochester, N. Y.: General Railway Signal Company. 435 pages, 283 illus. Price, $3.

As stated in the introduction of the book, the authors aim to "furnish data that will be useful to all those seeking a true understanding of the dynamic indication principle, and to those who are required to prepare bills of material for or to install, operate or maintain our electric interlocking." The book is divided into eighteen sections. The railway signal electric interlocking system as manufactured by the General Railway Signal Company is described in detail and complete instructions for installing and operating the system are given. Several sections are devoted to general data and other valuable information, making the book, as its name indicates, a handbook. It is of the convenient "handbook" size and has flexible covers. The book is clearly written and well illustrated, and the mechanical details have been well executed.

COST REPORTS FOR EXECUTIVES AS A MEANS OF PLANT CONTROL. By Benj. A. Franklin. New York: The Engineering Magazine Company. 139 pages; form inserts. Price, $5.

It is indisputable that proper information regarding the cost of production is the most essential aid to the manufacturer. The writer of the above-named treatise has given us an instructive book, in which he has endeavored to treat also the philosophical aspect—or, perhaps better, the common-sense aspect—of cost keeping. He says: "It is a happy feature of the element of expense that once the proper rules of distribution have been decided upon it becomes much simpler to obtain and distribute in costs than the elements of material and direct labor." It is difficult to disagree with the author in regard to this statement, but it is equally difficult to agree with him in regard to the common-sense problem which his statement involves. In his chapter on "Philosophy of Costs" the author has not altogether shed light upon the innumerable pitfalls of cost systems. He states that "a well-operated cost system is a species of insurance. It insures against a continuance of unprofitable policies and the taking of unprofitable orders." The fact is, however, that a cost system does not give out more than is put into it. It is one of the greatest exaggerations of the claims of those who have made capital out of "scientific management" that they have found a nostrum which is applicable to the problems of management and mismanagement of our manufacturing concerns. A good cost system is neither more nor less in the operation of a plant than accurate measuring instruments are in a tool room. It is much easier to obtain the latter than it is to obtain good tool makers who know how to use them; and it is much easier to devise cost methods than it is to know how far to trust to the inflexible figures and how to interpret them, continually keeping in mind their premises and the arbitrary data which constitute the "burdens" or the overhead charges. In solving problems of this kind the book before us should prove of assistance. The book is unlike most treatises on the subject, which are concerned with the headings and rulings of forms and cards and the routine of clerical details. Use is made of forms, but they are viewed from the standpoint of the executive in order to determine what are the vital facts as to material, labor and expense and their relation to one another. The author's discussion is not limited to any one business, but covers principles that can be carried out in various ways.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Electric Grill

The electric grill shown in the accompanying illustration is being put on the market by the Rutenberg Electric Company, Logansport, Ind. The device is made of cast aluminum which is highly polished. It is equipped with two cast-aluminum pans as shown and can be used for broiling, frying, etc.

CAST-ALUMINUM ELECTRIC GRILL

Vegetable-Paring Machine

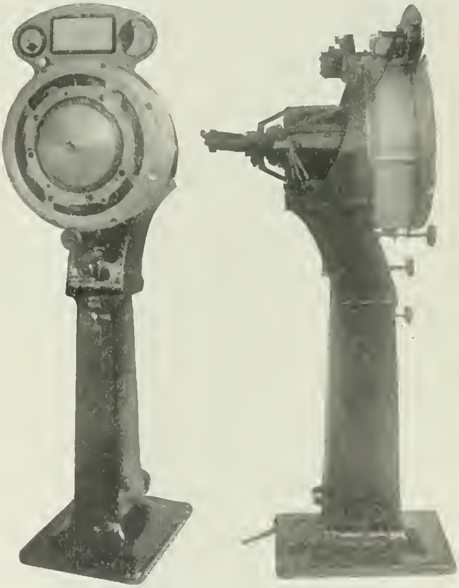
The machine illustrated herewith is designed for paring potatoes, turnips, carrots, etc., by means of a friction disk inside a cylindrical hopper. A 1-hp shunt-wound motor, which is rated at 120 volts and operates at 1800 r.p.m., is used to drive the device. The friction disk causes the contents to rotate and come in contact with a "diverter" fastened to the cylinder, which forces the vegetables back to the center of the disk, from where they are again taken to the side of the cylinder. This operation is repeated until the skins are removed. No tearing, pounding or brusing of the vegetables, it is declared, can result. Water is continuously sprayed over the contents of the hopper, washing and cleansing the vegetables and carrying off the parings and dirt through a waste outlet to the sewer. When the vegetables are pared sufficiently a door may be opened without stopping the machine and the contents can be emptied into any suitable receptacle.

ELECTRIC PARING MACHINE

This machine is manufactured by the American Paring Machine Company, Philadelphia, Pa., and the motor used in its operation is the product of the Diehl Manufacturing Company, Elizabeth, N. J.

Demonstrating Operation of Automobile Motor-Generator

The apparatus shown in the accompanying illustrations was used at the Chicago automobile show by the United States Light & Heating Company, to demonstrate the operation of its inherently regulated motor-generator for automobile lighting and starting. This equipment was described in the *Electrical World* of Jan. 10. The machine is mounted on a pedestal as shown and is driven by a small direct-connected motor. An ammeter and a tachometer are attached to the top of the pedestal. The motor develops 1 hp at 2000 r.p.m. This speed is exceeded sometimes during the demonstrations and is of course much higher than that attained in actual automobile service. The generator is designed to commence charging the battery at approximately 250 r.p.m. and gives a maximum output at about 500 r.p.m. The generator, therefore, requires little more than 0.25 hp for maximum delivery.



FIGS. 1 AND 2—FRONT AND SIDE VIEWS OF APPARATUS, DEMONSTRATING OPERATION OF MOTOR-GENERATOR

"Aero" Cable Car

The Aero cable car, illustrated herewith, weighs only 20 lb. complete and is constructed entirely of cold-rolled steel and crucible-steel castings, except the seat and pick-up roller, which are of oak. All metal parts are sherardized. The car is arranged so that it can be taken down in four parts, as shown in Fig. 1. The parts interlock in such a way that it is not necessary to take off any of the bolts or nuts when assembling or disassembling. All bolts are "upset," so that possibility of their becoming detached or lost is eliminated.

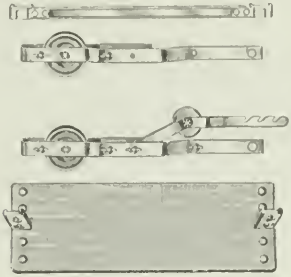


FIG. 1—DETACHED PARTS OF CAR

The wheels of the car, which ride on the messenger wire, are corrugated in such a way that they will pass freely over any cable hook or hanger. An adjustment is provided on the car which permits the latter's height to be increased or decreased for a long-bodied or a short-bodied man.

The brace bar which runs across the back of the car can be adjusted to the upper or lower position while the car is being used. Fig. 2 illustrates this bar in its upper position.

The attachment shown to the right of the car in Fig. 2 is called the pick-up roller and can be adjusted to different positions, according to the length of hooks or hangers used, so that the cable can be fixed at its proper distance from the messenger wire. Without this pick-up attachment the workman would be compelled to hold the cable in position for attaching hooks.

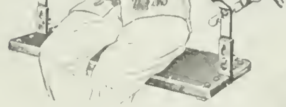
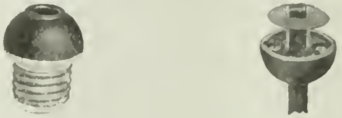


FIG. 2—WORKMAN USING CAR

The minimum weight of this car and the small space it occupies when knocked down make it especially valuable to telephone men. One man, for instance, can place the car and tools on a motorcycle and go miles into the country to repair a cable, whereas the same operation with a heavy car would require two men and a wagon, or the shipment of car and tools.

Separable Attachment Plug

Neatness and small size are the features of a separable attachment plug manufactured by the H. T. Paiste Company, Philadelphia, Pa. The device, which is illustrated herewith, is equipped with a fiber washer which slips down the shaft and fits into a shoulder in the edge of the cap. This washer covers the ragged wire ends and acts as a protection against accumulations of dirt.



FIGS. 1 AND 2—PLUG COMPLETE AND FIBER WASHER RAISED FOR WIRING

When installing, the washer is slipped off, leaving the contact screws exposed and easy to wire. A firm grip and good contact are secured by using folded bronze springs in the base. Nibs on these springs catch on recesses in the brass bars of the cap.

Terminal Connectors

In the illustrations herewith is shown an instrument terminal connector which has been put on the market by the Meliorate Manufacturing Company, 290 Taaffe Place, Brooklyn, N. Y. The body, which is made of hard-drawn brass, nickel-plated, is designed to accommodate the insulated portion of the wire, thus preventing the braid from fraying or sliding back from the terminal. The body reinforces the sleeve throughout.

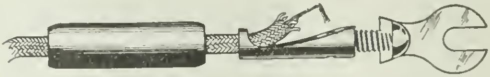


FIG. 1—FIRST STEP IN INSTALLATION OF CONNECTOR

The insulated sleeves are painted either red or black to denote opposite polarities. The sleeves are polished and moisture-proof, and they are said to be unaffected by temperatures up to 180 deg. C. The sleeve is the locking element, and when in position the wire cannot be removed from the terminal unless the sleeve is forced back and the contact face released. The contact faces are interchangeable, and one pair of leads may be used for different kinds of service without removing the body from the wire. In Fig. 1 is shown the first step necessary in the installation of the device; in this operation the copper strands should be twisted and the wire bent as shown. Fig. 2 illustrates the second step; the wire is inserted in the binding hole and the binding screw is tightened. Fig. 3 shows the connector (full-size) after the sleeve has been forced into position.

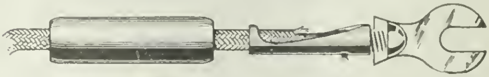


FIG. 2—SECOND STEP IN INSTALLATION OF CONNECTOR

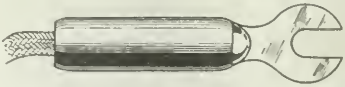
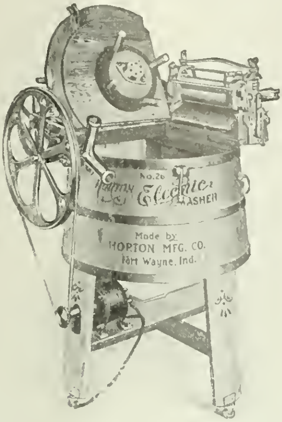


FIG. 3—CONNECTOR WITH SLEEVE IN POSITION

Electric Washer and Wringer

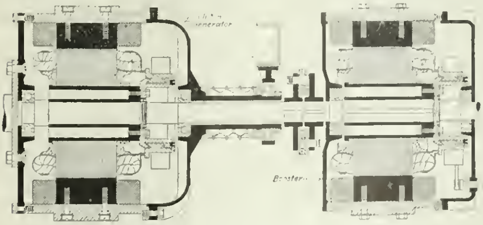
The electric washer and wringer shown herewith has been put on the market by the Horton Manufacturing Company, Fort Wayne, Ind. The machine is equipped with cut gears, thus making its operation practically noiseless and reducing friction to a minimum. The wringer has two reversible rolls which are supported on ball bearings. An automatic safety release is provided to protect the careless operator. By means of a special attachment, the washer and wringer can be operated by hand in case of temporary motor trouble. The motor used in driving this apparatus is the product of the Fort Wayne Electric Works, Fort Wayne, Ind.



WASHER AND WRINGER WITH ELECTRIC DRIVE

Electric Transmission for Automobiles

An electric transmission unit which replaces the flywheel, clutch, change-speed gear set, electric cranking equipment and lighting generator on automobiles was exhibited on a foreign car at the recent New York automobile show. This unit, which is placed directly back of the engine crank case, consists of two direct-current dynamos with their armatures mounted on a common shaft connected with the drive wheels. One dynamo serves as a combined magnetic-drag clutch and generator, the other acts as a booster motor which assists in driving the car at intermediate speeds.



ELECTRIC TRANSMISSION UNIT

The field yoke of the clutch generator is rigidly connected to and revolves with the engine crank shaft, at the same time magnetically dragging around with it the armature at a definite slip which depends on the current flowing in the latter's coils. Instead of wasting in resistance the energy generated by this slip, this power is utilized at intermediate speeds to drive the booster motor, whose field yoke is fastened to the chassis. A cross-section of the transmission unit is shown in the accompanying illustration. The gradation from low speed to high speed is accomplished by gradually decreasing the booster field excitation and finally short-circuiting the clutch generator's brushes at high speed.

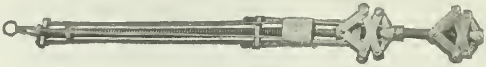
By decreasing the booster field excitation more current is drawn from the clutch generator, thereby increasing the magnetic drag on the latter's armature and consequently reducing the slip. At intermediate speeds the efficiency of transmission is therefore the combined efficiency of the two dynamos, while on high speed the efficiency is that of the clutch generator alone.

When operating at high speed the booster is no longer a motor but is converted into a generator to charge the storage battery. Provision is made for charging either at a 10-amp or a 30-amp rate. The booster may also be employed as an electric brake by placing the controller handle in the neutral position. Electric cranking is accomplished by operating the clutch generator as a motor on storage-battery energy.

Battery current is not drawn upon except in starting the engine. With this gear the gasoline engine can be run at its most efficient speed, all speed variations of the car being governed through the electrical transmission, thus avoiding the jolts sometimes resulting from sharp speed changes. The outfit weighs practically the same as the parts it replaces and costs only $25 to $30 more.

Creeping Conduit Threader

A conduit threader of a new type recently brought out by the Specialty Device Company, Cincinnati, Ohio, was exhibited for the first time at the National Independent Telephone Association's convention, Hotel La Salle, Chicago. As shown in the accompanying illustration, the device consists of an ingenious arrangement of springs, levers and grips mounted on a center rod in such a way that the entire device "walks" or creeps through the conduit when a series of pulls or jerks is exerted on the trailing rope. As will be noted from the construction of the device, a pull on the trailing rope puts in tension the four smaller ropes which run parallel to the center rod and also compresses the main spring behind the lever. When slack is let into these ropes again the spring expands to its original position, forcing the forward set of levers ahead for another step. Steel grips at the extremities of these groups of levers engage the interior of the conduit and hold the levers in position when an attempt is made to dislodge them. In case the device should encounter an obstruction while threading a conduit preventing its further progress, an extraordinarily sharp jerk on the rope will trip the spring holding the levers in the extended position and the device may then be pulled back to the starting point without difficulty. It is said that the creeper will traverse any conduit which may be threaded with rods and will pass around bends of long radius. With a trailing rope of ordinary sash cord the conduit creeper will thread a pipe at the rate of approximately 60 ft. per minute.



CONDUIT THREADER

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Hydroelectric Energy for American Woolen Company.—The Central Maine Power Company has obtained a twenty-year contract at Skowhegan, Maine, to supply electrical energy to the American Woolen Company's mills, 385 hp being required by June 1. On Feb. 1 the company will deliver 135 hp at the Marston Woolen Mills. It is anticipated that as a result of the development of hydroelectric power by the Central Maine Company the American Woolen Company will erect a new factory in the Skowhegan district.

Electrical Manufacturer Expanding Plant.—The Hill side plant of the Wagner Electric Manufacturing Company, 6400 Plymouth Avenue, St. Louis, Mo., is being expanded by the addition of a new building to cost $150,000, which will be devoted largely to the manufacture of the smaller products turned out by this company. The building in question is to be of reinforced-concrete construction throughout, four stories high, and will occupy a ground area of 272 ft. by 45 ft. When it is completed about 400 employees will be added to the company's payroll, which numbers at present over 1800.

Fuse Manufacturer to Build Larger Factory.—The Appler Refillable Fuse Company has asked the new Chamber of Commerce, of Syracuse, N. Y., for aid in finding a desirable location for temporary use until a new factory building can be erected to meet its requirements. The company proposes to manufacture, under the Appler patents, a complete line of refillable inclosed fuses of all voltages and capacities. G. W. Appler, president of the company, has spent several years experimenting with refillable inclosed fuses for heavy railroad and power work, and the company expects to place on the market a thoroughly reliable and practical fuse with a first cost not exceeding that of a non-refillable inclosed fuse.

Louisville Manufacturer to Install Motor Drive.—One of the largest electrical power installations of the year in Louisville, Ky., promises to be that of the American Oak Leather Company, which operates a large tannery and leather-cutting plant. The company has been using a few motors for the operation of its cutting machines and likes this form of power so well that an engineering examination of the plant is now being made with a view to putting in motors all through the tannery. The steam plant will be retained, and a generator of about 200-kw rating will be installed, together with a corresponding horse-power in motors. The leather company will be in a position to discuss machinery purchases in the near future. Its principal office is in Cincinnati, Ohio. F. E. Mooney is president, H. H. Bechtel secretary, and J. F. Taylor treasurer of the American Oak Leather Company.

Electrical News from the Isthmus.—The American Rotary Valve Company has obtained the contract for supplying the vacuum cleaning system in the new administration building at Balboa. This contract calls for six vacuum cleaning machines, equipped with 20-hp motors of the 230-volt, three-phase, twenty-five-cycle type, together with a complement of special valve and renovator fixtures and a supply of vacuum hose. In order to supply the shops at Balboa with electrical energy before the permanent electric system is in operation, the Miraflores power plant is being supplemented by the installation of one of the three generating units formerly in operation in the steam plant at Gatun. The unit consists of a Curtis steam turbine, directly connected to a 2200-volt, 60-cycle alternator. The American Bridge Company has started to make deliveries on the structural steel for the four substations to be erected as distributing centers for the energy generated at the Gatun hydroelectric plant.

Turbine Business Has Good Outlook.—In response to a request for information concerning the recent progress in the turbine business, the following statement was given out by the Terry Steam Turbine Company, of Hartford, Conn.: "The C. H. Wheeler Manufacturing Company has recently ordered from us two 300-hp non-condensing turbines, which will be used to drive the condenser auxiliaries for the new 15,000-kw turbine being installed by the Consolidated Gas, Electric Light & Power Company, of Baltimore. Our prime-mover business has been greatly stimulated during the past few months, but whether this is due to a natural increase in business or to the pushing of our 'return flow' turbines is hard to say at the present time. The latter type represents the latest improvement in our product and is especially designed for mixed-pressure and low-pressure work."

Cost Analysis in Chicago Electric Garage.—With the installation of a 100-kw and a 25-kw motor-generator set, a six-panel switchboard and additional charging circuits and meters, the Royal Electric Garage, 556 East Fortieth Street, Chicago, will make an effort to analyze the charging costs of the cars in its care. In addition to the meters installed by the Commonwealth Edison Company, the garage owners will connect a graphic meter on the alternating-current circuit to determine the characteristics of the garage load and will use direct-current meters to obtain records for each car. At present the garage has space for accommodating 140 machines with facilities for charging 65 cars simultaneously. Mr. G. H. Gamper, who was formerly connected, in a managerial capacity with central-station properties in Ohio, is general manager of the Royal Electric Garage.

Urges Surety Companies to Demand Uniform Contract Standards.—At the annual meeting of the American Society of Engineering Contractors, held in New York City on Jan. 16, one of the most important features was the presentation of a report by W. B. King, a prominent Washington lawyer and chairman of the sub-committee on public construction contracts, in which he offered certain suggestions advocating the establishment of more uniform and satisfactory contracts on municipal and other government work. He said that a movement to this end would receive the hearty support of the various credit and contracting associations and seemed to think that the quickest method for producing the desired changes would be to obtain combined action by the leading surety companies which bond contractors and are therefore primarily interested in their success or failure.

Central-Station Energy for Ford Automobile Building in Chicago.—The Ford Motor Company, of Detroit, has recently erected a large factory at South Wabash Avenue and East Fortieth Street, Chicago, where parts of cars made in the home factory are assembled for the Chicago district. Electrically driven elevators, pumps and other machinery have been installed throughout the building, energy being taken from the mains of the Commonwealth Edison Company. Of the 738 lighting circuits installed, twenty-four are used to supply energy to electric signs on the roof. Although the service entering the building has been installed for an ultimate rating of 500 hp, there is now in service but 200 hp in motors and about 150 kw in lighting. The switchboard has been placed at the end of the building, so that it will stand near the center of distribution when the building has been extended to its ultimate size. The factory, just completed, is of modern concrete construction, six stories high, with ground dimensions of 164 ft. by 230 ft. Twelve buildings of a similar type have been planned or built by the Ford Company for other cities of the United States which are considered centers of distribution for the company's product.

To Build Carels Diesel Engines in This Country.—Arrangements have been completed through W R. Haynie, American representative of Carels Frères, of Ghent, Belgium, for the manufacture of that company's type of Diesel engine in this country. The major part of the capacity of a large foundry and manufacturing plant has been secured for this purpose, and this plant will turn out principally engines of from 750-hp to 4000-hp rating, two-stroke cycle, single-acting, of the same general type as those already sold for industrial drive purposes to several American companies, including Phelps, Dodge & Company and the Coronet Phosphate Company. Carels Frères have had an experience of many years in the building of these engines, and it is planned to combine with this knowledge of design the production economies and facilities of an American factory, to supply Diesel engines in large units to the American trade.

Cleveland Electrical Exposition Proposed.—The Electric League of Cleveland is planning to hold an electrical exposition in that city some time in May, the exact date having not yet been fixed. This was announced Thursday of last week, following the adoption of a resolution indorsing the plan as presented by a committee appointed some weeks ago to investigate the advisability of undertaking an enterprise which involves so much work and expense. Representatives of about fifty manufacturing and sales companies agreed at this meeting to take space and co-operate in every way possible to make the exposition a success. M. T. Turner, of the Cleveland Electric Illuminating Company; N. H. Boynton, of the National Lamp Works, and T. B. Cagwin, of the Cleveland Telephone Company, compose the committee which made the investigation, and the report was presented by W. G. Rose, civic expert, who has had charge of most of the expositions and displays in Cleveland for some years past. The purpose of the exposition, as expressed by the report, is to advance the general interests of the electrical trade in Cleveland and vicinity; to educate the community as to the advantages of electricity for illumination, industrial power and general household use; to show the variety and scope of time and labor-saving devices operated by electricity; to make Cleveland the nation's electrical market during the period of the exposition, and finally to cause Cleveland to be known as "the Electrical City." Cleveland is the home of some of the largest electric companies in the country, and its financial men have been prominent in the promotion and operation of many other concerns making electrical devices and machinery, as well as in building electric railways and light and power plants in different sections of the country. Of late years the city has produced some of the finest and best electric automobiles, and the development of all these enterprises is yet in its infancy. For this reason as well as others it is believed that the exposition will prove a great success and awaken renewed interest in electrical matters. The following interests are among those which agreed to participate in the exposition: National Electric Lamp Association, Cleveland Telephone Company, Nungesser Carbon & Battery Company, Electric Welding Products Company, Adams-Bagnall Company, A. & W. Electric Sign Company, Western Electric Company, General Electric Company, Van Dorn Electric Tool Company, Case School of Applied Science, American Steel & Wire Company, Republic Electric Company, Chicago Pneumatic Tool Company, Cleveland Crane & Engineering Company, Electrical Contractors' Association, Cleveland Armature Works, Westinghouse Electric & Manufacturing Company, Electric Controller & Manufacturing Company, Cleveland Electric Illuminating Company, National Carbon Company, Gould Electric Storage Battery Company, Standard Underground Cable Company, Rauch & Lang Carriage Company, Leonard-Bundy Electric Company, Cleveland Switchboard Company, Johns-Manville Company, Sangamo Electric Company, Esterline Company, J. A. Roebling Sons Company, Electric Products Company and Electric Storage Battery Company.

Central-Station Service for Chicago's Largest Office Building.—Final contracts have been closed by which the Commonwealth Edison Company will furnish electrical energy for all purposes for the new office building of the Continental and Commercial National Bank of Chicago. This building occupies an entire city block and fronts on West Adams Street, South LaSalle Street, Quincy Street and South Fifth Avenue. It is the largest office building in the city, being 260 ft. high, extending 323 ft. on the east-and-west streets and 166 ft. on the north-and-south streets. It contains twenty stories, the main banking room being elaborately decorated and extending through several floors. Articles descriptive of the electrical equipment of this imposing building were printed in the *Electrical World* of July 26, 1913, pages 189-194, and Sept. 13, 1913, page 542. The greater portion of the available space in the building will be rented to tenants. The bank has entered into a long-term contract with the Commonwealth Edison Company by which it will buy all the electrical energy needed for the building at wholesale rates. In turn the bank will supply tenants at the regular retail schedule of the Edison company. Electricity is used for lighting and practically for all mechanical requirements. Heating will be furnished on a meter basis by the Illinois Maintenance Company, which is allied to the Commonwealth Edison Company. Four 500-hp boilers will be placed in the basement of the building and will be maintained and operated by the Maintenance company, the steam for heating being furnished on a metered basis. Electrical energy will be taken from the direct-current 115-230-volt mains of the Edison company. The building is to be ready for occupancy May 1, 1914. It is estimated that the electrical requirements for a year will be about 1,800,000 kw-hr. The total motor load is 1498 hp, of which 940 hp will be required for the twenty-six electric elevators, 283 hp for ventilating fans and 275 hp for pumps and miscellaneous machinery. The lighting load will consist of about 20,000 50-watt equivalents. The bank will occupy practically all of the building up to and including the fourth floor, with space also on the fifth and sixth floors. The Continental and Commercial National Bank is the largest in Chicago in amount of deposits and is said to be the second largest in the United States. The total lighting requirements for the bank and for the public lighting, as distinguished from tenant lighting, will amount to about 8000 50-watt equivalents, leaving 12,000 50-watt equivalents for tenants. Twelve of the elevators will run from the basement or the first floor to the twelfth story; ten express elevators will run from the first floor or the basement to the twentieth floor; two combination elevators will run from the sub-basement to the attic, and two private elevators for the use of the bank employees will run from the basement to the sixth floor. The building will contain a substation of the Commonwealth Edison Company. D. H. Burnham & Company are the architects for the building. Mr. Samuel Unsull, president of the Commonwealth Edison Company, and Mr. George M. Reynolds, president of the Continental and Commercial National Bank, personally interested themselves in the terms of the contracts by which electrical energy and heating will be supplied to the building. On the part of the central-station company the details of the contracts were worked out by Mr. P. Junkersfeld, assistant to the vice-president, and Mr. S. M. Bushnell, engineer of the contract department.

NEW YORK METAL MARKET PRICES

	Jan. 20			Jan. 27		
Copper:	Bid		Asked	Bid		Asked
Standard, spot*	.....		14.50	.....		14.50
	Selling Prices			Selling Prices		
	£	s.	d.	£	s.	d.
London, standard, spot*	64	12	6	65	12	6
Prime Lake	14.50	to	14.62½	14.75	to	15.00
Electrolytic	14.30	to	14.40	14.50	to	14.60
Casting	14.15	to	14.25	14.30	to	14.40
Copper wire base	15.50		.....	15.75		.....
Lead		4.10			4.10	
Nickel	40.00	to	45.00	40.00	to	45.00
Sheet zinc, f.o.b. smelter		7.50			7.25	
Spelter, spot	5.25	to	5.35	5.35	to	5.40
Tin, spot	37.70	to	38.00	39.12½	to	39.37½
Aluminum:						
Prompt delivery	18.75	to	19.00	18.75	to	19.00
Future	18.75	to	19.00	18.50	to	18.75

*OLD METALS

Heavy copper and wire	13.50	13.62½
Brass, heavy	8.75	8.87½
Brass, light	7.75	7.87½
Lead, heavy	4.05	4.05
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to Jan. 27 30,349

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*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Reorganization of Michigan Electric Stove Manufacturer.—The reorganization of the Copeman Electric Stove Company, of Flint, Mich., has been perfected. The capital stock has been reduced from $500,000 to $200,000 and the company will issue $100,000 new 7 per cent cumulative preferred stock. This concern was organized Aug. 14, 1911. The reorganized company will manufacture an improved model of the Copeman stove.

Forthcoming Annual Meeting in Chicago.—The annual meeting of the stockholders of the Commonwealth Edison Company, of Chicago, will be held at the office of the company, 120 West Adams Street, on Feb. 24, at noon. The transfer books of the company will be closed at 1 p. m. on Feb. 14 and will be reopened at 10 a. m. on Feb. 25. The annual meeting of the Public Service Company of Northern Illinois will be held at the office of the company, 137 South La Salle Street, Chicago, at 2:30 p. m., on Feb. 24. Transfer books will be closed in like manner with those of the Commonwealth Edison Company.

Great Western Power Company Has Prosperous Year.—Gross earnings of the Great Western Power Company from operation during the year ended Dec. 31 reached a total of $2,698,214, with net earnings of $1,732,244 for the same period. The company has been expanding its properties rapidly during the past year. Bonds were issued in the early part of 1913 and construction work has progressed on the generating station at Big Bend and on the impounding dam at Big Meadows, Cal. The capital stock of the Great Western Power Company is $27,500,000, all outstanding and all owned by the Western Power Company.

Central Union Telephone Company Receivers Decided Upon.—In the suit brought by William A. Read and others, against the Central Union Telephone Company, an agreement has been reached as to the receivers to be chosen, but no official appointments have been made. Those chosen are David R. Forgan, president of the National City Bank, of Chicago; Edgar S. Bloom, of St. Louis, Mo., vice-president of the Bell Telephone Company of Missouri, and Frank F. Fowle, of New York City, consulting electrical engineer. In the Jan. 10 issue of the *Electrical World* a lengthy note appeared, reviewing the causes back of the suit.

Annual Report of the Detroit Edison Company.—The report of the Detroit Edison Company for the year ended Dec. 31 showed the largest increase of earnings in its history. Gross earnings were 26.6 per cent larger than the figures for the preceding year. Great financial activity marked the company's progress in 1913. Early in the year a big increase in the common stock was made, and later a bond issue was found necessary, while at the close of the year a plan was inaugurated for the issue of a large amount of both stock and convertible bonds. This activity was a reflection of unprecedented construction and expansion activity on the company's properties. Gross earnings for 1913 amounted to $5,546,587 and net earnings to $2,324,360.

The United Gas & Electric Engineering Corporation Formed.—A company has been formed under the above name, with a capital stock of $100,000, all of which is owned by the United Gas & Electric Corporation, of New York. The new company will engage in the purchasing of supplies and material and has become the purchasing department of the owning corporation. It will also carry on a general consulting engineering and contracting business, paying special attention to the needs of the operating companies subsidiary to the United Gas & Electric Corporation and the American Cities Company. The officers of the new company are: George Bullock, president; S. J. Dill and J. S. Pevear, vice-presidents, and B. F. Wood, chief engineer. Its directors are George Bullock, S. R. Bertron, R. E. Griscom, J. S. Jenks, Jr., and John Gribbel.

Merger of Electric Vehicle Manufacturing Interests.—The Argo Electric Vehicle Company, of Saginaw, Mich., the Brock Electric Company, of Cleveland, Ohio, and the Borland-Grannis Company, of Chicago, all manufacturers of electric vehicles, have merged their businesses under the name of the American Electric Car Company, and will transfer their interests to Saginaw, where the various cars formerly manufactured in the cities of Saginaw, Cleveland and Chicago, respectively, will be continued under their present individual names. Frederick A. Brand, of Cleveland, will be president of the new company; Bruce Borland and U. B. Grannis, of Chicago, vice-presidents, and Theodore Huss, of Saginaw, secretary and treasurer. A number of additions will be made to the Argo factory to provide for the increased production under the new arrangement.

Progress of the Electrical Securities Corporation.—In 1904 the Electrical Securities Corporation was organized for the purpose of buying the securities of various public utility electric corporations and issuing against these its own collateral trust bonds. Since its organization $8,500,000 of the latter have been issued, of which $3,896,000 are outstanding. The capital stock of the Electrical Securities Corporation consists of $2,500,000 common and $1,000,000 of 5 per cent cumulative preferred stock, and the dividend rate during 1913 was 10 per cent per annum. The report of the company for the year ended Dec. 31 showed continued activity. Its gross earnings were $500,834 and its net earnings amounted to $249,295 for that period. The surplus for the past year amounted to $317,276 and the total surplus at the beginning of the present year was $1,287,221. The company is a subsidiary of the General Electric Company, of Schenectady, N. Y., and through this concern and the Electric Bond & Share Company, organized in 1905, the General Electric financial interests are handled.

Southern California Edison on 6 Per Cent Basis.—In the Nov. 15 issue of the *Electrical World* the statement was made that an increase in the dividend rate on the common stock of the Southern California Edison Company was anticipated, and the recent action of the directors in naming a quarterly dividend of 1½ per cent fulfilled this prediction. The preferred stock will also be on a 6 per cent per annum basis, starting with the April payment. This company recently issued $2,000,000 of new common stock, which was taken by the stockholders at 85. Since that move word has come of a proposed reduction in the maximum lighting rate over the entire southern portion of California from 8 cents to 7 cents per kw-hr. About a year ago the rate was reduced from 9 cents to 8 cents, and in spite of it the company's earnings showed a normal increase. The new rates will take effect on March 1. During the past ten years the gross earnings of the company have increased 445 per cent, the net earnings 465 per cent and the surplus 541 per cent. And in the same time there has been an increase in the connected lighting load of 452 per cent and the power load has increased 1928 per cent.

United Properties Company Reorganization.—An agreement was recently reached in San Francisco by which the interests of F. M. Smith in the United Properties Company of California and subsidiaries were sold to G. C. Moore, of Detroit, Mich., and an English syndicate. This move is considered favorable to Messrs. Tevis and Hanford, who have been negotiating lately for the acquisition of the Smith interests in the properties. This deal will be submitted for the approval of the California Railroad Commission and is contingent upon the action of that body. If approved, its result will be the disintegration of the United Properties Company of California and the reorganization of the subsidiary companies into a new holding company. The railroad properties will be segregated and their financing will receive special attention. Provision has been made for the extension of the $2,500,000 short-term notes held by N. W. Halsey & Company to Sept. 12, 1914, and the $1,150,000 collateral trust notes on the Key Route Basin property to Nov. 20, 1914. The immediate outlay required from the Moore associates was only $1,890,000, covering the purchase of 38,000 shares of preferred stock from the United Properties trustees and 25,000 shares of the same from the Smith trustees. Sufficient of the common stock was secured, together with the above and without payment, to give the purchasers a 70 per cent control. The total outlay necessary for the retirement of the company's entire obligations and for the payments on new work already under contract, amounts to $9,890,000. This agreement, as above outlined, will remove the cause of the recent differences between the original consolidators of the properties, will take care of the immediate financial obligations of the company, and will give a fixed value to the stock in the hands of the company's creditors.

Business Notes

The Cortlandt Engineering Company, formerly at 146 Liberty Street, has moved its office to 42 Broadway, New York City.

H. Olin Jones, architect and engineer, of Greenville, S. C., has announced the removal of his office from the Masonic Temple to the Skelton Building in that city, thereby gaining enlarged quarters.

The Manhattan Brass & Electrical Company, of 218 Grand Street, New York, is carrying on a jobbing business in brass and glass supplies for the electrical trade. Harry Helfman is president and Samuel Denemark is secretary and treasurer of the concern.

The Gray Brothers Electric Company, of Detroit, Mich., has recently secured the services of M. N. Murphy, who will have full charge of its electrical construction work. Mr. Murphy has served in various electrical engineering capacities for the past twelve years, with the Western Electric Company, the Johnson Electric Company, of Omaha, Neb., and the George A. Fuller Construction Company.

The A. & T. Storage Battery Company, with offices in the U. S. Rubber Building, New York City, will complete its manufacturing arrangements about April 1, when it will start the production of storage batteries for various services. The officers of the company are J. M. Splitdorf, president; W. C. Albers, vice-president, and D. B. Nally, secretary and treasurer. Mr. Splitdorf was formerly connected with the Splitdorf Electrical Company, of Newark, N. J.

The International Steam Engineering Company, with main office in the Grant Building, Atlanta, Ga., and branches in the Realty Trust Building, Charlotte, N. C., and in the Brown-Marx Building, Birmingham, Ala., took over on Jan. 1 the Southern territory agency for the Kerr Turbine Company, of Wellsville, N. Y. J. E. Weinbold will give personal attention to new business in territory including North and South Carolina and eastern Tennessee; Robert Stevens to Mississippi and Alabama, and W. R. Jennison to all other Southern territory.

New Industrial Companies

The Scientific Appliance Company, of Guttenberg, N. J., has been incorporated by E. Blum, E. Hunke and K. Hunke, of Guttenberg, N. J. The company is capitalized at $25,000 and purposes to deal in electro-medical apparatus and mechanics.

The Nitro Electric Corporation, of Glenn Ridge, N. J., has been incorporated with a capital stock of $50,000 by M. S. Powell, H. De G. King, of Glenn Ridge, and G. Colvin, of New York, N. Y. The company proposes to manufacture electric appliances, lamps, etc.

Crannell, Nugent & Kranzer, of New York, N. Y., have been incorporated with a capital stock of $15,000, to manufacture and deal in electrical apparatus. The incorporators are L. W. Crannell, F. L. Nugent and W. J. Kranzer, 507 171st Street, New York, N. Y.

The Case Heat-Signal Company, of New York, N. Y., has been chartered with a capital stock of $25,000 to manufacture and deal in electrical and mechanical instruments. The incorporators are C. A. Case, Joseph Hahn and W. S. Kain, 757 Sixth Avenue, New York, N. Y.

The Stromberg Electric Company, of Augusta, Maine, has filed articles of incorporation under the laws of the State of Maine with a capital stock of $490,000 to manufacture and deal in time-recording devices of all kinds. I. S. Kearney, of Augusta, Maine, is president and treasurer.

The International Engineering Corporation, Ltd., of Portland, Maine, has filed articles of incorporation under the laws of the State of Maine with a capital stock of $100,000 for the purpose of doing an electrical, mechanical, mining and civil engineering and general contracting business. The officers are A. F. Jones, president, and T. L. Croteau, treasurer, both of Portland, Maine.

Trade Publications

Storage Batteries.—The "Exide" storage batteries for automobile service are treated in Section X of the publications of the Electric Storage Battery Company, of Philadelphia, Pa.

Car Replacer.—The Electric Service Supplies Company has issued a leaflet illustrating its F. & P. car replacer and St. Louis trolley pick-ups. Both of these are urged as being profitable equipment for every car.

Electric Meat Slicer.—The A. J. Deer Company, Hornell, N. Y., is mailing illustrated folders relating to its "Royal" electric meat slicer. This device is self-contained with motor complete and is ball-bearing throughout.

Wire Pocket Book.—The Simplex Wire & Cable Company, of Boston, Mass., has issued recently a handy pocket manual on its product, giving among other things tables of wire weights, properties and prices, freight charges and test methods.

Rectifier.—The Mohawk Electric Manufacturing Company, Newark, N. J., in a recent catalog describes fully its alternating-current rectifier for charging storage batteries. All the information that the prospective user might wish to have is clearly set forth.

Public Utility Securities.—Stone & Webster, of Boston, Mass., have recently issued a booklet showing the condition of a number of the properties under their management. This publication should be of interest to prospective investors in public utility securities.

Portable Engines.—The Kansas City Engine Works, 1613 Crystal Avenue, Kansas City, Mo., in a recently published leaflet briefly describe the Elliott portable engines of various ratings. The igniter which is furnished with each 6-hp Elliott engine is also shown.

Lamp Guards.—The Electric Service Supplies Company has issued an attractive folder describing and illustrating its Keystone lamp guards. An effective illustration shows in detail the construction of its portable type. A conduit box type is also shown and listed.

Lighting Fixtures.—The "Multi-Lux" standard semi-indirect lighting fixture is the subject of a leaflet recently issued by the Multi-Lux Illuminating Company, The Arcade, Cleveland, Ohio. Its construction and an outline of its special features are given, together with a number of effective illustrations.

Motor Starters.—The Allen-Bradley Company, Milwaukee, Wis., has its imprint on a broadside referring to its type "H" motor starter. An effective fac-simile blueprint illustration shows the constructive features of this apparatus, and terse descriptions of its various parts will interest the prospective purchaser.

Instruments.—Electrical measuring, testing and scientific instruments, manufactured by Foote, Pierson & Company, are the subject of a comprehensive catalog of 100 pages. Each type of instrument is described in detail and is illustrated. A new universal photometer designed by Messrs. Clayton Sharp and P. S. Millar is discussed in this catalog.

Fans.—The 1914 catalog of the Robbins & Myers Company, Springfield, Ohio, gives illustrations and data regarding its direct-current and alternating-current ceiling, desk, oscillating and exhaust fans. The four center pages of the catalog are printed on heavy, lusterless paper, and the reading matter in this section is illustrated with human-interest pictures that show the uses of fans in the home and office. The two illustrations in color are attractive as well as the unique design on the front cover.

Electric Vehicle Charging Stations in New York City.—Owners of electric vehicles will find useful the booklet of information concerning charging stations within 150 miles of New York City, including a route map, which has just been issued by the New York Electric Vehicle Association. Among the data therein compiled and printed for the first time are rates charged for "boosting," the hours during which service may be had, and the maximum amperage and voltage available. These facts were secured in co-operation with the automobile bureau of the New York Edison Company. The booklet has been sent to all owners of electric vehicles in New York City and upon request a copy will be mailed to any one desiring it.

Personal Mention

Mr. E. Sloneker has resigned as electrician of the borough of Kutztown, Pa., to engage in the electrical supply business.

Mr. H. D. Fitch has succeeded Mr. R. A. Field as general manager of the Kentucky Public Service Company, Hopkinsville, Ky.

Mr. A. J. Short has received the title of superintendent of the Frankfort (Ky.) plant of the Kentucky Public Service Company.

Mr. F. D. Schaffer has been appointed general manager of the Chickasha (Okla.) Light, Heat & Power Company, vice C. G. Johnson, resigned.

Mr. R. L. McLellan, formerly associated with H. M. Byllesby & Company, Chicago, has been appointed sales manager of the Merchants' Heat & Light Company, Indianapolis, Ind.

Mr. M. L. Derge, superintendent of the Milligan Company of Elyria, Ohio, has been transferred to act in that capacity with the Trumbull Public Service Company at Warren, Ohio.

Mr. E. E. Bresnahan, who has been connected with the Fort Wayne Electric Works of the General Electric Company for several years, has been promoted to the position of purchasing agent.

Mr. H. C. Moore has been appointed manager for the Kentucky Public Service Company at Frankfort, Ky. Mr. Moore was formerly a member of the company's staff at Bowling Green, Ky.

Mr. A. V. Wynne, formerly electrical engineer of the Trumbull Public Service Company of Warren, Ohio, has been appointed superintendent of the Massillon (Ohio) Gas & Electric Company.

Mr. E. Vinning has been appointed resident local manager of the Idaho Railway, Light & Power Company at Caldwell, Idaho, vice J. D. Orr, who has been promoted to the office of district manager.

Mr. Charles Wirt, president of the Wirt Company, maker of electric-lighting appliances of Philadelphia, Pa., sailed on the S. S. *Berlin*, Jan. 3, for Naples. Mr. Wirt will be absent for about two months.

Mr. Edwin L. Sellars has been appointed new-business manager for the Kentucky Public Service Company, which operates electric-lighting properties in Bowling Green, Frankfort and Hopkinsville, Ky.

Mr. J. B. Johnson, of the Massillon (Ohio) Electric & Gas Company, has been made superintendent of the Milligan Electric Company at Elyria, Ohio, as successor to Mr. M. L. Derge, who has been transferred to Warren, Ohio.

Mr. A. J. Francis has been made manager of the Chicago office of the Fort Wayne Electric Works of the General Electric Company. Mr. Francis has been connected with the Fort Wayne office in Chicago for several years.

Mr. Asa Williams has been appointed superintendent of the Owensboro (Ky.) municipal light and water-works, and not superintendent of the municipal light and water plants of Fresno, Cal., as announced in our issue of Jan. 17, 1914.

Mr. Joseph E. Montague, vice-president and general manager of the Buffalo & Niagara Falls Electric Light & Power Company of Niagara Falls, N. Y., was unanimously elected president of the Niagara Falls Board of Trade at the annual meeting of the organization on Jan. 15.

Mr. J. D. Orr, local manager of the Idaho Railway, Light & Power Company at Caldwell, Idaho, has been promoted to the office of district manager, with headquarters at Nampa. Mr. Orr's territory now embraces the towns of Caldwell, Nampa, Middleton, Murphy, Silver City, Star, Eagle, Homedale, and all the surrounding rural districts.

Mr. R. E. Richardson, general manager of the Commonwealth Power Company, Kalamazoo, Mich., has resigned, and the office of general manager has been discontinued. Mr. Richardson will devote his time to other business interests. The Kalamazoo district will be managed by Mr. F. W. Blowers, present manager of the Kalamazoo Gas Company.

Mr. C. G. Johnson, retiring manager of the Chickasha (Okla.) Light, Heat & Power Company, was the guest of honor at a banquet by business and professional men on Jan. 20. Mr. Johnson will become affiliated with the Vicksburg (Miss.) Light & Traction Company, which is owned by the same interests that formerly owned the Chickasha Light, Heat & Power Company.

Mr. A. L. Pond, until recently Chicago manager for the Fort Wayne Electric Works of the General Electric Company, is now in charge of the Milwaukee office of the General Electric Company. Mr. Pond, who is an electrical man of wide experience, has been prominent in electrical circles in the West for a number of years. He is an associate of the American Institute of Electrical Engineers.

Mr. S. G. McMeen, of the Columbus (Ohio) Light, Heat & Power Company, has been elected president of the East St. Louis Railway, the East St. Louis & Suburban Railway and the East St. Louis Light & Power Company, East St. Louis, Ill., to succeed Mr. C. M. Clark, of E. W. Clark & Company, Philadelphia, Pa., as president of the first two companies and Mr. L. C. Haynes as president of the East St. Louis Light & Power Company.

Mr. McKew Parr has been elected general sales manager of the Hart & Hegeman Manufacturing Company, Hartford, Conn. Mr. Parr, who is a graduate of the United States Military Academy at West Point and a native of Baltimore, has been associated with the Hart & Hegeman Manufacturing Company since 1909. He has been connected with the Maryland Telephone Company, of Baltimore; the Southern Electric Company, of Baltimore, and the Cataract Electric Supply Company, of Buffalo. After representing the Hart & Hegeman Manufacturing Company in its Southern territory for two years, he was appointed advertising manager, in which capacity he continued until his recent promotion.

Mr. Wilbur B. Foshay has resigned his position as manager of the Northwestern Electric Company of Portland, Ore., to engage in general consulting work in the Wilcox Building, Portland, Ore. Previous to going with the Northwestern Electric Company, Mr. Foshay was for two years district manager of the Washington-Oregon Corporation, to which concern he went from the Pacific Power & Light Company. With the latter concern Mr. Foshay served as manager of the Walla Walla (Wash.) office and as manager of the Kansas Gas & Electric Company at Wichita, Kan. Mr. Foshay was at one time manager of the Fort Dodge (Ia.) Light & Power Company and served with the lighting companies in Hutchinson, Kan., and Tarrytown, N. Y. Besides his consulting work, Mr. Foshay will look after his interests in the Washington Public Service Company at Olympia, Wash.

Mr. John Z. Murphy has been appointed electrical engineer of the Chicago Surface Lines. Mr. Murphy entered street railway work in 1889 as chief operating engineer in charge of outside mechanical equipment with the West Chicago Street Railway. When that company changed from cable to electric drive Mr. Murphy was placed in charge of the construction of power houses. In 1900 Mr. Murphy was appointed chief engineer of the Union Traction Company in charge of all engineering work and continued in that capacity when that company was absorbed by the Chicago Railways. For the past seven years Mr. Murphy has represented the Chicago Railways on the Board of Supervising Engineers, Chicago Traction. Mr. Murphy will have charge of power stations, substations, distribution, metering and tunnels in his work with the Chicago Surface Lines.

JOHN Z. MURPHY

Dr. Emil Rathenau, the well-known German engineer, for many years head of the Allgemeine Elektricitäts Gesellschaft, celebrated his seventy-fifth birthday on Dec. 11. Telegrams were received from the Emperor and from Prime Minister von Bethmann Hollweg. The greetings of the

Kaiser were as follows: "By the grace of God you are to-day permitted to look back upon seventy-five years of prosperous work and successful life. It gives me much pleasure to tender you my warmest congratulations in grateful recognition of your valuable services in the development of the German electro-technical industry. Wilhelm I. R." The Prime Minister's message of congratulation was as follows: "Please accept my warmest congratulations on the occasion of completing your seventy-fifth year. You can look back with justifiable pride upon a long life in which inventive genius combined with untiring energy and an iron will have led to a long chain of successes. Your unerring eye for technical and economic possibilities has always enabled you to keep the highest goal in view, and with your infallible business knowledge you have not despised the smallest detail. You have thus created one of the largest industrial undertakings in the German Empire and brought it to the highest state of perfection—a guide in the great economic questions of the day and an example of the strict fulfilment of duty. It is a sincere pleasure to me to express my sentiments upon this day of celebration, with the wish that now after your convalescence from severe illness you will be spared for many years to come."

H. B. FLEMING

Mr. H. B. Fleming, formerly vice-president and chief engineer of the Chicago City Railway, has been appointed chief engineer of the Chicago Surface Lines, the official name of the unified properties of the Chicago Railways and the Chicago City Railway. Since its beginning Mr. Fleming has represented the Chicago City Railway on the Board of Supervising Engineers, Chicago Traction. He has been connected with the Chicago City Railway for the past fourteen years. After his graduation from Washington University, St. Louis, Mo., Mr. Fleming was made assistant engineer in the water department of the city of St. Louis. Later he was engaged in street-railway work in the operating and engineering department of the National Railway of St. Louis. When that company was absorbed by the St. Louis Transit Company he continued to serve in the engineering department until 1900. After resigning from the St. Louis Transit Company Mr. Fleming entered the service of the Chicago City Railway, and in 1905 he was appointed chief engineer, being promoted to membership on the Board of Supervising Engineers, Chicago Traction, in 1907. In March, 1912, he was elected vice-president and director of the Chicago City Railway. Mr. Fleming is a member of the American Society of Civil Engineers, the Western Society of Engineers, the Western Railway Club and the American Electric Railway Engineering Association.

Obituary

H. C. Meinholtz, vice-president of the Heine Safety Boiler Company, St. Louis, Mo., died Dec. 24. Mr. Meinholtz was born Feb. 7, 1868, at St. Louis. He attended the public schools and graduated from the Manual Training School in the fall of 1883. Entering the employ of the Heine Safety Boiler Company shortly after at the age of nineteen as draftsman, he was continuously connected with that company until the time of his death. He was made superintendent in 1895 and a vice-president in 1907. Mr. Meinholtz was a member of the Engineers' Club of St. Louis and of the American Society of Mechanical Engineers.

Dr. Benjamin O. Peirce, Hollis professor of mathematics and natural philosophy at Harvard University since 1888, died at his home in Cambridge, Mass., on Jan. 14. Professor Peirce was a native of Beverly, Mass., and was educated at Harvard University and the University of Leipsic, from which he received the degree of Ph.D. in 1879. His work in the physics department at Harvard began in 1884. Professor Peirce was a member of the American Physical Society and a fellow of the American Academy of Arts and Sciences and many other scientific organizations, besides being the author of several technical works and numerous scientific papers.

Charles F. Prichard, vice-president and general manager of the Lynn (Mass.) Gas & Electric Company and treasurer of the Gloucester (Mass.) Electric Company, died suddenly at his home in Lynn on Jan. 19. Mr. Prichard was one of the most noted gas experts in America, and was prominent in public utility affairs in the East, being a director of the Beverly (Mass.) Gas & Electric Company and prominent in affairs of the Massachusetts Electric Lighting Association. He was a native of Marblehead, Mass., and was educated at the Massachusetts Institute of Technology. In 1883, at the age of twenty-seven, he was made superintendent of the Lynn company, becoming general manager in 1901 and vice-president in 1908.

Edwin Emerson Nolan, head of the materials disposition department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., died at his home in Wilkinsburg, Pa., on Jan. 13. Mr. Nolan began work with the Westinghouse Electric Company in 1887 just about the time it began operations on Garrison Alley in the city of Pittsburgh. He was subsequently made superintendent of the Allegheny factory of the company and as such had charge of building the first alternating-current generators for the Niagara plant. He retained his position until the factory was converted into a foundry. In 1898 Mr. Nolan was sent by the Westinghouse Electric & Manufacturing Company to France to establish a factory at Havre, in which position he remained until 1902. He returned to the United States, and on account of his familiarity with Westinghouse apparatus was placed in charge of the materials disposition department, a position which he held until his death. Mr. Nolan was born in Chicago on Aug. 10, 1857. He is survived by a widow, two sons and two daughters.

WILLIAM COOPER

William Cooper, director of buildings and equipment of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., died of appendicitis at his home in Wilkinsburg on Jan. 23. Mr. Cooper was esteemed and respected by his associates and by all those who came in contact with him, and he was deeply beloved by those who knew him intimately. A man of great force and character as well as inventive ability, he has left a mark on the electrical engineering industry. Mr. Cooper was born near Watertown, N. Y., Nov. 24, 1861. At the beginning of the nineties he was chief engineer and master mechanic of the Twin City Rapid Transit Company, of St. Paul, Minn., from where he went to join the engineering department of the General Electric Company. There he did some valuable work in connection with the effect of high density in armature cores on the commutation of railway motors. After leaving Schenectady, Mr. Cooper became general superintendent of the Bullock Electric Manufacturing Company at Cincinnati, Ohio, where he developed the multiple voltage system, which was epoch-making in the operation of electrically driven machine tools. He also developed the teaser system for the operation of printing presses. After leaving the Bullock company he joined the Westinghouse Electric & Manufacturing Company, where his inventive faculties found scope in the development of the electro-pneumatic system of multiple-unit train control. His personality was also a great factor in the Westinghouse organization and led to his becoming director of buildings and equipment of the company, which position he held at his death. The electrical industry has lost a valuable man, and those who knew him well have lost one of the truest and most fearless of friends, whom they will mourn for many years.

Construction

New England

SKOWHEGAN, MAINE.—The American Woolen Co., of Skowhegan, has entered into a 20-year contract with the Central Maine Pwr. Co. to furnish electricity to the amount of 385 hp to operate its mills. Of this amount 135 hp is to be available at the Marston Mills Feb. 1. The remaining 250 hp is to be delivered at the present shoe factory building, now owned by the American Woolen Co., by June 1.

WESTFIELD, MASS.—Bids will be received until Feb. 9 at the office of the Westfield gas and electric works, Westfield, Mass., for furnishing and installing, complete under one contract, a 600-kw turbine-alternator and condenser. T. T. Logie is manager.

PASCOAG, R. I.—At a meeting of the Pascoag fire district taxpayers held recently it was voted to discontinue the municipal generating plant and purchase electricity from the Rhode Island Transmission Co. to operate the municipal electric-lighting system, to take effect either July 1 or Sept. 1, 1914. The contract is for a period of 20 years.

NEW HAVEN, CONN.—Bids will be received by the board of fire and police commissioners, Department of Fire and Police Service, New Haven, Conn., until Feb. 3, for furnishing the city of New Haven with 3250 ft., more or less, 50-conductor lead-covered underground cables. Each conductor shall be 14 B. & S. gage annealed copper wire. S. J. Metzger is secretary board of fire commissioners.

Middle Atlantic

ARCADE, N. Y.—Within the next 12 months the village of Arcade expects to purchase a general line of supplies for wiring, etc. J. H. Howard is village clerk.

BUFFALO, N. Y.—Bids will be received by Francis G. Ward, commissioner of public works, Room 5, Municipal Building, until Feb. 3, for furnishing and installing the heating and ventilating apparatus in the proposed new 16-room school building on Germain Street, near Amherst Street; also for furnishing material and labor to install the steam-main, pumps, traps, etc., in the tunnel connecting the heating and power plant of the new Technical High School building with the new school building on Clinton Street, corner of Cedar. A separate proposal must be submitted for each division of the work.

FREEPORT, N. Y.—The managers of the municipal electric-light plant expect to purchase miscellaneous supplies, including wire, meters, transformers, etc., for the municipal electric-light system.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until Feb. 9, for installing electric equipment in new Public School 97, on Mangin Street, near East Houston Street. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent, Park Avenue and Fifty-ninth Street.

SODUS, N. Y.—Within the next 12 months the Wayne Pwr. Co., of Sodus, expects to erect a 6-mile transmission line from Atlanta to Naples (11,000 volts, 35-ft. and 40-ft. poles), also a complete distributing system in Naples, including tungsten series street-lighting system of about 100 40-watt lamps; also to purchase 1000 poles, 40 to 50 miles of bare and weather-proof wire, etc. (transformers and meters now under consideration), one General Electric transformer and a constant-current regulator for street-lighting system. The company is also considering the development of a 200-ft. waterfall, obtaining about 300 kw for four hours. G. R. Mills is president.

WEEDSPORT, N. Y.—At a special election held Jan. 21 the proposal to appropriate $18,000 for a municipal electric-light plant was defeated. On Nov. 26 the taxpayers voted to appropriate $15,000 for the installation of a plant.

WILLIAMSON, N. Y.—Bids will be received by the water commissioners of Williamson, N. Y., until Feb. 11 for the construction of a water-works system, which includes 8 miles of 10-in., 8-in. and 6-in. cast-iron pipe and laying same, valves and hydrants, pumping station and intake; gravity mechanical filters, power pumping machinery, and concrete reservoir. Plans, specifications, form of proposal and contract may be seen at the office of the water commissioners, Williamson, and obtained at the office of H. C. Kittredge, engineer, German Insurance Building, Rochester, N. Y., for which a deposit of $10 will be required to be refunded upon return of same. Proposals to be addressed to R. M. Cheetham, Williamson.

CHESTER, PA.—The Beacon Lt. Co., of Chester, has been awarded a contract for furnishing electricity to the American Viscose Company's plant at Marcus Hook. Ballinger & Perrot, of Philadelphia, are engineers and architects.

KITTANNING, PA.—For the purpose of furnishing electricity to the new mining operations being installed on the Shawmut Road, the Kittanning El. Lt. Co. is planning to extend its high-tension transmission line along the Pittsburgh & Shawmut railroad from Kittanning to West Mahoning, thence up Mahoning Creek to Timblin, in Jefferson County.

MEADVILLE, PA.—Plans have been prepared by the Erie R. R. Co., for the construction of a large power plant in connection with its shops in Meadville, to cost about $200,000. The plans provide for the installation of 1600 hp, with arrangements to increase it to 3200 hp when necessary. It is not definitely decided whether the plant will be built or not.

BROADWAY, VA.—We are informed that the proposal to issue $3,000 in bonds to establish a municipal electric-light plant was defeated at an election held recently. Reported in the issue of Jan. 24 to have been carried. C. R. Whitmore is city clerk.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 17, for furnishing at the various navy yards and naval stations supplies as follows: Boston, Mass., Schedule 6321—one electrically heated oil-tempering bath; Schedule 6322—103 fire-control telephones. Brooklyn, N. Y., Schedule 6312—five hydraulic turbine tube cleaners, 120 receiver cords for double-head receivers for wireless apparatus, 140,000 ft. silicon bronze aerial wire; Schedule 6314—10,000 sq. ft. compressed sheet cork for insulating; Schedule 6319—seven electrically operated ice-cream freezers. Washington, D. C., Schedule 6318—1250 lb. pure lead wire in 50-lb. coils, 2800 lb. soft-rolled copper sheets. Bids will also be received at the same place until Feb. 24, as follows: Puget Sound, Wash., Schedule 6328—24 single-stroke, 12-in., 125-volt general alarm bells; Schedule 6325—one electrically operated dough-mixing machine, one electrically operated meat and food chopper. F.o.b. works: Schedule 6338—six electrically operated air compressors, complete. Schedule 6339—44 converting turbo-generating sets from 5 kw to 10 kw. Key West, Fla., Schedule 6334—2000 duct ft. four-duct terra-cotta conduits. Newport News, Va., and Brooklyn, N. Y., Schedule 6336—miscellaneous electrical equipments. Washington, D. C., Schedule 6329—one monorail electric traveling hoist (1½ tons lifting capacity). Indian Head, Md., Schedule 6330—installing and putting in working condition one coaling plant. Washington, D. C., Schedule 6337—one hydraulic pressure pump. Applications for proposals should give the schedule desired by number. T. J. Cowie is paymaster-general, U. S. N.

North Central

BATTLE CREEK, MICH.—The contract for lighting fixtures for the new city hall has been awarded to the R. Williamson Co., of Chicago, Ill., for $4,240.

FENTON, MICH.—The Flint El. Co., of Flint, which recently secured a franchise in Fenton to furnish electrical service here, has obtained most of the right-of-way for its transmission line. As soon as the weather permits work will begin on the erection of the line.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Pwr. Co. is extending its transmission lines to Casnovia, Bailey and Grant to furnish electrical service in those places for which franchises were secured last spring.

GRAND RAPIDS, MICH.—Bids will be received by H. N. Morrill, business manager of the board of education, Grand Rapids, Mich., until Feb. 16, for construction of South High School building, including general construction, plumbing, heating, ventilating and wiring, as per plans and specifications on file at the offices of the architects, Robinson & Campau, Houseman Block, Grand Rapids. Henry E. Crow is president of board.

LANSING, MICH.—A petition has been filed with the City Council asking that the ornamental street-lighting system on East Michigan Avenue be extended.

LISMORE, MICH.—Plans, it is reported, have been prepared by Earl D. Jackson, consulting engineer, Capitol Bank Building, St. Paul, for an electric-light plant in Lismore.

MANISTEE, MICH.—The Manistee County El. Co., it is reported, has announced that it will construct a dam on the Manistee River, to be known as the Lower Junction dam, near High Bridge, about 18 miles from Manistee. Work will be started on the dam within three months, and when completed it will develop about 7000 hp.

RAVENNA, MICH.—Local business men are considering the organization of a company, with a capital stock of $25,000, to develop the water-power in Crockery Creek, from which it is estimated that 300 hp can be developed.

READING, MICH.—The board of electric-light commissioners has recently completed the erection of a new boiler room and coal-storage room (38 ft. by 56 ft.) and is installing a 75-kva, 2300-volt, three-phase, 60-cycle Western Electric generator, one generator switchboard panel and one feeder panel, together with Tirrill regulator for above machine. Two 150-hp Bass return tubular boilers have just been installed. Burr K. Goodman is superintendent.

ROGERS CITY, MICH.—The State Railroad Commission has granted the Rogers City El. Lt. & Pwr. Co. authority to issue $10,000 in capital stock.

UNION CITY, MICH.—The electric light and water works commissioners may install a 1000-gal. pump in connection with the water-works system in the spring. It also expects to purchase in the spring some poles, and will probably erect eight more ornamental lamp standards for five-lamp clusters. F. O. Webber is superintendent of the water and light plant.

VASSAR, MICH.—Within the next 12 months the electric light commissioners expect to expend about $600 for lamps and $100 for electrical supplies. W. A. Peck is superintendent.

BATAVIA, OHIO.—The Board of Public Affairs expects to purchase within the next two or three months one small tank pump. Howard Duckwall is superintendent.

BOWLING GREEN, OHIO.—The Lake Erie, Bowling Green & Napoleon Ry. Co., of Bowling Green, expects to purchase 100 poles, 10 transformers, 36 meters and 250 incandescent lamps. C. G. Taylor is receiver.

CANAL DOVER, OHIO.—The Board of Public Service will purchase in the near future some poles and transformers for the municipal electric-light plant. Osmond Galmond is director of public service.

CHILLICOTHE, OHIO.—The Chillicothe El. R. R., Lt. & Pwr. Co. has purchased a 250-hp Erie City water-tube boiler for delivery April 1. F. K. Sexauer is assistant manager.

CINCINNATI, OHIO.—Bids will be received by the Board of Hospital Commissioners of the city of Cincinnati until Feb. 17 for furnishing labor and material for the erection of the special contagious building for the new General Hospital of the city of Cincinnati, including electric wiring, lighting fixtures, vacuum-cleaning system, dumb-waiter, sterlizing equipment, telephones, clock and elevator. Drawings and specifications are on file at the office of the board of hospital commissioners, Burnet Avenue, Cincinnati, and at the office of Samuel Hannaford & Sons, architects, Hulbert Block, Cincinnati. Frederick S. Spiegel is president.

CLEVELAND, OHIO.—Bids will be received by A. R. Callow, commissioner of purchases and supplies, 511 City Hall, Cleveland, until Feb. 3, for furnishing approximately 88,000 ft. of cable for the Fire Department. Specifications may be obtained at the office of the commissioner. Alfred A. Benesch is director of public safety.

CLYDE, OHIO.—Within the next few months the Board of Public Affairs expects to purchase one motor-driven deep-well pump of 300 gal. capacity. H. B. Dirlam is clerk of board.

COLUMBUS, OHIO.—The name of the Columbus Ry. & Lt. Co. has been changed to the Columbus Ry., Pwr. & Lt. Co. Harold W. Clapp is general superintendent.

GIBSONBURG, OHIO.—The city officials have entered into a contract with the Gibsonburg El. Lt. & Tel. Co. to light the streets of the city for a period of ten years. Work will begin as soon as possible on the installation of the new street-lighting system. It is understood that a day service will be established.

LYNCHBURG, OHIO.—Within the next 12 months the Board of Public Affairs expects to erect a new pole transmission line and to purchase one boiler, an exciter, one panelboard, 10 new transformers and 20 meters for lighting service and 400 incandescent lamps. C. W. Morrow is superintendent of the municipal electric-light plant.

MANCHESTER, OHIO.—The Board of Public Affairs expects to purchase within the next 30 days material for wiring a moving-picture theater building (26 ft. by 90 ft.), using rigid iron conduit; also within the next three months to purchase 25 6.6-amp tungsten lamps (2200 volts) and street hoods complete; also within the next six months to purchase 15 5-amp, single-phase wattmeters, about 300 lb. No. 6 and No. 8 triple-braided wire and 100 lb. No. 10 double-braided iron wire. B. P. Stone is manager.

MAUMEE, OHIO.—The Valley Lt. & Pwr. Co., of Maumee, expects to purchase within the next two months 15 6600-volt transformers (from 2 kva to 15 kva), three 75-kva transformers (all 6600/220/110 volts), insulators for 12 miles of pole line, lightning arresters and blocks. H. E. Lovett is local manager.

MONROEVILLE, OHIO.—The Board of Trustees of Public Affairs is contemplating changing the system of the municipal electric-light plant from 133 cycles to 60 cycles in the near future. E. M. Alberts is secretary of board.

NELSONVILLE, OHIO.—The Hocking Pwr. Co., of Nelsonville, it is reported, has secured a site for its proposed new power house and has purchased equipment for a 5000-kw plant; it also has bought 1000 acres of coal lands from which it will secure fuel. Work, it is understood, will begin on the plant within the next two months.

PAULDING, OHIO.—Within the last six months improvements have been made to the municipal electric-light plant and water-works system involving an expenditure of $30,000, and including the installation of a 150-hp boiler, two 80-kva Ridgway engines and generators (changing the system from direct to alternating current), rebuilding the city distribution system, and installing 100 series incandescent street lamps, an auxiliary motor-driven deep well and central-station pump, and erection of a 76,000-gal. steel water tank. A day service has also been established. L. O. Farnsworth is superintendent.

ROCKFORD, OHIO.—Within the next six months the Rockford El. Ltg. Co. expects to erect a transmission line from Rockford to Mendon, a distance of 10 miles; also to purchase within the next six months a regulator for switchboard and lightning arresters for 12 miles of rural line. S. J. Robinson is secretary.

SALINEVILLE, OHIO.—The Salineville El. Lt., Ht. & Pwr. Co. expects to purchase within the next eight months one 150-kw to 180-kw, single-phase, 60-cycle, 1100-2200-volt generator (second-hand). Material for lighting system not yet decided upon. P. S. Hart is superintendent.

UHRICHSVILLE, OHIO.—Plans are almost completed for the merger of the Twin City Trac. Co., of Dennison; the Midland Pwr. & Trac. Co., of Cambridge; the Coshocton Lt. & Ht. Co., of Coshocton, and the Lafayette Lt. & Pwr. Co. with the Ohio Service Co., which will result in the immediate improvement of the light and power service in Uhrichsville and in Dennison. The Ohio Service Co. will begin work in the spring on the erection of a transmission line from Coshocton to Uhrichsville and Dennison, so that electricity may be obtained from the plant in Uhrichsville as well as from the power station in New Philadelphia.

ZANESVILLE, OHIO—Plans which will probably be presented to the City Council are being considered by the Civic Improvement Association for the installation of a municipal electric light plant. The plans provide for the purchase of the Hook Brothers and Aston mill with water-power rights, the property to be used as a site for a municipal power station.

CENTRAL CITY, KY.—The establishment of a large power plant to be operated in connection with a traction line at Central City is reported to be under consideration. Dr. W. H. Netherland, of Louisville, is interested in the project.

PEMBROKE, KY.—The R. H. Power Co., successor to the Pembroke Lt., Pwr. & Wtr. Co., of Pembroke, has recently completed the erection of a 19,000-volt transmission line from Hopkinsville, a distance of 10 miles. Within the next 12 months the company expects to purchase material for the erection of 27 miles of transmission line, including transformers, poles, transmission towers, lightning arresters, insulators, underground conduit, distribution cable and wire, meters, tub transformers, rectifiers, arc lamps, incandescent lamps, lamp-posts, etc. S. G. Ragsdale is general manager.

WINCHESTER, KY.—The installation of an ornamental street-lighting system in a subdivision of the city, recently opened, is contemplated by Victor Bloomfield, N. R. Ratcliff and others.

ANGOLA, IND.—The Indiana Utilities Co., of Angola, has recently completed the erection of 20 miles of transmission lines, connecting Pleasant Lake, Hudson and Waterloo, Ind. R. E. Nihan is superintendent.

LOOGOOTEE, IND.—Within the next six months the Loogootee El. Lt., Pwr. & Wtr. Co. expects to purchase an engine. George E. King is secretary.

MADISON, IND.—The Madison Lt. & Ry. Co. has applied to the Public Service Commission for permission to issue $25,000 in bonds, the proceeds to be used for additions to its power plant and extension of the lighting service to Hanover.

TROY, IND.—The Town Board is reported to have granted DeHaven & McIntyre, of Hardinsburg, Ky., a franchise to install an electric-light plant in Troy.

ALEDO, ILL.—The Tri-County Lt. & Pwr. Co., of Aledo, operates electric-generating stations in Keithsburg, Aledo, Alexis and Woodhull, all in Illinois, and supplies electrical service in Aledo, Alexis, Alpha, Woodhull, Rio, New Windsor, New Boston, Joy and Keithsburg, and is now erecting transmission lines to Viola, North Henderson and Heaton, which places will be connected up soon. The company has a contract with the Edwards River Pwr. Co., whose plant is 1 mile south of Matherville, for energy to operate its entire system, starting out with a maximum of 2000 kw, stepping up from 2300 volts to 33,000 volts, which will be its main distribution at 60 cycles. This will soon be available, when all the other generating stations will be closed down as soon as the various towns are connected up. Construction has been completed from the Keithsburg power station through New Boston, Joy, Aledo and Gilchrist to the Edwards River power station. A new transmission line has already been erected from Alpha to Woodhull, and an old line from Alpha to Rio and New Windsor will be rebuilt. A. M. Barron is general superintendent.

CHICAGO, ILL.—Bids will be received by John McGillen, clerk of the Sanitary District of Chicago, Room 700-900 South Michigan Avenue, Chicago, until Feb. 5 for furnishing electrical apparatus and supplies, including coils, steel poles, insulators, underground conduit, cable, weather-proof wire, etc. For details see proposal pages. Thomas A. Smith is president of board of trustees.

CHICAGO, ILL.—Bids will be received by the city of Chicago, Room 406, City Hall, until Feb. 2, for furnishing at its water-works shops, 2304 South Ashland Avenue, Chicago, 8 tons of ingot copper and 7 tons of old copper trolley wire, according to specifications on file in the office of the Department of Public Works, Room 406, City Hall. L. E. McCann is commissioner of public works.

BAUDETTE, MINN.—Bids will be received by the Village Council of Baudette until Feb. 2 for furnishing and installing equipment at the municipal water and light plant as follows: One boiler, one engine and generator (directly connected) with belted exciter, switchboard panel, boiler-feed pump, steel smokestack with brick stack base and horizontal smoke connection to connect new boiler in plant, with all proper connections and accessories. Franz W. Schmidt is acting clerk.

CROOKSTON, MINN.—The Electrical Devel. Co. has completed a new hydroelectric development, consisting of a 14-ft. dam (which can be raised to 20 ft. by flashboards) and power house for three units. Only one unit has been installed, consisting of a 500-kva Westinghouse three-phase, 60-cycle, 2300-volt generator and accessories, and one 750-hp Morgan-Smith high-speed waterwheel, operating under a 16-ft. head.

FARIBAULT, MINN.—Bids will be received at the office of the State Board of Control, State Capitol Building, St. Paul, until Feb. 9, for alterations and additions to the north wing of the School for the Blind, Faribault; also for alterations and additions to the south wing at the School for Blind at Faribault, including general contract work, heating and ventilating, plumbing and electrical work; also for the erection and completion of the Grand View Cottage at the School for Feeble-Minded at Faribault, including general contract work, heating and ventilating, plumbing and electrical work. Plans and specifications for the above work may be obtained from C. H. Johnston, architect, 715 Capital Bank Building, St. Paul, Minn. Copies of plans and specifications may be seen at the Builders' Exchange in St. Paul and Minneapolis. Bids will be received collectively or separately on each division.

GEORGETOWN, MINN.—The Farmers' Elevator Co., it is reported, is contemplating the installation of an electric-light plant for the purpose of furnishing the towns in this vicinity with electrical service.

GLYNDON, MINN.—The Glyndon Lt. & Pwr. Co., recently incorporated, is installing an electric plant to supply electricity for lamps and motors in Glyndon. The equipment will include one 20-hp oil engine, one 15-kw generator, one booster generator, one four-panel automatic switchboard with automatic service for regulator, one 63-cell, 120-amp-hr. storage battery complete. Machinery has already been purchased. Mr. Geigler, of the Globe El. Co., of Milwaukee, Wis., is engineer in charge of the work. Walter Shave is interested in the company.

LE SUEUR, MINN.—The town of Le Sueur may possibly purchase a 75-kva generator for the municipal electric-light plant during the coming summer. George Sunderman is superintendent.

LITTLE FALLS, MINN.—Preparations are being made by the Little Falls Wtr. Pwr. Co. of Minnesota for the construction of a new concrete dam next summer, to cost from $60,000 to $70,000. The company also proposes to erect a new power house in 1915. John L. McCague, of Omaha, Neb., is president of the company.

MINNEAPOLIS, MINN.—Bids will be received by George H. Hayes, comptroller University of Minnesota, Minneapolis, until Feb. 12, for the erection of service building, Elliott Hospital, at the University of Minnesota, Minneapolis, including the general contract work, heating and ventilating, plumbing and electrical work, in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capital Bank Building, St. Paul, Minn. Bids will be received collectively and separately. Copies of plans and specifications may be seen at the Builders' Exchange in St. Paul and Minneapolis and at the office of the comptroller.

ALLISON, IA.—Plans are under way for submitting the question of bonding the town for the installation of a municipal electric-light plant to the voters.

CRESTON, IA.—The Creston Mutual El. Lt., Ht. & Pwr. Co. has erected transmission lines to Afton, a distance of 10 miles, and has also installed one 750-hp cross-compound Corliss valve Ball engine, one 250-hp Heine boiler, one 400-kw General Electric generator and one 40-hp, 2200-volt motor-driven exciter. George E. Cornelius is manager.

DENISON, IA.—At an election held recently the proposal to issue $65,000 in bonds for the purchase of the local electric-light plant and for extensions and improvements to same was carried.

INDEPENDENCE, IA.—The city of Independence has recently purchased two horizontal tubular boilers (150 hp, 72 in. by 18 ft., 150-lb. pressure) from the Murray Iron Works, Burlington, Ia., for the municipal electric-light plant. George D. Warren is superintendent.

MARSHALLTOWN, IA.—The city of Marshalltown expects to purchase electrolier posts (not yet decided when) for the municipal street-lighting system. Door L. Lamb is superintendent of parks and public property.

MASON CITY, IA.—The installation of a municipal electric-light plant in Mason City is reported to be under consideration.

GALT, MO.—A 20-year franchise has been granted to Jacob H. Nulf and Norman D. Jordan, of the Union Lt. & Pwr. Co., of Kansas City, to install and operate an electric-light plant in Galt, together with a street-lighting contract. Work will begin immediately on the installation of the system.

LAREDO, MO.—The City Council has granted Jacob H. Nulf and Norman D. Jordan, of the Union Lt. & Pwr. Co., of Kansas City, a 20-year franchise to construct and operate an electric-light plant in Laredo, subject to the approval of the voters.

SIBLEY, MO.—Bonds to the amount of $18,000, it is reported, have been voted for the installation of a municipal electric-light and power plant.

TARKIO, MO.—The Tarkio El. & Wtr. Co. expects to erect a transmission line and to purchase poles, wires and insulators for same. W. F. Marshall is manager.

WARRENTON, MO.—Within the next three months a new street-lighting system (consisting of about 40 tungsten lamps) will be installed in connection with the A. F. Sievert electric-light plant; some line material and several transformers will be purchased within the next three months.

COGSWELL, N. D.—Within the next 12 months the Cogswell El. Lt. & Pwr. Co.

expects to purchase a 10-hp to 15-hp gas engine and a 7½-kw to 10-kw generator. H. L. Saylor is secretary.

FORDVILLE, N. D.—The village of Fordville is reported to be contemplating the installation of a combined electric-light plant and fire protection system and would like to correspond with firms and parties interested. For further information address the secretary of the Commercial Club of Fordville.

LARIMORE, N. D.—Within the next three months the town of Larimore expects to purchase one 30-hp Muncie oil engine; also within the next six months 36 lamp-posts and fittings for street-lighting. N. J. Powell is auditor and manager.

LIDGERWOOD, N. D.—The Lidgerwood Mill Co. expects to purchase within the next 12 months a 60-kva generator and an 80-hp to 100-hp steam engine (directly connected), an automatic voltage regulator and meters as needed. W. R. Movius is president.

SHELDON, N. D.—The Village Board is contemplating the installation of a street-lighting system.

VALLEY CITY, N. D.—The electric light commissioners expect to purchase within the next six months two 250-hp boilers, 175-lb. pressure, with superheaters for 150 deg., one tub-transformer and 25 series arc lamps. O. N. Bergman is superintendent.

WYNDMERE, N. D.—We are informed that an electric-light plant will be established in Wyndmere in the spring, but it has not yet been definitely decided whether it will be a municipally owned or a private plant. If a municipal plant is decided upon, it will be submitted to the voters on March 18. As yet an engineer has not been engaged.

AURORA, NEB.—Within the next two months the Aurora El. Co. expects to erect a new building, remodeling walls, roofs, etc., adding new front additions (58 ft. by 25 ft.) for offices, workshop, meter room and supply room, for which contract has been awarded to the Middle West Construction Co., of Lincoln, Neb. The company also expects to purchase some electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, switches, etc. Earl A. McCreery is secretary and manager.

BLAIR, NEB.—The Blair El. Lt. & Pwr. Co. has recently purchased a 14-in. by 36-in. Corliss engine and a 120-kw Westinghouse generator with switchboard. E. V. Capps is local manager.

ELWOOD, NEB.—The electric light and water-works commission expects to purchase a 60-hp engine and a 35-kw direct-current generator. It is not yet decided when the contracts will be placed. O. E. Coate is superintendent of the electric-light department.

HEBRON, NEB.—It is expected that an ornamental street-lighting system (consisting of about 30 posts) will be installed some time between now and May 1, 1914. O. P. Hess is superintendent of the municipal electric-light plant.

SPENCER, NEB.—Within the next five months Wood Brothers, owners of the local electric-light plant, expect to erect a new building.

EUREKA, KAN.—At an election held Jan. 20 the proposal to establish a municipal electric-light plant was defeated. R. M. Wilson, proprietor of the local electric-light plant, whose franchise has expired, will ask for a new franchise in the near future.

STOCKTON, KAN.—The city of Stockton has recently awarded a contract to the Merkle-Hines Machinery Co., of Kansas City, Mo., for an 8-in. by 19-in. Smith-Valle triplex pump directly connected to a 30-hp General Electric 2200-volt, three-phase motor. O. M. Goodrich is superintendent.

WICHITA, KAN.—The Kansas City Gas & El. Co., of Wichita, expects to purchase within the next 12 months 1200 kva in transformers (from 5 kva to 50 kva), 300 poles (30 ft. to 60 ft.), 4000 insulators (2300 volts), 75,000 lb. weather-proof insulated copper wire (sizes 0000 to No. 10), 300 alternating-current, 110-volt, two-wire and three-wire, 5-amp to 10-amp meters; also 800 series tungsten lamps (80-watt and 100-watt) and 50 series magnetic arc lamps, 1000 electric irons and 700 miscellaneous devices. J. H. La Grant is purchasing agent and Theodore Slade is assistant to manager.

Southern States

HENDERSONVILLE, N. C.—The Hendersonville Lt. & Pwr. Co. expects to erect a power house (No. 2) on the Big Hungry River within the next three months. The work will be done by the company under the charge of W. H. Bangs, engineer and superintendent. Within the next three months the company also expects to purchase a 150-kw to 175-kw, three-phase, 60-cycle, 2300-volt generator (900 r.p.m.) and waterwheels to drive same. R. M. Oates is president.

HIGH POINT, N. C.—Within the next six months the electric light commission expects to erect about 1 mile of distribution line in the suburbs. A distribution line about 2 miles long has been erected to the rural districts at the expense of the customers along the lines. H. C. Bulla is manager.

KINGS MOUNTAIN, N. C.—The managers of the municipal electric-light plant would like to receive catalogs and prices on vacuum cleaners. G. T. King is superintendent of the municipal electric-light plant.

MOORESVILLE, N. C.—The town of Mooresville will erect immediately a substation and 1 mile of three-phase transmission line for power load. It will also purchase within the next few months an ornamental street-lighting system for the business section. James L. Donald is superintendent.

NORTH WILKESBORO, N. C.—The town commissioners are contemplating the installation of an engine and boiler as auxiliary to water-power for the municipal electric plant.

ROANOKE RAPIDS, N. C. — The Roanoke Rapids Pwr. Co., it is reported, contemplates the installation of an electric plant. The company already has a franchise to operate in Roanoke Rapids.

TROUTMANS, N. C.—The installation of an electric-light plant is reported to be under consideration by the town officials.

WENDELL, N. C.—Bonds to the amount of $15,000 have been voted for the installation of a municipal electric-light plant. It is reported that a site, including dam and building on the Little River, has been purchased. Electricity will be transmitted 4 miles. The contract for installing the plant is said to have been awarded to the J. W. Smith El. Co., of Norfolk, Va.

WILMINGTON, N. C.—Within the next three months the Tidewater Pwr. Co., of Wilmington, expects to purchase one 500-kw rotary converter with switchboard for same; also within the next few months to purchase a complete street-lighting system (type undecided) and the usual amount of electrical appliances and supplies. Raymond Hunt is superintendent of electrical department.

LAKE CITY, S. C.—Bids will be received by the Board of Public Works, Lake City, S. C., until Feb. 10, for the installation of an electric-light plant, in accordance with plans and specifications on file in the office of the board; also for prices on engine, boiler, generator and electrical equipments for a 100-hp plant.

WEST UNION, S. C.—The construction of a hydroelectric plant at Rhett Shoals on Big Cane Creek, 2 miles below West Union, is reported to be under consideration by W. A. Strothers and J. W. Bell, of Walhalla. Electricity generated at the plant will be transmitted to West Union and Walhalla.

VALDOSTA, GA.—We are informed that G. I. Tilman, civil engineer, of Whigham, will have charge of the construction of the proposed power plant on the Willachoochee River. A. B. Langford, of Valdosta, reported in the issue of Jan. 10 to be making preliminary surveys for the proposed plant, is interested in the project.

JACKSON, TENN.—The citizens on Jan. 19 voted in favor of issuing $25,000 in bonds for extensions and improvements to the municipal electric-light plant. J. L. Williamson, of Jackson, is engineer in charge.

NASHVILLE, TENN.—The Nashville Trac. Co., which proposes to build a new street railway line in Nashville, will begin operation as soon as the city commissioners approve the application of the company for certain rights-of-way. The company has contemplated building a power plant in the Green River coal fields, 85 miles from this city, but now that the city has obtained a reduction in coal rates, this plan may be abandoned and a power plant erected in the city. One of the propositions reported to be under consideration is securing the municipal light and power plant in the event that the city contracts with the Tennessee Pwr. Co. for hydroelectric power, which has been discussed.

RICHTON, MISS.—The installation of an electric-light plant in Richton is under consideration. John MacDonald and others are reported to be interested in the project.

CAMDEN, ARK.—The Arkansas Pwr. Co., recently incorporated, has purchased the plants of the Camden Pwr. Co., of Camden, the Malvern El. Co., of Malvern; the Arkadelphia El. Lt. Co., and the Wilson Wtr. & El. Co., both of Arkadelphia, and the Standard Ice & Lt. Co., of Magnolia; J. H. Meek, of Fordyce, is president of the company, J. W. Lee, of Malvern, treasurer, and J. L. Longino, of Little Rock, secretary.

HOT SPRINGS, ARK.—The Citizens' El. Co., of Hot Springs, controlled by the Federal Lt. & Trac. Co., of New York, N. Y., has erected a new turbine station with an output of 2825 kva and has purchased four 316-hp Heine boilers, one 1250-kva General Electric turbine, two 300-kw General Electric motor-generator sets for railway service and one 20-panel switchboard. It has also erected 2 miles of trunk line from new power house to distributing points. W. A. Haller, 60 Broadway, New York, N. Y., is general superintendent of the Federal Lt. & Trac. Co.

RUDDELLS, ARK.—The Arkansas Lime Co., it is reported, expects to purchase a 180-kw, 220-volt direct-current generator, with switchboard complete and 12 motors from 10 hp to 40 hp each.

NATCHITOCHES, LA.—The city of Natchitoches expects to purchase within the next four months one 10-hp pumping plant for the Normal School; also within the next six months one 50-kw generating unit, consisting of generator and engine (three-phase, 60 cycles, 2300 volts) and switchboard, material for 1 mile of line (primary and secondary) for residential lighting. W. E. Aymond is superintendent.

VINTON, LA.—Bids will be received by the parish school board of Vinton, La., for the erection of a two-story (17-room) brick school building until Feb. 10. Plans and specifications may be obtained from A. H. Humphrey, architect, of St. Charles, upon deposit of $5, which will be refunded upon return of same. Heating, plumbing and electric wiring will be in separate contracts. F. M. Hamilton is secretary and treasurer of board.

WINTHROP, LA.—It is understood that an electric-light plant will soon be installed in Winthrop, for which a franchise has been granted.

BOWIE, TEX.—The Bowie Lt. & Pwr. Co., recently incorporated, has taken over the electric plant of the Bowie El. Lt. & Pwr. Co., which it will operate until the new plant is completed. Plans have not yet been completed for new equipment. W. C. Woodlief, P. O. Box 1615, Dallas, Tex., is engineer in charge of the work. The general office of the company is at 1006 Commonwealth Building, Dallas, Tex.

CAMERON, TEX.—The Cameron Wtr., Pwr. & Lt. Co. is contemplating enlarging its plant during the coming year. The company is considering adding to its equipment a 250-kw engine-driven generator, but no definite conclusion has been reached. The Scott Consulting Engineering Co., of Dallas, Tex., has charge of the engineering work for this company. C. W. Lawrence is secretary and manager.

DALLAS, TEX. — Extensive improvements are contemplated by the Dallas Consol. El. Ry. Co., involving an expenditure of $6,000,000, to include double-track viaduct across Trinity River bottom to Oak Cliff, additional equipment for power station, improvements and extensions to carshops and carhouses, interurban terminal building, completion of underground electric wiring, etc. The Stone & Webster Engineering Corpn., of Boston, Mass., has charge of the work.

EL PASO, TEX.—The El Paso El. Ry. Co., it is reported, contemplates the installation of a 4000-kw turbo-generator with condenser and switchboards, 2600-hp Babcock & Wilcox boilers, 1000-kw motor-generator set for railway service and additional cooling tower. The Stone & Webster Engineering Corpn., of Boston, Mass., has charge of the work. H. S. Potter is general superintendent.

PECOS, TEX.—The City Council is contemplating the installation of an ornamental street-lighting system in the business district.

SAN ANGELO, TEX.—J. D. Sugg, owner of the local street railway system, is contemplating extensions to the system and the erection of a new power plant.

Pacific States

MOUNT VERNON, WASH.—Preliminary plans have been prepared by the Pacific Northwest Trac. Co., of Mount Vernon, for extending its transmission lines from here to La Conner. Electricity will be supplied to farmers along the line. The Pacific company, it is reported, will purchase the power plant of the La Conner Pwr. Co.

TACOMA, WASH.—The Pacific Iron & Steel Co., of Tacoma, has recently signed a five-year lease with the city of Tacoma for a tract of tideland on the Middle Waterway, where it will build an electric blast smelter, at a cost of about $50,000. Five furnaces will be installed. The first unit will be in operation by April 15, and other units will be installed at once. George Lewis Casey, of Seattle, is president.

TACOMA, WASH.—Bids will be received by Nicholas Lawson, commissioner of light (closing date not yet announced), for furnishing material for the proposed cluster-lamp system, to cost $36,000, as follows: 31,500 ft. of No. 8 5000-volt, steel-taped cable; 2500 ft. No. 10 duplex 5000-volt cable; 252 6.6-amp inverted luminous arc lamps, 246 metal posts, 255 series cut-outs, 15,000-volt insulation; five 6.6-amp, series-arc mercury rectifier sets, without switchboard panel. Bidders may submit bids on any or all units.

EUGENE, ORE.—Plans for the installation of electrical equipment at the Springfield mill of the Booth-Kelly Lumber Co. provide for about 2500 hp in motors ranging from 5 hp to 300 hp. Motors over 50 hp will be 2200-volt, three-phase, and under 50 hp will be 440-volt, three-phase. General Electric equipment will be used throughout. Electricity for operating the plant will be furnished by the Oregon Pwr. Co. from its Springfield plant. A switchboard will be installed in the machine room. All transformers will be of oil-cooled General Electric type and will be installed in concrete vaults. It is expected to have the plant in operation by July 1, 1914. The installation was designed by R. G. Sittler, of the West Coast Engineering Co., of Portland, Ore.

CHICO, CAL.—Plans are being considered for the installation of a new street-lighting system in Chico.

COACHELLA, CAL.—Application has been made to the State Railroad Commission by the Electric Ser. Co. for authority to issue $75,000 in capital stock for the erection of an electric plant in the Coachella Valley. James H. Northrup, Roger G. Lewis and Nolan B. Stadley are interested in the company.

SAN BERNARDINO, CAL.—The Southern Sierras Pwr. Co. is preparing plans to enlarge its plant at Barstow and to extend its distribution system to cover the entire city of San Bernardino. The company plans to furnish many of the ranchers in the Mojave Valley with electricity for lamps and motors. W. W. Brison is district manager.

SAN LUIS OBISPO, CAL.—Plans have been submitted to the City Council for lighting the business section of the city with electroliers. The estimates provide for the installation of 101 standards, carrying three lamps each (two 60-watt lamps and one 100-watt lamp), to cost about $12,000.

SAN RAFAEL, CAL.—The Council has passed a resolution authorizing the erection of 97 electroliers along Fourth Street from East Street to Tamalpias Avenue and on B Street from Second to Sixth Street. The cost of the system is estimated at about $10,000.

WOODLAND, CAL.—The State Water Commission has granted the Yolo Wtr. & Pwr. Co. permission to appropriate 500 second-ft. of water from Cache Creek, the outlet of Clear Lake. The company proposes to irrigate 150,000 acres of land in Yolo County, near Woodland. It is estimated that 50,000 hp can be developed under the permit granted the company.

KELLOGG, IDAHO.—Within the next six months the Long Valley Lt. & Pwr. Co., of Kellogg, expects to erect about 10 miles of 6600-volt transmission line; also to purchase one 300-kva generator, a 500-hp waterwheel and four 25-kva transformers. Walter C. Clark is president.

NEW MEADOWS, IDAHO.—The Adams County Lt. & Pwr. Co., of New Meadows, has secured a site on the Little Salmon River for its proposed hydroelectric power plant. The proposed plant will be equipped with 370-hp waterwheels, 250-kw generator, switchboard, etc., and three 150-kw transformers for generating station. Substations in Meadows and New Meadows will be equipped with three 50-kw transformers; Council and Cambridge, three transformers, 50 kw each; Midvale, three, 75 kw each; McCall, three, 25 kw each, and Tamarack, three 75-kw transformers; 2600 cedar poles will be used for 81 miles of three-phase overhead lines; the number of lamps and meters not decided upon. The company will do all its wiring and will carry wiring supplies for inside work to the amount of $5,000. Electricity is furnished by the company in Cambridge with a temporary hydraulic installation. The company will do all its own work. No contracts have yet been placed for equipment of hydroelectric plant. W. H. Hill, of Grangeville, is engineer in charge. B. Gustad is president and general manager.

DEER LODGE, MONT. — The Deer Lodge El. Co. expects to purchase a carload of poles, three or four transformers, wire, meters, etc. H. H. Zenor is secretary and treasurer.

GLENDIVE, MONT.—Within the next six months the Glendive Ht., Lt. & Pwr. Co. expects to build a new plant, equipped with one 500-kw steam turbine, one 300-kw steam turbine, with boilers, switchboard, smokestack, coal conveyor, etc. Frank C. Hughes is manager.

LAMAR, COL.—The Intermountain Ry., Lt. & Pwr. Co., it is reported, will apply to the City Council for a franchise to install and operate an electric-light and heating plant in Lamar.

TRINIDAD, COL.—A movement has been started by the Chamber of Commerce for the installation of an ornamental street-lighting system, which includes the erection of a large electric arch at the gateway of the city. A. L. Branson, Eli Jeffreys and V. M. Friar are interested.

ELKO, NEV.—Within the next 12 months the Elko-Damoille Pwr. Co., of Elko, expects to purchase electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, switches, etc. The company purchased on Dec. 1, 1913, the gas-engine-driven plant of the Elko Wtr. & Lt. Corpn. B. G. McBride is manager.

ALAMOGORDO, N. M. — Within the next three months the Alamogordo El. Lt. & Pwr. Co. expects to purchase one 120-hp engine (Diesel type) and an 80-kw generator.

LAS CRUCES, N. M.—Within the next six months the Las Cruces El. Lt. & Ice Co. expects to purchase one or more boilers (probably 200 hp each). D. W. Morgan is manager.

PORTALES, N. M.—Within the next six months the city of Portales expects to purchase 54 poles and eight or ten 5-hp motors. W. E. Keeter is manager.

TUCUMCARI, N. M.—Within the next two months the Tucumcari Lt. & Pwr. Co. expects to purchase 27,000 ft. No. 6 weatherproof wire and 50 30-ft. poles, one 5-kw regulating transformer and 30 ornamental brackets for series tungsten lamps. S. B. Richey is resident manager.

Canada

LETHBRIDGE, ALTA.—Tenders will be received until Feb. 9 for the installation of an electric passenger elevator, including motor, generator, etc., for a public building at Lethbridge. Plans and specifications may be obtained from the Department of Public Works, Ottawa, Ont. R. C. Desrochers is secretary.

VICTORIA, B. C.—The Stamp Falls Pwr. Co. has been organized to take over the Ritchie Agnew Pwr. Co. and the British Columbia Hydraulic Pwr. Co. on Vancouver Island. It is understood that the new company will install new equipment and make extensive additions to the plants.

WINNIPEG, MAN.—Tenders will be received by the Board of Control, Winnipeg, until Feb. 20, for furnishing overhead construction and line materials required by the city Light and Power Department during the year 1914. Plans and specifications may be obtained from the office of the Light and Power Department, 54 King Street, Winnipeg. M. Peterson is secretary of the board of control.

BERLIN, ONT.—The City Council is contemplating asking the Hydro-Electric Commission of Ontario to prepare a report of the probable cost and feasibility of erecting a transmission line from Berlin to Woodstock, via New Dundee, Plattsville and Tavistock; it is also proposed to discuss the question of extending the township lines in Waterloo County.

LONDON, ONT.—The London El. Co. is contemplating making additions to its power house and equipment, to cost about $125,000. C. T. Barnes is manager.

MOOSE JAW, SASK.—It is reported that provision is being made by the government for the installation of a power house to furnish power for the new elevators at Moose Jaw. It is understood that a gas-producer plant will be installed. This will increase the cost of the elevator plant from the original estimate of $1,200,000 to $1,500,000.

SASKATOON, SASK.—New equipment is being installed at the municipal power plant, including a 3200-kw turbo-generator and condensing equipment, supplied by the Canadian Westinghouse Co.; also two centrifugal pumps with a rating of 86 hp and 110 hp respectively, with a combined capacity of 7200 imperial gallons. T. G. McIntosh is secretary.

Mexico

MEXICO CITY, MEX.—Application has been made to the federal government by Antonio Villa Ahiji and Faustino E. Moranda for a concession for the use of the waters of the Rio Blanco and the Los Xuxchites waterfall, in the State of Vera Cruz, the power to be used to generate electricity.

Miscellaneous

PANAMA.—Bids will be received by the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Feb. 6, for electrical cable, conduits and fittings and miscellaneous electrical apparatus, steel shapes and plates, steel reinforcing bars, valves, etc. Blanks and general information relating to this circular (No. 824) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

AUCKLAND, N. Z.—Tenders will be received by S. Irwin Crookes, consulting engineer, 14 Palmerston Buildings, Auckland, N. Z., until March 26, for equipment of hydroelectric power plant of the Dominion Portland Cement Co., New Zealand, at Wairua Falls as follows: Section 1—hydraulic equipment, including turbines with a rating of 1500 hp each, governors, valves, etc.; section 2—generators with a rating of 1000 kw each, exciters, automatic regulators, etc. Specifications and drawings may be obtained at the office of A. S. Lascelles & Co., Maritime Buildings, 8-10 Bridge Street, New York, N. Y. For details see proposal pages.

New Incorporations

WILMINGTON, DEL.—The Huntsville Consol. Gas Co. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000 for the purpose of generating and selling electricity and gas for lamps, heaters and motors. The incorporators are: F. D. Buck, B. M. Grawl and G. W. Dillman, of Wilmington.

DAWSON SPRINGS, KY.—The Dawson Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by D. B. Kevil. J. S. Kevil and E. A. Stevens.

LOUISVILLE, KY.—The Standard Ltg. & Htg. Co., of Louisville, has been incorporated with a capital stock of $1,000 to establish a plant. T. C. H. Vance, Inter-Southern Building, Louisville, is in charge.

ROCKCASTLE, KY.—The Mount Vernon Pwr. Co. has been incorporated with a capital stock of $5,000 by L. W. Bethurum, E. S. Albright, C. D. Sutton and others.

WAYLAND, N. Y.—The Wayland-Steuben Pwr. Co. has been chartered with a capital stock of $50,000. The incorporators are V. M. Kimmel, J. Kimmel and O. F. Kiefer, of Wayland.

CLEVELAND, OHIO.—The Guttentag Lt. Co. has been incorporated with a capital stock of $5,000 by Harry Guttentag, A. M. Wittenberg, J. B. Wulkom and Sidney Mendelson.

PORTLAND, ORE.—The Garibaldi Pwr. Co. has been incorporated with a capital stock of $15,000 by Charles J. Schnabel, Newton C. Smith and J. B. Ofner.

LUDLOW, PA.—A charter has been granted by the State Department for the Ludlow El. Co. to operate in Hamilton Township, in conjunction with the Ludlow Natural Gas Co. The company is capitalized at $15,000. The incorporators are Homer Shoemaker, George R. Barnett and E. E. Barnitz.

MARION, S. D.—The Marion Lt. & Pwr. Co. has been incorporated with a capital stock of $25,000 by J. A. Hereen, John Groepel, M. H. Dains and S. H. Dains, of Marion.

BANGS, TEX.—Articles of incorporation have been filed for the Bangs Fuel & Lt. Co. with a capital stock of $10,000. The incorporators are James W. Wayman, Charles Hart and R. F. Hart.

MEADOW VIEW, VA.—The Edmonson El. Co. has been incorporated with a capital stock of from $5,000 to $25,000. The officers of the company are: D. H. Edmonson, president, and S. W. Edmonson, secretary, both of Meadow View.

SEATTLE, WASH.—The Pwr. Devel. Co. has been incorporated with a capital stock of $100,000 by W. S. Summers, Frank MacKean, H. S. Volkmar and others.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 20, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,084,595. Booster Regulation; C. Ambruster and H. M. Beck, Chicago, Ill. App. filed March 24, 1906. For compelling or controlling the charge or discharge of a battery.

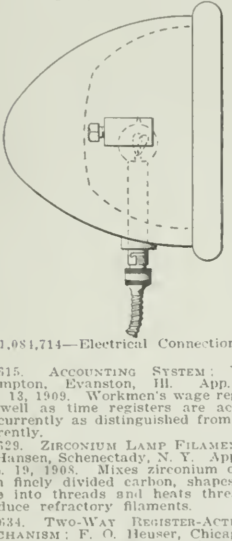
1,084,610. Railway Signaling System; W. J. Cook, Denver, Col., and S. Deutsch, Chicago, Ill. App. filed Aug. 29, 1911. Block system including normally closed circuit with electromagnet and intermittently closed circuit with motor for moving semaphore arm.

1,084,611. Accounting Device; W. J. Crumpton, Superior, Wis. App. filed June 11, 1908. For accounting and indicating at all times the time or wages to be credited to a large number of workmen. (Sixty-seven claims.)

1,084,612. Automatic Accounting System; W. C. Crumpton, Evanston, Ill. App. filed March 6, 1909. Register-actuating arrangement for time or wage accounting. (Fifty-eight claims.)

1,084,613. Accounting System; W. J. Crumpton, Evanston, Ill. App. filed May 26, 1909. Time, wage, job and cost accounting. (Eighty-seven claims.)

1,084,614. Accounting System; W. J. Crumpton, Evanston, Ill. App. filed Sept. 16, 1909. Wage and cost accounting system, including individual as well as totalizing register.



1,084,714—Electrical Connection

1,084,615. Accounting System; W. J. Crumpton, Evanston, Ill. App. filed Oct. 13, 1909. Workmen's wage registers as well as time registers are actuated concurrently as distinguished from intercurrently.

1,084,629. Zirconium Lamp Filament; C. A. Hansen, Schenectady, N. Y. App. filed Feb. 19, 1908. Mixes zirconium oxalate with finely divided carbon, shapes mixture into threads and heats threads to produce refractory filaments.

1,084,634. Two-Way Register-Actuating Mechanism; F. O. Heuser, Chicago, Ill. App. filed April 16, 1909. The register reading is increased or decreased according to the direction in which the armature of an electromagnet is actuated.

1,084,641. Advertising Device; H. J. Keating, Chicago, Ill. App. filed Aug. 6, 1912. Includes a solenoid for lifting the arm of an advertising figure.

1,084,645. Electrical Appliance; J. H Lehman, New York, N. Y. App. filed Dec. 3, 1912. Circuit-breaker for magneto and distributor used for ignition purposes.

1,084,657. Cover for Telephonic Apparatus; G. H. Nash, Highbury, London, Eng. App. filed Jan. 9, 1911. Cover for electromagnetic relay having movable contact points.

1,084,660. Accounting System; A. F Poole, Chicago, Ill. App. filed June 11, 1908. Individual wage and time registers are actuated by a step-by-step movement controlled by electromagnetic means.

1,084,661. Accounting System A F Poole, Chicago, Ill. App. filed April 9, 1910. The particular rate at which a certain individual register shall be operated is determined by inserting a connecting plug in any particular jack.

1,084,669. Accounting System; C. H. Tallmadge, Chicago, Ill. App. filed March 1, 1909. Each workman has assigned to him a wage register which automatically indicates the amount of wages he has earned.

1,084,670. Piecework-Accounting System; C. H. Tallmadge, Chicago, Ill. App. filed Dec. 20, 1909. For indicating the wages of a workman who is employed on piecework.

1,084,672. Automatic Time-Accounting Device; A. A. Thomas, Chicago, Ill. App. filed Nov. 18, 1908. Electrically actuated device operates register at end of periodic intervals, the workman being required to close his switch at the beginning of an interval.

1,084,673. Spot-Welding Machine; E. Thomson, Swampscott, Mass. App. filed May 10, 1913. Transformer mounted on a pedestal and the welding electrodes are supported vertically in line with the transformer.

1,084,674. Maintaining a Constant Power-Factor in a System of Distribution; A. A. Tirrill, Schenectady, N. Y. App. filed Aug. 20, 1908. Automatically regulates the field excitation of the synchronous machine in response to changes in the power-factor.

1,084,684. Accounting System; L. A. Williams, Evanston, Ill. App. filed Jan. 26, 1909. Each register has two indicators, one for wages and one for time.

1,084,685. Accounting System; L. A. Williams, Evanston, Ill. App. filed Feb. 11, 1909. A waste-wage register is actuated when the workman is not employed on a specific job and ceases actuation when actuation of the job register begins.

1,084,686. Automatic Time-Accounting Device; L. A. Williams, Evanston, Ill. App. filed Feb. 24, 1911. For automatically taking account of the workman's time or wages.

1,084,698. Controller for Electric Motors; J. H. Hall, Cleveland, Ohio. App. filed Oct. 16, 1912. Motor is first connected to the supply circuit through a transformer and then directly to the supply circuit.

1,084,703 Electric Cut-Out; A. V. A. McHarg, New York, N. Y. App. filed April 30, 1913. Cut-out block for three-wire system.

1,084,706. Fuse Plug; T. E. Murray, New York, N. Y. App. filed June 9, 1913. Fuse plug of the type adapted to enter between pairs of spring contacts.

1,084,714. Electrical Connection; J. C. Stearns, Worcester, Mass. App. filed March 22, 1913. For connecting an armored cable with a lamp or the like.

1,084,720. Electric Meter; G. M. Willis, Chicago, Ill. App filed Jan. 5, 1910. Has a cover plate protecting the armature and special terminal posts sealed to prevent accessibility.

1,084,721. Shunt for Measuring Instruments. G. M. Willis, Chicago, Ill. App. filed Feb. 17, 1911. Shunt adapted for use with any particular electrical instrument.

1,084,722. System for Electrical Distribution, J. L. Woodbridge, Philadelphia, Pa. App. filed April 19, 1904. Includes a "floating" battery arranged to do more or less regulation of the station load.

1,084,723. Dynamo-Electric Machine; J. L. Woodbridge, Philadelphia, Pa. App. filed April 20, 1909. Constructed to give a constant single-phase current output.

1,084,741. Electrical System of Distribution; R. C. Hull, Philadelphia, Pa. App. filed Oct. 25, 1911. Controls field excitation of variable-speed dynamo to give substantially constant potential.

1,084,745. Electric Primer; C F. Lindsay, Fairfield, Conn. App. filed Sept. 8, 1913. Constructed so that all pressures exerted in the primer tend to tighten the parts, making it absolutely gas-tight.

1,084,765. Signaling System for Railways; J. D. Taylor, Edgewood Park, Pa. App. filed June 17, 1908. Of the type in which the track rail forms the return path for the propulsion current.

1,084,780. Signaling System; C. E. Beach and H. W. Doughty, Binghamton, N. Y. App. filed April 9, 1912. Provides indicating means so that it can be quickly ascertained which auxiliary station was the one actuated.

1,084,809. Light-Reflecting Device; E. C. McKinnie, Chicago, Ill. App. filed Jan. 30, 1913. Semi-indirect lighting fixture.

1,084,822. Loud-Speaking Attachment for Telephones; H. W. Prance, London, Eng. App. filed June 25, 1913. Trumpet supported in connection with a telephone receiver.

1,084,856. Method of Manufacturing Phosphoric Acid; M. M. Haff, Ottawa, Ontario, Canada. App. filed Sept. 27, 1913. Electrically heats silicious material with phosphatic material.

1,084,877. Electric Heating Table or Counter; E. C. Cary, Baltimore, Md. App. filed Feb. 24, 1913. Table with recesses for the dishes or pans and electric heaters in said recesses.

1,084,907. Tactical Naval Tracer; F. Spalazzi, Rome, Italy. App. filed June 17, 1911. Automatically records the course of the ship and also on the same sheet the course of an enemy's ship.

1,084,910. Method of Localizing Faults in Cables and Circuits; J. H. J. A. Stephenson, Hamburg, Germany. App. filed Nov. 14, 1911. Machine which indicates automatically and without calculation the distance of a fault in the cable.

1,084,924. Magneto-Electric Generator; M. C. Brenot, Issy-les-Moulineaux, France. App. filed March 18, 1912. Special form of mechanical interrupter.

1,084,809—Light-Reflecting Device

1,084,926. Hand-Lamp; C. F. Burgess, Madison, Wis. App. filed Sept. 13, 1913. Has an adjustable focusing lens for focusing or dispersing the light.

1,084,931. Starter and Ignition Control; J. B. Entz, Cleveland, Ohio. App. filed Jan. 18, 1913. Eliminates the possibility of premature ignition when engine is being turned over by the starter.

1,084,932. Testing Device for Jump-Spark Ignition Systems; T. H. Estes, Texarkana, Tex. App. filed Oct. 28, 1912. Insulating handle with a wire bent to form two parallel spaced bridging terminals.

1,084,936. Electric Ground Clamp; R. R. Forbes, Mount Holly, N. J. App. filed Dec. 20, 1911. Adjustable to fit pipes of different sizes.

1,084,991. Furnace for Refining Metals; E. C. Wills, Frederick, Md. App. filed Jan. 30, 1913. Electric furnace mounted to rock for the purpose of air treatment and to eliminate the dross.

1,085,011. Equipment for Locomotives; C. L. Bopp, Waterloo, Ia. App. filed March 14, 1912. Brush attachment for taking current from a third-rail for signaling purposes.

1,085,036. Selective Apparatus; G. H. Groce, Chicago, Ill. App. filed Dec. 7, 1908. Employed where it is necessary to operate apparatus at a plurality of stations selectively and independently.

1,085,069. Telautographic Apparatus; G. S. Tiffany, Summit, N. J. App. filed April 5, 1912. Employs magnets of the consequent-pole type instead of those of the salient-pole type previously used.

1,085,089. Process of Electric Welding; L. S. Lachman, New York, N. Y. App. filed Aug. 12, 1910. Longitudinal and transverse members welded by partially embedding one in the other and subjecting to welding current and pressure.

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Qualifications of Commissioners A number of vacancies are to be filled in the Public Service Commissions of New York, and the Governor is now being importuned to heed the recommendations of various factions in making choice of fit persons for the positions. We have already placed on record our estimation of what should be the make-up of a properly constituted public service commission. Based solely on a survey of the work of commissions and bearing in mind that no one body of men possesses a mortgage on all the brains of the country, we have maintained that one member should be an engineer of eminent qualifications, one an expert accountant, one an economist of repute, another a lawyer of broad experience, and a fifth member one who possesses special knowledge of transportation questions. Regulation has not yet been so rooted in the structure of the body politic that as a principle it can by either the public or the utilities be regarded as settled. Indeed, it is now being weighed in the balances, and if it is found wanting, municipal ownership and operation is the only logical outcome. Utilities should insist on regulation which is fearless and just, and this can only be obtained from truly representative commissions. Theirs is an economic and not a political function. A commission made up entirely of lawyers or politicians, though they may be beyond reproach, is not properly constituted for the work of public service regulation.

Emergency-Service Radio Apparatus Elsewhere in this issue mention is made of the fact that during the past few weeks radio inspectors in the United States Department of Commerce have refused to permit transatlantic steamships to leave United States ports because of defective wireless apparatus. It is decidedly unfortunate if such conditions are common, as the instances noted would seem to indicate. In case of accident at sea, which is likely to put the ship's engine room out of commission in short order, the storage-battery and induction-coil transmitter are relied upon to call for help by radio. When the emergency transmitter itself is put out of commission by a damp insulator or a defective interrupter, as in the two recent cases, the sublime confidence of the seagoing public in wireless as an all-potent savior would appear misplaced. It is high time that all passenger steamers were equipped with emergency or auxiliary transmitters which are really worthy of the name. The present fault is not the result of an inherent limitation of radio signaling itself, but, rather, of a policy of false economy in expenditures for equipment.

Uniformity in Service Rules In Wisconsin, as in many other states, there is an almost complete lack of uniformity on such matters as the policy to be followed in defraying the cost of making extensions of distribution lines, the amount of discount on bills, the amount of deposit required from customers, if any, and, in general, the rules affecting relations with customers. Complying with a suggestion of the Railroad Commission of the State, the Wisconsin Electrical Association has appointed a committee on uniform policies for electric distribution-system extensions and commercial-service rules. While it is, of course, improbable that complete uniformity in these respects can be effected all over the State, there seems to be no reason why like policies should not be adopted in communities of about the same size where like conditions prevail. In its work of applying to the electrical utilities of the State for information on these subjects the committee should receive the hearty support of all the electric-service companies and municipal plants in the State. Moreover, the subject could well be taken up by other state associations.

Energy Basis for Street Lighting The recommendations of a committee of the City Club of Milwaukee as to the steps to be taken for the solution of the street-lighting problem in that city, abstracted elsewhere in this issue, are of more than passing interest. The plan advocated is to contract with the city for the purchase of electrical energy for street lighting, on the kilowatt-hour basis, leaving the type of street-lighting equipment to be determined by the city and the purchase of such equipment to be made directly at the city's expense. One of the economic reasons urged for this plan is the elimination of any double payments for depreciation on equipment, but still more important is the flexibility of the plan which would enable the city to purchase improved street-lighting appliances as fast as would be justified on economic grounds without the political turmoil of a change of contract. At the present time there is a strong temptation for any central-station company to leave well enough alone and attempt to make no change in an existing street-lighting contract until it expires, unless the contract be for a much longer term than is now common. The plan proposed is not altogether novel, as some cities have purchased street-lighting energy on the kilowatt-hour basis for years, nor is it altogether new for the city to own the lamps and equipment. It is not devoid of merit as a substitute for the common present basis of so much per lamp year for a given type of lamp for a certain term of years. The ownership of the poles, conduits and wires used for street-lighting purposes should not, however, be carried to the point of unnecessary duplication of equipment of this type already owned by the supplying company.

Alternating-Current Supply in New York City

The station of the United Electric Light & Power Company on the Harlem River at 201st Street, New York, described in part elsewhere in this issue, serves to emphasize the rapid advances which have been made in central-station engineering practice in recent years. Its general scheme is characteristic of Murray design in that the arrangement of the coal and ash handling equipment, boilers, turbines, exciters, switches, control, etc., does not differ materially from that in the Waterside and other stations built by the same engineer. As in the other stations in New York City referred to, the aim has been to provide for any blowout, short-circuit or other accident in such a manner that the rest of the system, not directly affected, should not be tied up. To accomplish this result feeders, connections, leads, buses, etc., have been thoroughly insulated and isolated, so that trouble on one line cannot be communicated to another and thus interfere with continuity of service. The same precautions are seen in the underground distribution system connecting the 201st Street station with the Waterside stations of the New York Edison Company.

Chief among the noticeable features in the new station is its small boiler equipment compared to that in the Waterside Station No. 2, for instance. Each station is rated at 120,000 kw, and yet the 201st Street station of the United Electric company has only thirty-two boilers while the New York Edison station has ninety-six. This great difference in steaming capacity is due primarily to the use of bituminous coal and also to the better water rates of the turbines and auxiliary steam equipment. The Waterside boilers were designed to burn No. 3 buckwheat coal, which was hand-fired; but the increasing price of the low-grade anthracite has also compelled the adoption of bituminous coal and stokers there so that not all of the ninety-six boilers are now needed. The installation of horizontal turbines instead of vertical machines was to be expected in view of their size and in the light of recent design, and it is worthy of note that whereas the vertical turbines in the Waterside station operate at a speed of 750 r.p.m., the horizontal turbines in the 201st Street station have a speed of 1800 r.p.m. The water rate of the latter is also less by almost three pounds. The placing of the feed-water pumps in the basement of the turbine room with the turbine auxiliary equipment instead of in the boiler room coupled with the extra room allotted to the apparatus will no doubt show its effect in the saving of labor made possible thereby.

The past history of the United Electric Light & Power Company makes interesting reading. Formed for the express purpose of introducing alternating current in New York City, its growth has been steady despite its early handicaps and the great direct-current system of the New York Edison Company. Were it located in some other borough, away from the hypnotic spell of the well-advertised word Edison, it would be always thought of as one of the great electric companies of the country. Last year it disposed of as much electrical energy was generated by all of the electric-light stations of Rhode Island put together the year before. The company has with much foresight located its station at a strategic point, for the city is constantly growing in its direction, and sites along the waterfront are becoming scarce. Abundant water for condensing purposes is at hand in the Harlem River. The stream being also navigable, shipments of coal by boat can be received at all seasons of the year and at all stages of the tide. Considering all the natural advantages and the types of the units installed, the station from an operating viewpoint should not only be exceptionally easy to handle, but very efficient as well.

Parallel Operation of Transformers

If the grouped transformers have equal transformation ratios and equal reactance factors, then they will divide their load conformably, although not necessarily in proportion to their individual ratings. However, if either the transformation ratios differ or the reactance factors differ, then irregular behavior may be looked for, and some particular transformer may overheat considerably. Theoretically, improvement can be made in the condition by inserting an adjustable impedance into the circuit of the overloaded transformer, but this is a complicated and troublesome procedure that can seldom be resorted to in practice.

In an article of which we publish the first part in this issue Mr. Waldo V. Lyon deals with dissymmetrical parallel operation very thoroughly and in a somewhat novel way. He develops the general formula of the branch current in any one of a parallel group of transformers under an assigned joint load, and then considers the ideal vector components of current that each transformer would carry if all the members of the group were symmetrical and differed only in size. He then finds the local deviation current component in each transformer due to variation in the ratio of transformation, next the deviation component due to variation in reactance factor, and lastly the deviation component due to variation in impedance with respect to rated load. The actual current taken by each transformer is then the ideal current plus its three deviation components. The numerical work of finding the components is simple if the transformation ratios are all alike. When, on the contrary, the transformation ratios differ the numerical work is considerably increased.

It follows from what is indicated in the article that there are certain constants which pertain to a transformer and which may become important when the transformer is operated in parallel with others. These constants ought to be stated on the name-plate when the transformer is of any but the smallest sizes. The rated output, frequency, voltages and current are now generally indicated. In addition, it is very desirable that the ratio of transformation at rated load should be added, as well as the numbers of primary and secondary turns; also the short-circuit volts, amperes and apparent power, as measured on the high-tension side with the low-tension winding short-circuited. From such a set of specifications the behavior of any group of transformers operated in parallel could be predicated whenever it might be necessary to compute the probable result. In the absence of these additional data, the behavior of a motley group of parallel transformers is more or less a matter of good luck, and the work required to test the individual transformers in order to deduce the required data may be very troublesome and expensive to obtain.

Additional Anti-Trust Legislation

It is to be expected that the pending anti-trust legislation, based on the message of President Wilson, will be the subject of much discussion. Comments by some of the readers of the *Electrical World* are published elsewhere in this issue. Those who, at our request, have given expression to their opinion naturally touch on the points that seem to them to be the most important. These relate largely to the broad question of regulation of consolidated units. The holding company is discussed by one contributor, the proposed amendment of the Sherman law by another. In the meanwhile the program of the administration is receiving the active consideration of Congress. Already Mr. Brandeis and several others have appeared before committees of the House of Representatives to outline their views. It is to be supposed that after they have had their inning business men who are vitally affected will have a chance to be heard. If a chance is not offered freely, they should take steps to open the way and discuss publicly the effect of new laws upon their internal organization and prosperity.

We have urged this action before. It is urged again because there appears to be a disposition to withhold criticism of administration policies. If these policies are not in the best interest of business and the country, the time when business men should say so is now. If they do not say so, the public will take silence as consent. The country is on the eve of the most important legislation affecting general trade and industry to be enacted since the Sherman law. It has before it the President's general description of what he deems to be the voice and need of business. It has also the definite expression of the message in bills now under consideration in committees of Congress. It is tolerably certain that some legislation will follow. To this legislation business will have to conform. Conformity and prosperity will be better than conformity and disaster. That there may be prosperity it is desirable that the laws shall not roughly upset present reasonable practices. Business men know what these practices are. It is clearly their duty to have a part in the program.

Studies of the Vapor-Tube Lamps

In the Digest this week we publish an abstract of an important paper by Mr. J. Bujes on photometric studies of the Moore vapor-tube lamp made in the laboratory of the Technical High School at Charlottenburg, Germany. The studies were chiefly directed toward the matter of light distribution, of which the original paper contains an exhaustive account. A Moore tube lamp as a whole is difficult to investigate photometrically, since the continuous length is so great that one must work with the photometer far within the distance at which the variations from the inverse square law become embarrassing. One can, of course, dodge the difficulty to a certain extent by taking illumination measurements on the working plane, but in any inclosed space these are so dependent on the nature and position of the bounding surfaces that the results obtained are not easily comparable with those which would be reached under other circumstances. The method followed by Mr. Bujes is probably the most logical one for obtaining definite knowledge of what the tube will do. It consisted of building a temporary photometer room about a section of the tube installed, and then examining suitable elements of the tube to determine the characteristics of the light emission. The emission curve of the element leads to data for the integration of the effect of the radiation over a long tube.

The special characteristic of all tube illuminants is that the light is due to volume radiation instead of surface radiation to an extent which shows very conspicuously in the data of the paper before us. The fact that gaseous illuminants act in this way has, of course, long been well known, since one of the familiar forms of Geissler tube, the so-called "end-on" variety, is constructed with special reference to obtaining high intensity by utilizing volume radiation. The effect of this factor being ascertained, one is in a position to calculate results with some certainty. The nature of the variation due to volume radiation may be readily seen by comparison with a straight incandescent filament. This, being opaque, gives a light intensity which falls off in a perfectly definite way at angles oblique to the axis. A tube light at such angles gets advantage from a greater depth of radiating gas, and a very considerable advantage, in spite of the fact that internal reflections within the tube cut down the available radiation at angles near the axis to considerably below the value which it would theoretically have. The upshot of the work here recorded is that a comparison on the basis of mean hemispherical candle-power is unfair to a tube lamp, only the integrated radiation furnishing a suitable basis for the output.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Proposed Los Angeles Contract with Power Companies

A draft of the contract with power companies under which the city of Los Angeles proposes to lease, with ultimate right to purchase, the distributing systems of power companies has been completed. The contract has been gone over by a committee of the City Council and approved. It will be submitted to the companies and, if approved, will be reported to the City Council. The next step will be to submit the contract to the vote of the people in March. If the contract is approved, the Railroad Commission of California will be asked to fix the price which the city shall pay for the distributing systems at the end of the lease period of five years.

Taft on Public Ownership

Ex-president William H. Taft at a banquet at the Canadian Club in the King Edward Hotel in Toronto on Jan. 29 sounded a note of warning to the Canadians on public ownership of utilities. His statement was in part as follows: "Let me warn you to act with care in the operation of your great public utilities. Public ownership may be all right; I don't know. But I do know that public operation of the people's needs is a mighty dangerous thing to dabble with. The business of governing bodies and councils is not to operate; their business is to attend to the affairs which concern them, and they have no right to invest sums of money in utilities while more needed things are left in want. Let them who think otherwise try it in a small way," he said, "and let them who would rush ahead do so and then foot the bill, for I warn you again that a high tax rate is not a pleasant platform on which to come before the electorate."

Water-Power Legislation at Albany

The Legislature of New York State will begin this week to plan the State's future policy concerning hydroelectric development. Three bills have been prepared by the Conservation Commission. They are designed to pledge the State to a plan of developing and utilizing as much of its waste water-power as possible and to provide methods for carrying this policy into effect. One bill which carries no appropriation is designed to give the commission power to regulate the flow of rivers and streams by the erection of dams and reservoirs and to vest it with authority to contract with municipalities or public service corporations to supply water-power or electricity for municipal, commercial or irrigation purposes. This measure also would give the commission complete jurisdiction over the surplus waters of the Barge Canal.

To provide for the establishment of experimental plans is the object of the two other bills. The first of these is practically a redraft of the Murtaugh-Patrie bill of last year, which was vetoed by Governor Sulzer. It would locate the first experimental station at Vischer's Ferry, on the canalized portion of the Mohawk River, the electrical energy developed to be sold by the State in the "Capital District." It carries an appropriation of $650,000, of which $282,000 would be made available this year. This bill is understood to have the indorsement of Governor Glynn. The provisions of the remaining measure are identical with the "Capital District" bill, except that it will authorize a hydroelectric plant at any point along the canal and will make available immediately upon its passage $300,000 of a desired appropriation of $700,000.

President Wilson to Outline Policy on Water-Power Control

President Wilson will shortly outline his policy relative to the control of water-powers on navigable streams. There is reason to believe that the policy will be in direct conflict with the views on the question entertained by Mr. Gifford Pinchot and other leading spirits in the American Conservation Association. Democratic leaders in Congress are favorable to state control of water-power sites, the control that Mr. Pinchot alleges means turning them over to the so-called water-power trust.

The President will give his views to Congress on the subject of water-powers either in a special message or in an address to committees that have jurisdiction over this legislation. Members of these committees who have discussed the question with administration leaders predict that when the President makes known his views Mr. Pinchot will begin a warfare like that which was waged on the previous administration. Democratic leaders are strongly opposed to the levying of a federal tax on water-powers and take the position that the authority of the national government over navigable rivers is limited to seeing that the navigability of such streams shall be maintained at all times. They hold that public works which may be erected on these streams are under the law subject to supervision by the states in which they are situated, and this is also stated to be the view of the administration. It has been represented to the administration that material progress in many states has been halted by the failure of Congress to enact general legislation relative to the control of water-powers. For this reason efforts will be made to put a law through this session.

Canadian Municipalities Voice Need of Moderate-Priced Electric Range

Over 150 representatives from Berlin, Waterloo and the counties of Waterloo and Oxford, Ontario, assembled at Berlin on Jan. 30 to discuss Hydro-Electric questions. During the meeting the following resolution was proposed and carried: "That whereas electricity for culinary purposes is safer, more sanitary and in many cases cheaper than artificial gas in Ontario, and would be an attractive feature in the Hydro-

Electric system generally and an especial boon to the farming community and to the towns and villages where gas is not available;

"And whereas the use of electricity for domestic purposes is restricted, because a durable standard type of electric range of moderate cost is not available, and the extensive public service by the Hydro-Electric Power Commission of Ontario would assure a large non-competitive market for a satisfactory electric stove, with a resulting large increase in energy consumption, producing a corresponding reduction in prices;

"Therefore, this meeting of representatives from Oxford and Waterloo Counties begs respectfully to urge upon the commission that it appears highly desirable that the commission should endeavor to develop as soon as possible a satisfactory type of electric range, not leaving the cost of experimental work entirely to private interests, and that as soon as a satisfactory type of range can be produced at moderate cost the commission should manufacture the same for the various municipalities."

Uniform Policies in Making Extensions of Distribution Lines

At the recent meeting of the Wisconsin Electrical Association Mr. W. H. Winslow, then president, brought up the subject of the desirability of uniform practice in making extensions of distribution lines by electric-service companies. Since then the Railroad Commission of Wisconsin has asked the association to make an investigation of the rules followed by all the electrical utilities in the State in relation to the practice adopted in making extensions. The association has expressed its entire willingness to comply with this suggestion and has appointed a committee on uniform policies for electric distribution system extensions and commercial service rules. This committee will conduct an inquiry on the subject and tabulate, or digest, the information received. It consists of Mr. H. G. D. Nutting, Milwaukee, Clement C. Smith properties, chairman; Mr. John St. John, Madison, Madison Gas & Electric Company, and Mr. A. E. Peirce, Eau Clair, Chippewa Valley Railway, Light & Power Company. Mr. Nutting, it will be remembered, presented at the convention an interesting formula which he has devised to be used in considering the advisability of making extensions. In addition to its work in relation to extensions, the committee will endeavor to bring about some uniformity in commercial service rules, such as uniform discount rates, uniform invoice blanks and uniform rules affecting consumers.

Report on Massachusetts Water-Power Conservation

The Massachusetts Commission on Water-Power Conservation has filed its report with the Legislature. The board outlines the absence of complete information upon the use of water-power within the State and recommends a further appropriation to permit exhaustive study of existing conditions, with obligation to report to the next Legislature in January, 1915. It shows the need of defining the responsibilities and privileges of riparian owners in accordance with modern possibilities of storage and regulation of flow; touches upon the rapid development of hydroelectric installations within the State in recent years, and cites the work of the federal government in conjunction with the State of Massachusetts in investigating present conditions, pointing out that the present Harbor and Land Commission, the Geological Survey and other sources are in possession of data which should be assembled under one cover.

The report states that the rising cost of coal makes water-power conservation of great importance to manufacturers, and that the State's policy should be defined as to such developments. The board feels that until further investigation takes place no attempt should be made to decide whether public or private development should be encouraged. It is estimated that several times the developed water-power of 185,996 hp (1909 census) is annually wasted by inadequate conservation of resources. In the year quoted the total power developed in the State for manufacturing was 1,175,071 hp.

Serious Interruption of Ontario Hydro-Electric Service

The electric service of the Hydro-Electric Power Commission of Ontario throughout the Niagara district, extending from Niagara Falls, Ont., to Toronto on the north and to London and St. Thomas on the west, approximately 420 miles of high-tension and 20,000 miles of low-tension lines, was interrupted for nearly eight hours on Saturday, Jan. 31. At about 6 o'clock in the evening a local hurricane swept across the transmission line between Niagara Falls and Dundas in a straight, narrow streak at right angles to the line. The wires were heavily incased in ice owing to a prevailing sleet storm, and thus were also taut and brittle. When the gale struck them two wires snapped and were blown across the others, short-circuiting the line and throwing every city and town in the Municipal Electrical Association's Niagara zone in darkness until nearly 2 o'clock Sunday morning. The greater part of the delay in restoring service was taken up in locating the break, which when finally found involved the stringing of a considerable length of new wire.

The effect in some of the large cities such as Toronto and London was spectacular. The streets of Toronto are lighted exclusively from the Hydro-Electric system, and many thousand homes are also supplied from that system. The interruption, coming on the busiest night of the week, caused great inconvenience. The service of the Toronto Electric Light Company, Ltd., however, was not interrupted, nor were the street railways of Toronto affected, both being supplied with energy from Niagara Falls by the Toronto Power Company, and having auxiliary steam equipment in Toronto. Many of the moving-picture theaters had to close down, and the opera performance in the Royal Alexandra Theater, which depends on Hydro-Electric service exclusively, did not commence until after 9 o'clock, at which time a temporary connection with the system of the Toronto Electric Light Company, Ltd., was made. The civic car lines, of course, were put completely out of business, and residents of the St. Clair, Danforth and Gerrard districts had to walk home through snowdrifts.

Reports from other municipalities indicate that their condition on Saturday night was a duplicate of Toronto's on a smaller scale. Steam reserve plants were put to use in a few cases, but the opera house at Galt had to depend upon the light from candles. The street railway in London was kept going from the company's steam plant, which is still used for part of the supply, and lighting from this source was secured for a performance at the Grand Opera House. The London & Lake Erie Radial Railway, however, was completely demoralized, and passengers from stalled cars were eventually transported to their destinations by buses sent out for them in the middle of the night. London residents who sought to buy candles were confronted with the fact that all grocery stores were closed at 7 o'clock under a new by-law.

Commenting on the mishap, the Hon. Adam Beck, chairman of the Hydro-Electric Power Commission, said on Feb. 1 that a second line has been surveyed between Dundas and Niagara Falls, which is 6 miles shorter than the present one. This will be constructed at once, and there will then be four circuits to Dundas instead of two, as at present. The additional lines will be of extra heavy aluminum, reinforced by steel. The present line from Dundas to London and St. Thomas will be duplicated with the new extra-heavy aluminum conductor which is to be used also on the extension to Chatham and Windsor.

Comments on the President's Message

At the request of the *Electrical World*, the following expressions of opinion on the message of President Wilson on anti-trust legislation have been given:

Mr. Hugo Reisinger: "The message of President Wilson of Jan. 20, regarding trusts and monopolies, has my full approval. Of course, a satisfactory settlement is a difficult and intricate matter, and I am afraid the whole question will never be solved satisfactorily because the trusts will always find, through advice of their eminent lawyers, ways and means to get around the law. In my mind the trust question can only be solved to the entire satisfaction of the people if the articles which the trusts manufacture and control are put on the free list, because the high duty which we had, and which to a great extent we still suffer under, has created the trusts and kept them for the last sixteen years in a flourishing condition. I know what I am talking about, because I have been fighting a trust for years, and notwithstanding that I proved before the committee on ways and means that the article in question can be manufactured here as cheap as abroad, or perhaps cheaper, and the trust even admitted that it had a monopoly of the business, it is still protected by a duty of from 30 per cent to 40 per cent. I am an admirer of President Wilson and of Mr. Underwood, and if they have not succeeded in reducing the tariff to the proper level, it was not their fault."

Mr. W. S. Barstow, W. S. Barstow & Company: "In asking me for my views on the message presented to Congress by President Wilson on Jan. 20, I presume you mean in this connection that part of the message referring to holding companies and interlocking directorates. A careful consideration of the subject convinces me that this part of the message does not apply to purely security holding companies interested in the securities of public utility properties, where such public utility properties are far apart in different states and where the holding company is simply used as a means of equalizing the risks of investment for small holders and the securing of expert management and economical financing as applied to the operating companies themselves. At the present time almost all of the operating companies are under the jurisdiction of public service commissions in the various states, and through these commissions the public, as well as the investor, is protected."

Mr. Arthur Williams, New York Edison Company: "It would be difficult, I find, to express an opinion upon the message of President Wilson. The effect upon myself was very favorable. One of the unfortunate features of some of our regulatory laws is their indefiniteness, through which industry is subjected to vagaries in the mental attitude of those temporarily in power. Fair laws, drawn with reasonable definiteness, will cure a great deal of the uncertainty and unrest of the past."

Mr. W. N. Matthews, W. N. Matthews & Brother: "I believe that the last message of our President dealt with some very important matters in such a delicate way as to inspire the confidence of all who read it."

Mr. J. J. Sullivan, president American Railways Company: "As the President has made a new departure in speaking directly to Congress on subjects which he deems of pressing importance, I believe that it is the duty of all good citizens to lend him their unequivocal support. When he asserts that no one who obeys the laws need fear we must not be afraid, for we all desire to uphold and maintain justice and the supremacy of the Constitution of the United States and all the laws made in conformity therewith. I believe that the turning point has come in the industrial conditions, when improved business will result from the renewed endeavor, initiative and enterprise of the American people unhampered by useless and confusing laws."

Mr. H. Ward Leonard: "As regards the suggestion that the Sherman law be accurately defined by amendment, I think this more likely to weaken its benecial effect than to strengthen it. As illustrative of this I direct attention to the fact that the bill recently introduced to accomplish this definition of the Sherman law does not seem to embrace within its scope such a contract as that which resulted in the board of patent control of the General Electric and Westinghouse companies, which was disbanded not long ago after fifteen years of existence. Under the Sherman law as it now exists such a contract would probably be held to be illegal, while it apparently could not be held to be illegal under the exact but incomplete definition of the Sherman law which is contained in the said bill. Those who drafted the Sherman law intentionally and wisely left to the courts the definition of its scope, and in my opinion any attempt to define accurately by numerous amendments the precise scope of the Sherman law will merely result in sanctioning contracts deliberately intended to restrain trade but ingeniously drafted so as to run the gantlet of exact but inadequate definitions."

Government Ownership of Telephone Lines

Postmaster-General Burleson submitted to the Senate on Jan. 31 a report dealing with the subject of government ownership of telegraph and telephone lines. The report was prepared by a committee of officials of the Post Office Department in compliance with a resolution of the Senate requesting information on this subject. Mr. Burleson did not comment upon the matter in submitting the report of the committee.

The committee recommends a government monopoly of telegraph, telephone and radio communications and such other means for the transmission of intelligence as may develop hereafter. It would have Congress acquire by purchase at appraised value the commercial telephone lines with the exception of the farmers' lines. Its recommendation is that Congress authorize the Postmaster-General to issue in his discretion and under such regulation as he may prescribe revocable licenses for the operation by private individuals, associations, companies and corporations of the telegraph service and such parts of the telephone service as may not be acquired by the government.

The committee says that there is an advantage in economy in the merger of post offices and telephone stations. It shows that the capitalization of the entire telephone system of the country is approximately $900,000,000, but suggests that the appraised value of the properties would fall considerably short of this amount. The committee definitely recommends the acquisition of the telephone lines without the telegraph system, holding that the expense of equipping the telephone system for telegraphy would involve only the cost of the instruments and would therefore be negligible. It declares that the acquisition of the telegraph service of the country would necessitate taking over the duplicate plants of two companies controlling this service with duplicate expenses of maintenance.

Mr. F. H. Bethel, vice-president New York Telephone Company, made a statement in which he said the report of the committee was principally remarkable for the lack of knowledge displayed of conditions both here and abroad.

Architects and Illuminating Engineers in Joint Session

At a joint meeting of the Chicago Section of the Illuminating Engineering Society and the Chicago Architects' Business Men's Association, Jan. 27, Mr. J. B. Jackson, one of the engineers of the Commonwealth Edison Company, presented a paper entitled "Planning Lighting Installations," the purpose of which was to assist architects in laying out lighting plans for buildings. Mr. W. A. Durgin gave one of his short talks in the series relating to the fundamentals of illumination. By means of ingeniously constructed models he pointed out to the architects what they should know in order that they might understand the language of the illuminating engineer.

In his paper Mr. Jackson explained why it is more satisfactory to plan lighting installations before buildings are erected than to wait until they are completed. He then showed a method by which the necessary data for any class of building can be worked out. In connection with this method four tables were presented to the members in blueprint form giving data concerning the characteristics of incandescent lamps now on the market; foot-candle intensities recommended for various classes of service; desirable sizes of bays for different types of rooms, and the necessary watts per square foot in buildings of different finishes with various types of reflectors in order to produce 1 ft.-candle illumination. Examples were worked out in the paper, and the tables themselves were presented in such a way as to be of practical value to the architect.

During the discussion of the paper Mr. A. J. Sweet, Milwaukee, said that one of the ideals of the illuminating engineer of to-day is to reduce the eye strain which is one cause of the increase in ocular trouble in the United States at present. The speaker also told of the work of the committee of the Illuminating Engineering Society which is devoting much time to remedying conditions that produce eye strain.

Hearing on Anti-Trust Legislation

The committee on interstate and foreign commerce of the House of Representatives began hearings on Jan. 30 on the bill providing for an interstate trade commission. The judiciary committee of the House has begun hearings on other bills comprised in the anti-trust legislation program of the administration.

Mr. Louis D. Brandeis testified in favor of the proposed trade commission, and said that it should be vested with power to prescribe a system of accounting for interstate corporations and to compel publicity. He suggested that this be done by methods similar to those followed by the Interstate Commerce Commission for carriers. With a total of 305,000 corporations in the country, Mr. Brandeis did not expect that uniformity in accounting would be adopted at once. He thought, however, that it would be possible to require like methods of accounting for like kinds of business and corporations.

Representative Stanley, of Kentucky, who appeared before the judiciary committee of the House, argued that corporate forces had waged a campaign for more than a decade for the interpolation by construction into the Sherman law of "unreasonable" as applied to restraint of trade. He argued that Congress should wipe that construction out of the law by express statute.

Mr. Felix H. Levy, of New York, of counsel for the government in the tobacco case, in testifying on Feb. 3 opposed the section of the trade relations bill which proposes to prohibit so-called exclusive selling agency contracts, and said that this would be a dangerous proposition for the business world. This section would overthrow a long line of court decisions approving selling agencies where no element of combination in restraint of trade was present. The prohibition, if included in the bill, should be restricted to concerns engaged in monopoly.

Mr. Seth Low, of New York, president National Civic Federation, submitted a tentative draft of an interstate trade commission bill. He declared that the bill pending before the committee would give a commission too drastic power of search of corporations.

Government Radio Supervision

In order to insure the use of adequate wireless telegraph apparatus for emergency, as well as regular, service on shipboard, the United States Department of Commerce now refuses to permit steamships with defective radio apparatus to leave United States ports. In accordance with this policy, the S. S. *Cedric* was boarded by United States Radio Inspector R. H. Marriott shortly before she was due to sail from New York on Jan. 29. The auxiliary radio transmitter, which consisted of a "ten-inch" hammer break induction coil operated from storage cells, was found not to be in operating condition. After a repair to the ground lead was made the coil sparked satisfactorily, but then the hard-rubber roof insulator leading from the operating room caught fire and had to be replaced. In order not to delay the ship further, Inspector Marriott agreed to remain aboard as she passed down the bay, expecting that the necessary repairs might be completed before Staten Island was reached. Even with the new insulator installed, however, it was not possible to get a spark on the auxiliary set. An entire outfit of antenna insulators was therefore brought out on a tug by the Marconi Wireless Telegraph Company's inspector. Before these arrived at about 2:30 p. m. the operator had succeeded in getting the set working, so that it was then passed by the United States inspector. It appeared that the defective operation of the auxiliary was attributable to leakage through damp aerial insulators and that after these were dried (by sunlight and leakage currents) signaling was possible. The new set of insulators was kept aboard by the *Cedric,* nevertheless.

The S. S. *Majestic,* sailing on Jan. 30, had somewhat similar trouble. During an inspection by Mr. Marriott on Jan. 29 the auxiliary transmitter set fire to the roof insulator, which thereupon had to be renewed. On Jan. 30, about half an hour before sailing time, it was found that the induction coil would not produce a spark at all.

As in the *Cedric's* case, the United States inspector agreed to go as far out as Staten Island with the ship and to allow her to proceed from there if the coil were in repair by that time. After some labor and readjustment the operator succeeded in getting the set to spark, and the new roof insulator appeared to hold, so that the inspector was able to "pass" the equipment.

Co-operation by Individuals

Mr. Martin J. Wolf, of Chicago, statesman-at-large for the Jòvian Order, gave a talk on "Co-operation" at the luncheon of the Chicago Jovian League on Feb. 2. Mr. Wolf showed that under modern conditions of industry the old adage that "Competition is the life of trade" is no longer strictly true. It might be true of what has been termed "benevolent competition," but actually, under present-day conditions, co-operation tends toward greater efficiency. Co-operation is a matter for each individual to take home to himself. He must co-operate for the other fellow as well as in his own interests, remembering that one cannot get more out of co-operation than he puts into it. In the electrical industry probably the central station must be regarded as the basis on which all other departments are to build. No one department of the industry nor one individual in it is independent of the others. The trouble is that all want restricted competition in selling and unrestricted competition in buying. This very human tendency must be combated. Mr. Wolf pointed out also that the central-station companies advocate regulated monopoly in selling their product, but when they come to buy machinery or supplies they are apt to want unrestricted competition. He thought perhaps there might be some inconsistency here. Co-operation is really the result of a natural law of human society. When a salesman says that he "pulled all the strings" he knew of to close a certain transaction, the statement means simply that he availed himself of the benefits of co-operation. One man cannot accomplish anything worth while and do it alone. The sum total of concerted activity toward a given end is what is called co-operation. In other words, co-operation is utilizing the efficiency of numbers. It is a true note in that modern harmony which means efficiency.

California Investigations of Inductive Interference

Since its last progress report, summarized in the *Electrical World* of Oct. 11, 1913, page 733, the joint committee on inductive interference, authorized by the California State Railroad Commission, has prepared some thirty technical reports on results obtained from studies of the parallels between transmission and telephone lines described in that issue. Some of the conclusions reached are as follows:

The fundamental sixty-cycle wave of voltage or current is of relatively little importance in the production of noise in telephone circuits. It becomes of importance, however, if it gives rise to longitudinal voltages of sufficient magnitude to constitute a physical hazard, to interfere with the operation of grounded signaling devices or superimposed telegraph service, or to operate protective apparatus on the circuits.

Harmonic Frequencies Cause of Noise

The harmonics of the voltage and current waves are of chief interest as the cause of noise in telephone circuits, particularly the higher harmonics or those within the range of the voice frequencies. The fundamental and lower harmonics are important as disturbing factors in telegraph circuits.

The above facts show clearly the great desirability, from the standpoint of inductive interference, of having wave-forms of voltage and current in power circuits free from all harmonics. That such a condition does not obtain in the present state of the art is a basic cause of the disturbance to communication circuits paralleled by power circuits. Furthermore, the above facts emphasize the desirability that designers and manufacturers eliminate, as far as practicable, those features of design favorable to distorted wave-forms.

Balanced and Residual Components

In order to facilitate the analysis of the inductive effects of a power circuit on parallel communication circuits, the voltages and currents of a three-phase power system can be conveniently regarded as made up of components which exhibit distinct characteristics and can be treated separately. In any three-phase system in which the three voltages between pairs of wires are equal in magnitude, the voltage between any wire and ground can be considered to be the vector sum of two voltages which are called the balanced and the residual components respectively. The balanced components consist of three equal voltages between the three wires and ground, the vector sum of which is zero. The residual components consist of three equal voltages between wires and ground which are in phase with each other.

The residual voltage of the system is defined as the vector sum of the voltages of the three conductors to ground. It is, therefore, three times the residual voltage of the individual conductors or three times the equivalent single-phase voltage of the three conductors in parallel with respect to the earth. The currents flowing in the three wires of a three-phase circuit may be considered to be composed of three sets of currents, namely: (1) balanced components consisting of equal currents in each of the three line wires whose vector sum is zero; (2) a single-phase current flowing in a loop composed of two of the wires; (3) a residual current divided equally between the three wires and returning through the earth. Residual current is defined as the vector sum of the three line currents and is, therefore, the equivalent single-phase current flowing through the three line conductors in parallel with the earth completing the circuit.

Longitudinal and Transverse Induction Phenomena

For the purpose of clearness it is convenient to classify induction phenomena as longitudinal or transverse, referring to their manifestations on a metallic circuit. Longitudinal induced voltage refers to the voltage induced between the circuit and ground in the case of electrostatic induction and along the circuit between the two ends of the exposure in the case of electromagnetic induction. The transverse induced voltage of a circuit is the difference between the longitudinal induced voltage of the sides of the circuit. In the case of electrostatic induction this voltage acts between the two sides of the circuit, and in the case of electromagnetic induction it acts around the metallic circuit.

It has been found in the case of the power lines investigated that the fundamental fifth, seventh and eleventh harmonics are prominent in the balanced currents and voltages, while the fundamental third and ninth harmonics are prominent in the residual currents and voltages of the power system.

By a comparison of the prominent harmonics in the currents and voltages of the power system with those of the induction in the telephone circuits it is evident that the longitudinal induction arises principally from the residual voltages and currents, while the transverse induction shows principally the characteristics of the balanced voltages and currents together with some effect from the residual voltage and current.

Calculation of Image-Conductor Positions

In computations of electromagnetic induction, experience has indicated that the distances between wires and their images cannot be assumed to be twice the height of the wires above the ground. Special tests carried out to determine the equivalent depth of the image conductors indicated this depth to be approximately 300 meters below the earth's surface. Owing to the electrostatic shielding effect of neighboring objects, it was found, also, that the computed electrostatic induction was greater than that actually observed, indicating that in effect the ground surface was brought nearer to the conductors. Electrostatic shielding of the circuits under test, by grounding other circuits on the telephone lead at one point, reduced the electrostatic induction, particularly the longitudinal induction.

The field engineering staff of the committee is now at Santa Cruz, where it is investigating the subject of transpositions on the 17-mile parallel between the 22,000-volt, three-phase line of the Coast Counties Gas & Electric Company and a toll lead of the Pacific Telephone & Telegraph Company.

Meeting of New Jersey Electrical Contractors

One of the most successful meetings ever held by the New Jersey Electrical Contractors' Association took place at the Ridgeway Hotel, Camden, N. J., Jan. 24. In his presidential address Mr. E. P. Strang, of the Strang Electric Company, said that the electrical contractor of to-day is not the electrical contractor of the past, who had his office in his hat, and every time his hat blew off changed his place of business. Men of the latter type, he said, made it hard for the legitimate contractor to do business on business principles. He extolled the benefits to be derived from membership in the National Electrical Contractors' Association and voiced the necessity of closer co-operation between the contractors themselves. After the routine business was disposed of, Mr. A. H. Moses addressed the meeting on the subject of "The Architect and the Electrical Contractor." "We are all dependent upon one another," said Mr. Moses, "and each branch of work, whatever it may be, must help in the great general work of co-operation. Contractors should, therefore, strive to be fair and just in estimating and in doing good work so as to win the confidence of all those with whom they come in contact. In this way friendly and beneficial relationships will be formed."

After Mr. Moses' address a recess was declared and the manufacturers and jobbers were admitted to the session. Mr. E. Ward Wilkins, of the Partrick, Carter & Wilkins Company, Philadelphia, Pa., made a very interesting talk on conditions in the trade as they were and as they are. Mr. J. P. Alexander, of the General Electric Company, described the equipment of a Trenton pottery, and after a number of other manufacturers and jobbers had spoken upon the good the New Jersey Electrical Contractors' Association was doing, Mr. Farley Osgood, of the Public Service Electric Company of New Jersey, made an interesting talk upon the relation of the Public Service Electric Company of New Jersey toward the electrical contractors. Mr. Osgood was followed by Messrs. Vanderpoole, Sawin, Pemberton, Harberson, Cox and Young, all of the Public Service Electric Company. Others who took part in the proceedings were Mr. Gaffrey, of the Municipal Underwriters, who talked upon municipal inspection; Mr. Dorris, of the Underwriters of the Middle Department, who spoke of the relation of the inspector toward the electrical contractor, and Mr. J. W. Kelley, chief of the Electrical Bureau of Camden, N. J., who explained the law requiring the licensing of contractors there.

A banquet was given in the evening after which the following officers were elected: President, Mr. E. P. Strang, of Camden; vice-president, Mr. Charles Newman, of Passaic; secretary, Mr. J. Van Dyke, of Asbury Park; treasurer, Mr. P. H. Jaehnig, of Newark. The board of directors comprises Messrs. J. T. Plaskett, of Merchantville; S. H. Smith, of Trenton; Carl F. Adams, of Trenton; R. P. Ward, of Dover, and R. McGown, of Newark, N. J. The next semi-annual meeting of the association will be held at Long Branch, N. J.

Storage-Battery Wood-Separator Patent Upheld

Judge Thompson of the United States Court for the Eastern District of Pennsylvania handed down on Jan. 27 an opinion upholding the validity of United States Patent No. 1,000,330, relating to wood storage-battery separators, issued to Mr. Norman Dodge Aug. 3, 1911, and assigned by him to the Electric Storage Battery Company, of Philadelphia, in the suit brought by the latter company against the Philadelphia Storage Battery Company. The patent in question relates to the treatment of wood separators to remove the acetic-acid-forming constituents of the wood, which deleteriously attack the positive plate, while retaining such constituents as beneficially affect the negative plate. The defendant contested the validity of the patent on the grounds of prior invention and state of the art, and also denied infringement, claiming that neither of its processes of soaking the wood in a sulphuric-acid-water solution or in a 3 per cent solution of caustic potash was specifically mentioned in the patent, which employs, however, the term "alkaline solution." The judge ruled that where an unpatented device the existence and use of which are proved only by oral testimony is set up in complete anticipation of a patent the proof sustaining it must be clear, satisfactory and beyond a reasonable doubt, but held that in the present case the defendant had not sustained the burden of proof to overthrow the presumption of validity of the complainant's patent.

Depreciation as Affecting Valuation and Fair Return

A discussion on the paper by Mr. John W. Alvord on "The Depreciation of Public Utility Properties as Affecting Their Valuation and Fair Return," presented before the American Society of Civil Engineers, is published in the January *Proceedings* of the society.

Mr. W. J. Wilgus says that whether or not a depreciation fund is actually set aside would seem to be immaterial. What the public is interested in is the proper upkeep of the property without an increase for that purpose of the capital burden which it is expected to bear through the rate.

Mr. J. E. Willoughby says that the method of penalizing the owner suggested by Mr. Alvord—the deduction of the accrued depreciation from the reproduction cost new—is a confiscation of property to the amount of the accrued depreciation because the amount of the accrued depreciation was originally and necessarily put into the property before any depreciation could take place, and whatever has taken place is properly to be regarded as an expense of operation.

Mr. Frank C. Boes said that one cannot expect to deduct $3,000 from a ten-thousand-dollar plant in fixing rates and still have a ten-thousand-dollar service maintained. Does one pay less for milk given by old cows or for apples grown on old trees?

Mr. Allen Hazen said that it is clearly the privilege and duty of public service corporations to charge rates that will permit marking off a proper allowance for depreciation. When this allowance has been once determined and marked off there would seem to be no equitable reason why the capital thus marked off should be further considered in connection with the question of fair rates.

Mr. H. C. Vensano said that the whole question as to whether or not depreciation should be deducted from physical valuations for rate-making purposes would seem to be largely a matter as to whether or not the public utility had been handled correctly. It would seem that no theory of any kind can be made to apply to a property which has not been handled reasonably and honestly by its management and at the same time be made to apply equally to a well-managed property.

Mr. William B. Jackson believes that undue importance is placed on depreciation of plant *per se* without due consideration being given to the question whether the property has been kept in such condition as to give substantially as good and economical service as a new property and is fully safeguarded by its reserves from financial breakdown.

Mr. Henry Floy said that where a corporation is created and the money of owners is invested, after notice, under conditions prescribed in advance by regulating bodies, there can be no fair or honest objection to the insistence on accumulation of depreciation funds out of revenue and the use of such funds in any reasonable way, but they cannot necessarily be used as a measure of the value of the property on which rates are to be fixed. With respect to corporations that have been in existence for a considerable period of time without commission regulation and have been following certain generally accepted principles with the consent, more or less definite, of public authorities, Mr. Floy takes emphatic exception to the proposition advanced by Mr. Alvord that value for rate-fixing purposes must be determined by deducting the amount of a computed but not accumulated reserve fund from the cost of reproduction new.

Contributions to the discussion were also made by Messrs. Leonard Metcalf, F. Lavis, Clinton S. Burns, Stuart K. Knox and J. H. Gandolfo and Dr. Alexander C. Humphreys.

Proposed Electrification of Los Angeles & San Diego Beach Railway

The Railroad Commission of California has rendered a decision under which the Los Angeles & San Diego Beach Railway Company is to make application for extension of its franchise, agreeing, if the extension is granted, to apply for permission to issue bonds. The proceeds of the bonds shall be used to electrify the road and provide better service.

The company now operates with steam trains and gasoline motor cars. Testimony showed that the steam trains were generally on time and that but few delays greater than five minutes occurred, but the gasoline motor cars were a source of great annoyance and had frequent breakdowns. The company stated that it had endeavored to obtain electric storage-battery cars to be used to replace the steam equipment and the gasoline motor-car equipment, but that after negotiation with two electric storage-battery car companies the matter was dropped for the reason that the manufacturers could not guarantee the operation of cars built under and to comply with the company's specifications.

The General Electric Company and the Westinghouse Electric & Manufacturing Company have made estimates as to the cost of electrifying the line. The estimate is approximately $300,000. The City Council of San Diego has been unwilling to grant the franchises desired unless electrification is promised. The commission took occasion to investigate as to the probable ability of the company to pay bond interest from the operation of the road on an amount sufficient to electrify. From the testimony introduced Mr. H. D. Loveland, the commissioner who wrote the decision, is of the opinion that the operation of the road would easily pay interest at ordinary rates on an issue of bonds sufficient to electrify.

Midyear Meeting of American Electric Railway Association

The midyear conference of the American Electric Railway Association was held at the headquarters in New York on Jan. 29 and 30.

One of the principal addresses, which was made at the annual dinner of the association, was by Mr. Guy E. Tripp, chairman of the board of directors Westinghouse Electric & Manufacturing Company. Mr. Tripp spoke on "Public Relations." He advocated co-operation with the public. He does not mean co-operation with the self-appointed advisers of the people who fill the magazines with misstatements of facts and upon such premises build their arguments. "For example," said Mr. Tripp, "take the misstatement by Mr. Brandeis in *Harper's Weekly* that the Westinghouse Electric & Manufacturing Company and the General Electric Company are only alleged competitors. If all his facts are as false as that one (and I know that one to be false), his conclusions are worthless."

Mr. Tripp added that public service corporations now understand that regulation and competition are the only alternatives lying between unrestrained operation for private profit and government ownership. They have also learned that regulation is better than competition. Mr. Tripp also believes that the people understand that regulated private ownership is a great deal better than government ownership. Public service securities ought to be a favored and preferred investment, and he believes they will be so when public confidence has been secured.

Mr. Tripp also took up the subject of holding companies. He said: "That those in control of these centralized organizations should so conduct their business that no injury will result either to the public service industry or other business interests is a principle the importance of which cannot be overestimated. For example, the support and approval of my company and its stockholders cannot be expected in those cases where centralized control results in a door closed to our fair competition and a serious loss to us."

Mr. Henry W. Anderson, vice-president Virginia Railway & Power Company, made an address at the annual dinner on "The Relations of Public Service Companies and the Public."

At the conference on Jan. 30 a report of the joint committee on joint use of poles was approved. The committee reported that it had received various comments and criticisms from member companies on the report presented at the 1913 convention. The Pennsylvania Street Railway Association sent in a general protest against the form of agreement. The committee will meet again about Feb. 18 and will analyze the suggestions and make such revisions as in its judgment are advisable, and these will be placed in the hands of member companies and others interested not later than

May 1. The committee will meet again in July so as to prepare a final report for submission to the 1914 convention.

Mr. Halford Erickson, of the Railroad Commission of Wisconsin, read a paper on "The Economic Aspect of Regulation Compared with Profit-Sharing with the Municipality." Mr. Erickson strongly favors regulation.

Mr. C. L. S. Tingley, vice-president American Railways Company, read a paper on "Present-Day Influence of Labor on Legislation."

At a meeting of the committee on public relations a sub-committee was appointed to draft a platform of principles on questions of public policy for the association, to outline a plan of educational publicity and to prepare a plan for raising a publicity fund of $50,000 or more. The members of the sub-committee are Messrs. James H. McGraw, chairman; Guy E. Tripp, C. Loomis Allen and Frank R. Ford and Col. T. S. Williams. Mr. Thomas N. McCarter, chairman of the committee on public relations, is ex officio a member of the sub-committee.

The American Museum of Safety informed the association that a gold medal with silver and bronze replica, in memory of Anthony N. Brady, will be granted annually to the American electric railway which does the most to promote safety of service.

Annual Meeting of the Western Association of Electrical Inspectors

In last week's issue was published an account of the first two days' sessions of the ninth annual convention of the Western Association of Electrical Inspectors held in the new Hotel Gibson, Cincinnati, Jan. 27-29.

At the concluding sessions on Jan. 29 reports were presented by the following standing committees: "Installation and Operation of Induction Motors," by Mr. K. W. Adkins, of Kansas City; "Architects' Specifications," by Mr. F. H. Moore, of Indianapolis; "Signal Systems," by Mr. F. S. Anderson, and "Rubber-Covered Wire," by Mr. V. H. Tousley, of Chicago.

Installation and Operation of Induction Motors

Mr. Adkins spoke of the difficulty of choosing wiring tables which covered satisfactorily the necessary sizes of motor leads for motors of various speeds, voltages, sizes and load connected at starting. He presented tables giving the sizes of motor leads and sizes of starting fuses under these varying conditions, in the determination of which the time element of the fuse and the usual conditions of acceleration were taken into consideration. The time element somewhat reduces the size of fuse necessary for motors in which the starting current is quickly reduced.

Discussion

In the discussion which followed the reading of the paper Mr. F. A. Barron, of the General Electric Company, described some exhaustive tests made recently at the Schenectady research laboratories, where motors of different sizes were started some fifty times with fuses so chosen as just to fail of blowing. Curves were plotted showing that, other conditions remaining the same, the amount of overfusing necessary varies from about four times the rated motor current in 1-hp sizes to about twice the current in large sizes. While high-speed motors take a somewhat greater initial current, the longer duration of starting in the case of slow-speed motors necessitates the use of fuses of about the same size as in the case of the high-speed motors.

The discussion further brought out the fact that automatic non-fusible cut-outs are desirable at lower current-carrying capacities than are now generally permitted by the National Electrical Code, for reasons of economy and convenience as well as of safety to property and life. The recommendations of the committee were summarized as follows: All induction motors of 5 hp and over should be provided with approved starting devices. Each alternating-current motor of 1/4 hp or over should be provided with separate fuse protection. Proper rated running fuses should be installed on all motors of 1 hp and over. An approved auto starter will be accepted in lieu of switches as required by the rules, provided the switches of the auto-starters disconnect all the wires running to the motors. Motors without compensators must be started by means of an approved double-throw switch provided with spring releases on the starting side, so that it will remain in its starting position only when held there. In classes of service where fuse protection is of secondary importance the committee recommends the installation of motors especially designed for heavy overloads, and that the leads to such motors be of sufficient size to be properly protected by the required fuses. If induction motors of the squirrel-cage type are used in this class of service, heavy conductors are required in addition to approved starting devices equipped with overload release, no-voltage release and circuit-breakers equipped with time-element devices. The committee also recommends that motor manufacturers place on the nameplate of polyphase motors of the slip-ring type the ratio of transformation existing between the stator and rotor currents.

Architects' Specifications

Mr. F. M. Moore, in his report for the committee on architects' specifications, gave an outline of wiring features which should be covered, and offered suggestions as to the scope of a desirable specification and of each section. He emphasized the necessity of personal relationships between the electrical inspector and architect.

Rubber-Covered Wire

Mr. Victor H. Tousley in his report drew attention to the fact that there still is a lot of old-code rubber-covered wire on the market, and that cheap contractors are urged by energetic salesmen to buy this material of inferior insulation, the main consideration being the extra discounts. He said that, from his experience in Chicago, the principal offenders are among the fixture supply dealers and manufacturers, especially the makers of portable lamps. One cause for the use of the inferior old-code wire is the great competition among the smaller, or what are commonly known as the grip-sack contractors. This competition is greatest in the smaller sizes of wire, for this is the most in demand and the least capital and equipment are required for its installation. He attributed the wide use of defective wire to the fact that the Underwriters' factory inspection service is not clothed with sufficient authority. He maintained that the laboratory inspector at the factory should be allowed to test the entire product instead of only a portion of the product, and should also have authority to demand the destruction of all wire not coming up to the specifications. He recommended that the Underwriters' Laboratories refuse label service to any factory manufacturing old wire, and that coils not supplied with a genuine factory inspection tag should not be accepted by wiremen. He condemned strongly the imposition on the public of insulation dangerous to life and to property.

Discussion

Much discussion greeted the report, and a statement of the position assumed by the Underwriters' Laboratories toward the manufacture of inferior rubber-insulated wire was made by Mr. A. G. Latta, of Chicago.

Mr. Latta called attention to some of the difficulties surrounding the enforcement of some of the recommendations of Mr. Tousley, and said that the Underwriters' Laboratories are doing all that they consistently can to stop the sale of the old-code product and welcome any suggestions as to how their efforts can be made more effective. A simple test to apply on wire suspected of not being up to the new-code standard is the so-called stretch test on the rubber insulation. He asked for the laboratories the earnest co-operation of every electrical inspector in the field, assuring them of every assistance in the promotion of safe electrical wiring.

Election of Officers

On the recommendation of the nominating committee the following officers were chosen for 1914-1915: Mr. B. W. Clarke, of Detroit, president; Mr. H. M. Maxwell, first vice-president; Mr. F. H. Moore, of Indianapolis, second vice-president, and Mr. H. B. Long, chairman of the executive committee.

On Jan. 30 the members of the association were taken in automobiles to the Cincinnati Water Works and to the Cincinnati Car Works. The delegates were afterward the guests of Mr. G. W. Cleveland, manager of the Cincinnati Fire Prevention Bureau, at a luncheon in the Business Men's Club.

On the whole, the work of the convention was unusually well planned, and the continuance of standing committees appeared to bring very useful results. There was a large attendance of manufacturing and central-station men, to whom the discussion was at all times open, and there was a noticeable spirit of co-operation for the betterment of the whole industry.

Public Service Commission News

Vermont Commission

Counsel for the New England Telephone & Telegraph Company have filed a brief with the Public Service Commission demurring to the proposed reduction in telephone rates. The commission has been investigating the company's tariffs since last summer, and the board was reorganized by Governor Fletcher on account of the refusal of the former members to consider the question. The company contends that reduction in rates at the present time would be unjust and confiscatory, that no evidence has been taken to show that the present rates are unreasonable, and that the proposed schedule would wipe out the present small margin of profit of the five companies, with resultant crippling of the service. A decision is expected about March 1.

California Commission

The Railroad Commission of California has authorized the Pitt River Power Company to issue $90,000 preferred stock, of which $30,000 will be used in payment for a hydroelectric site and $60,000 to cover the cost of construction of a hydroelectric plant. The latter amount of stock is to be issued only after the company has filed and has had approved a detailed statement of proposed construction expenditures.

The company now has an authorized capital stock of $500,000, of which $132,500 is preferred. The $30,000 of preferred stock is to be given to J. H. Logan in exchange for property on which Burney Falls is situated, which is to be the site for the power plant. The property to be transferred is described as consisting of certain land and the water rights incident thereto. In granting the application the commission states that it must not be understood as finding that the value of the property to be transferred amounts to $30,000. Neither must the commission be understood as placing any value upon whatever water rights are transferred to the company.

Ohio Commission

The Public Service Commission of Ohio has asked for an appropriation sufficient to enable it to make appraisals of utilities. The commission mentioned specially in this connection the telephone companies in Cleveland, the Cincinnati Traction Company, and the Bucyrus Light & Power Company.

New Jersey Commission

The Board of Public Utility Commissioners of New Jersey has handed down a decision dismissing the petition of the Jersey Power Company for authority to issue $75,000 stock, the proceeds to be used for the construction of transmission lines in Morris County. The board says that the evidence shows that the company intended to obtain its power from the Jersey Corporation at Boonton, the latter organization not being a public utility, and further that the controlling interests in both companies are to a large extent the same. The board holds that the desire to use the proceeds of this stock as shown is one that lends itself to the purpose of those who might be bent on escaping the control which the law of the State seeks to throw around public utilities generally, and that where the generating company is not a public utility, and therefore is exempt from the regulation designed for such, and when the electric energy transmitted by the transmission company is generated by a concern not under public regulation and control, the board cannot exercise the power conferred upon it by statute.

Indiana Commission

The Public Service Commission of Indiana, by its approval of an issue of $850,000 bonds by the Richmond Light, Heat & Power Company, aroused comment at Richmond. Opponents of the company there contend that the commission has in reality established a new valuation for the plant.

The commission is expected to approve a new date schedule, filed recently by the Indianapolis Telephone Company for four-party lines. The new rate for this class of subscribers is to be $15 annually. The status of the plan to merge the Central Union Telephone Company holdings in Indianapolis with those of the Indianapolis company remains unchanged, since the commission announced that it probably would be more than a year before the question could be taken up.

The commission has sent out warnings to utilities against the purchase of accounting systems from agents. The commission has supplied electric light, gas and water companies with forms for accounting systems, and forms will be prepared soon for use by heating and telephone plants. The commission has been told that agents have been attempting to sell forms which do not have its approval.

The death of an employee of the Cincinnati, Hamilton & Dayton Railroad in Indianapolis during a terrific sleet storm, which broke many wires and is believed to have caused a trolley wire to fall across a railroad telephone wire, has inspired the commission to begin an investigation of the possibilities of better insulation for telephone systems. The employee was killed when telephoning from one of the booths kept for the use of trainmen on the railroad. Commissioner Payne immediately notified officials of the road and electrical experts in Indianapolis that he would conduct a hearing to ascertain whether more perfect insulation and better protection from falling wires might be secured, at least on the telephone systems of railroads.

The sleet storm in the last few days of January caused thousands of dollars of damage to utility companies throughout Indiana. In Indianapolis the Central Union Telephone Company reported 500 poles down. The commission in several instances received requests to assist the companies in restoring service.

Massachusetts Commission

The Public Service Commission of Massachusetts has received a petition from the Providence & Fall River Street Railway Company for authority to increase its local fare unit from 5 cents to 6 cents, on the ground that the former rate is inadequate to prevent an annual deficit, despite the fact that the company has never paid dividends.

Maryland Commission

The Maryland Public Service Commission has resumed the hearing on the petition of the Mayor and City Council of Easton asking that the Easton Light & Fuel Company improve its plant and reduce rates. Testimony was presented in regard to the general condition of the plant and its ability to furnish gas and electricity. Mayor Higgins of Easton stated to the commission that a bill had been introduced in the Legislature giving Easton the right to erect a municipal electric plant.

Current News Notes

Binghamton, N. Y., Restrained from Issuing Bonds for Municipal Plant.—The Appellate Division handed down a decision at Albany, N. Y., on Jan. 21 in the case of W. S. Lyon, of Binghamton, against the Common Council of that city, restraining the issuance of a bond issue of $158,200 for a municipal lighting plant in Binghamton, N. Y.

* * *

Kalamazoo (Mich.) Municipal Lighting Plant Nearing Completion.—On Jan. 28 fires were lighted under the boilers in the 1000-kw municipal lighting plant which has just been erected at Kalamazoo, Mich. A celebration has been planned for Feb. 14, when the city's new "white way" will be lighted for the first time. Energy for this lighting will be supplied from the municipal lighting plant.

* * *

Across the Alps in an Electric Bus.—Settling any question of the hill-climbing abilities of the electric vehicle, an electric-bus service has been established across the Alps from Airolo, Switzerland, to Ulrichen, Italy. The route traverses the Bedretto valley and Nufenen Pass. Each car carries twenty-two passengers and makes the trip in one and three-quarter hours, running at 12 to 22 miles per hour.

* * *

Prize Winners in N. E. L. A. Section Contest.—In the H. H. Scott prize competition given under the auspices of the National Electric Light Association, in which contestants were asked to give the best ten reasons why employees of member companies should join a company section of the N. E. L. A., awards have been made as follows: First prize, $25, Mr. Roy G. Monroe, Denver Gas & Electric Light Company; second prize, $15, Mr. Herbert A. Seymour, Commonwealth Edison Company, Chicago; third prize, $10, Mr. Walter Christ, Philadelphia Electric Company.

* * *

A Quarter of a Million Tons of Coal in Storage.—A fuel agent and thirteen clerks are necessary to conduct the work of the fuel department of the Commonwealth Edison Company and some of the allied Insull companies, according to Mr. C. E. McBride, who recently read a brief paper on the subject at a company section meeting of the N. E. L. A. The Commonwealth Edison Company burns about 5000 tons of coal daily and its coal bill is about $2,000,000 a year. About 250,000 tons of coal is kept in reserve in or near Chicago at all times. Nearly all of this is of egg or lump size, as the danger of fire from spontaneous combustion is much less with the larger sizes. Thermometers are placed in all coal piles and weekly records of temperatures are taken. It is frequently found necessary to move piles of screenings or mine-run coal to prevent or fight fires.

* * *

An Electromagnetic Explanation of Animal Intelligence.—A certain recent astounding instance of intelligence on the part of a trick elephant who could add, subtract and perform simple arithmetical problems now seems to be explained on the basis of electromagnetic aid given the animal by his astute trainer. One day, while watching a lifting magnet at work, the showman conceived the idea of using the subtle lines of magnetic force to direct the movement of his pachyderm's proboscis. Accordingly, a special blackboard was arranged, there being mounted behind it a number of electromagnetic pole pieces in the shape of numerals. The elephant was easily taught to rub a piece of chalk aimlessly back and forth over the board surface, but when the proper circuit was switched on corresponding to the sum desired the huge beast would unwittingly trace the answer in black and white, to the rapt amazement of his audience.

* * *

Sun-Power Plant at Cairo, Egypt.—Tests on the sun-power plant at Meadi, near Cairo, Egypt, which has a sunshine-collecting surface of 13,000 sq. ft., heating five boilers, have shown an average of 1170 lb. of steam generated per hour, the pressure varying from 1.1 lb. and 1 lb. per sq. in. above atmosphere. A maximum output of 1442 lb. of steam per hour was obtained about noon Aug. 22, 1913. These experiments were conducted under favorable weather conditions, the average shade temperature being 95.5 deg. Fahr. and the mean humidity 35 per cent. The computed maximum steam production per square foot of sunshine-collecting area was 0.12 lb. per hour. A steam engine, especially designed to operate on pressures of 1 lb. per sq. in., consumes 22 lb. per brake-hp-hour when carrying a load of 97.5 hp. If use had been made of nine boilers instead of five, it is declared that the engine could have been operated for twelve and one-quarter hours per day with a load of 95 brake-hp.

* * *

Frills Increase the Rate.—In a recent issue the *Kenosha News*, of Kenosha, Wis., said in discussing changes which have been brought about by commission regulation: "A rate for a public utility now is absolutely under State supervision, and any time that the utility gets the 'all that the traffic will stand' idea it is promptly taken out of it by the commission. Rates are now a matter of scientific arrangement of figures. If the people of a community demand underground wires, painted poles and a lot of other things that go to the beautifying of a city, they can have them, but they must pay for them. If the company is forced to increase its investment, the rule of the commission works automatically and it gets along with the increase of investment permission to increase the rate. Utility service is worth just so much. This price is set for utility service without any frills. If the frills are to be put on, the service is made more costly just the same as the dress of the woman is made more costly by the addition of a lace girdle."

Improved Efficiency of Tungsten Lamps.—During the last few months the specific consumption of tungsten lamps has been considerably reduced, this increase in efficiency having been brought about by gradual refinement of the methods of construction and the materials which enter into the manufacture of the lamps. Perhaps the most noteworthy of these changes is that for the 110-volt lamps in sizes larger than 100 watts. The specific consumption of these units has been reduced to 0.90 watt per candle, directly increasing the candlepower over 11 per cent. The 20-watt, 110-volt lamp has been similarly improved from 1.25 watts to 1.17 watts per candle, while the new 40-watt lamp has a specific consumption of 1.10 watts per candle. "Half-watt" street series lamps, having an actual specific consumption of 0.7 watt per candle, are now regularly available in 80, 200, 350, 600 and 1000-watt sizes for both 6.6-amp and 7.5-amp circuits. For 110-volt multiple operation there are offered both a 750-watt lamp of the above efficiency and a 1000-watt lamp which operates at 0.65 watt per candle.

* * *

SOCIETY MEETINGS

Chicago Jovian League.—At the luncheon of the Chicago Jovian League on Feb. 2 Mr. R. C. Leonard, of the Nashville Railway & Light Company, statesman for Tennessee, made a few remarks. The principal address of the meeting was delivered by Mr. Martin J. Wolf, Hotpoint Electric Heating Company, who talked on co-operation. Cuff links were distributed to twenty-three members for securing candidates for the recent rejuvenation. These cuff links bear the Jovian emblem and are of gold, gold plate or silver, depending on the number of candidates secured by the recipient.

* * *

Convention Plans of New England N. E. L. A. Section.—The executive committee of the New England Section of the National Electric Light Association has decided to hold the sixth annual convention of the section on Sept. 2-4 inclusive, at the New Mathewson Hotel, Narragansett Pier, R. I. A reception will be held on the opening day, followed by a technical program of much interest, and it is expected that the time and place will be favorable to a large gathering. Mr. C. C. Wells, of Middlebury, Vt., is president, and Miss O. A. Bursiel, 149 Tremont Street, Boston, Mass., is secretary of the New England Section.

* * *

Philadelphia Section, N. E. L. A.—At a meeting of the Philadelphia Electric Company Section of the National Electric Light Association, Jan. 19, Prof. Robert H. Fernald delivered an address on "The Possible Central-Station Plant of the Near Future," advocating generation of electrical energy at the mouth of the mine. The commercial branch met Jan. 26, when Mr. Edwin Hulley read a paper on "Selling Electric Motor Service." At the accounting department meeting of Jan. 13 Mr. E. G. Walls spoke on the topic of depreciation. The meter and engineering department branches held a joint meeting Jan. 5, which was addressed by Mr. Louis G. Smith.

* * *

Joint Meeting of Municipal Art and Illuminating Engineering Societies in New York.—A joint meeting of the Municipal Art and Illuminating Engineering Societies will be held on Feb. 11 in the Engineering Societies Building, New York. Mr. Arthur Williams, vice-president of the Municipal Art Society, will represent that organization, the subject of his speech being "Some Notes on Present-Day Street Lighting." An address will also be made by Mr. C. F. Lacombe, chief engineer of the Department of Water Supply, Gas and Electricity, who will present the results of a recent trip to Europe to investigate the street lighting of cities there in a paper entitled "High-Intensity Lighting of European Cities, Compared with New York."

* * *

Commonwealth Edison Company Section, N. E. L. A.—At the meeting of the Commonwealth Edison Company section of the National Electric Light Association in Chicago on Jan. 29 a number of short papers were read to explain the workings of different departments of the company's business. Mr. W. R. White told about the information bureau, Mr. E. W. Jones of the laboratories of the testing department, Mr. O. A. Witte of the outside work of the testing department, Mr. C. E. McBride of the fuel department, Mr. F. J. Kaeter of the contract department, Mr. Harold Wright of contract order routine, and Mr. R. B. Kennedy of load dispatching. The author of each paper was asked to make a summary of it in four minutes, and a minute and a half was given to each man taking part in the discussion, with two minutes for the author in closing. Among those who discussed the papers were Messrs. R. H. Hastings, auditing department; W. A. Schaefer, cashier's office; J. W. Ferguson, contract department; George H. Jones, contract department; C. A. Keller, engineering department; J. C. Manley, construction department; W. H. Childs, operating department; H. Foster, Northwest station; E. Mandel, testing department; W. J. Dwyer, credit department; A. F. Bronwell, distribution department; Otto Hanf, treasury department, and A. G. DeClerq, Northwest station. The Mandolin Club gave some pleasing music, the Glee Club sang, and Mr. W. J. Norton gave a humorous monologue.

* * *

Chamber of Commerce to Discuss Anti-Trust Legislation.—The Chamber of Commerce of the United States will hold its second annual meeting in Washington, D. C., on Feb. 11 to 13. On the afternoon of Feb. 11 the report of the committee on patents, trade-marks and copyrights will be presented by Mr. James G. Cutler, Rochester, N. Y. On the evening of that day addresses will be made by Mr. William B. Wilson, Secretary of Labor, on "The Relation of the Department of Labor to Industries and Commerce," and by Mr. Charles A. Prouty, of the Interstate Commerce Commission, on "Physical Valuation of Railroads." Anti-trust legislation will be discussed on Feb. 12. Concentration of industry in the United States and respects in which the Sherman law requires definition will be taken up first. The abolition of holding companies and interlocking directorates will be considered. Another subject will be the rights and privileges of private parties in invoking the aid of the Sherman law. The functions of a federal interstate trade commission will be discussed. Another point is as to the industrial efficiency of the trust form of organization. Among the speakers will be Dr. Charles R. Van Hise, president University of Wisconsin; Mr. Louis D. Brandeis, Boston, Mass.; Mr. Frederick P. Fish, formerly president American Telephone & Telegraph Company; Mr. Victor Morawetz, New York; Prof. Henry R. Seager, Columbia University, and Mr. Henry R. Towne, president Yale & Towne Manufacturing Company. The subject of maintenance of retail prices will be discussed on Feb. 13. The opening address on this subject will be made by Mr. Joseph E. Davies, commissioner of corporations, Department of Commerce. At a banquet to be held on Feb. 12 an address will be made by Mr. William C. Redfield, Secretary of Commerce.

Alternating-Current Supply in New York City—I

New station of the United Electric Light & Power Company at 201st Street and Harlem River—History of alternating-current growth in New York

THE new 201st Street generating station of the United Electric Light & Power Company, New York City, representing a present investment of $5,000,000 and an additional amount of about $1,000,000 when fully equipped, is the latest word in central-station construction in that city. The station has just been placed in operation and embodies features of engineering interest. The United Electric Light & Power Company, it should be pointed out, distributes alternating current exclusively throughout the entire borough of Manhattan, whereas the New York Edison Company distributes direct current. The service of the United Electric Light & Power Company is entirely underground, and north of 135th Street on Manhattan Island the service of the company prevails exclusively. In round numbers more than 34,000 customers are supplied with energy by this company.

Growth of Alternating-Current Service in New York

The growth of alternating-current service in the borough of Manhattan is inseparably linked with the history of this company, which was expressly organized for the purpose of introducing the alternating-current system in New York City. Although the United Electric Light & Power Company was incorporated on Feb. 4, 1887, under the name of the Safety Electric Light & Power Company, which was changed to the present corporate title on Dec. 9, 1889, its history goes back as far as 1880, when the United States Illuminating Company, which was subsequently taken over by the United Electric Light & Power Company, was formed. The early business of the United States Illuminating Company consisted in selling outright or in installing and maintaining dynamo machines with arc lamps and appurtenances on a daily, weekly or monthly charge. At first these plants were installed where steam was available, the steam being purchased at so much per horsepower, the rates ranging from $75 to $130 per hp-year, delivered at the countershaft. The system at that time used was developed by Mr. Edward Weston, and the apparatus was manufactured by the Weston Electric Light Company. The latter was early acquired by the United States Electric Lighting Company, which was in turn later controlled by the Westinghouse company. The United States Illuminating Company acquired the exclusive control of the Weston system for the city of New York and for some of the adjacent counties including Kings, Queens, Richmond and Westchester, as

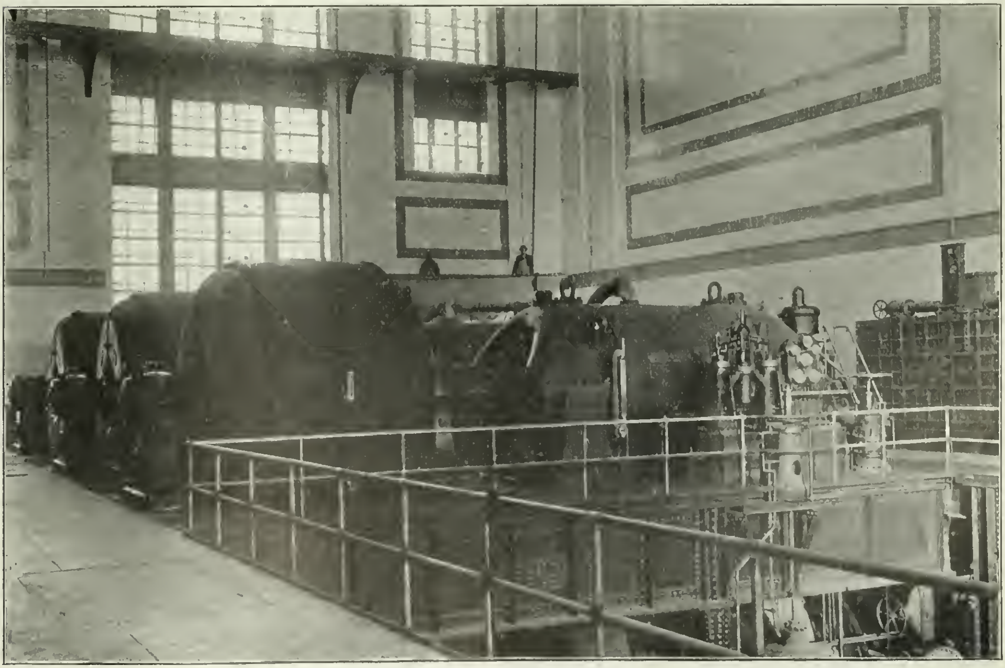


FIG. 1—19,000-KVA TURBO-GENERATORS

well as Hudson, Bergen and Union Counties in the State of New Jersey.

On May 1, 1881, the company rented the first floor and basement of the premises at 90 Chambers Street, where there was installed for experimental purposes a fifty-light Weston dynamo belted to a 20-hp horizontal steam engine. The first generators from which customers were supplied were in the basement of the old Equitable Building at 120 Broadway. The United States Electric Lighting Company had also about that time installed a machine in the basement of 215 Center Street and another in the basement of 414 Sixth Avenue, both of which were afterward taken over by the United States Illuminating Company. At that time the circuits were run entirely over the housetops.

FIGS. 2 AND 3—ELECTRICALLY OPERATED ASH CARS AND ENDLESS-CABLE-OPERATED COAL CARS ON WEIGHING SCALES

By 1884 the company had eight stations in operation, feeding 590 arc lamps and about the same number of incandescent lamps from about 109 miles of circuit. For city arc service 75 cents a lamp a night, or $273 a lamp a year, was received, the rates for commercial arc service being as high as $1.25 a lamp a night. Energy for incandescent lamps was supplied at a flat rate of $3.50 a lamp a month. One of the important early installations was that of the Brooklyn Bridge (1883). The plant was installed by the United States Electric Company and operated by the United States Illuminating Company. The installation consisted of seventy Weston arc lamps, and the posts, frames and much of the original wire are still in service. During 1884-1885 two larger stations were erected, slow-speed reciprocating engines being used with ten, twenty and fifty-light machines belted from countershafting. At that time the gross annual income of the company from all sources, including rental from plants, had reached the sum of approximately $275,000.

Meanwhile the Edison system, the first station for which was placed in operation in New York in September, 1882, was making relatively great advances, and the Brush company had also established a plant on Elizabeth Street and was doing quite a large arc-lighting business. On May 31, 1887, franchises were granted to six additional electric light companies by the Board of Aldermen. In that year the alternating-current system was first brought to the attention of the Safety Electric Light & Power Company, and a proposition was submitted by the Westinghouse company whereby the Safety Electric Light & Power Company was to acquire the system under a license agreement. Two years later the plant and property of the United States Illuminating Company was leased by the Safety Electric Light & Power Company, and the first commercial alternating-current incandescent lighting service was begun in New York City. During 1891-1892 the United Electric Light & Power Company had acquired the property of the Brush Electric Illuminating Company. The inclosed arc lamp was being developed during the same period, and the Brush and Weston series systems were rapidly becoming obsolete, and finally disappeared.

The alternating-current system was pushed with great energy and skill by the Westinghouse and Thomson-Houston companies, but for several years progress was hindered by the difficulties encountered. In the first place alternating-current motors had not been developed to a point where they would bear comparison with the then-existing direct-current motors; neither was alternating-current arc lighting developed for commercial uses, so that these and many other drawbacks hampered the rapid growth of the business. Up to 1895 the United Electric Light & Power Company had 135 miles of subway duct under rental, but its service did not extend north of Fifty-ninth Street. The original primary service was 1000 volts, single-phase, 133 cycles. A station at Twenty-eighth and Twenty-ninth Streets and East River was bought by the United States Illuminating Company and was enlarged from time to time. On March 17, 1896, the first commercial operation of directly connected alternating-current generators was successfully inaugurated at that plant, which finally became the sole generating station of the company and was kept in operation until Nov. 18, 1907. On the later date the plant was shut down, the site and equipment being sold to the city of New York for hospital purposes.

It became imperative that immediate arrangements be effected for the generation of sixty-cycle energy, and as a temporary expedient generating equipment was installed at the Waterside station of the New York Edison Company, and substations were equipped with transformers for sixty-cycle service and with motor-generator apparatus, so as to make it possible to use twenty-five-cycle energy from Waterside station as an emergency or reserve supply. Up to the opening of the

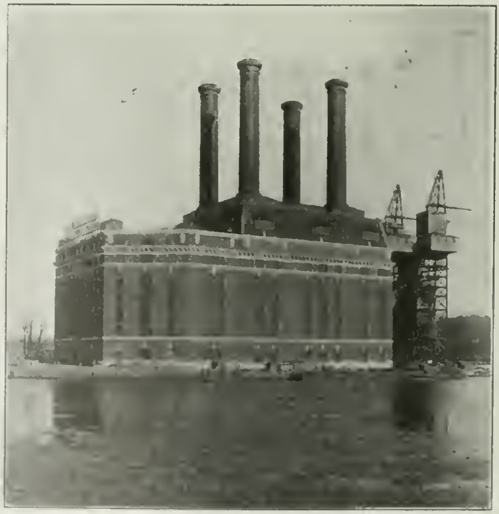


FIG. 4—EXTERIOR OF STATION, SHOWING COAL-HOISTING APPARATUS

new station sixty-cycle energy has been generated in the Waterside stations of the New York Edison Company at 6600 volts and 7500 volts, sixty-cycle, three-phase, and delivered to substations, where it is transformed to 3000-volt, two-phase energy for primary distribution. With the starting up of the United Electric Light & Power Company's 201st Street station, however, the generation of sixty-cycle energy for New York City and the surrounding territory was transferred to the new station, which will be assisted only at peaks by the Waterside stations. The two systems are connected by four tie lines, which follow different routes so as to preclude the possibility of all four failing at once owing to any mishap.

The United company's plant is laid out to accommodate all the boiler and generating equipment which it is expected will be needed in the next ten years. In 1913 the United company produced and purchased 62,656,409 kw-hr. of energy, and that distributed to its consumers exceeded by 34.7 per cent the energy distributed during the previous year. During 1913 there was a general increase in the sixty-cycle load in all sections of the United company's territory. It is interesting to note that in 1909 the ratio of energy demand to the total was 45.86 per cent south of Fifty-ninth Street, 21.49 per cent from Fifty-ninth Street to 135th Street and 32.65 per cent north of 135th Street, while in 1913 the ratios in these districts were respectively 32.66 per cent, 20.22 per cent and 47.12 per cent, showing that the majority of the energy demand has shifted northward. The section north of 135th Street on Manhattan Island is supplied exclusively from the mains of the United company, and all that important electrical development in the northern section has been along the lines of sixty-cycle supply.

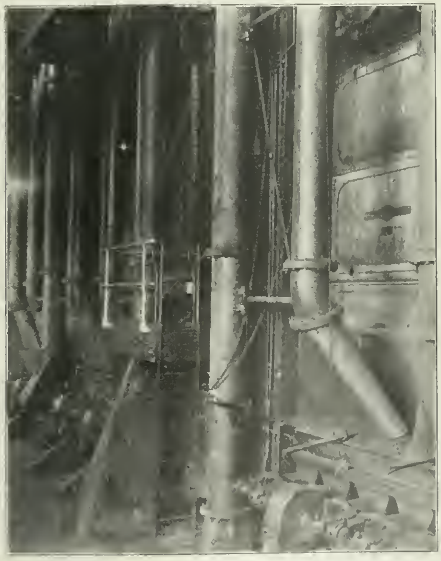


FIG. 5—COAL DOWNTAKES AND CONSTANT-SPEED MOTOR DRIVING STOKERS

Features of Generating Station

One of the main features in the 201st Street station is the almost universal use of turbine-driven auxiliaries, no reciprocating engines being employed except for hoisting coal and circulating lubricating oil. Relatively high-speed main generating units are installed, each being equipped with a blower driven by two motors, one acting as an emergency reserve. Duplicate high-tension buses divided into four sections are employed which can be connected in two loops through bus-tie switches and reactors. The 7500-volt induction motor-driven exciters also charge the storage battery and will deliver 250 volts to 350 volts direct current, thus making it unnecessary to operate a booster generator. The storage battery end-cell switch is operated automatically by a specially designed remote-control switch which shows when the end-cell switch is operating and indicates the number of cells in series. Elaborate coal and ash handling apparatus is installed and the mammoth coal bunkers located just below the roof are designed to prevent spontaneous combustion. Space is provided for a double deck of seventy-two boilers, only thirty-two of which are at present installed. These are equipped with the most modern automatic apparatus and with special-drive stokers.

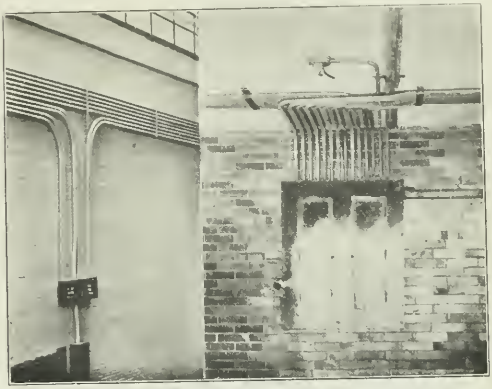


FIG. 6—TYPICAL CONDUIT WORK ON WALLS AND CEILINGS

Each bank of high-tension transformers feeding the tie lines and substations is cooled by individual motor-driven blowers which start automatically when the transformer bank is energized. A special three-phase balanced alternating-current lighting scheme is employed in the station which permits of connecting small polyphase motors to the lighting distribution panels when necessary. A new system of heating the high-tension galleries is employed which eliminates the danger caused by steam or water escaping near the bus compartments. An ingeniously constructed load-indicating device for the boiler rooms is used which records on a tape the load, the time when a signal is transmitted from the high-tension switch room to the boiler room, and the time it is acknowledged. Among other features is the use of a 30,000-volt testing outfit with outlets at different points in the station. Provision is made for testing all auxiliaries and main turbines without setting up temporary apparatus.

Location and General Description

The station, which is of fireproof construction with an exterior of red brick, artificial granite and terra cotta, occupies about 62,220 sq. ft. of space at 201st Street, where the Harlem River joins Sherman Creek. It is divided into three sections and is about seven stories high. The high-tension bus and switching galleries are at the west end of the building, the turbo-generators and auxiliaries in the adjoining section, and the boilers, coal and ash handling apparatus at the east end of the station. The building rests on 6600 piles driven to rock bottom.

The walls of the engine room, corridors and office space are faced with white-enameled tile, and the floors are of granolithic concrete set in cast-iron panels. In the boiler room the walls are made of salt-glazed brick to prevent dust collecting on them and to facilitate cleaning. From the ground floor to the roof of the boiler room there is no obstruction to ventilation, as grating has been employed for flooring on the several landings. This construction will prevent dirt accumulating and at the same time provide a light, airy and cool boiler room. Every part of the building is well lighted either through skylights or wall windows. The engine room is especially bright, having a mammoth window at each end and a large wire-glass skylight in the monitor. All window sashes are operated by a compressed-air system. Artificial illumination in the engine room is provided by thirty 500-watt tungsten lamps supported from ornamental wall brackets 45 ft. above the floor. Electric illumination in the other parts of the building is afforded by smaller units supported either from the walls or ceiling by rigid pendent fixtures. All doors and windows are constructed of metal. One passenger elevator installed in the west end of the building serves the galleries and office, while three others carry freight.

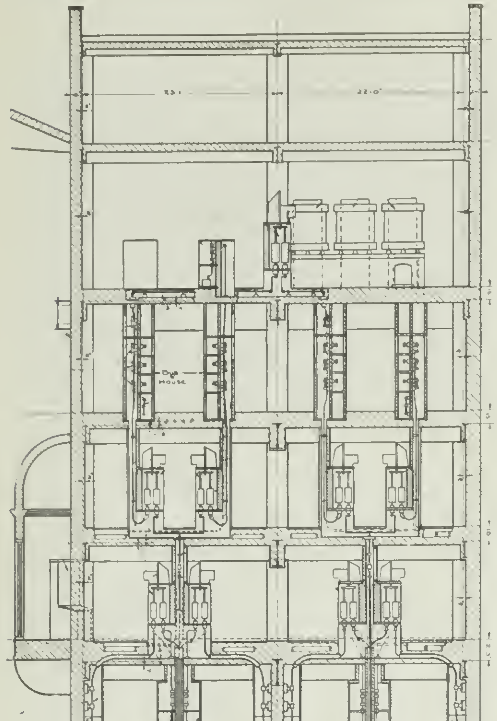


FIG. 7—HIGH-TENSION BUS AND SWITCH GALLERIES

Coal-Handling Apparatus and Bunkers

Coal is delivered by boat to the Harlem River side of the building and is hoisted 184 ft. by 1.5 ton grab buckets to the top of a steel coal tower, where it is dumped into hoppers and passed through crushers. From the crusher the coal is conveyed in 3-ton cars, operated by an endless-cable system, to the 15,000-ton concrete coal bunkers located just below the roof of the boiler room. The coal hoists (one in each tower) are operated by one-man-control reciprocating engines. Three hundred tons of coal can be unloaded per hour when hoisting the buckets at 1200 ft. per minute. The crusher and endless cable operating the coal cars are driven by induction motors controlled by the men who fill the cars and weigh them. As constructed at present it is necessary to cease coal hoisting if the cable cars are tied up as the hoppers over the crushers are merely temporary receptacles and cannot hold much. Larger receiving hoppers will be installed later with steam valves between them and the crushers so it will be possible to operate the hoists continuously regardless of temporary interruptions to coal-car operation.

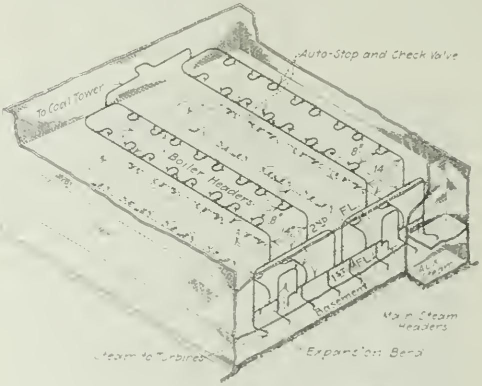


FIG. 8—LAYOUT OF BOILER AND MAIN STEAM HEADERS

The 15,000-ton bunkers occupy the entire width and length of the upper part of the boiler room, and their walls have been constructed with sufficient slope to prevent coal accumulating in pockets and causing spontaneous combustion. The bunkers are V-shaped and are made of granolithic concrete supported by steel girders and trusses.

Boilers and Stokers

While space has been provided for a double-deck arrangement of seventy-two boilers, only thirty-two 650-hp Babcock & Wilcox boilers have been installed. This is all that will be required even with eight 19,000-

kva turbo-generators operating, as the United company contemplates forcing the boilers when the eight generators are installed. When the energy demand exceeds the output of eight 19,000-kva generators, higher-rated generators will be installed and the second deck of boilers erected. The boilers now in place are arranged in four rows of eight each with General Electric indicating and recording steam-flow meters in each header connecting a row of boilers with the main header. Besides the usual brick setting each boiler is provided with an additional heat insulation of asbestos board and magnesia and a sheet-steel casing. The boilers are set especially high (10 ft. above the floor) to provide sufficient combustion space when the boilers are overloaded. A steam pressure of 200 lb. will be maintained ordinarily and the temperature of the steam raised 125 deg. Fahr. by superheaters each having 750 sq. ft. of heating surface. Each drum on every boiler is equipped with a safety valve as well as an individual feed-water connection. The height of the water in the drums is maintained at a constant level by S. C. automatic regulators connected to the middle drum of each boiler. The boilers are also equipped with steam soot blowers for cleaning the tubes.

The stokers are operated in groups of four by constant-speed induction motors and the rate at which coal is fed to the grates is regulated by Reeves variable-speed cone transmissions. The stokers are connected by inclosed-chain drive to their respective group-drive shafts beneath the floor. Each shaft in turn is driven through an inclosed silent chain by a 30-hp Westinghouse motor, thus requiring eight motors for the present boiler installation. Each of these motors has sufficient power to drive all stokers in one row. In emergency this can be done by closing a clutch which connects the end of the adjoining shafts. While each stoker is capable of feeding about 6000 lb. of coal per hour, only 2500 lb. of coal is normally fired per hour, the boilers operating with a gas speed of 10.6 ft. per second in the flues. On a boiler in each section is installed an electric tachometer indicating the speed of the stoker-driving mechanism. On this instrument is a movable scale of air pressures below the fire giving the proper relation between this pressure and the stoker speed. Apparatus is also installed so that an analysis can be made of the flue gas from each boiler.

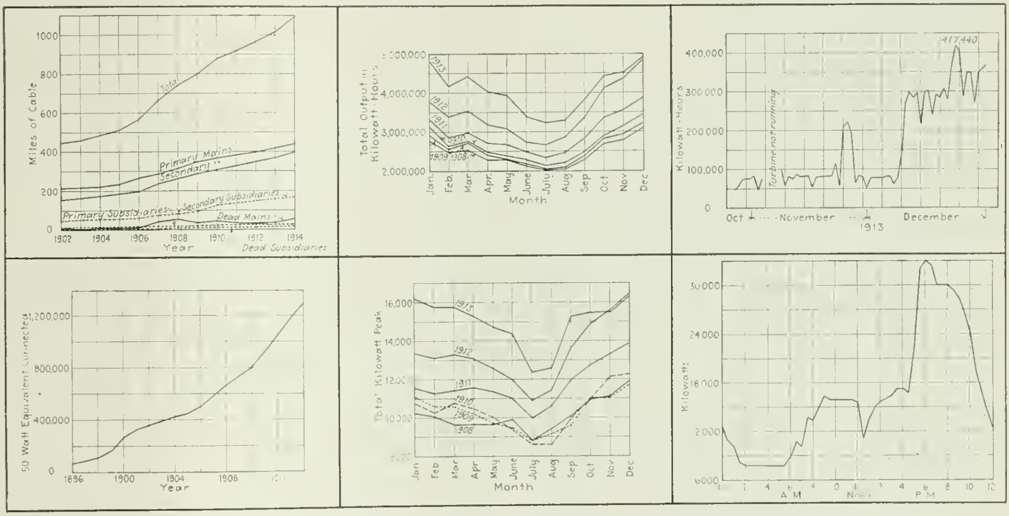


FIG. 9—DATA CURVES RELATING TO UNITED COMPANY'S BUSINESS

Taylor underfeed stokers are employed, the coal being delivered to their hoppers through elliptical-shaped downtakes communicating with the 15,000-ton bunkers located above. The downtakes, which are self-supporting, consist of vertical pipes (three to each pair of boilers) extending from the bunkers to the ground floor, where they rest on cast-iron pedestals in the firing aisle. Coal valves are placed in the lower ends of alternate vertical downtakes to allow coal to be delivered into the firing aisle for emergency hand firing. The same downtakes are arranged to feed boilers which may be installed later on the second deck. Normally the coal is delivered to the stoker hoppers through pipes branching off from the vertical downtakes and fastened to the front boiler header. Piston-type coal valves operated by chains are placed in these branch pipes above each hopper. To permit opening boiler headers for tube inspection, repair, etc., the branch pipes have been hinged on the vertical downtakes so that they may be swung from the headers.

The draft over the fires is maintained partly by 300-ft. stacks, of which there are four (one to each set of boilers), and partly by air pressure beneath the grates. The latter is furnished by Sturtevant blowers in the basement. The stacks are constructed of steel lined with hard red brick, the intervening space being filled with cement. Sufficient pressure is maintained beneath the grates just to overbalance that above, thus preventing any leakage of cold air through the boiler settings or smoke ducts.

There are four sets of forced-draft blowers, each consisting of three Sturtevant fans connected through helicoidal gearing to steam turbines. One fan of each set is held as a reserve, the other two being capable of delivering 80,000 cu. ft. against a static head of 5 in. of water. Each blower set delivers air to a duct supplying eight boilers.

In a later issue of the *Electrical World* will appear a description of the remaining mechanical equipment, including the cinder catchers, ash-handling apparatus, steam-header piping, etc., followed by a detailed account of the features of the electrical equipment.

Booster-Control Test on Metropolitan Railway, Paris

Obtaining acceleration and retardation in electric traction by varying voltage at armature terminals and currents in field circuits with motor-generator sets. By Charles Jacquin

ONE of the most important problems of electric traction is that of efficiency in acceleration and retardation. If we ignore commercial claims, it must be admitted that very little progress has been made in this field, especially with direct-current equipment. The standard method of combining series-parallel operation with the use of resistances has two important drawbacks—it wastes energy in starting and stopping, and, in multiple-unit equipment, it leads to great complication.

In single-phase equipment the speed can be regulated by the use of an auto-transformer or an ordinary transformer to vary the voltage applied to the motors. This method looks very simple on paper, but those who have had experience know that it is not so attractive in practice. The absence of resistance losses is certainly of great advantage on suburban lines, but it is of little importance on trunk lines with few stops. The difficulty lies in passing from one voltage step to another.

In 1894, just twenty years ago, the Ward-Leonard system was tried on the Heilmann locomotive, which carried a gas engine coupled to an electric generator. On this locomotive the speed regulation of the traction motors was obtained by varying with a small special exciter the independent shunt excitation of the main generator. This method had the disadvantage of weight, but the saving of energy in starting and stopping was incontestably good and the control was very simple. These tests, which were made on the former Western (now State) Railways, were considered a great success.

About 1895 the Western Railway made further tests with the straight Ward-Leonard system, comprising a booster in series with the traction motors instead of a gas-electric set. In this outfit the booster produced an emf which permitted the motor voltage to vary from zero to double the line potential. The tests were discontinued because the starting was not automatic, regeneration was practically impossible and, lastly, the system did not allow multiple-unit operation

It was not until 1913 that any further work of importance was done in this field. Then an important step was taken by the Jeumont company (Ateliers du Nord et de l'Est de la France à Jeumont) in the construction of a new control equipment for the Metropolitan Railway of Paris.

An interesting point about the new control is that it is merely a small modification of a device which has been applied to European mining machinery for the last four or five years. In short, it is the application to electric traction of the Ward-Leonard principle in which the voltage at the traction motor armature terminals is varied by means of a motor-generator set, the currents in the field circuits of the traction motors being independently varied by means of another motor-generator set both mechanically and electrically associated with that just mentioned. The railway apparatus has been developed chiefly by M. Legouez, chairman of the Société pour l'Industrie des Chemins de fer. The surprising results hereinafter quoted were obtained from a test of several months' duration on a Metropolitan train.

Apparatus and Connections of Booster Control System

The wiring scheme of the Jeumont company's control system is shown in one of the accompanying diagrams The letters M_1 M_2 and m_1 m_2 represent the rotors and fields of the ordinary direct-current traction motor, the two armatures being permanently operated in series and the two fields being permanently connected in series The machines F_1, F_2 and F_3 represent the motor-generator set, the functions of which will now be explained F_1 and F_2 represent a booster group and F_3 a small regeneration dynamo. The booster group itself comprises two commutating machines F_1 and F_2, the rotors of which are mounted mechanically on the same shaft, one working as a motor and the other as a generator. The functions of these machines are reversible, depending upon operating conditions, but F_1 is always connected in series with the traction motors by a two-way switch

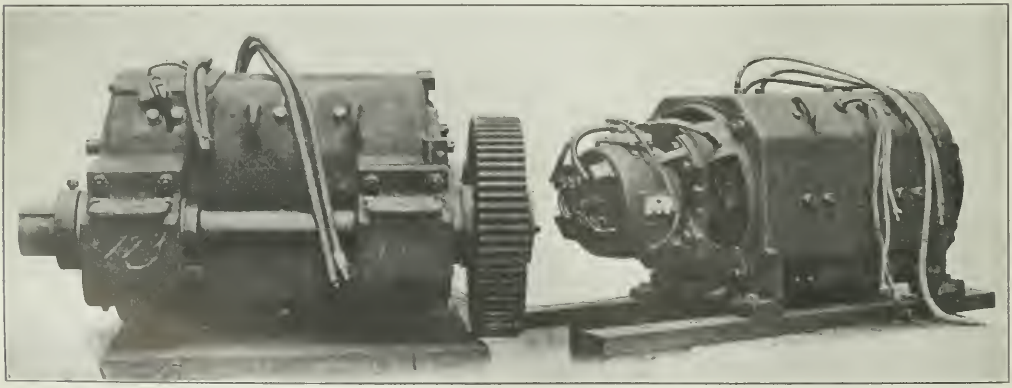


FIG. 1—175-HP TRACTION MOTOR

"3." By means of switch "4" the armature of F_3, the regeneration dynamo, is joined in parallel with the field coils of the traction motors. This machine serves for varying the excitation of the traction motors. The machine F_2, which operates at a constant speed, is simply a combined dynamo connected across the line, its shunt-exciting circuit being shown as D and its series circuit as D_2. The regulating generator F_1 has two exciting circuits, one being the circuit H which receives a constant current from the line X and the other the circuit E connected in shunt with its own armature and that of machine F_3. The regeneration dynamo F also has two exciting circuits, one, A, connected directly across the line X to produce a constant excitation, the other, B, connected in parallel with the armature circuit of the regulating dynamo F_1 to give an excitation varying in direction and intensity with the emf of this machine; that is to say, the excitation of F depends upon the speed of the traction motors.

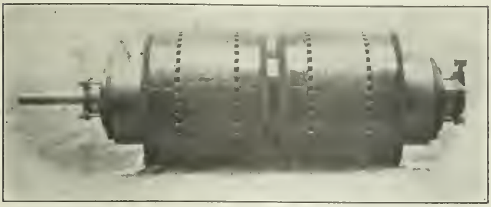


FIG. 2—ARMATURE OF BOOSTER REGULATOR

In starting from rest, the line switch is closed, the reversing switch 2 of the regeneration dynamo being in the proper position. Then the booster group is brought to normal speed with the small rheostat rh, machine F_2 now acting as a motor. Until this moment switch 3 has been kept open to avoid excessive current in the main motor circuit. As soon as the booster group has attained its normal speed switch 3 is closed according to the direction of propulsion. The real starting operations follow next.

At first the emf of machine F is in a direction to subtract from the main line voltage and thereby to decrease the voltage impressed on the traction motors. Under these conditions F_1 operates as a motor and drives F_2 as a generator, which therefore returns energy to the line X. Subsequently, as the main traction motors accelerate, the voltage across F_1 is reduced and finally reaches zero, under which condition the two traction motors operate as if in ordinary series connection, receiving the full line voltage. When the higher speed of travel is reached the dynamo F_2 runs as a motor and drives F_1 as a generator to produce an emf which adds to that of the line until the voltage impressed upon each traction motor is equivalent to that obtained during ordinary parallel connection. In this fashion, as the accompanying curves show, acceleration is obtained without waste of energy or discomfort to passengers. The reverse of the foregoing movements occur during retardation, the switch 2 being reversed, thereby altering the excitation of machine F_1, varying the emf impressed upon the traction motors and causing energy to be returned to the line.

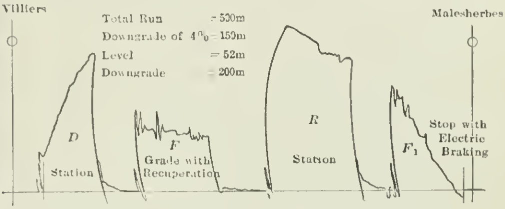


FIG. 4—ENERGY-CONSUMPTION CURVE

Estimate Energy Savings

The tests show an energy saving of 20 per cent. For instance, on one run the energy consumption of an ordinary multiple-unit equipment was 60 kw-hr. and of the new Jeumont equipment only 48 kw-hr. In braking it was found possible to regenerate 30 per cent of the energy used in starting. If the Jeumont system was applied to all trains of the Metropolitan Railway, the annual saving would be 20,000,000 kw-hr., or $200,000, at the very low rate of 1 cent per kw-hr. Other accessory but not insignificant advantages of this saving in energy would be less heating of the air in the subway and in the cars, less brake wear and metallic dust.

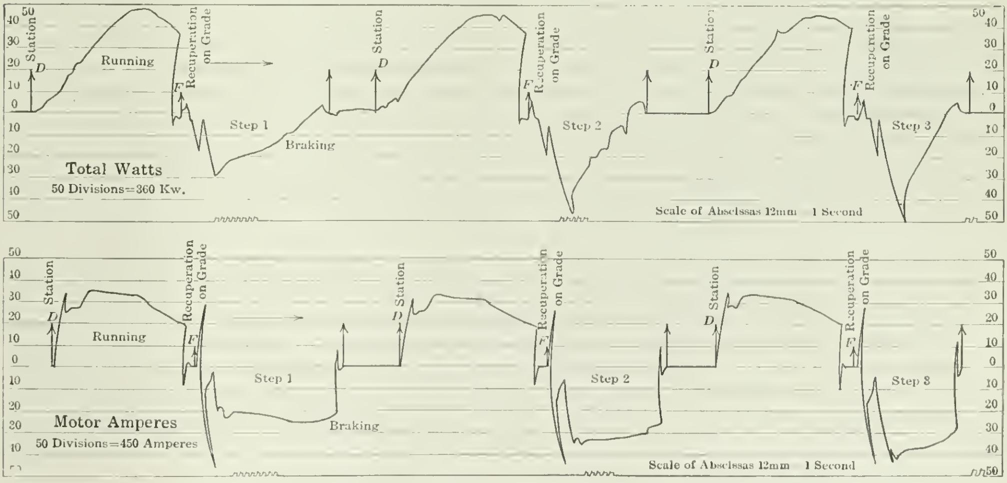


FIG. 3—ENERGY AND CURRENT CURVES OF BOOSTER-CONTROL SYSTEM

During the running period this control acts as a regulator to maintain a constant current automatically despite variation of speed due to grades, curves, etc. This system can readily be applied to multiple-unit trains with great simplification of apparatus. For instance, it would permit on a Metropolitan motor car with ordinary multiple-unit control the elimination of two contactors, of one reverser and of the starting resistances, a total of 990 lb. As the new devices weigh 4070 lb. per motor car, the actual increase in weight due to using a more efficient control would be 3080 lb.

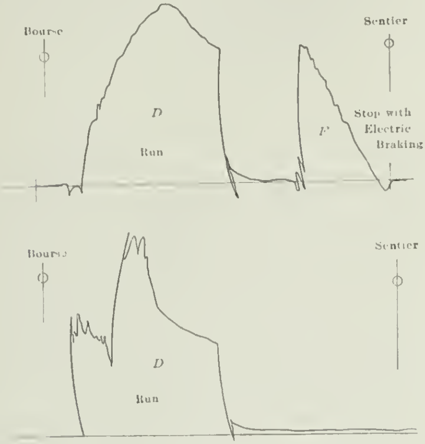


FIG. 5—COMPARISON OF ENERGY CONSUMPTION

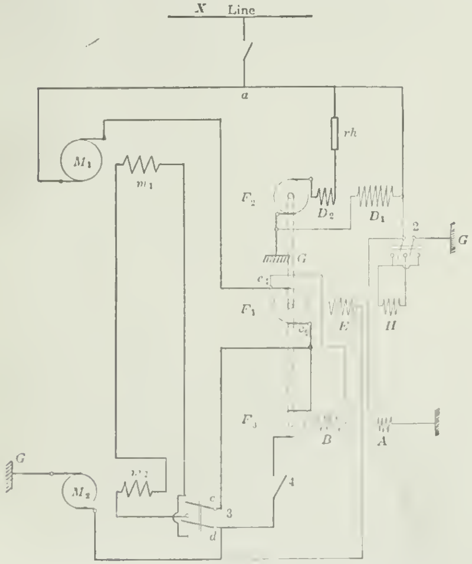


FIG. 6—CIRCUIT CONNECTIONS OF BOOSTER-CONTROL SYSTEM

The new system can be readily adapted for several maximum running speeds to permit most economical operation over sections with varying conditions. Three such maximum speeds were in service on the test train mentioned.

Preventing Buzzard Short-Circuits

In constructing its new aluminum-conductor transmission line into Baltimore from Holtwood, the Pennsylvania Water & Power Company has adopted a special spacing of 9 ft. between conductors to prevent "buzzard short-circuits." On the present lines very large birds, under proper weather conditions, may cause interruptions, but the new spacing of 9 ft. is expected to obviate this trouble.

Standardization of Battery Dimensions an Impediment to Development

Below is given an abstract of a paper read by Mr. E. J. Mudge, of the United States Lighting & Heating Company, New York, before the recent annual convention of the Society of Automobile Engineers, New York, criticising the battery specifications adopted by the society at that meeting.

Specifications requiring that batteries shall not exceed 7.5 in. in width and 9.5 in. in height, said Mr. Mudge, will discourage the future development of batteries for starting devices, since these dimensions will prevent variations in plate sizes and cell assemblies. The size specified practically compels the use of a plate having a width much greater than its height—a proportion not desirable, especially when various parallel combinations are required and the length of eight-cell to twelve-cell batteries has to be minimized. Should any shorter plates than those now employed be used to conform with the prescribed 9.5-in height, the battery itself would have to be increased about 6 in. in length, making it longer than most cars can accommodate.

Limiting the height of a storage battery to 9.5 in. will also discourage any special efforts to design batteries having the proper expansion space above the plates and provisions for maintaining the proper acid height. Although the extension of battery handles above the terminals and connections may minimize short-circuits, there is no particular reason why such practice should be standardized, as the metallic battery cover will serve the same purpose if properly designed.

Mr. Mudge believes that the final voltage on a discharge test conducted at the 5-amp rate should be 1.7 volts per cell instead of 1.8 volts to give a fair average for all sizes of batteries. To conform with the present general practice it was suggested that 70 deg. Fahr., instead of 80 deg., be used as the standard temperature at which to rate batteries. Specifications should also include the height of the acid above the tops of the battery plates and the specific gravity of the acid at full charge when the electrolyte has evaporated to a level just covering the tops of the plates. The last specifications especially should be required during factory tests to prevent manufacturers deliberately overrating batteries by using too concentrated electrolyte or too large a volume of acid. If the surface of the electrolyte is above the normal level, the acid will, when evaporated, become so concentrated as to destroy the wooden separators.

The method prescribed in the S. A. E. specifications for determining the ability of a storage battery to respond to high rates of discharge for short periods, when operating an electric cranking motor on automobiles, is considered very satisfactory by the author, as it will test the conductivity of the cell connectors and the mechanical construction of the battery. The method of rating is based on the maximum amperes which can be discharged for twenty minutes with a final emf of 1.65 volts per cell.

Parallel Operation of Transformers—I

Calculation of current in transformers connected in parallel, the total current being resolved into its components by vector and symbolic analysis. By Waldo V. Lyon

In discussing parallel operation of electrical apparatus some writers lay considerable stress upon the so-called interchange or local currents which exist in the circuits between the apparatus but which are not present in the external circuit. Except in some special cases this method may lead to erroneous conclusions. It is, moreover, a reduction of a more general analysis in which the current in any one circuit is divided into several components each of which has a definite significance. If there are, say, three factors which affect the parallel operation of electrical apparatus, the current in any one branch may be divided into four components. The first is the ideal current which would exist if each of the factors had no effect. The second component is due wholly to the action of the first of these three disturbing factors, and similarly for the other two components. Thus, if any one of the disturbing factors is not present the component of the current which it in general produces is zero.

It is the present purpose to apply this method of analysis to the case of transformers operating in parallel. Owing to the close agreement of the simple theory with actual practice, the analysis is more exact with transformers than with any other apparatus. In dealing with transformers under load conditions, it is customary to neglect the exciting current and to assume that the core loss is constant. It can be shown that the errors introduced thereby are very small and, as far as the losses go, tend to offset one another.

The vector diagram which will be used to represent the conditions existing in a single transformer is given in Fig. 1.

The primary voltage V_1 is equal to the secondary voltage V_2 multiplied by the ratio of transformation a plus the equivalent impedance drop referred to the primary side. It is unimportant how the equivalent impedance is actually divided between the two sides of the transformer. This is only true, however, when the exciting current and the effect of a change in the mutual flux on the core loss are negligible.

If the equations that follow were written in full the voltage, current, impedance and admittance would be expressed in the symbolic notation of complex quantities.

The general condition for parallel operation is that the primary voltages and the secondary voltages shall be the same for all of the transformers. When the ratios of transformation are equal the solution is simple.

$$aV_2 + I_1z_1 = V_1$$
$$aV_2 + I_2z_2 = V_1$$

I_1, I_2, etc., are the primary currents and z_1, z_2, etc., are the equivalent impedances, referred to the primary sides of the transformers. These equations may be written:

$$I_1 = y_1 (V_1 - aV_2)$$
$$I_2 = y_2 (V_1 - aV_2)$$

The total current, I_0, is equal to the vector sum of the individual currents and is:

$$I_0 = I_1 + I_2 + \ldots = (y_1 + y_2 + \ldots)(V_1 - aV_2)$$

Since in general the total current would be given, this equation should be solved for the common impedance drop.

$$(V_1 - aV_2) = \frac{I_0}{Y_0}$$

Y_0 is the sum of the admittances expressed in the notation of complex quantities. The current in the first transformer is given by:

$$I_1 = \frac{y_1}{Y_0} I_0 \qquad (1)$$

If the ratios of transformation are not the same for the several transformers, the solution is nearly as simple. In this case the equations are written:

$$a_1V_2 + I_1z_1 = V_1$$
$$a_2V_2 + I_2z_2 = V_1$$

The ratios of transformation are a_1, a_2, etc., the currents in the several transformers are I_1, I_2, etc., and the equivalent impedances, referred to the primary sides, are z_1, z_2, etc., respectively. The primary and secondary potential differences are V_1 and V_2 respectively. Solving the first of these equations for I_1:

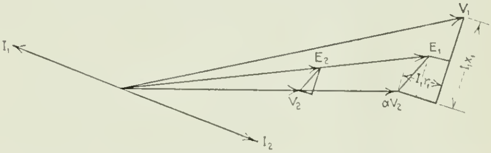


FIG. 1—VECTOR DIAGRAM OF CURRENTS AND VOLTAGES

$$I_1 = \frac{1}{z_1}(V_1 - a_1V_2)$$

This is more conveniently written as:

$$I_1 = y_1V_1 - a_1y_4V_2 \qquad (2)$$

The total current on the primary side is the sum of the currents I_1, I_2, etc., and is:

$$I_0 = I_1 + I_2 + \text{etc.}$$
$$I_0 = (y_1 + y_2 +) V_1 - (a_1y_1 + a_2y_2 +) V_2$$

If Y_0 is substituted for $(y_1 + y_2 +)$ and Σay for $(a_1y_1 + a_2y_2 +)$ this equation may be solved for V_2 and written in the following simple form:

$$V_2 = \frac{Y_0V_1 - I_0}{\Sigma ay}$$

If this value of V_2 is substituted in equation (2) the solution for I_1 becomes:

$$I_1 = y_1V_1 - a_1y_1\left(\frac{Y_0V_1 - I_0}{\Sigma ay}\right)$$

In this equation all of the quantities are known and thus the current in any transformer can be exactly determined. For the purpose of numerical solution it is better to change this into the form:

$$I_1 = a_1y_1 \frac{I_0}{\Sigma ay} + y_1\left(V_1 - a_1 \frac{V_1Y_0}{\Sigma ay}\right) \qquad (3)$$

The independent variables in equation (3) are y_1 and a_1. If the ratios of transformation are all equal this equation reduces to the form shown in (1).

This, then, is the general solution for the current in one of a number of transformers that are connected in parallel.

When the ratios of transformation are equal the current in each transformer is zero at no load. (See equation 1.) When the ratios are not equal, however, there is always current in at least two of the transformers at no load, but if three or more are connected in parallel some of them may not carry current at this time. Even under load conditions it is possible, though not probable, that there will be no current in one transformer when two are operating in parallel alone.*

In order to apply the principle of analysis which has been outlined, it is first necessary to determine the factors which influence the parallel operation of transformers. These are three: First, the ratio of transformation; second, the ratio of equivalent resistance to equivalent reactance, and, third, the equivalent impedance volts at the maximum allowable current. Under the assumptions of negligible exciting current and of core losses which depend only upon the impressed primary voltage these are the only factors which affect parallel operation. Thus the total current to any one transformer should be divided into four components. The first is the ideal current which would exist if the transformers were perfectly suited for parallel operation. The second is the component which is caused by unequal ratios of transformation. The third is the component caused by the inequality of the ratios of equivalent reactance to equivalent reactance in the several transformers, and the fourth is the component caused by the inequality of the equivalent impedance volts at maximum allowable current. The actual current in the first transformer in the general case is given in equation (3). If the ratios of transformation are the same, the current is as given in equation (1) The difference of these two currents gives then the component of the current which is due wholly to the inequality in the ratios of transformation. This component will be designated as B.

$$B = y_1 \left\{ V_1 - a \left(\frac{Y_0 V_1 - I_0}{\Sigma a y} \right) \right\} - y_1 \frac{I_0}{Y_0}$$

This equation for B may be rewritten in a better form:

$$B = y_1 \left(V_1 - \frac{I_0}{Y_0} \right) \left(1 - a_1 \frac{Y_0}{\Sigma a y} \right)$$

The independent variables are y_1 and a_1.

The second factor of the component B is the primary voltage less what may be called the average equivalent impedance drop in the transformers referred to the primary side. Thus it may be said to a very good degree of approximation that this component B is independent, both in phase and in magnitude, of the total load current.

In order to find the third component, assume that the ratios of transformation are equal and that the equivalent resistance and the equivalent reactance of each transformer are adjusted so that, although their equivalent admittances remain unchanged, the ratio of resistance to reactance is the same for each. In this case the component B is zero and the current in the first transformer is given by equation (1). Since the ratios of resistance to reactance are the same for each of the transformers, the currents are all in time-phase and the ratio, $\frac{y_1}{Y_0}$, is the same as the ratio of the numerical value of the admittance of the first to the sum of the numerical values of the admittances of the several transformers.

This latter ratio will be expressed thus: $\left[\frac{y_1}{\Sigma y} \right]$

One may then write $I_1 = \left[\frac{y_1}{\Sigma y} \right] I_0$ (4)

The third component, C, of the current in the first transformer is the difference between equations (1) and (4) and is:

$$C = \left\{ \frac{y_1}{Y_0} - \left[\frac{y_1}{\Sigma y} \right] \right\} I_0 \qquad (5)$$

This component is in general neither in time-phase nor in time-quadrature with the total load current I_0. It is zero when the ratios of equivalent resistance to equivalent reactance are the same for all of the transformers.

Assume that the components B and C are zero, so that the actual current in the first transformer is given by equation (4). The current in any transformer will at all times be proportional to the total load current. If the transformers are suited for ideal parallel operation, each will carry its maximum allowable current at the time when the total load is a maximum. Let I_1', I_2', etc., be the maximum allowable currents for the transformers. These may or may not be the rated values of the full-load currents, as some transformers may be rated more conservatively than others. In want of better data, however, they should be taken as such. In this case the equation need not be in complex notation since all of the current vectors are in time-phase. The total maximum possible load current is the sum of the currents in the several transformers and is

$$\Sigma I' = I_1' + I_2' + \dots$$

The proportion of this that the first transformer should take at this full-load condition is $\frac{I_1'}{\Sigma I'}$, and hence this is the proportion of the total load current that this transformer should take at all times. This may be called the ideal current A.

$$A = \frac{I_1'}{\Sigma I'} I_0 \qquad (6)$$

This is the first and most important of the components into which the actual current is divided.

The fourth component, D, is the difference between the actual current when the ratios of tranformation and the ratios of equivalent resistance to equivalent reactance are equal for all of the transformers and the current which would exist under the ideal condition. That is, it is the difference between the values given in equations (4) and (6).

$$D = \left\{ \left[\frac{y_1}{\Sigma y} \right] - \left[\frac{I_1'}{\Sigma I'} \right] \right\} I_0 \qquad (7)$$

If the impedance volts are the same for all of the transformers at the time they are carrying their maximum allowable current, this component, D, is zero.

The actual current may now be expressed as the sum of its four components. That is:

$$I_1 = A_1 + B_1 + C_1 + D_1$$

$$I_1 = \left[\frac{I_1'}{\Sigma I'} \right] I_0$$

$$+ y_1 \left(V_1 - \frac{I_0}{Y_0} \right) \left(1 - a_1 \frac{Y_0}{\Sigma a y} \right)$$

$$+ \left\{ \frac{y_1}{Y_0} - \left[\frac{y_1}{\Sigma y} \right] \right\} I_0$$

---

*If I [illegible] 0, and I [illegible] I [illegible] a_1 [illegible]

Under any ordinary conditions this would be a very small current at a very low power-factor

$$+ \left\{\left[\frac{y_1}{\Sigma y}\right] - \left[\frac{I_1'}{\Sigma I'}\right]\right\} I_0 \qquad (8)$$

If the value of the actual current is desired, it is best found by solving equation (3), and it is only when we wish to determine the effect of the several components that it is necessary to use equation (8). To repeat, the first component is the current which would exist if the transformers were suited for ideal parallel operation. The second component is zero if the ratios of transformation are equal. This component is practically independent of the total load on the transformers so that its phase relation with respect to the load current depends upon the power-factor of the load. The third component is zero if the ratios of equivalent resistance to equivalent reactance are equal. It is directly proportional to the total load and may either lead or lag the resultant current. The fourth and last component is zero if the transformers have the same equivalent impedance volts for maximum allowable current. It is also directly proportional to the total load and may be either in time-phase or in time-opposition to the resultant current. When three or more transformers are operating in parallel it is possible to have the components B, C and D present in two of them and absent in the others.

The vector diagram which shows the phase relations of these components with respect to the total load current is given in Fig. 2. The diagram is drawn for two transformers. The component D is always in phase or in opposition to the ideal current, while the component C is in practice nearly in quadrature with it. The sum of their quadrature components for all the transformers must of course be zero. The vector sum of each of the components B, C and D for all of the transformers is also zero. That is:

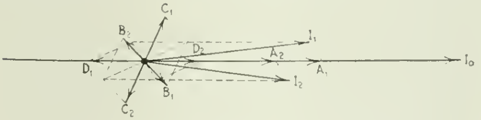


FIG. 2—VECTOR DIAGRAM SHOWING PHASE RELATIONS OF COMPONENTS

$$\Sigma B = 0,\ \Sigma C = 0,\ \Sigma D = 0;\ \text{but}\ \Sigma A = I_0.$$

Since in the aggregate none of these components except A appears in the line, they may be called "local currents."

Under the assumption of a practically constant core loss, the output of any transformer is determined by the current it carries. It is thus important to find the effect of each of these components on the copper loss. The effect of the component D is simplest to find. If the components B and C are both zero, the total current is:

$$I_1 = A_1 + D_1.$$

The component D may be either in time-phase with or in time-opposition to the component A. The heating due to the current is proportional to I_1^2 or to $(A_1^2 + 2\,A_1D_1 + D_1^2)$. The additional heating due to the component D is proportional to $(2\,A_1D_1 + D_1^2)$, and the fractional increase is proportional to $\left(\frac{2\,D_1}{A_1} + \frac{D_1^2}{A_1^2}\right)$. In actual practice the first term of this expression would probably in most cases be greater than the second and so would determine the sign of the expression; that is, D may be either a positive or a negative quantity. Observe that the additional heating due to this component is far from being proportional to the square of its value. Thus, owing to the inequality of the equivalent impedance volts at maximum allowable current, the heating in some transformers is greater and in some is less than it should be, so that some transformers will reach their limit of permissible output before the others.

The other components, B and C, are in general neither in time-phase nor in time-quadrature with the total load current, and the additional heating produced by each of them may be found by the same method of analysis. The additional heating produced by the component of the current which is caused either by the inequality in the ratios of transformation or in the ratios of equivalent resistance to equivalent reactance likewise is not proportional to the square of this component.

Since the phase relation of the second component B with respect to the load current I_0 depends upon the power-factor of the load, the additional heating which it causes will also depend upon the power-factor of the load. The additional heating caused by the other components, C and D, is independent of the power-factor. If the proper amounts of resistance and reactance are added to each of the transformers these latter components, C and D, can be reduced to zero in every transformer for all conditions of load. At certain loads the additional heating caused by the component B may be zero in at least one transformer. But this component will disappear in all of the transformers only when the number of turns in the primary and secondary coils are altered so that they are in the same ratio for all transformers.

The determination of the effect that these components have on the total output of the transformers, together with a numerical example, will be given in a later issue.

Central-Station Service for Constantinople

The conveniences of electricity are soon to be made available in the Turkish capital and the devout Mussulman may shortly exchange his piastres for the kilowatt-hours of enlightenment and progress. Heretofore Constantinople has had no central-station electric-lighting system, although a few buildings such as apartment houses, hotels and office structures had private plants of their own. A foreign syndicate, La Société Anonyme d'Électricité Ganz, of Budapest, Hungary, is now installing a modern plant to furnish lighting and motor service for the city generally. Some of the equipment was purchased in America. A complete telephone system is also being installed, and the street-railway company is now engaged in electrifying its lines.

New Field of Education for Engineering Universities

Certain American universities are now making a practice of allowing their professors of engineering to engage in outside professional work, some even going so far as to require men of their teaching staff to keep in close touch with the problems of public utility regulation. The regents of the University of Michigan recently declared that such teachers "not only should be permitted to engage in professional work outside of their university work, but should be encouraged to engage in such work, in so far as it can add to the effectiveness of their work as teachers and does not impair their services to the university, and where such work relates to problems of public interest the special kinds of skill to be found in such a teaching staff should, as far as posible, be made available to all."

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

"Can I Be of Further Service?"

Among the employees of the Southern California Edison Company the habit of showing a personal interest in customers' problems is encouraged. When called to take care of any trouble the repairman, after the complaint has been attended to, personally informs the consumer that the repair has been made and asks pleasantly if there is anything else that needs looking after. Customers of the company in the Venice (Cal.) district seem to appreciate that kind of attention.

Pension System of Northern Illinois Company

On Jan. 1 a pension system similar to that of the Commonwealth Edison Company was announced by the Public Service Company of Northern Illinois. Pensions are given to three classes of employees—those at least fifty-five years old who have worked thirty years for the company; those at least sixty years old whose service is twenty years, and those at least sixty-five years old who have a record of fifteen years of service. In computing the annuity that consecutive five-year period when the employee received his highest salary is taken as the basis. The average pay for that period is multiplied by the number of years of service, and the annuity is 1.5 per cent of the product.

Wiring on Monthly Payments in Kansas City

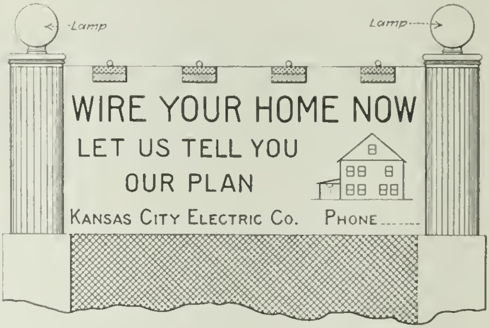
During the last thirty months the Kansas City (Mo. Electric Light Company has been financing prospective customers who cannot afford to pay the entire cost of a wiring installation at the completion of the job. According to the plan in force, the contracts secured by the lighting company's solicitors are awarded in rotation to three contractors in the city, each contractor receiving every third job regardless of its size or character. These firms do the work and at the completion of the installation are paid in full by the lighting company. The new customer then has the privilege of paying the electric-service company for the wiring in twelve equal monthly payments.

Surprise, however, has been occasioned by the fact that, although the company offers to finance customers for a period of twelve months, the majority of the accounts are in reality settled in full within periods of from three to four months. When the present system of financing customers' installations was adopted it was estimated that by this time the company would have $100,000 invested in wiring, but, owing to the desire of customers to pay in full, the sum involved is now only approximately $20,000. The wiring business has been good, some 2600 houses having been equipped within the thirty-month period, and Mr. Louis H. Egan, general manager of the company, points to the above figures as evidence that the time allowed for payments need not be extended over one year.

Success of Illuminated Sign Exchange Plan at Kansas City, Mo.

As described in the *Electrical World* of July 5, 1913, the Kansas City (Mo.) Electric Light Company has an agreement with the Thomas Cusack Sign Company whereby the electric-service company lights 250 linear ft. of signboards upon which its advertisements are painted by the sign company. As soon as one display space is sold to a customer desiring a lighted board the lighting company's sign is transferred to another board, still retaining 250 ft. of space.

Throughout the last six months the success of the plan has been marked, for no sooner has the electric service company occupied and lighted a board than it has been demanded by some prospective advertiser. The lighted billboard space is more than 3000 linear ft.



ELECTRIC-LIGHTED BILLBOARD, KANSAS CITY, MO.

Recently an endeavor has been made to add artistic quality to the advertising space, the boards being erected between pillars bearing electric lamps in diffusing globes. In the open spaces formerly left void beneath the painted panels lattice is now used to hide the unsightly wooden framing. Indirect illumination of the boards is furnished by tungsten lamps in reflectors supported on pipe framing.

A Ball to Finance "White-Way" Lighting

The town of Red Lake Falls, Minn., which obtains its electricity from the Red River Power Company, of Grand Forks, N. D., developed a new method for financing its "white-way" installation. This was by means of a "white-way" ball, with tickets at $5 each.

The city of Minot, N. D., in addition to renewing its street-lighting contract with the Consumers' Power Company, has recently made arrangements for the supply of energy for the operation of a new "white-way" lighting system at Minot, consisting of sixty ornamental standards, each carrying one 60-watt lamp and four 40-watt lamps.

Central-Station Service in Milwaukee's Newest Hotel

Mr. G. E. Bernecker, contract agent for the Commonwealth Power Company, Milwaukee, Wis., is authority for the statement that the company's load has been doubled practically within a year, and further, that of Milwaukee's large downtown hotels only two remain which are not served from the circuits of the Commonwealth Power Company.

Two months ago the new Hotel Wisconsin was opened, adding approximately 600 kw of connected load to the central-station lines. Of this load about 470 hp is in motors and the remainder in lamps.

For lighting the main lobby, dining rooms, ballroom and other principal public places indirect fixtures and ornamental hanging lanterns are employed. Particularly harmonious lighting effects have been obtained in the lobby, where hanging lanterns of oak and art glass are used. Candelabra side lamps about the lobby add to the effect.

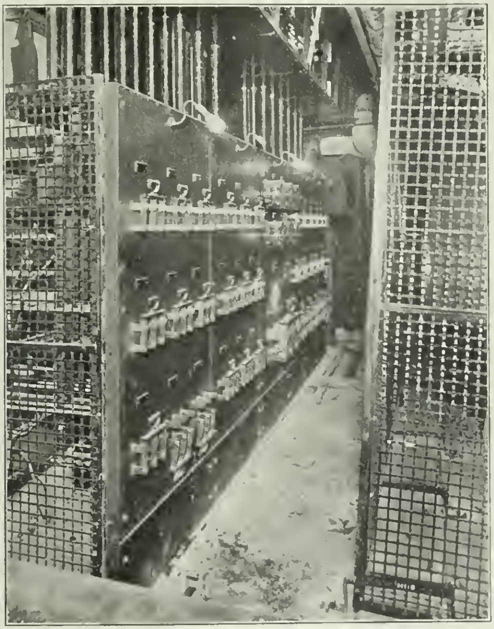


FIG. 1—230-VOLT SWITCHBOARD IN HOTEL WISCONSIN, MILWAUKEE

Central-station service enters the building underground from the downtown substations of the company over a three-wire, 230-volt direct-current system. Inside the structure energy is distributed from a switchboard designed by Holabird & Roche, the architects, Chicago, and built by George F. Rohn, Milwaukee. The construction employed is of interest in that all horizontal leads from the switches to the interconnecting busbars are insulated in round fiber tubes. A few of these tubular insulators may be seen in Fig. 1 through the iron wicker-work incasing the switchboard.

The largest motor in the installation is the 80-hp, 220-volt Allis-Chalmers machine shown in Fig. 2, driving the 50-ton Vilter ammonia compressor. Although no ice is frozen in the building, refrigeration is furnished for the various cold-storage rooms and for the air coolers which will be used in summer time. Centrifugal brine pumps for the refrigerating system have been installed in duplicate, the two units being driven by 5-hp, 220-volt Watson motors. Two 5-hp motor-driven pumping sets circulate ice water to all the rooms, while water for ordinary house service is supplied to the twelve floors by two 20-hp triplex pumps.

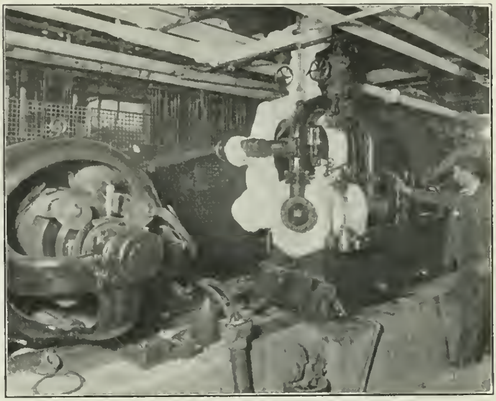


FIG. 2—REFRIGERATING EQUIPMENT

The hotel is heated with steam from the central-station company's low-pressure mains. Two 7.5-hp Watson motors are installed to pump a partial vacuum on the exhaust side of the local heating system, thus increasing the speed of the steam flow. Three 5-hp Wagner motors pump waste water and sewage from the basements of the hotel situated below the drainage level. In the kitchen motors are employed, ranging from 0.5 hp to 5 hp in rating, for washing dishes, chopping meat, peeling and mashing potatoes and polishing silverware. The laundry likewise is electrical ipped, one 15-hp , two 5-hp motors driving rough-dry tumblers, and a 1-hp motor driving a mangler.

Five 40-hp Westinghouse motors automatically driven by Cutler-Hammer control apparatus operate the main elevators for the hotel. The control apparatus and a portion of this battery of machines are shown in Fig. 3. In addition to these elevators, one 20-hp

New-Business Development at Kokomo, Ind

The Indiana Railway & Light Company, which o ates a central station at Kokomo, Ind., supplying ser to a population of approximately 25,000, incluc Kokomo and several smaller towns in the immed vicinity, has issued its annual report on the conne load of its lighting and power department for the y ended Dec. 31, 1913. Among the figures submitted those given in the accompanying table:

DATA FROM ANNUAL REPORT OF INDIANA RAILWAY LIGHT COMPANY

Class	December 31, 1912	December 31, 1913	Gain	Perc ag
Commercial customers	705	864	159	
Residence customers	1997	2677	680	
Motor-service customers	148	179	31	
Total	2850	3720	870	
Street-lighting series 7-amp arcs	253	269	16	7
Street lighting series 100-watt tungsten	0	49	49	
	[illegible]	2888	579	

Westinghouse motor is used for driving an alley hoist for handling baggage and trunks.

The ventilating system of the hotel is equipped with two 7.5-hp and three 5-hp Allis-Chalmers motors driving the fans on the twelfth floor near the air intake. One 7.5-hp and two 5-hp motors supply water to the air washers connected to this ventilating system.

A feature of the electrical service in this hotel is the use of the telautograph. By means of this device the clerk can write orders at his desk which are instantly delivered in his own handwriting to the linen room, kitchen, dining room or engine room, the message being recorded whether the person in charge of these departments is present at the time or not.

Lighting in the upper corridors and individual rooms has been carefully laid out in the effort to procure both economical light distribution and the greatest convenience to guests. Switches in each corridor permit the lamps in the halls to be lighted in alternate groups or all together. In addition to the usual lighting equipment in the individual rooms, an additional flush socket is installed in each for guests who wish to use a reading lamp or an electric appliance of any sort.

Mr. G. H. Travis, chief engineer of the establishment, points out that no coal is burned in this hotel, as lighting, heating and motor service are all furnished from the electric and steam mains of the Commonwealth Power Company, while cooking in the main kitchen is done on gas ranges.

A Perambulating Lamp Carton

The float shown herewith, representing a huge tungsten-lamp carton, served as an effective advertisement for the Citizens' Light & Power Company, of Adrian, Mich., in an industrial parade held recently in that city. The giant carton, painted with its familiar colors, measured 13 ft. by 8 ft. by 6 ft. and was carried on an electric runaout. Much of the attention which this float received was attributed to the concealment of its means of propulsion and to the noiseless operation of the electric vehicle inside it.

Quoting the words of Mr. H. A. Fee, manager of the company, "it was the most effective piece of straight advertising in the parade." After being removed from the electric runabout, the carton was hoisted to the roof of the Citizens' Light Company's office building, where it attracted additional attention until destroyed by the big storm which recently did so much damage on Lake Huron.

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Meter Regulations and Rules in Various States

Mr. F. A. Vaughn, chairman of the committee on electric-service rules revision, made an interesting report to the Wisconsin Electrical Association at the convention in Milwaukee on Jan. 15. He spoke of the rules for electric service of the Railroad Commission of Wisconsin, which were put in force Oct. 9, 1913, as an excellent compilation of its kind. Other states are copying these rules and in some cases making changes which are less desirable from the point of view of electrical utilities. There is a widespread tendency throughout the country to follow the standards set by the Railroad Commission of Wisconsin. Mr. Vaughn recommended that the association should have a standing committee on meters and rules to co-operate with the committees of other state associations and with those of national organizations, so that a uniform, standardized system of service regulations may be developed. The Wisconsin association continued its committee, of which Mr. Vaughn is chairman. Mr. S. B. Way and Mr. George Allison, of Milwaukee, are the other members of the committee.

In his report Mr. Vaughn referred to the work done by the National Electric Light Association and the Association of Edison Illuminating Companies. He spoke of the "Code for Electricity Meters" and the "Electrical Meterman's Handbook," with which the Wisconsin commission's rules and those of the two commissions in New York State comply almost to minute detail.

Recently the Wisconsin rules were adopted in West Virginia, except that a comparatively slight change was made by which it is the duty of the State to seal all meters. Therefore, as in Canada, the utilities do not know the condition of their own meters unless they have reason to have confidence in the State's engineers. A vigorous protest against this feature of the rules is being made in West Virginia.

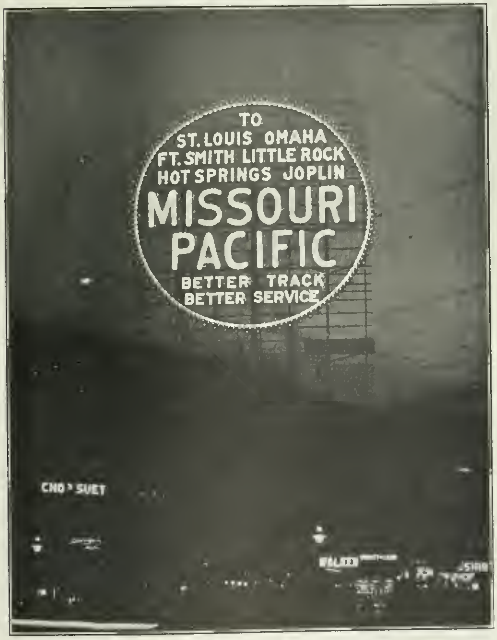
Mr. Vaughn pointed out that the commission for the Second District of New York recently made a ruling which unintentionally precludes the possibility of ever using an ampere-hour meter in that district for the measurement of energy. The commission has indicated more recently that it did not intend to make such a broad ruling. It may be possible to find a remedy. On this point Mr. Vaughn says: "This last error is a serious one in view of recent developments in ampere-hour meters here and abroad and the thorough discussion that is going on in the national association's committee on meters, as well as the interested attitude of the Wisconsin commission in the possible use of the ampere-hour meter for a large number of places where an inexpensive meter is desirable and probably practicable."

The interesting announcement was made that the committee on meters of the National Electric Light Association expects to divide the United States and Canada into seven geographical sections, one for each member of the committee. By keeping in touch with the chairman of the committees on meters of the state associations, and also with the public policy and rate research committees of the N. E. L. A., and with other authorities, it is hoped that the N. E. L. A. meter committee will be able to foresee and participate in any movement preparatory to making service rules by any state commission.

In the original draft of rules for electric service of the Railroad Commission of Wisconsin there was one—tentative Rule 28—intended to provide that maximum-demand instruments or indicators should be tested in as careful a manner as would be required for a watt-hour meter for an installation of the same size. The Wisconsin committee saw that no demand indicators on the market could be adjusted to comply with this rule. A promise to make strenuous attempts to standardize the practice and develop better meters through the manufacturers caused the commission to strike out, for the time being, tentative Rule 28 and withhold further rulings on maximum-demand indicators for approximately one year, when the various committees on meters will be able to report the progress of development. The National Electric Light Association has undertaken an exhaustive investigation of the characteristics of maximum-demand meters. When this work is completed and practice becomes more uniform and meters are developed capable of performing certain functions under given conditions, it may be safe to frame a substitute for tentative Rule 28.

Railroad's Large Electric Sign, Kansas City, Mo.

Now that the railroads are beginning to realize the value of electric-sign advertising, some of them are rapidly becoming good customers of the electric-service companies in the territory which they traverse. One of the large signs erected recently in Kansas City, Mo., sears the night sky with illuminated claims for the better track and better service of the Missouri Pacific Railroad to points south, east and west of Kansas City. The text of the sign is inscribed in a 60-ft. circle of colored lamps which may be seen for a great distance. There are about 900 lamps in the sign, most of which are 5-watt tungsten and 4-cp carbon units.



LARGE RAILROAD SIGN

Educational Window Display

The People's Light Company, operating electric, gas and steam-heating properties at Davenport, Ia., recently made use of a window display in its office which was intended to be of educational interest to the company's patrons in any branch of its service. Electrical energy taken through a meter mounted in the window drove a small reciprocating air-lift pump, the air intake for the pump being conducted through a gas meter. The air was then used to lift the water through the piping shown in the illustration and through the steam meter at the left. Thus the three meters—one registering electrical energy consumed by the motor, the gas meter registering air taken through the air-lift pump, and the steam meter registering water—were shown in operation before the eyes of the public. Glass tubing used instead of pipe showed the travel of the water and placards explained the other operations. Disassembled meters were placed on the floor of the show window.

WINDOW DISPLAY, DAVENPORT, IA.

New-Business Development at Kokomo, Ind.

The Indiana Railway & Light Company, which operates a central station at Kokomo, Ind., supplying service to a population of approximately 25,000, including Kokomo and several smaller towns in the immediate vicinity, has issued its annual report on the connected load of its lighting and power department for the year ended Dec. 31, 1913. Among the figures submitted are those given in the accompanying table:

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Total	2850	3720	870	30
Street-lighting series 7-amp arcs	253	269	16	7
Street lighting series 100-watt tungsten	0	49	49	
Motor hp	2309	2888	579	25
Electric irons	950	1755	805	84

Plans have been outlined for the coming year for extensive rural development. Efforts will be made to extend electric service to at least 200 farmers during 1914. Mr. O. M. Booher is manager of the new-business department.

Illumination and Wiring

A Formula for Distribution-Line Extensions

In making distribution-line extensions most central-station companies at present follow the practice of requiring that the estimated yearly gross revenue for one or more years from the extension contemplated must be equal to or greater than the cost of the extension, not including meters, transformers and service drops. The fallacy of this rule, as pointed out by Mr. H. G. D. Nutting, assistant to Mr. Smith, of the Clement C. Smith properties, Milwaukee, Wis., in a paper before the recent Wisconsin convention, is evident from the fact that the cost of operating a new extension is not a function of the partial investment alone.

The proper extension policy, asserted the speaker, should be such as to make the natural development of the business the maximum, most continuous and ultimate possible for the benefit of both the central station and the community served. Such a condition, said Mr. Nutting, is expressed by the formula $R = aI + bL + cM + dT + frK$, in which R is the gross yearly revenue in dollars that must be received from the new extension to make it pay; I is the cost of the extension in dollars, including meters, transformers, poles, wires and all apparatus required; L the actual length of wire used, measured in feet regardless of size of wire; M the number of prospective meters or consumers to be connected; T the number of transformers that will be required, regardless of size; r the cost of kilowatt-hours at the station switchboard (including, say, 10 per cent profit), and K the estimated kilowatt-hours which will be delivered to the extension per year.

The fifth term of the formula, rk, should be selected with care as, standing alone, it represents the absolute minimum rate at which electricity can be sold without a continuous loss. The value of f (the per cent loss) can be approximately found for most stations. Even though it may vary from 10 per cent to 50 per cent, it will not affect the results much. It usually runs from 20 per cent to 30 per cent.

Factors Constant for a Given Plant

The coefficients a, b, c, d and f are variables which become constant for any given central station as explained below.

First, a represents the sum of the rates of interest, profit, depreciation and taxes for the particular utility, expressed as a decimal. For example:

Rate of interest and profit.	0.075
Rate of depreciation on line	0.100
Rate of taxation.	0.025
	$a = 0.200$

Next, b equals the cost per year of operating and maintaining 1 ft. of wire regardless of size. This includes miscellaneous distribution system, operating labor and supplies and expenses and also the maintenance of overhead lines. The value of b for any particular utility is arrived at by dividing the above annual distribution system expenses by the number of feet of wire operated, both primary and secondary.

The cost per consumer (or meter) per year for meter and miscellaneous expenses is represented by c and includes labor of removing and resetting meters, labor of inspecting and testing meters, meter department supplies and expenses, maintenance of meters, consumption expenses, such as lamp renewals, consumers' premises expenses, etc.; commercial expenses, such as cost of collecting, reading meters, promotion of business, etc.; general expenses, such as salaries of general officers, law expenses, maintenance of general office, etc.; undistributed expenses, such as injuries and damages, insurance, utility equipment expenses, etc.

The value of c for any utility is arrived at by dividing the sum of the above-mentioned expenses by the present number of consumers. It will be found that this is one of the largest factors in the formula.

Coming to d, this equals the cost per transformer per year and includes labor of inspecting, removing and resetting transformers and the maintenance of transformers. The d item is arrived at by dividing the above expenses by the number of transformers in use.

Again $f =$ unity plus the average percentage of loss and unaccounted-for energy in the distribution system, expressed as a constant. Thus, if the loss is 30 per cent, $f = 1 + 0.30 = 1.3$.

Applying the formula to a proposed extension in the case of a specific utility where

$a = 0.20$ $b = \$0.003$ $c = \$10.00$
$d = \$1.50$ $f = 1.3$ $r = \$0.015$

it becomes

$$R = 0.2I + 0.003L + 10M + 1.5T + 0.0195K$$

Although at first sight the formula may seem complicated, when it is realized that it is merely the sum of the various expenses contributing to the cost of operating the new extension, its simplicity will be evident.

Application of the Formula

A case involving six prospective customers is cited in which

I (the investment) = \$500
L (the length of wire) = 5000 ft.
M (the number of consumers) = 6
T (the number of transformers) = 1
K (the kilowatt-hours delivered) = 900 (estimated)

Then

$$R = 0.2\,(500) + 0.003\,(5000) + 10\,(6) + 1.5(1) + 0.0195\,(900)$$
$$= \$100 + \$15 + \$60 + \$1.50 + \$5.85$$
$$= \$193.95$$

This means that, barring prospective further business from this extension, it cannot profitably be made unless the six prospective customers will guarantee \$194 a year, or \$32.33 each.

Again, it will be interesting to apply the formula to the simple case of a service drop from a secondary line where

$I = \$10$ $M = 1$ $K = 150$
$L = 100$ ft. $T = 0$

Using the formula:

$$R = 0.2I + 0.003\,L + M + 1.5\,T + 0.0195\,K$$
$$R = 0.2\,(10) + 0.003\,(100) + 1 + 0 + 0.0195\,(150)$$
$$= \$2 + \$0.30 + \$1 + \$2.92$$
$$= \$6.22$$

This will be the minimum amount the customer must pay annually to permit of the extension meeting its cost, not including energy consumption, commercial, general and undistributed expenses. If these latter are included, the cost will be about \$15.

It is evident from the foregoing that the degree of conservatism a company wishes to pursue is contained in the value of c used. c will vary from 1 to 15 in different cities, depending on circumstances as set forth previously.

Applying the Formula to the Future

While no one, observed Mr. Nutting, can predict accurately the future, knowledge of statistics and tendencies in certain sections of cities will, however, enable a manager to pass fairly reliable judgment as to the number of customers likely to be added in that territory in a certain number of years. The application of the formula to this condition will be illustrated by an example in which five applicants for electric service required the following conditions to be met in order to serve them:

$I = \$400 \quad M = 5 \quad K = 750$

$L = 4000 \text{ ft.} \quad T = 1$

$$R = 0.2\ (400) + 0.003\ (4000) + (1)\ 5 + 1.5\ (1) + 0.0195\ (750)$$
$$= 80 + 12 + 5 + 1.50 + 14.60$$
$$= \$113.10$$

The estimated value of R equaled \$90, meaning that \$23.10 a year would be lost on this extension.

If there is reason, however, to believe that in three years six more customers could be added without further line extensions, one may apply the formula to the extensions under these conditions as if they were immediate, thus:

$$R = 0.2\ (472) + 0.003\ (4600) + (1)\ 11 + 1.5 + 0.0195\ (1650)$$
$$= 94.40 + 13.80 + 11 + 1.50 + 32.20$$
$$= 152.90$$

Estimated $R = 11 \times \$18 = \$198$, which is \$45.10 per year more than the cost of serving the eleven customers.

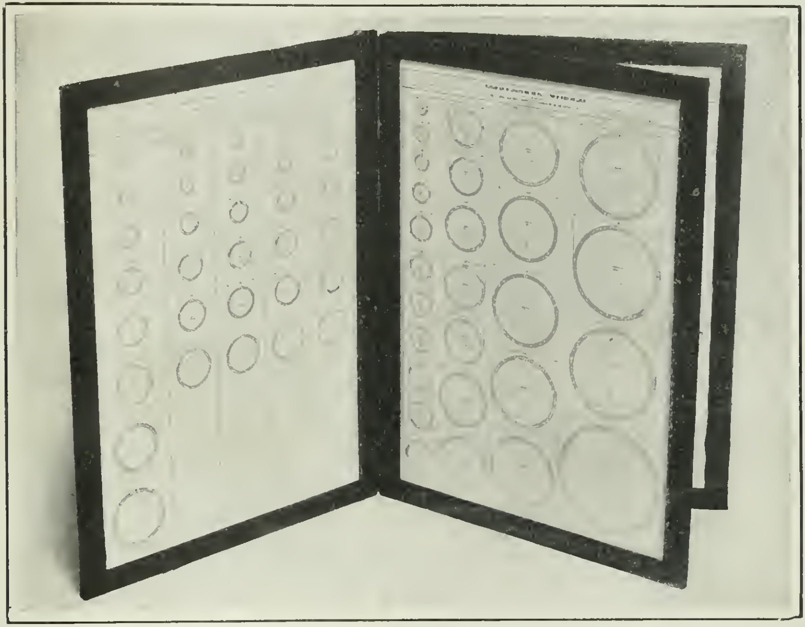
On the original extension for five customers the company would lose $3 \times 23.10 = \$69.30$ in three years. Evidently from the above calculations, this loss (including interest) would be made up in approximately one and one-half years after the six additional customers came on. In view of this it is advisable to make the original extension for five customers, notwithstanding the fact that the requirements of the first conditions are not satisfied.

While the above formula can be applied under almost every condition met with in central-station practice, asserted Mr. Nutting, he cautioned that it should not be used indiscriminately. Any practical rule requires the exercise of fair judgment. The principal value of a formula of this kind is that if any changes or modifications are made in its terms the conditions accompanying the change are completely known. Furthermore, the degree to which any factor may be changed is apparent, and the results can be anticipated.

Standard Sizes of Conduit for Wires and Cables

Recognizing the desirability of accurate data on the proper size of conduit to be used in installing wires and cables, the National Electrical Contractors' Association has prepared a set of six charts giving this information in detail by means of full-size sketches.

In the past there has been a disposition to use conduits of too small interior diameter. In the present charts, therefore, care has been taken to recommend conduits of sufficient size to cover all working conditions, at the same time avoiding extravagant sizes. The charts were prepared after careful study of actual conditions and have been officially adopted by the National Electrical Contractors' Association. Conduits and conductors are shown full size in addition to giving the actual external diameter of the conduit and the carrying capacity of the wires used in accordance with the changes which have been recently made in the National Code.



CHARTS SHOWING SIZES OF CONDUITS FOR WIRES AND CABLES

The charts are substantially mounted in wooden frames hinged together and provided with a backing board for convenient hanging. There will be three in the complete set, two charts being mounted on each sheet, and each chart is marked with the name of the system shown on the reverse side.

The National Electrical Contractors' Association has borne the work and expense of preparing these charts and in the interest of standardization is prepared to furnish the sets at cost, \$3 per set, from its headquarters at Utica, N. Y.

Ornamental Tungsten Lighting, Menominee, Mich.

So large a percentage of the merchants on the main street of Menomineee, Mich., have accepted the liberal street-lighting offer of the Menominee & Marinette Light & Traction Company that an almost continuous "white way" has been created along the city's thoroughfare. Ornamental standards of the type shown in the accompanying night scene are furnished to patrons of the central-station company under one of two contracts. In one the company agrees to purchase, install and operate the units, the customer paying the electric-service company $3.10 per post per month. Later, if the customer wishes to purchase the ornamental standard himself, a monthly charge of $2.60 is made for its operation.

ORNAMENTAL TUNGSTEN LIGHTING

Each standard carries one 100-watt lamp and four 60-watt lamps. Operating from dusk till midnight it is estimated that the lamps will be turned on for about 2200 hours per year. At this rate the energy consumed by the units will net the company about 4 cents per kw-hr.

Recent Telephone Patents

A new transmitter which has been patented by Mr. H. C. Egerton, of Passaic, N. J., is assigned to the Western Electric Company. The diaphragm carries the movable electrodes, while the stationary electrodes are carried in heavy metal blocks, one on each side of the diaphragm. The blocks are recessed to form cups, the electrodes being at the bottom of the cups. The lips of the cup bear against felt washers, which in turn bear upon the diaphragm to seal the cup.

Mr. W. B. Oliver, of Collingswood, N. J., has patented a very sensitive transmitter for use of the deaf. This adjustable instrument he calls a micro-telephone. A carbon block forms the rear electrode, the front being a carbon diaphragm. The carbon block contains several recesses which contain carbon granules, the latter bearing upon both electrodes. Provision is made for adjusting the space relation of the two electrodes, and a screw is projected into the bottom of each recess so that the space remaining for granules may be adjusted. The patent has been assigned to the Oliver Electric Company.

Another device for the use of the deaf has been patented by Mr. K. M. Turner, of Jamaica, N. Y., and consists of a lady's handbag within which is carried an acousticon instrument. The transmitting part of the device is placed directly behind a perforated section of the bag. Two registering notches in the frame of the handbag permit the passage of a receiver cord.

Letters to the Editors

Ozone Machines and Public Health

To the Editors of the Electrical World:

Sirs:—In further reference to the subject of "Ozone Machines and Public Health," treated in your issues dated Nov. 15 and Nov. 29, 1913, there is one point that has not been brought out which seems to me to be a vital one. It is this: Will ozone in concentrations agreeable to the human organism kill the bacteria that are ejected into the air when a person suffering from tuberculosis or other diseases of the respiratory passages coughs or sneezes?

In the act of coughing or sneezing considerable mucus, laden with germs, is projected in a finely divided state or in minute bubbles so that it will float in the air for some time and can be breathed by persons near by, and in all probability it is by this means that such diseases are commonly propagated in public.

The bacteria so given off are moist and growing instead of dormant, as is the case where they have been dried, and in such condition it would seem that they should be acted upon somewhat as if they were in water.

If experiment should show that the moist germs of tuberculosis or other respiratory diseases can be destroyed under the above conditions by a concentration of ozone that is not disagreeable, then there could be no doubt as to its value in preventing the spread of infection in schoolrooms and other places of public gathering.

In all probability not much can be expected of ozone as a curative agent in diseases of the respiratory tract, for in most of such diseases the active germs are so covered by mucus that they are well protected. Nor can we expect the ozone machine to become a popular piece of household furniture, even if it should be proved that ozone will kill moist germs floating in the air, for the diseases mentioned are still very generally handed around the family through kissing or other contacts, and until we observe privately some of the precautions that we now commonly observe publicly, family colds will be as popular as at present, and the ozone machine but a useless piece of bric-à-brac.

Adrian, Mich. H. A. Fee.

Electric Service, Energy and Charges

To the Editors of the Electrical World:

Sirs:—I do not quite follow the reasoning of Mr. C. E. Wendell, who, in discussing energy charges in your issue dated Jan. 10, 1914, says that since it is cheaper to operate one isolated plant rather than two adjoining plants, therefore central stations should serve isolated plants at a rate somewhat less than they can manufacture the energy themselves. There seems to be a flaw in his reasoning. When two isolated plants are combined, all of the services offered by the two are combined; that is, the new plant supplies not only electricity, but heat, refrigeration, engineer's services and general supervision of machinery. On the other hand, a central station supplies electricity only.

I think it has never been questioned that the central station can manufacture electricity at the switchboard more cheaply than the private power plant, with the possible exception of the large internal-combustion engine plant; but this has little to do with the case, because the manufacturing cost is a small proportion of the total cost to the consumer and the service supplied by the central station is only one of the many services supplied by the isolated plant.

I have no quarrel with a rate based upon maximum demand *at the period of the maximum demand on the central station*, but can there be any possible justification for a rate based on quantity of energy used other than a reasonable allowance for the extra cost of billing, metering and collecting, with such incidental service as the supply of lamps and testing of meters? By rate based upon maximum demand, I mean a uniform rate to large and small consumers for electricity used during the peak-load period, which may usually be considered to be from 4 p. m. to 9 p. m. during the months of November, December, January and February, and another uniform rate for electricity used during all other periods. The cost of billing, metering and collecting, etc., might be covered by a separate uniform charge per consumer, but experience in the sale of other public utilities is against this practice.

Interesting results are obtained from a study of the actual profit on the wholesale business taken by central stations. On any reasonable basis of allowance for fixed charges caused by the maximum demand of wholesale customers in New York City the profit to the central-station company is almost negligible, and the same investment applied to developing retail consumption would have resulted in a far larger profit to the company itself while at the same time the isolated plants would have gone in where they logically belong —in large buildings where a great demand exists for heat and other services as well as electricity. As a matter of fact, the whole amount of the profit derived from the wholesale business could be derived by the central stations in New York City from the business now supplied by isolated plants during summer months if the central stations were to offer a rate sufficiently attractive to cause isolated plants to shut down during the summer months, as they could very well do, because no investment whatever would be required. I firmly believe that the solution of the problem will be along the lines of co-operation rather than competition.

New York, N. Y. P. R. Moses.

What the Service Will Bear

To the Editors of the Electrical World:

Sirs:—At a recent hearing before one of the state public service commissions, in an application for a reduction of the rate on gas for lighting service, the commissioner before whom the hearing was held is reported to have said that inasmuch as the gas for lighting purposes was the same in quality and was delivered through the same pipes as the gas used for fuel purposes there seemed to be no good reason why the lighting rate should be above the rate charged for fuel gas, the latter rate being lower than the rate for gas-lighting service.

Volumes have been written upon the subject of equitable rates for gas and electric service, but almost all writers upon the subject devote themselves to the question of dividing the cost of the service equitably between the different classes of consumers—few seem to consider the subject of the relative value of the service. On the contrary, those who actually make and put into force rates for gas and electric service consider most carefully how much the service will bear. The old reproach that public service corporations charge "all the traffic will bear" seems to have caused this phase of the subject to be ignored in public discussions, while it remains an important consideration in the actual making of rates.

It seems to the writer that equitable rates for gas and electricity are based upon two fundamental propositions—(1) that the rates should yield an adequate return upon the investment as a whole, and (2) that the rates should be proportional to what the service will bear. The first relates to the responsibility of the service company and has been generally accepted as a just principle. It needs no discussion. The second proposition relates to the responsibility of the consumer and is the subject of this discussion.

Under competitive conditions it is necessary for the seller of a commodity or service to secure the highest price possible and for the purchaser to secure the commodity or service for the lowest price possible, and under non-competitive but regulated public service this condition is modified only to the extent of the seller being limited to an adequate return upon the capital invested. The purchaser has no more right to demand a rate for service below that which will render an adequate return than the seller has to demand a price which is above that which the purchaser can afford to pay for that particular service. Both purchaser and seller are entitled to equal consideration in deciding upon that neutral meeting ground where business relations will be mutually advantageous.

If gas and electric rates were based only upon the requirement of yielding an adequate return upon the capital invested, without considering the varying value of the service to different classes of consumers, consider the effect upon the consumer and the company.

Large lighting companies sell electric energy for from 1 cent to 15 cents per kw-hr. This energy is produced by the same prime movers and generators, is often delivered over the same wires and is precisely the same in quality for the varying classes of service represented by these widely differing rates. It cannot be shown that the cost of the service to the lighting company varies in anything like this proportion between the different classes of service. Why, then, are such widely varying rates almost universal among electric-service corporations? It is simply because rate makers have considered not only the cost of production and delivery but also "what the service will bear," and the writer holds that this consideration is justifiable and, furthermore, that it is in the interest of the consumers as a whole.

If an electric service company were compelled to sell its whole output at one rate, or if rates were determined strictly upon the cost of the service to the company, it is obvious that the lower rates would have to be materially increased if the total revenue were to be maintained. This increase in the lower rates would exclude a large portion of the electric service which is now in most active competition with other forms of energy, thus narrowing the field of central-station service, while the decrease in the higher rates would render the bills for the small lighting consumer absurdly small for the benefits received. In other words, a small increase in rates for motor service would lose that class of business to the central station, while the higher rates for the small lighting consumer are not burdensome and do not call for a material reduction to a single uniform rate.

The difference in value to the consumer between electric energy used for motors and that used for lamps is more striking than the difference in value of gas used for fuel and gas used for light, but the same principles obtain to justify a higher rate for the higher class gas-lighting service than for the fuel service which is in such active competition with other fuels.

The two most notable examples of charges adjusted to "what the service will bear" are shown in railroad freight rates and in postage rates, and no one can deny that the greatest good to the greatest number results from this adjustment of rates according to the ability of each class to bear the charge that is imposed on it.

This may seem an academic discussion of long-accepted principles, but recent tendencies in legislation and regulation seem to point toward a leveling of rates regardless of relative benefits to the consumer, and it seems time to admit and strongly maintain that one of the basic principles of rate-making is that the rates should be proportional to what the service will bear.

Utica, N. Y. H. B. SWEET.

Rates for Electric Service

To the Editors of the Electrical World:

SIRS:—In the issue of the *Electrical World* of Dec. 20, 1913, there is a letter by Prof. C. M. Jansky criticising an article by Mr. S. M. Kennedy in your issue of Nov. 22 in regard to rates for electrical energy. In the last paragraph of his letter Professor Jansky states what he believes to be a "fallacy" in the usual method of apportioning costs with relation to rates. And he states: "Underlying this there is another assumption, namely that the *public service* company is a *private* concern." As this is classed by Professor Jansky with another fallacy, the supposition is—and it is borne out by the rest of the paragraph—that this assumption is also a "fallacy." In support of this he quotes Mr. Max Thelen, a member of the California Railroad Commission, who says that "the fundamental relationship existing between the public and its public utilities is that of principal and agent."

The "fallacy" of this character of argument by Professor Jansky and Mr. Thelen is that there is no absolutely exact definition and no definite limit as to what constitutes a "public-service company" or "public utility." The various states have directly or by implication constituted a great many businesses into "public utilities," and these vary greatly between these different states. Those businesses classed as public utilities in some states are not so classed in other states. While it has been generally accepted hitherto that a public utility was a business that served the whole of the public with light, heat, water or transportation, this list of utilities has been greatly increased during the past few years until it has virtually reached its climax in Oklahoma, where a recent decision of the Public Utilities Commission was to the effect that under certain conditions a newspaper was a public utility.

Followed out logically to its conclusion, as shown by the increasing number of businesses brought under the public utilities commissions in the various states, it would seem that there is no kind of business whatever that may not at some time in the near future be made into a public utility.

The mere fact of its being legislatively stated and fixed that a certain character or kind of business is a public utility does not change the principles of the costs and rates or prices of that business. Even when the municipality, the state or the government takes charge of a certain line of business it cannot, without injustice to some, change the basic commercial principles on which a business should be run. It is, therefore, even more unreasonable to require that while a public utility business is owned and operated by private individuals it should be run on principles or under practices that violate absolutely every proper principle or practice of private business.

In reality—although this belief may seem in certain cases to be very much disguised—the general public fully realizes that it obtains a better service from its utilities when they are privately owned than when owned by the community or government, and one of the facts that have been entirely lost sight of by people of Professor Jansky's belief is that such utilities privately owned and operated receive no reward at all for their general greater efficiency over a publicly owned and operated utility, and that the return to the privately owned utility is only an exact and minimum wage. In other words, although a more perfect service to the public is given by a privately owned utility than by one publicly owned, yet there is no greater recompense or incentive given to the privately owned one than is given to the less efficient publicly owned one, or as the laws and commissions express it, all that is due a privately owned utility is "a reasonable return" on its physical investment.

That is neither just nor equitable. The public should divide the extra profit caused by the efforts of those owning or operating the privately owned public utilities with those whose efforts created those extra profits. If through the work and skill and ability of the private owners the costs to the consumer are lessened, a portion of that lessened cost is equitably due those who create it. At the present time in all private businesses *not* "utilities" such extra profit is ungrudgingly allowed by the public to these private concerns, and yet tomorrow, doing exactly the same businesses in exactly the same way, these businesses may be declared to be public utilities and robbed of what is equitably due them.

While it is true that there is no sharp line that can be drawn as to exactly what is the proper and exact price or rate of the product of any public utility, there is the fact that the present existing rates or prices may be lowered by the skill, energy or forethought of the private operators, and my contention is that a portion of this lessened cost—which is in reality an increased profit at the standing rates—is due to those whose efforts lessened these costs.

It is on this basis and on the grounds stated above that such radical principles and practice as those preached by Mr. Thelen and Professory Jansky are neither equitable nor wise. In the present state of municipal governmental affairs no greater calamity could happen to the country than for every municipality to be compelled instantly to take over and operate for itself its various public utilities. Those who are fully acquainted with the general condition of municipal government in the United States at the present time can imagine what would be the results if this should happen. The only thing that prevents such a national calamity at this moment is the private ownership and operation of the public utilities in each community, and to those because of whose ability such evil results as those above referred to are deferred there should be allowed a more adequate reward than a "reasonable return" on the physical property.

To theorize on what should be done if everything and everybody were perfect is one thing; to attempt to force the theory into practice before conditions are in any way fitted for that practice is the greatest of unwisdom. For this to be done as a whole all over the country would be disastrous but might possibly be called "equitable." To insist on this in certain localities or in specific cases is absolutely unjust and unreasonable. There are too many variants in the public utility business at the present moment—and municipal government is one of the greatest of them—for any one to attempt to fit the conditions now existing to any theory which presupposes perfection in men and matter. Mr. Thelen's and Professor Jansky's theories or practices may possibly come to full fruition later on, but to try to enforce either at the present moment would be doing a tremendous injury to that very public whom it is erroneously supposed to benefit.

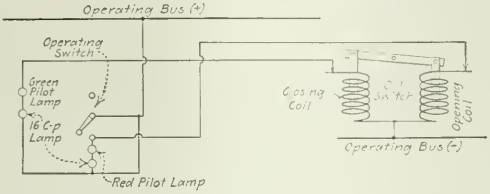
Dallas, Tex. H. S. COOPER.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Prevention of Accidental Operation of Remote-Controlled Circuit-Breakers

The Commonwealth Edison Company of Chicago had trouble at times with remote-controlled switches opening when pilot lamps in the circuits burned out. Upon investigation it was discovered that when a small pilot lamp failed enough energy was available at the lamp to fuse over the base and allow the solenoid to operate the switch. The diagram below shows how these troubles are being prevented in some of the substations of the company. An ordinary 16-cp lamp placed in series with the pilot lamp adds resistance to the circuit so that at no time will current enough be available to operate the solenoid switch unless the operating switch is closed. In some instances small fuses are used instead of 16-cp lamps.



CARBON LAMPS IN SERIES WITH PILOT LAMPS TO PREVENT SERVICE INTERRUPTIONS

Methods of Thawing Water Pipes by Electricity, and Energy Required

Prolonged cold spells which at this season are likely to sweep the country, freezing up water-supply pipes and inconveniencing householders, make timely the topic of thawing such frozen conduits by electricity. Herewith are summarized, therefore, methods of melting electrically ice plugs in buried pipes, either by the use of special transformer apparatus, by adapting standard equipment to pipe-thawing duty or by using only the simplest apparatus.

Electric pipe-thawing practice in general may be divided into two classes—one, most used, in which the heat to melt the ice is generated by passing a large current through the pipe, and the second in which an electrode is immersed in the fluid contained in the pipe, heat being generated as in a water rheostat, by electrolyzing the water near the ice plug. The first method requires large currents and considerable equipment but gives quick results, while the latter avoids the need of special apparatus and can be accomplished in a few hours by a single operator.

Energy for thawing pipes may be obtained in several ways, among them these: By using one or more transformer units to step energy at distribution pressure down to 50 volts or 100 volts; by using energy direct from low-voltage alternating-current or direct-current service wires, or by employing a portable gasoline-engine-driven generator.

Where transformers are used 10-kw or 15-kw units are usually large enough for any ordinary job. If two are required to give a larger current output, their primaries may be connected in series or in parallel, depending on the voltage of the supply source, while the secondaries are connected in multiple. Fuses and demand indicators are usually sufficient to protect the primary circuits. In thawing service transformers may be run, however, at several times their ordinary rating, as they are actually used for only short periods and the heat generated in them is radiated quickly in the cold air. A simple water-barrel rheostat can be employed to regulate the current in the secondary circuit, but it is more generally customary when thawing with transformers to connect the terminals directly to the pipes without any resistance in series except that of the pipe itself. An impedance coil having about twenty turns of wire wound on an old 15-kw transformer core may be employed to replace the water rheostat, current regulation being obtained by changing the number of turns on the core. When thawing service pipes it is generally advisable to disconnect the house piping where it joins the street pipe, in order to prevent the current following any short cut back through some small pipe in the house which may fuse and cause a fire.

A water rheostat made from a water barrel or metal ash can is the only apparatus required when low-voltage service wires are tapped for energy to thaw pipes.

The cost and trouble of collecting and assembling apparatus for thawing only one or two cases of frozen pipes may sometimes be prohibitive. Under such conditions it is sometimes simpler to attach one wire (the grounded side) of a low-voltage circuit to the frozen pipe, which should have been previously filled with a salt solution of water, then threading into the pipe a second weather-proof insulated wire having several narrow rings of insulation removed near the end to allow electrolysis of the solution. The heat generated is concentrated near the ice plug, and as the latter melts the wire can be pushed farther into the pipe. From 3 ft. to 4 ft. of ice per hour can be thawed in this way with a current of 20 amp. This scheme may be modified by inserting in the pipe an electrically heated cartridge unit.

Portable electric thawing outfits may be made by temporarily mounting gasoline-engine-driven generators, transformers or water rheostats on motor trucks during the winter, removing them when no longer required so that the truck may be used for other purposes at other seasons.

Another thawing outfit of an unusual kind employed a 16-to-1 series transformer with its secondary connected in series with a bank of eight 80-watt lamps fed from a 110-volt circuit. The primary winding has large cross-section and is consequently suited to deliver large currents to pipe-thawing circuits.

When drain and waste pipes from boilers are frequently subjected to freezing conditions it has been suggested that a small-diameter iron pipe be permanently fastened along the central axis of the drain. Weather-proof insulated wires can then be fastened to each end of the pipe and when ice clogs the drain the small-diameter pipe can be heated by electricity until the ice core is melted enough to allow the hot water from the boilers, auxiliary engines, etc., to drain through and do the rest of the thawing.

In the accompanying table are shown results obtained with electric thawing apparatus. In one case, where 2000 services were thawed, the energy used per service varied from 2 kw-hr. to 4 kw-hr. Another company offered a flat rate of $6, $8 and $10 for thawing 0.5-in., 0.75-in. and 1-in. pipe services respectively, and made a time and energy charge on pipes of 1.25 in. diameter or over. Several central-station companies have made a charge of from $10 to $13 per pipe thawed and have made a nice profit thereby, besides the invaluable service rendered customers and fellow-citizens.

TIME AND ENERGY REQUIRED TO THAW WATER PIPES

Pipe Size, In.	Length	Amperes	Voltage	Time Required, Minutes	Kw-hr.	Method
1.00	100 ft.	150	60	20	....	Pipe resistance
......	16 ft.	......	......	..	10	Water rheostat
0.75	......	100	......	8	42	Pipe resistance
6.00	1 blk.	......	100	60	75	Pipe resistance
0.75	......	127.5	110	13	.....	Pipe resistance
0.75	16 ft.	20	......	270	1.75	Water rheostat
1.00	100 ft.	150	60	25	....	Pipe resistance
0.50	125 ft.	125	100	10	120	Pipe resistance
0.50	60 ft.	140	130	20	6.1	Pipe resistance
0.50	125 ft.	120	120	30	7.2	Pipe resistance
0.50	120 ft.	120	130	15	3.9	Pipe resistance
0.50	100 ft.	110	120	40	6.6	Pipe resistance
1.25	75 ft.	175	115	30	10.1	Pipe resistance
2.00	100 ft	150	130	30	9.8	Pipe resistance
2.00 0.50	30 ft. 50 ft.	60	130	30	3.9	Pipe resistance
2.00	30 ft.	110	...	....	59.4	Pipe resistance

Inspection of Overhead Distribution Systems

Some practical points of interest were made in the report of the committee on standards for inspection of overhead-distribution systems presented on Jan. 16 at the Milwaukee convention of the Wisconsin Electrical Association. The committee says that the objects to be gained by systematic inspection are (a) reduction in hazard to employees and the public generally and (b) the improvement of service rendered to customers. Ideal inspection can only be made with the aid of competent inspectors, and the scarcity of such men constitutes the principal difficulty in securing the desired results. Space provided on the poles and between the wires carried on the poles or cross-arms must be sufficient so that the linemen can keep clear of grounded wires or live wires while working on other wires. Appliances which men are required to reach more or less frequently, such as cut-outs, fuse blocks, disconnecting switches, lightning arresters, etc., should be so placed and arranged that a man standing on pole steps or on his spurs may reach them without coming in contact with other equipment, especially ground wires cleated to the poles or grounded guys.

Inspection means the reporting of all cases of unduly slack wires, decayed or burned poles, cross-arms or pins, as well as wires in contact with, or in dangerous proximity to, other wires, trees or buildings. The accident hazard may be reduced if attention is given to the proper guying of pole lines and the equipment of guy wires with strain insulators. Where guy rods enter the ground they should be protected by wooden guards or boxes painted white.

All lines should be inspected at a certain frequency. This frequency will vary with the character of the construction, the proximity of trees and other structures, the voltage of the line and the relative importance of the different lines. The committee gave the following schedule to be used in determining the minimum frequency of inspection: Lines carrying 7500 volts or over, every three months; lines carrying 1000 to 7500 volts, every six months; lines carrying less than 1000 volts, every year. Some form of regular orders and reports should be adopted by the inspectors. Orders to inspectors should be definite and might read as follows:

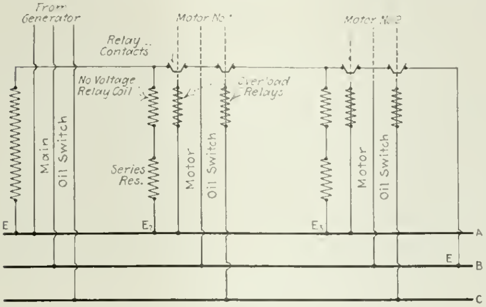
"Inspect feeder No. —, covering distance between ——— Street and ——— Street, and report all defects found to exist in connection with this feeder and all other lines supported upon the same poles. Your inspection shall include the inspection of all primary mains and branches connected to this feeder. You will report daily the portions of the feeder or its branches covered by your inspection that day, and report on forms provided all defects discovered. Should you discover a dangerous condition which you cannot temporarily correct, you will immediately communicate with the office and report such dangerous condition, and remain at the point of danger until help arrives or you are otherwise relieved."

The report forms should show a diagram of a pole with cross-arms and pins and give a printed list of defects to be looked for, so that the inspector may check off readily the items which are not found and indicate otherwise—as, for instance, by a cross mark—the locations of defects. The back of the report form should be used for written description of conditions which cannot be indicated on the diagrams, as, for instance, corroded guys and bad clearances. The committee gave a list of possible defects to be printed on the report forms. These require an examination of poles, cross-arms, cross-arm braces, pins, insulators, tie wires, lightning arresters, potheads and cables, disconnecting switches, fuse blocks, transformers, wires, brackets, street-lighting fixtures, service connections, railway attachments and foreign attachments. The committee did not recommend the making of voltage tests by inspectors. The report was presented by Mr. S. B. Way, vice-president of the Milwaukee Electric Railway & Light Company, chairman, the other members of the committee being Mr. C. R. Phenicie, of Green Bay, and Mr. Peter Valier, of La Crosse. The committee was continued.

Electric Interlocking of Motor Operation

The wiring scheme shown herewith permits the interlocking of any number of electric motors which are intended to be operated simultaneously, the arrangement being such that if one motor oil switch in the system opens all the rest will automatically open likewise. This feature of motor control is provided by reconnecting in the manner shown the overload and no-voltage relays which are regularly furnished with oil switches. *A*, *B* and *C* represent the three legs of a three-phase motor-circuit. Across one pair of these legs is connected a series circuit consisting of all the relay contactors, a series resistance and the no-voltage coil of the main feeder switch. The no-voltage coils on the motor oil switches are also connected in series with definite resistances as shown, while the overload relay coils are connected in the usual manner.

Any relay contactor upon opening will thus trip the no-voltage relays of the other motors either directly or indirectly by first tripping the main oil switch. The scheme described is in use in the Commercial Milling Company's flour mill at Detroit, Mich., where the satisfactory production of flour depends on the simultaneous operation of all the machines in the system. The resistances shown in the series with each no-voltage relay coil were inserted in the case mentioned since these coils were not designed to operate on 440 volts, the difference of potential between the feeder legs. If the scheme shown is applied to a system containing several motors, it would be advisable to connect E, E_1, E_2, etc., to a separate operating bus energized by a small step-down transformer connected across one phase. If this were done no energy would be wasted in resistors, and the contactors which are exposed on the oil-switch panels would not be carrying a fatal voltage.



SCHEME FOR INTERLOCKING MOTORS

Motor-Driven Blower Keeps Station Exciter Cool

Unfortunately the generating station of an electric-service company in the Middle West is situated in a small valley where a breeze on hot summer days is a rare thing. Consequently the temperature in the station oftentimes reaches a degree not foreseen by the designer of the electrical equipment. An overloaded exciter is the principal sufferer from these conditions, and when a hot wave sweeps the country the machine becomes overheated to the point of smoking. At such times a small motor-driven forge blower is placed on a box near the exciter and its blast directed at the heated windings. With this additional ventilation the exciter has been induced to "pull over" the peaks without noticeable damage.

Use of Twenty-five-Cycle Transformers on Sixty-Cycle Circuits

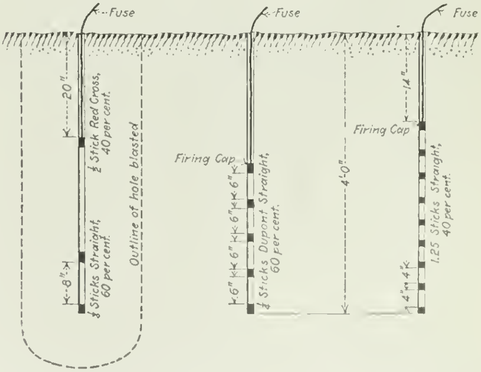
We have a large number of twenty-five-cycle transformers which were formerly used on a 6600-volt circuit. Will it be possible to use these same transformers on a 60-cycle, 6600-volt circuit without changing their construction? D. A. H.

The output of a transformer can always be increased without sacrificing the efficiency if operated at a higher frequency than that for which it was designed. This is true because an increase in frequency (provided other things remain the same) will not affect the eddy-current loss and will reduce the hysteresis loss, thereby permitting a larger copper loss at the same efficiency. Eddy-current loss in a given transformer is proportional to the square of both the frequency and the maximum flux density, but the latter is directly proportional to the potential impressed across the transformer, and inversely proportional to the frequency. It therefore follows that the eddy-current loss is directly proportional to the square of the impressed voltage and independent of the frequency. Hysteresis loss, on the other hand, is proportional to the frequency and the 1.6 power of the maximum flux density in the core. Combining this relation with the proportionality of the flux density previously given, it follows that the hysteresis loss is directly proportional to the 1.6 power of the voltage and inversely proportional to the 0.6 power of the frequency. By increasing the frequency from twenty-five to sixty cycles the hysteresis loss will be decreased by about 15 per cent.

Digging Post Holes with Dynamite

Please advise me concerning methods of digging pole holes with dynamite or giant powder, giving information on the quantity to be used at a charge, arrangement of blast, cost, etc. I have some poles to set in a clay formation which is very difficult to dig by hand. J. F. K.

Assuming that a pole hole 4.5 ft. deep with an average diameter of 16 in. is to be opened, a vertical hole about 2.25 in. in diameter to receive the explosive is first bored to the required depth. A good tool to use is a hollow crown drill having a cutting head 1.75 in. in diameter and a cross-bar 2.25 in. thick. With such a tool one man can drill a 4-ft. hole in five minutes. Good results may also be obtained by driving a 4-ft. punch bar into the earth, meanwhile striking it transversely at intervals to facilitate withdrawal. To prevent earth from falling into the hole after the charge is placed, a cylindrical paper cartridge should be fitted loosely into the drill hole. Before inserting this tube in the hole, however, the dynamite stick should be subdivided and the pieces distributed in the tube by means of a graduated stick, as shown in the accompanying diagrams. Pins may be pushed through the tube into the dynamite to maintain the spacing after the cartridge is inserted in the hole. The exploding cap should be placed in the top stick and the fuse allowed to protrude about 2 in. or 3 in. from the top of the hole, which should be left untamped. If these directions are carried out, according to one of the large powder manufacturers, there will be no general upheaval of earth when the dynamite explodes, and the operator may stand within 2 ft. or 3 ft. of the hole. After the blast very little loose earth is left in the hole, and that remaining may be removed with an ordinary post-hole digger in from five to ten minutes. The cost of opening the earth averages from 25 cents to 30 cents per hole, as compared with 50 cents when dug by hand. The number of holes which a given crew of men can blast in a day is also considerably larger. By properly supervising the work two diggers, one flagman, one hole trimmer and one fuse setter can open from thirty to fifty holes a day.


Fuse
Fuse
Fuse
20"
½ Stick Red Cross, 40 per cent.
Outline of hole blasted
8"
½ Sticks Straight, 60 per cent.
Firing Cap
6"
6"
6"
6"
½ Sticks Dupont Straight, 60 per cent.
4'0"
14"
Firing Cap
1.25 Sticks Straight, 40 per cent.
4"
4"

ARRANGEMENT OF DYNAMITE CHARGES FOR BLASTING POLE HOLES

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Iron Losses of Transformers, Generators and Motors.—J. Fischer-Hinnen.—A mathematical paper, illustrated by diagrams, on the determination of the iron losses in transformers, generators and motors. The measurement of the iron losses in transformers and induction regulators shows greater losses than would be found from the "loss figure" (verlustziffer) with application of the usual formulas. Under these conditions the exact determination of the "loss figure" has no practical value. It would be more important to organize investigations on a large scale for the purpose of finding formulas which are applicable in practice. For the same frequency the losses increase approximately with the second power of the induction. If the losses are calculated separately, it is recommended to replace the power 1.6 in Steinmetz's formula by 2, simplifying the calculation. The so-called "eddy-current constant" varies within wide limits and depends not only on the "loss figure," but also on the thickness of the sheets. Particularly impressive are the differences between calculated and measured losses in direct-current machines and single-phase alternators. The situation is similar in the case of three-phase motors.—*Elek. u. Masch.* (Vienna), Jan. 4 and 11, 1914.

Commutation of Single-Phase Commutator Motors.—Klaudius Schenfer.—An account of an experimental investigation of the commutation conditions in single-phase commutator motors with interpoles, built by the Siemens-Schuckert company. Oscillographs are given of the quantities which influence commutation, especially the curves of the magnetic fluxes of the current in the armature, of the additional current in the short-circuited coil and of the commutation voltage. A curve of the variations of current density below the brushes is plotted, and from the form of this curve the author concludes the correctness of the old commutation theory according to which the formation of sparks is due to too high a current density at the brush.—*Elek. u. Masch.* (Vienna), Jan. 11, 1914.

Heating of Pipe-Ventilated Machines.—Alex. Gray. An account of an experimental investigation, the principal results of which are as follows: The temperature rise of the windings is proportional to the total copper and iron loss in the machine and is independent of the distribution of this loss. The bearing friction loss has little effect on the internal temperature of the machine. If the quantity of air passing through the machine be increased by increasing the area of the air passages, the air velocity being kept constant, the temperature rise will be reduced, but in most cases an increase in the air velocity will be more effective.—From *Elec. News* (Canada); slightly abbreviated in London *Electrician*, Jan. 16, 1914.

Negative Stray Induction Coefficients.—H. S. Hallo.—With reference to the paper of Rogowski and Simonds on stray fields in alternating-current transformers and commutator motors the author discusses the possibility of negative stray induction coefficients. Whether such coefficients can become negative depends on the definition of stray fields. The author discusses mathematically transformation and stray-field conditions for the general case of the transformer, provided that the winding is distributed in any manner.—*Elek. u. Masch.* (Vienna), Jan. 4, 1914.

Voltage Regulation of Rotary Converters.—A note on a recent British patent (No. 29,338, 1912) of the Siemens Dynamo Works and J. C. Wilson. The exciter shunt-field winding is in series with a resistance controlled by an automatic regulator with its coils connected on the direct-current side of the set.—London *Elec. Eng.*, Jan. 15, 1914.

Lamps and Lighting

Incandescent Lamps.—A note on a recent British patent (No. 2901, 1913) of the British Thomson-Houston Company and the General Electric Company of this country. To prevent blackening of incandescent lamps, cryolite, a double fluoride of sodium and aluminum, is ground to a powder, made into a paste and applied to a part of the lamp interior, where a temperature of between 300 deg. and 800 deg. C. is attained during normal burning. The claims cover the use of a double halogeneous salt or compound of aluminum and an alkaline metal or alkaline-earth metal, including a double fluoride of aluminum and an alkaline metal.—London *Elec. Eng'ing*, Jan. 15, 1914.

Moore Tube.—J. Bujes.—An article illustrated by diagrams in which the author shows that the luminous radiation from the Moore tube must be considered as "volume lighting" instead of as "surface lighting" as in the case of incandescent lamps. The usual method of rating the candle-power of incandescent lamps by their mean horizontal candle-power is not applicable to Moore tubes. For this reason the comparison of the specific consumption of both sources of light on the basis of their mean horizontal candle-powers must lead to wrong results. To get figures of practical value one has to compare the consumption of watts required to produce the same mean illumination of the floor by the two types of lamps under conditions otherwise the same. This comparison is made for a square room illuminated either by Moore or by vertically suspended incandescent lamps. The author finds that the Moore tube consumes less energy and concludes that vertically suspended incandescent lamps without acessories have a poor efficiency. He thinks that for this reason there is an advantage in the use of the incandescent lamps with horizontal filaments which are now on the market.—*Elek. Zeit.*, Jan. 15, 1914.

Generation, Transmission and Distribution

Mechanical Refrigeration.—H. J. Macintire.—The first of a series of articles on the physico-chemical principles on which mechanical refrigeration is based. In the present instalment the author discusses the choice of refrigeration with reference to cost and chemical and physical properties.—*Metall. and Chem. Eng.*, Feb., 1914.

Electricity in French Coal Mines.—J. Mathivet.—A detailed illustrated description of the use of electricity in the installations of the Compagnie des Mines d'Anzin. There are nine power stations with ratings varying between 500 kw and 6000 kw. The aggregate rating of the nine stations is 13,250 kw. Methods of interconnection between different stations and methods of wiring and distribution are described and illustrated in diagrams.—*La Revue Elec.*, Jan. 16, 1914.

French Transmission System.—A. SCHOEN AND M. CHARLET.—The conclusion of the illustrated article on the transmission and distribution system of the Compagnie Electrique de Franche-Comté, supplying the Jura district from Besançon to Auxonne. There are four power stations with an aggregate capacity of 1500 hp in water-power and 450-hp steam equipment.—*La Lumière Elec.*, Jan. 3, 1914.

Hydroelectric Stations of France.—Statistical tables giving notes on equipment, etc., of 113 new public water-power stations in different districts in France. While there were only seven such stations in 1880 and 1174 in 1909, there are now 1287.—*La Revue Elec.*, Jan. 16, 1914.

Electricity in the Pyrénées.—A review of the development of hydroelectric industries in the Pyrénées mountains.—*La Lumière Elec.*, Dec. 6, 1913, and Jan. 10, 1914.

Traction

Electrification of Swiss Railways.—J. REYVAL.—An account of the work of the Swiss commission which has investigated the prospects of electrification of Swiss railways with a view to determining that system which would be most satisfactory from an engineering and economic standpoint. Its conclusion is in favor of the single-phase system.—*La Lumière Elec.*, Jan. 10, 1914.

Installations, Systems and Appliances

The "Extralight" Flat-Rate Controller.—H. STAFFORD HATFIELD.—Flat-rate systems using a device to limit the power supplied to a consumer to a certain predetermined amount prove inconvenient when the consumer occasionally wants to exceed his normal limit for an evening. The author describes a cheap and reliable limiter which may be put out of action by the consumer as often as he wishes, up to a certain number of times agreed upon. After some hours the controller automatically resumes its function. The number of times agreed upon is limited adjustably and cannot be exceeded until the apparatus has been reset by a representative of the company. A dial shows the consumer at any time how many free evenings remain to him. In Fig. 1 is shown the working of the arrangement in normal conditions. *A* is a glass tube, with two sealed-in platinum connections *E* and *F*. It contains mercury (shaded black) and an iron rod *B* which connects the two mercury surfaces and thus permits the current to flow through the winding of the electromagnet *D* into the consumer's premises. The tube is filled with an indifferent gas. When the current rises above a certain limit, depending upon the distance of the poles of the magnet *D* from the glass tube, the iron rod *B* is attracted, and the circuit is interrupted but is immediately completed again by the falling of the rod so that a rapid blinking of the lamp occurs. At *C* the tube is closed by a plug of dense, porous material. When the tube is turned up into the position shown in Fig. 2 and then turned back as Fig. 3, the mercury takes up a different position, flooding the space *K* and placing the gas in *H* under compression. The result of this is to put the limiter out of action, since the contacts are short-circuited and the attraction of the iron rod no longer serves to interrupt the current. At the same time the gas in *H* begins to diffuse slowly through the porous plug back into the other part of the tube, the level of the tube sinking in *K* and rising in *H* to correspond. In this way the former state of affairs is restored after the lapse of a time depending on the resistance to the passage of gas through the porous material, and easily determined in the manufacture of the instrument. This time is, furthermore, extremely constant, being almost independent of temperature. The device, however, does not require great accuracy, since it is merely intended that the light should be free a whole evening. The bulb *H* serves the following purpose: When the limiter acts with the mercury in the normal position heat is developed in the space *K* and expands the gas, which drives the mercury quickly down beyond the reach of the iron rod and breaks the circuit altogether. The bulb *H* allows the necessary gas space for this to occur. The consumer must thus at once switch off the extra demand so that misuse of the apparatus is prevented.—London *Electrician*, Jan. 9, 1914.

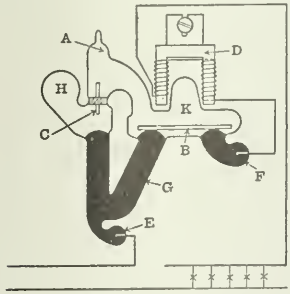
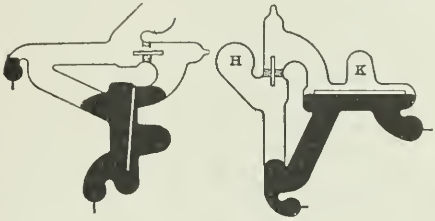


FIG. 1—WORKING ARRANGEMENT FLAT-RATE CONTROLLER



FIGS. 2 AND 3—DIFFERENT POSITIONS TO PUT LIMITER OUT OF ACTION

Swiss Central-Station Statistics.—An account of the latest statistics of the central stations of Switzerland based on the replies received on inquiry blanks sent out to the plants themselves. The replies seem to have been very incomplete so that the rating figures for 1911 are even less than those recorded for 1910. For this reason no further abstract of the figures is here given. —*Elek. Zeit.*, Jan. 15, 1914.

Wires, Wiring and Conduits

Wiring.—DETHIOLLAZ.—An illustrated article on the methods of fixing conductors to insulators.—*La Lumière Elec.*, Jan. 10, 1914.

Electrophysics and Magnetism

Kelvin Effect.—J. SPIELREIN.—A mathematical paper on the absorption of electromagnetic waves by a cylindrical conductor (Kelvin effect). The author gives the theory in a form applicable for numerical applications and develops a new method of integration which is simpler than that which makes use of Bessel functions.—*La Lumière Elec.*, Jan. 3, 1914.

Electrochemistry and Batteries

Gas Battery.—KARL SIEGEL.—A translation in abstract of the author's German paper recently noticed in the *Digest* on a new gas battery of relatively high output, the special feature of which is the use of electrodes in the form of platinized lumps of carbon, about 3 mm

(0.118 in.) in diameter, in flat earthenware cells, with carbon plates for making the electric connections.—London *Electrician*, Jan. 16, 1914.

Electric Iron Smelting.—Joh. Harden.—An analysis of the reasons which have led to comparatively unfavorable results in the trials of electric iron smelting at Hardanger in Norway.—*Metall. and Chem. Eng'ing*, February, 1914.

Refractory Material.—A note on a recent British patent (No. 29,389, 1912) of the British Thomson-Houston Company and the General Electric Company of this country. Silica, carbon and an aluminum silicate with or without manganese oxide are heated in a "smothered-arc" furnace until reduction takes place. A sublimate is formed and condensed in a housing round the furnace. The product will stand compression without much loss of its heat-insulating properties. The proportions of the constituents used are approximately 4 : 2 : 4 : 1. —London *Elec. Eng'ing*, Jan. 15, 1914.

Units, Measurements and Instruments

Electro-Analysis.—D. F. Calhane and T. C. Wheaton.—An article on the successful substitution of brass gauze as a cathode in place of platinum in several cases of electrolytic analysis.—*Metall. and Chem. Eng.*, Feb., 1914.

Notation.—The editors of the *Elektrotechnische Zeitschrift* announce that they have adopted the following notation for all articles in that journal, in agreement with the German Association of Electrical Engineers and the Berlin Electrical Society: Length l, mass m, time t, radius r, diameter d, wave-length λ, volume V, angles and arcs α, β, phase difference φ, velocity v, acceleration of gravity g, angular speed ω, number of revolutions n, efficiency η, pressure (force per surface) p, modulus of elasticity E, absolute temperature T, the temperature in degrees measured from the melting point of ice t (when temperature and time occur both in one and the same formula, the temperature is designated by δ and the time by t), quantity of heat Q, specific heat c, specific heat at constant pressure c_p, specific heat at constant volume c_v, thermal coefficient of elongation α, intensity of magnetization , magnetic field intensity $\mathfrak{H}$, magnetic flux density or induction $\mathfrak{B}$, magnetic permeability μ, magnetic susceptibility $\varkappa$, electromotive force E, quantity of electricity Q, coefficient of self-induction L, electric capacity C, electric current I, electric resistance R. All these symbols are to be used in formulas. The unit of power (mechanical as well as electrical) is the kilowatt, but to prevent misunderstandings, if, for instance, the power of a turbine driving a dynamo is given, it should be said that the power on the turbine shaft is 2500 kw. Notations of units are as follows: For length, *m* (meter), *km*, *dm*, *cm*, *mm*, $\mu = 0.001$ *mm;* for surface, *a*, *ha*, m^2, km^2, dcm^2, cm^2 mm^2; for volume, *l* (liter), *hl*, *dl*, *cl*, *ml*, km^3, m^3, dcm^3, cm^3, mm^3; for the mass, *t*, *kg*, *g*, *dg*, *cg*, *mg*. Of electric units only *S* has so far been adopted for the siemens, the unit of conductance. These symbols of units are to be used only in connection with numerical figures, but never in formulas; for instance, it is correct to write that the length is 500 *m*, but $E_1 = 4.44\, \nu N_1 \Phi_1 \times 10^{-8}$ volt. The same issue contains a summary by K. Strecker of the different notations and units which have been adopted by the International Electrical Commission, the German Association of Electrical Engineers and other societies with reference to other notations and units proposed and likely to be adopted.—*Elek. Zeit.*, Jan. 1, 1914.

Silver Voltameter.—E. B. Rosa, G. W. Vinal and A. S. McDaniel.—The third paper by the authors on the subject, giving an account of their second series of quantitative experiments and the preparation and testing of silver nitrate. Using the small porous-cup voltameter the emf value, 1.01827_8 volts, is found for the Weston normal cell at 20 deg. C. The difference between the values obtained with the large porous-cup voltameter and the smaller sizes is due to impurities present in the electrolyte, which may be partially removed by electrolysis. This phenomenon is called the "volume effect." The temperature coefficient of the voltameter appears to be zero if the electrolyte is pure. Deposits on gold and platinum cathodes are in agreement. For testing the purity of silver nitrate special methods have been devised. Estimates of the acidity may be made to within one part in 1,000,000, using iodisine as an indicator. For testing the solutions for reducing agents and colloidal silver $N/1000$ potassium permanganate has been successfully used. Methods of preparing silver nitrate of a satisfactory purity have been found. These differ considerably from previous methods owing to the conditions demanded by the voltameter work. The fusion of silver nitrate is discussed at length with particular reference to the decomposition of the salt after all of the acid has been expelled.—*Bulletin* Bureau of Standards, Vol. IX, No. 4, Dec. 15, 1913.

Moving-Coil Galvanometer.—At the recent exhibition of the British Physical Society a new moving-coil galvanometer devised by André Onwood was shown. Its feature consists in an entirely new type of suspension which results in an increased sensibility and stands exceptionally rough handling without injury. The instrument requires no leveling. The suspension is illustrated in Fig. 4. A small tube *b* is attached to the bottom of the moving coil *a*, and this is extended downward by a small rod *f*, to the end of which is attached a balance weight *e*. The phosphor-bronze suspension wire *c* is attached to a center pin *g* at the bottom end of the tube and to a tiny spiral spring suspended at the center of the iron core *d*. This spring is not shown in the illustration. As the coil is suspended from its center it always hangs vertically, and consequently a very small air-gap can be used. Such a small air-gap has hitherto been possible only with a pivoted coil, with the attendant disadvantages of the friction of the pivot. With this instrument there is no friction, and therefore its deflections are very uniform. The spring in the suspension takes up any small shocks to which the instrument is subjected, and in the case of a severe jar the coil rests against the sides of the air-gap, and no damage is done. If the instrument is not set up horizontally, any error introduced by the scale not being parallel to the swing of the pointer (which must always be horizontal, as it is connected to the coil) is counterbalanced by the fact that the field cuts the coil at a small angle to the horizontal and consequently exerts

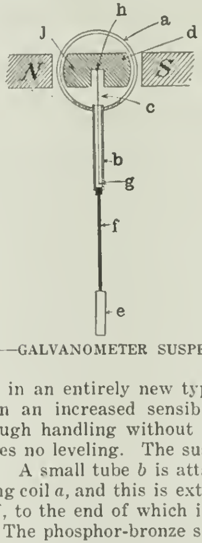


FIG. 4—GALVANOMETER SUSPENSION

a smaller torque.—London *Electrician*, Jan. 9, 1914.

Localizing Cable Faults.—The Land und Seekabelwerke A. G., in a long communication illustrated by diagrams, discusses the recommendation recently made by various authors that for the localization of cable faults the voltage-drop method is more suitable than the bridge-zero method. The conclusion is reached that the bridge-zero method is more exact and more convenient. On the other hand, in another communication Rich. Randhagen reaches the opposite conclusion, that the voltage-drop method is superior.—*Elek. Zeit.*, Jan. 8, 1914.

Measuring the High-Temperature Resistivity of Refractories.—E. F. Northrup.—An illustrated description of a new and very convenient method for determining the electric resistivity of refractories at high temperatures, together with the results obtained by this method for alundum.—*Metall. and Chem. Eng.*, February, 1914.

Electrostatic Voltmeter.—An illustrated description of the Szilard electrostatic voltmeter (Fig. 5), which has only a single quadrant consisting of a pair of sectors *S*, which are carefully insulated. The bridge *PP* holds the axle *X* between two rubies. This axle supports in its central point a needle *I* one wing of which has the same circular form as the needle of Lord Kelvin, while the other end is straight and pointed. A spiral spring mounted on the axle *X* gives a directing force to the needle. The two sectors of the quadrant are made of magnetized steel and constitute the damping system. No other part of the apparatus consists of magnetic metal. The insulating material *A* is completely inclosed and protected. The terminal *B* is connected to the sectors *S*. The apparatus is intended as a substitute for electroscopes in all their applications and for electrometers in many cases.—*La Revue Elec.*, Jan. 2, 1914.

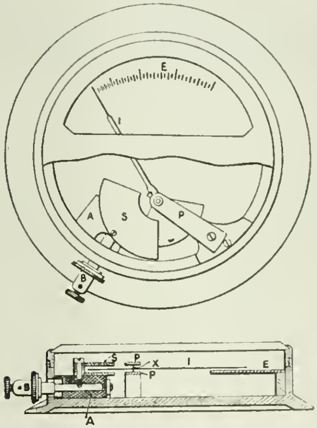


FIG. 5—DIAGRAM OF ELECTROSTATIC VOLTMETER

Megohm-Meter.—An illustrated description of the megohm-meter of Chauvin and Arnoux which permits the measurement of high resistances up to 100,000 megohms at a potential of 300 volts.—*La Revue Elec.*, Jan. 2, 1914.

Telegraphy, Telephony and Signals

Loading of Telephone Lines.—J. G. Hill.—A long abstract of a mathematical paper read before the (British) Institution of Post Office Electrical Engineers. The author endeavors to give the theory of loading with induction coils in as simple a form as possible. —London *Electrician*, Jan. 16, 1914.

Book Reviews

Factory Lighting. By Clarence E. Clewell. New York: McGraw-Hill Book Company, Inc. 161 pages, 100 illus. Price, $2.

A very practical treatise on industrial lighting in factories from the standpoint of the designing illuminating engineer, based on experience in factory illumination. The book assumes a certain familiarity on the part of the reader with the elementary principles of light and illumination. It enters at once into practical applications of those principles. Numerous pictures are given illustrating the installations described. The ten chapters of the book relate to the following subjects: General items; illumination design; lighting; installation work; lighting maintenance; office lighting; drafting-room lighting; factory lighting; power-house lighting; iron and steel mill lighting, and machine tool lighting. The book will commend itself not only to works managers and illuminating engineers but also to central-station salesmen who want the most practical information on good and bad lighting without algebra or details of photometry.

Light, Radiation and Illumination. Translated from the German of Paul Högner by Justus Eck. New York: D. Van Nostrand Company. 88 pages, illus. Price, $2.50.

A handbook in "The Electrician" series, and a good translation into English of Högner's volume. It contains many useful illuminating-engineering tables and diagrams. The sections into which the book is divided relate to the following subjects: Light emission from surfaces; light emission from bodies; light emission from arc lamps; radiation density; unidirectional illumination; calculation methods; street illumination; determination of vertical surface illumination from mean horizontal surface illumination. It would assist the reader of future editions of the book if a short chapter were inserted on units and their magnitudes. Thus the "lux" is largely employed as a unit of illumination throughout the book, apparently with the meaning of a meter-international candle. Nevertheless, it is difficult to find any statement to this effect, and the term "lux" is frequently used by German writers with a different meaning; namely, the meter-hefner.

A Primer of the Internal-Combustion Engine. By H. E. Wimperis. New York: D. Van Nostrand Company. 144 pages, illus. Price, $1.

For those who approach a new subject for the first time, an elementary book covering the ground broadly, while laying stress on fundamental principles, is very helpful because the essentials are not lost sight of in a multiplicity of detail or a searching scientific analysis. As an introduction to more advanced works, this primer fulfils its purpose admirably, the matter being well arranged and the language clear and simple. After an introductory chapter giving a brief outline of the historical development of the internal-combustion engine, the theory of heat and the laws governing the behavior of gases and vapors are clearly presented. The ideal engine is then considered, being followed by a description of the various types of practical engine. One chapter is devoted to fuels and gas producers, while details such as methods of ignition, speed-governing and carburetors receive their due share of attention. The last chapter describes the nature of tests as usually made on engines of this type. The value of the book to teachers and students is greatly enhanced by the numerical problems which are given at the close of the several chapters.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

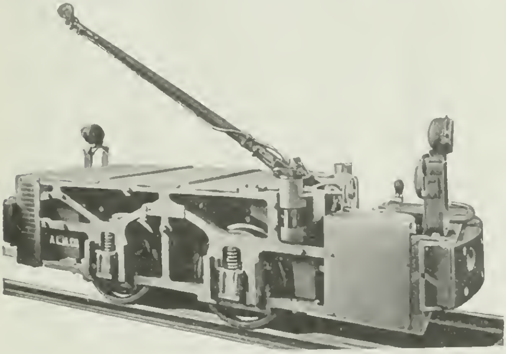
Hand Searchlamp

The hand searchlamp illustrated herewith is being put on the market by the Niagara Searchlight Company, Niagara Falls, N. Y. It is known as the army type of lamp. Energy is obtained from a battery of two cells. The battery and the reflector are inclosed in a one-piece metal case with a mottled-bronze outside finish. The reflector is made of burnished silver. The cap at the battery end and the lens holder are screwed on to the case. The small tungsten lamp is put in circuit by a slide contact shown in the illustration.

HAND SEARCHLAMP WITH METAL CASE

Electric Mine Locomotives

The Anaconda Copper Mining Company, Butte, Mont., recently ordered seventeen 3.5-ton and 4-ton locomotives for underground haulage from the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The locomotives, one of which is illustrated herewith, are of the open-frame, bar-steel type of construction, and each is equipped with two 11-hp commutating-pole motors.

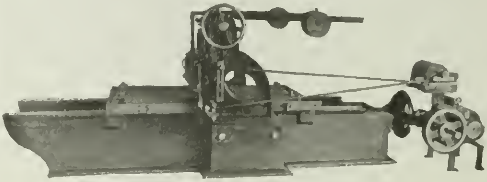


MINE LOCOMOTIVE

The Anaconda company and its subsidiaries use a large number of electric mine locomotives. In the past this company has preferred the tractors with standard steel-plate construction, sometimes referred to as the armor-plate type. Recently, however, the open-frame bar-steel locomotives have been experimented with and have been found so satisfactory that the foregoing order resulted.

Electric Drive for Stone Planer

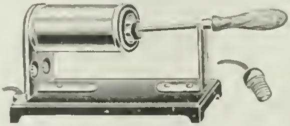
A lithographers' stone planer, manufactured by the Fuchs & Lang Company, New York, and driven by a Diehl motor of the commutating-pole, reversible type, is shown herewith. The motor is operated by a starting and reversing switch, controlled by a rod attached to the bed of the machine. The motor works approximately one and three-quarter times as fast in the reverse direction when not cutting as in the forward direction when cutting. Power is transmitted from the motor to the planer by a rawhide pinion, a cast-iron gear and a worm gear. A dynamic brake for quick stopping is unnecessary. By means of the motor drive the former double belting from the overhead shaft has been eliminated, together with the noise due to the shifting of the belt at each reversal.



STONE PLANER WITH ELECTRIC DRIVE

Electric Heater for Soldering Irons

The Current Electric Company, 16 East Kinzie Street, Chicago, has just put on the market an electric heater for soldering irons. With this device the mechanic who has soldering to do uses the same irons which he has been employing, but heats them electrically instead of by means of gas or gasoline. As will be seen from the illustration, the iron is thrust point foremost into the furnace, the heating coil surrounding the tube on which the iron rests. Heaters are made in three sizes, namely, 100-watt, 350-watt and 500-watt. The 100-watt furnace is adaptable for jewelers' work and can be operated for a few cents a day. All three types are said to be more economical in operation than gas furnaces of like size. Tests on the medium-sized furnace showed that the interior of the furnace becomes red hot when operated empty in less than five minutes. An iron which fills the aperture can be heated



ELECTRIC HEATER FOR SOLDERING IRONS

to the necessary temperature for soldering in about eight minutes with the furnace starting cold. With the furnace heated an iron can be brought to a temperature suitable for soldering in about three minutes. Each unit is mounted on a cast-iron base and is equipped with a strip-steel support for the soldering iron. In case of accident or burn-out the heating element can be readily replaced.

Vertical Charging Rectifier

Herewith is illustrated a rectifier designed for the automatic charging of automobile storage batteries. The apparatus is of the vertical type, use being made of a squirrel-cage alternating-current motor placed beneath the direct-current generator. By this arrangement the commutator, which alone requires any attention, is placed at the top and is therefore easily accessible. The two machines are rigidly joined together in one frame and the rotating parts are assembled on one shaft. Ball bearings are used both at the top and bottom of the shaft, the lower set being a combination thrust and annular bearing for carrying the weight and maintaining the horizontal alignment, while the upper set is an annular bearing for keeping the shaft vertical.

An alternating-current solenoid switch controlling both the alternating-current and direct-current circuits brings the machine up to speed as soon as the main switch is closed by the discharge of the battery into the generator, thus operating the machine as a motor. The alternating-current line is cut off from the motor by this switch while the starting operation is taking place. This switch also provides for automatically restarting the apparatus in case of line interruptions. When the battery is fully charged the switch automatically stops the machine.

CHARGING APPARATUS

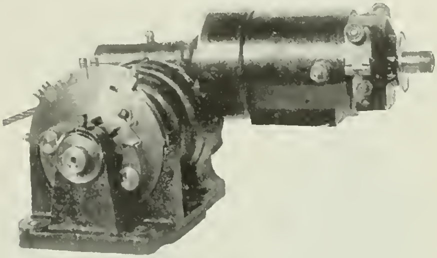
This Wotton rectifier is manufactured by the Electric Products Company, Cleveland, Ohio.

Electric Emergency Brake for Automobiles

An electrical device for operating the emergency brakes on either old or new automobiles without removing the hands from the steering wheel has been developed by the Hartford Suspension Company, Jersey City, N. J. It consists of a small high-speed electric motor connected by an irreversible worm gear to a drum around which winds a cable operating the brake-bands.

This actuating unit measures 8 in. long by 6 in. wide and 4 in. high and is so light that practically no weight is added to the car when the usual emergency brake lever and connections which it replaces are removed. The motor is capable of exerting a 1000-lb. pull on the cable with an input of 30 watts and is designed for pressures of 6, 12 and 24 volts.

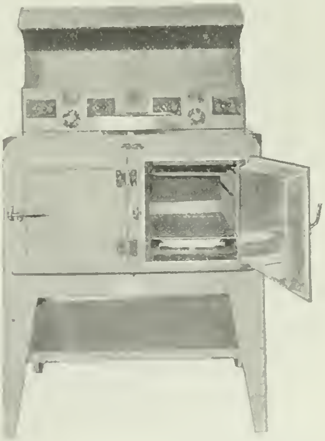
This form of electric brake was originally brought out to replace the Westinghouse air equipment for railroad service. The chief merit of the electric brake is its high speed of operation, as it requires only one-fifth second as compared with five seconds for air-brake operation. The device can be made to brake gradually or instantaneously, depending on the length of contact allowed by the automatic controller. The controller lever may be mounted on the steering column and can be moved either forward or backward to apply or release the brakes. A slight forward movement of the lever causes a clicking sound, at the same time allowing the motor to revolve a definite number of times. Further forward movement repeats the operation. To apply the brakes suddenly the lever should be pushed to the extreme forward position.



ELECTRIC AUTOMOBILE BRAKE

Automatic Electric Range

A portable range put on the market by the Olston Electric Stove Company, Los Angeles, Cal., is shown herewith. The range is constructed entirely of sheet metal and aluminum, no castings being used. The ovens are insulated chambers and retain practically all the heat generated. An automatic thermostat, which is adjusted from the outside by a knob and a pointer attached to a dial, controls the heat produced. The thermostat can be set for any predetermined degree of heat and when the desired temperature is reached the thermostat automatically cuts off the energy supply; then as the oven gradually cools the heating unit is automatically put in circuit again and brings the oven back to the predetermined temperature.



ELECTRIC RANGE

The oven at the left in the illustration is fitted with one heating element in the bottom. This oven is 11.5 in. wide, 11.5 in. high and 16 in. deep. The right oven is fitted with a heating unit in the bottom and one in the top, the latter being used for broiling and toasting. The size of this oven is 11.5 in. by 11.5 in. by 18 in.

The range is equipped with a porcelain broiler pan and four wire grates. The condensation is carried to a drip pan by means of troughs and conductors. The hot plate as shown is a permanent fixture of the range.

Variable Frequency Alternators

Alternating-current generators equipped with pole-changing devices by means of which the periodicity of the machines can be altered without great variations in speed are illustrated in Figs. 1 and 2.

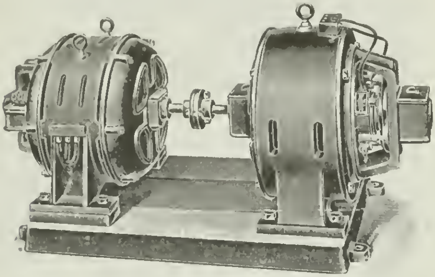


FIG. 1—ALTERNATOR COUPLED TO MOTOR

With alternators wound for forty to 160 cycles and having speeds varying from 800 to 1600 r.p.m. six-pole and twelve-pole windings are used. The field has twelve polar projections which by means of a double-pole switch are arranged to give two north poles and two south poles alternately or a north pole and a south pole alternately, in the former case making six poles and in the latter twelve poles. The stator winding consists of a circuit comprising six main coils and six accessory coils, the latter being used only for the six-pole combination.

By means of a double-pole switch the stator coils can be arranged to give a six-coil, twelve-pole winding. The coils are wound with empty slots in the middle and between them, and when arranged to give six north poles the intermediate spaces form the six south poles, thus obtaining a twelve-pole stator. When connected to give six poles of alternating polarity the spaces between the coils which are wound with the accessory coils are connected in circuit by the switch.

Fig. 1 illustrates an alternator coupled to a motor and Fig. 2 shows the combined type of alternator and motor. These machines, which are used for testing alternating-current motors for any frequency or voltage and also for wireless telegraphy, medical work, meter testing, etc., are manufactured by the Crypto Electrical Company, 149 Bermondsey Street, London, S. E.

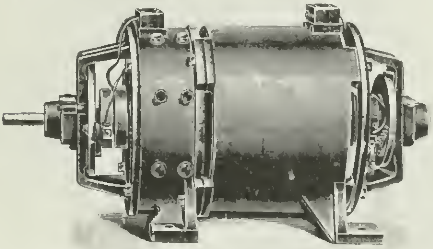
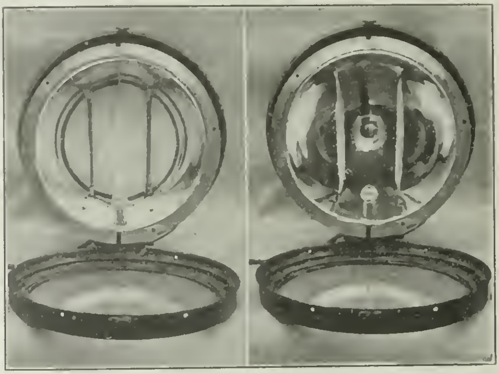


FIG. 2—COMBINED TYPE ALTERNATOR AND MOTOR

Convertible Automobile Headlamp

The automobile headlamp illustrated herewith has been designed both for use in city streets where glare is undesirable and on country roads where a stronger light is needed. The device consists of two pairs of translucent wings mounted on pivots or bearings fastened in the headlamp reflector. These wings are opened and closed by electromagnets inside the cover of the lamp. When reduced light is desired, the wings are closed by pressing a push-button located on the dashboard or any other convenient part of the car. With the wings closed, no glare is apparent, but the road in front of the car is illuminated with a strong, diffused light. By pushing another button the wings are opened and a concentrated searchlamp beam is available.

This lamp, which is called the Nodaz headlamp, is manufactured by the Ward-Leonard Electric Company, Bronxville, N. Y. The apparatus for producing the two distributions of light is designed so that it can be attached to practically any headlamp.



CONVERTIBLE HEADLAMP FOR AUTOMOBILE

Storage Battery for Electric Starters

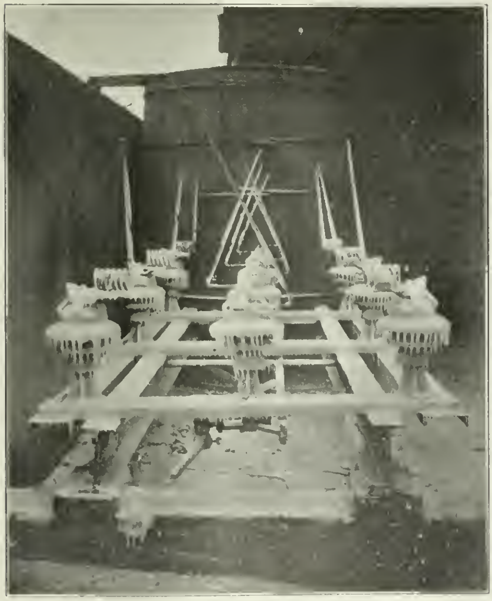
The Philadelphia Storage Battery Company, Philadelphia, Pa., has brought out a new type of storage battery for use with automobile electric cranking apparatus. This battery is made in 6-volt, 12-volt, 16-volt, 18-volt and 24-volt sizes, having ratings of 80, 100, 120 and 160 amp-hr. at normal discharge. Diamond-grid plates are used for both positive and negative elements, and each cell is made a separate unit in itself by using outside lead connectors. Wooden separators are employed between the plates and a double cover, and an

AUTOMOBILE STORAGE BATTERY

air chamber is provided on each battery. Heretofore the starting batteries made by this company had inside connections, and when a weakness developed in one cell it was necessary to remove the entire top of the battery to get at the trouble. Now it is necessary only to cut the lead connectors with a "hot knife" and withdraw the faulty cell. The batteries conform to the standards of the Society of Automobile Engineers and are equipped with drop handles.

Effect of Ice Formation on Pole-Top Switches

The Delta-Star Electric Company, Chicago, Ill., has been conducting tests to determine the effect of ice formations on pole-top high-tension air-break switches. The illustration shows an ice-covered switch used in one of these experiments. The switch was mounted on the factory roof, where plenty of water could be obtained, and a heavy spray was directed over the entire switch for several hours. The ice deposit secured was much heavier than would occur ordinarily during a severe sleet storm; but in spite of the heavy frozen coating the switches were readily opened. The illustration gives an end view of the switch after being opened, the method of mounting, source of water supply, etc., being clearly shown.

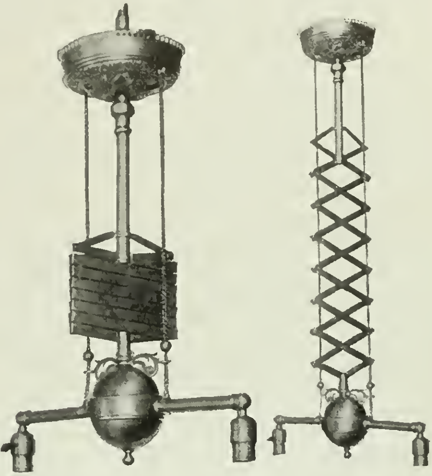


ICE-COVERED POLE-TOP SWITCH

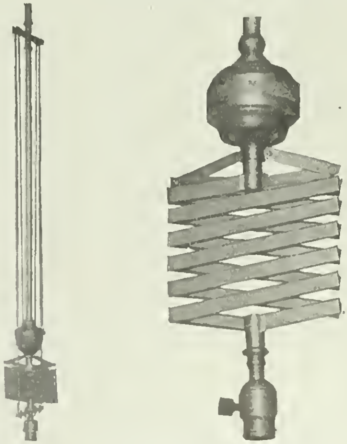
Extensible Electric-Lamp Fixtures

The extensible lighting fixtures illustrated herewith are designed for raising or lowering electric lamps over desks or tables and adjusting them to any position desired. The extensible arm is similar in construction to a pair of lazy-tongs. The device can be attached to a single-lamp, a two-lamp, a three-lamp or a four-lamp chandelier, and the old equipment need not be discarded as the fixture is adaptable to practically any style of chandelier. All wires are hidden behind the bars of the extensible arm. Different methods of counterbalancing distinguish the various types of fixtures, the arms in all cases being of the same design.

In Fig. 1 is shown a fixture having a spring at the top as a counterbalance. Fig. 2 illustrates the same type with arm partly opened or drawn out. In Fig. 3 is shown a device which, instead of a spring, has a receptacle that slides up and down the tubing shown. This receptacle is equipped with counterbalancing weights the number of which are varied according to the number of lamps used. Fig. 4 shows another style of fixture with weights for counterbalancing. In this type the cross-arm and chains shown in Fig. 3 are not used, the extensible arm being fastened directly to the receptacle and supporting the entire weight of the lamp. Such a fixture is suitable for single lamps, and, by doing away with the receptacle, it can also be used as an extensible wall bracket.



FIGS. 1 AND 2—FIXTURE WITH SPRING COUNTERBALANCE



FIGS. 3 AND 4—FIXTURES WITH COUNTERBALANCING WEIGHTS

These fixtures are being put on the market by Mr. Frederick Garrecht, Idaho City, Idaho.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Electric Drive for Kentucky Steel Plant.—The Louisville (Ky.) Gas & Electric Company reports that Grainger & Company, of that city, who operate a structural-steel plant, have shut down the three steam engines which have been used in driving the machinery in their establishment. The central-station company has received a contract to supply the entire energy requirements of this steel-fabricating concern.

Manufacturer of Electric Washers Optimistic.—The following extract from a letter from J. A. Winger, of the Automatic Electric Washer Company, Newton, Ia., carries a breath of undisguised optimism. He says in part: "We certainly had a splendid business last year, showing the greatest increase in our history, and 1914 is starting out finely. We believe that it is going to surpass anything heretofore achieved. There is a very optimistic feeling expressed by everyone with whom we come in contact."

Operating Company to Push Electric-Vehicle Business.—The United Electric Light & Power Company, of New York, has established an electric-vehicle bureau for the purpose of furthering the sale and use of electric vehicles in New York City. It is the United company's desire to co-operate with the firms distributing vehicles and accessories and with the garages and owners of vehicles. Data on transportation and operation will also be collected. D. F. Tobias has been appointed manager of the new electric-vehicle bureau.

Motor Specialties in Demand.—The Menominee (Mich.) Electric Manufacturing Company, of which L. W. Wood is sales manager, and which makes small electric motors, desk fans, vacuum cleaners and other specialties, reports an especially active demand for washing-machine and electric-piano motors. One interesting feature about the vacuum cleaner made by this concern is that it employs twin exhaust fans. These fans are placed on each side of an air-cooled electric motor, each fan being mounted on the extension of the motor shaft.

Industrial Power Contract at High Load-Factor.—The By-products Coke Corporation, Chicago, has recently signed a contract with the Commonwealth Edison Company by which it is to be supplied with 400 kw continuously throughout the entire twenty-four hours of the day. The change which is being made does not necessitate the purchase of additional equipment, as the same motors which have been operating the coal conveyors and pumps at the coke plant will be connected to the central-station company's circuits. The total load of the By-products Coke Corporation's plant is nearly 1800 hp.

Importer Looks for Growth in Arc-Lamp Business.—The H. M. Hirschberg Company, 39 East Twentieth Street, New York, reports that its business last year was, if anything, ahead of expectations. The sale of both lamps and carbons increased very materially. The outlook for 1914 is in a measure even better, as on the advent of the company's new long-hour flaming-arc lamp, which is now virtually ready for the market, it expects a very great increase of business. The outlook for the carbon trade is also very bright, although the increase of duty on flame carbons is making it a little difficult for the company to compete in some lines.

Storage-Battery Manufacturer Gives Dinner in Chicago.—The Electric Storage Battery Company, of Philadelphia, gave its sixth annual "Exide" dinner on the evening of Jan. 28 at the Midday Club in Chicago. The occasion was simply a get-together meeting for electric-vehicle manufacturers and dealers and the distributors of "Exide" batteries. Herbert Lloyd, president and general manager of the company, presided, and there were no speeches, the entertainment consisting of a vaudeville and cabaret show. There were about 250 guests present, including representatives of the Baker, Rauch & Lang, Chicago Electric, Borland-Grannis, Ohio Electric, Broc, Waverly, Walker, Argo and General Vehicle companies.

Brickyard Adopts Individual-Motor Drive with Central-Station Energy.—The Chicago Brick Company, operating a yard in Riverdale, Ill., with an annual output of about 50,000,000 bricks, is discarding its steam engines for motor drive, with energy to be furnished from the mains of the Commonwealth Edison Company. The motors will range in size from one of 200-hp rating, driving the brick machine, to the 3-hp motors for various auxiliaries. The company has been operating motors totaling 180 hp for some time, supplementing its steam engines, and these motors, together with those being installed, will provide a connected load of about 1000 hp. Steam from the boilers will be used in the future as an atomizing agent for the oil burners under the brick ovens. Tests made by the Commonwealth Edison Company on other brickyards near Chicago show that approximately 13 kw-hr. is consumed in making 1000 bricks.

Electric Signs Find Favor in China.—During the past year the use of electric signs grew rapidly in Hongkong, but was confined to the comparatively simple varieties. Several of the large Chinese department stores and restaurants display electric signs of some size bearing Chinese characters. The use of electric and other signs is strictly limited by the local government, because of the prevalence of severe storms, and in order also to save the landscape from being unduly defaced. On the other hand, the merchants of that city are increasingly active in applying modern methods to their advertising and selling, and the field for small electric signs is correspondingly better. Electrical energy is comparatively cheap, and with the steady expansion of electric lighting service the sign and appliance business should increase. It is thought that some of the large shipping concerns in Hongkong would be good customers for electric signs and general illumination.

Line-Crossing Protection.—As evidence of the increasing attention being paid to the protection of overhead crossings of high-tension lines over telegraph and telephone circuits, it is worthy of note that clamping sets made for this purpose by the Clark Electric & Manufacturing Company, New York, have recently been installed by the Des Moines City Railway Company, the Milwaukee Electric Railways Company, the Aurora, Elgin & Chicago Railways Company, the Consolidated Gas, Electric Light & Power Company, of Baltimore, the South Carolina Light, Power & Railways Company and the Penn Public Service Company. These sets have recently been approved by the American Telephone & Telegraph Company, Chicago.

Commercial Vehicle Standards Issued in Card Form.—From the Automobile Chamber of Commerce, Inc., of 7 West Forty-second Street, New York, a set of cards has been recently issued showing the more important standards for commercial-vehicle manufacture and sale. There are seven cards in the set, and the standards covered are warranty, speed rating, body-weight allowance, overload, caution plate, frame width and length, and demonstration charges. The warranty is a new form, approved Dec. 3, 1913, and supersedes the motor-truck warranty recommended by the N.A.A.M. in 1912. It is a combination of this with the standard passenger-car warranty, adopted in 1910, and covers both commercial and passenger vehicles. An effort is being made to place these standards in the hands of all manufacturers of commercial vehicles and to get them to apply them in their production and sales departments. The National Automobile' Chamber of Commerce, Inc., is the successor of the National Association of Automobile Manufacturers and the Automobile Board of Trade.

No "Free" Service Under New Automobile Selling Plan.—In the Jan. 24 issue of the *Electrical World* note was made of a new selling plan inaugurated by the General Motors Truck Company, of Pontiac, Mich., by which that company hopes to give better satisfaction to its customers, as well as to simplify its own problems. Part of this plan consists of dropping the "free" service scheme used in the past, and it appears that this portion was not sufficiently emphasized in the former note. The company states that it will continue to co-operate to the fullest extent with its customers, to guarantee its trucks fully, to make good anything that is wrong either in material or workmanship, and to give competent instructions regarding operating and care. Another detail of the plan, which has just been brought out, is that it eliminates all trading propositions. The company does not now take in old trucks at any price. By the shortening of credits, elimination of the "free" service and exchange features of the old plan, better engineering in the selection of the car for each special job, and an increase of production, the company expects to reduce the price of its trucks and at the same time do a better business.

Electrical Equipment Ordered from the Westinghouse Company.—The following are among the recent orders for electrical equipment received by the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa. The Southern Power Company has ordered one 3000-kva portable substation, consisting of one steel car-switching outfit, three 1000-kva transformers and one 20-hp motor for driving a Sirocco blower. An order has been placed by Fitzpatrick & Hoepfner for one 200-kw, three-wire, compound-wound generator; one 150-kw, three-wire, compound-wound generator; one 100-kw, 1100-r.p.m., three-bearing motor-generator set, comprising a three-wire, compound-wound generator and a 500-volt shunt-wound motor; sixteen direct-current 230-volt motors, ranging from ½ hp to 5 hp, for use with fans and blowers; one commutating turning tool, and one air-cooled portable electric blower to be used on 110-volt direct current. From Leslie B. Grant an order has been received for one 250-kva, 2300-volt, three-phase, sixty-cycle generator, with one 12½-kw exciter; three 85-kva, sixty-cycle transformers and three lightning arresters, 6600-volt, indoor mounting, and switchboard. The above manufacturer will furnish to the Public Service Electric Company a 1000-kva, sixty-cycle, 13,200-6600-volt three-phase, 2600-volt two-phase, duplex transformer. The St. Clair County Gas & Electric Company has bought one 1000-kva frequency-changer set, one 250-kva frequency-changer set, one 50-kw three-bearing motor-generator set, consisting of a 175-hp, 220-volt, three-phase, twenty-five-cycle, 720-r.p.m. induction motor and a 150-kw, 720-r.p.m. compound-wound generator, and three 500-kva, twenty-five-cycle transformers.

Electrically Driven High-Pressure Pumps for Boston, Mass.—In order to provide increased protection against fire for the congested business district of Boston, Mass., it has been decided to erect a high-pressure central pumping station between the Boston Commons and the Public Gardens, from which will radiate a system of special high-pressure watermains, covering that entire district and devoted exclusively to fire service. In case of fire in this district, the alarm will be sounded in the pumping station and the fire houses simultaneously, and within forty-five seconds a pressure of 300 lb. per square inch will be put on the system. This will do away with the necessity for fire-engine service and only the hose lines will have to be brought to the scene of the fire. The Westinghouse Electric & Manufacturing Company has entered into a contract with the city of Boston for all machinery and equipment for this pumping station. The contract calls for six 3000-gal. per minute, six-stage centrifugal pumps; six 700-hp, 6000-volt, sixty-cycle motors; six 13,200-volt, twenty-five-cycle, 800-hp motors, with switchboard and controlling apparatus, traveling cranes and all heavy piping and large valves necessary for the complete equipment of the station. Each pump will be connected by a magnetic coupling on one end to a 700-hp, sixty-cycle motor and on the other end to a 800-hp, twenty-five-cycle motor. Under normal operation each pump is driven by the sixty-cycle motor, drawing energy from the lines of the Edison Electric Illuminating Company of Boston. However, should any mishap occur to the sixty-cycle supply the pump can be instantly operated by its twenty-five-cycle motor, fed from the lines of the Boston Elevated Railroad Company. The motors have wound secondaries, and they do not start until the first point of the automatic controller has been passed. At this point the circuit of the magnetic clutch, between the motor and the pump, is completed. A potential of 13,200 volts was contemplated in the design of the 800-hp motors and is the highest ever used in a motor with a phase-wound secondary.

Mica Mining in India.—Mr. Leo Meirowsky, of the firm of Meirowsky Brothers, 146 Liberty Street, New York, who own and operate their own mica mines in India, with headquarters at Giridih, near Calcutta, has been in this country for the past six or eight weeks and has just left on his return trip. Shortly before his departure for India, Mr. Meirowsky gave some interesting facts to an *Electrical World* representative concerning the mica mining industry in India and the general progress of that country along electrical lines. The mica crystals occur in layers of varying thickness, extending from the surface to an indefinite depth. So far the deposits have not been worked to a depth greater than 300 ft. or 400 ft., and the best grade of mica is generally found at about 150 ft. below the surface. The early native methods of mining were very crude and consisted simply of digging holes in the ground wherever an outcrop of mica was found. The vein was followed as far as a single laborer could do the digging and carry out the mica and refuse. The result was that only the best mica was removed for sale, as the expense for taking out the cheaper grades was too large in comparison to their market value. Another result was that the limits of production possibilities of the mica deposits were soon reached and with the increasing demand for mica the use of more intensive methods was forced. Meirowsky Brothers introduced successful modern methods in 1905 and since that time have by the application of steam power and up-to-date tools achieved a large increase in production. Also the poorer grades of mica can now be extracted with profit. The demand for mica of all grades has increased so rapidly, however, that the supply could not keep pace with it and for the past few years there has been a steady tendency toward increasing prices. Concerning the general progress of the electrical industry in India, Mr. Meirowsky stated that in the larger cities of that country municipal-owned generating stations are supplying electrical energy for lighting service and trolley lines, and to quite a large extent for operating electric fans. Motor drive is not used to any great extent, as far as he knows, although the cotton and jute industries use electrical energy for lighting.

NEW YORK METAL MARKET PRICES

	Jan. 27		Feb. 3	
Copper:	Bid	Asked	Bid	Asked
Standard, spot*	.....	14.50	.....	14.75
	Selling Prices		Selling Prices	
	£ s. d.		£ s. d.	
London, standard, spot*	65 12 6		66 7 6	
Prime Lake	14.75	to 15.00	15.00	to 15.25
Electrolytic	14.50	to 14.60	14.75	to 14.85
Casting	14.30	to 14.40	14.55	to 14.65
Copper wire base	15.75	to	15.87½	to 16.00
Lead	4.10		4.15	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.25		7.25	
Spelter, spot	5.35	to 5.40	5.50	to .....
Tin, spot	39.12½	to 39.37½	40.25	to 40.50
Aluminum:				
Prompt delivery	18.75	to 19.00	18.75	to 19.00
Future	18.50	to 18.75	18.50	to 18.75

*OLD METALS

Heavy copper and wire	13.62½	13.75
Brass, heavy	8.87½	8.87½
Brass, light	7.87½	7.87½
Lead, heavy	4.05	4.05
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to Feb. 3....................1,030

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*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Annual Report of the Mount Whitney Power & Electric Company.—The gross earnings of the Mount Whitney Power & Electric Company for the year ended Dec. 31 amounted to $562,852 and the net earnings came to $306,395 during the same period, both of which figures represented material increases over the corresponding figures for 1912. A surplus of $176,495 was realized after deducting all taxes, maintenance and other charges. At the present time there is a good deal of construction work in progress for the company, but it also has a rapidly growing territory, and the new business is expected to more than take care of additional expense for extensions of the service.

Ohio Commission Halts Sale of Utility Property.—The application of the Ohio Service Company for permission to purchase the properties of the New Midland Power & Traction Company was filed recently with the Ohio Public Utilities Commission, but the consent of that body has been withheld, on the ground that the proposed purchase price was in excess of the value of the properties to be acquired. The latter consisted of an electric-lighting and ice-making plant at Cambridge, Ohio, the street-railway lines in that city, and the interurban line between Cambridge and Pleasant City, Ohio, together with franchise rights and other assets. It was proposed by the Ohio Service Company to pay for this combined property $900,000, of which $250,000 was to be in capital stock and the remainder in 6 per cent convertible notes.

Dividend Increase by the Galveston-Houston Electric Company.—On Jan. 22 the directors of the Galveston-Houston Electric Company declared the regular 3½ per cent semi-annual dividend on the preferred stock and the same amount on the common stock, both payable March 16. In the case of the common stock this represents an increase of 1 per cent per annum and places the stock on a 7 per cent basis, which, according to C. M. Clark, secretary of the company, can be conservatively maintained with the present rate of earnings. An issue of $600,000 in three-year 6 per cent bonds falls due on April 1, 1914, and, in order to retire these debts and meet other capital requirements of the current year, there will be offered to holders of both preferred and common stock the right to subscribe pro rata to $1,000,000 of unissued common stock. If paid for in full, this stock will carry the 3½ per cent dividend, payable March 16. As an option this stock may be paid for in two equal instalments.

Georgia Railway & Electric Stock Issue.—Subscription rights to $541,600 of the common stock of the Georgia Railway & Electric Company are being offered to stockholders at $118 a share on the basis of one share of new stock to each twenty shares of stock held. A guaranteed dividend of 8 per cent per annum is paid by the common stock and the Georgia Railway & Power Company also guarantees 5 per cent dividends on the preferred stock. The issue of the above common stock brings the capitalization of the Georgia Railway & Electric Company up to $8,514,600, the full amount at present authorized. The subscriptions have to be made on or before Feb. 15 and a syndicate has made arrangements for purchasing all stock not taken by the stockholders. This company was incorporated in January, 1902, as a consolidation of the Atlanta Railway & Power Company, the Atlanta Rapid Transit Company, the Georgia Electric Light Company and the Atlanta Steam Company. It owns the entire capital stock of the Atlanta Gas Light Company and the Atlanta Northern Railway.

Claims of Bullock Shareholders Adjusted.—An agreement has been reached between O. H. Falk, president of the Allis-Chalmers Manufacturing Company, and C. L. Harrison, A. C. Shinkle and G. D. Eustis, representing the holders of preferred stock of the Bullock Electric Manufacturing Company, as to the plan for taking care of the interests of those stockholders under the reorganized business. The Allis-Chalmers company owns the common stock of the Bullock company, and last January because of financial difficulties of the former the dividends on the preferred stock of the latter, for the last quarter of 1912, were passed. No dividends have since been paid on that stock and part of the agreement consists in payment in cash of all dividends due up to Jan. 1, 1914, amounting to 7½ per cent. The main part of the plan consists in exchanging for $100 par value of preferred stock of the Bullock company $80 par value in 6 per cent bonds of the Allis-Chalmers company, maturing in twenty or twenty-five years, with the option of redemption at any time up to Feb. 1, 1915, with the latter company at $95. There are 243 individual holders of the $1,170,000 preferred stock of the Bullock company, of whom a majority have already approved the above plan. A bond issue of $936,000 will be required to carry out the plan.

Merger of California Electrical Utilities Contemplated.—Plans are on foot for the merging of the Northern California Power Company, Consolidated, and the Oro Electric Corporation by the formation of a holding corporation which will take over the stocks of these two companies in exchange for its own securities. The Oro Electric company was organized in 1911 with a capitalization of $6,500,000 common and $3,500,000 in 6 per cent preferred stock and $10,000,000 bonds, while the Northern California Power Company was incorporated in 1908 and has a capital stock of $10,000,000 with $7,167,200 bonds. The former company controls water-power sites capable of yielding a total of 133,000 hp. The latter operates five hydroelectric plants with a combined output of 57,000 hp. The two concerns which it is planned to merge are working in largely the same territory and have been supplying very similar industrial demands, so the consolidation will probably bring little change in operating policy. In the Jan. 4, 1913, issue of the *Electrical World* note was made of a contract between these two concerns, whereby the Oro company was to obtain 20,000 hp from the other company pending the completion of the former's generating station in Yellow Creek. As noted in the Dec. 13, 1913, issue, the Northern California company supplies energy for extensive electrolytic ore-refining operations in its territory and the Oro company has a large demand for energy for the same purpose.

Central Union Telephone Company Receivership.—In the case of William A. Read and others against the Central Union Telephone Company and others, the receivers have been agreed upon, as previously announced. This is the action brought by minority stockholders on the charge that the American Telephone & Telegraph Company, the controlling owner of the Central Union Telephone Company, has "milked" the company in such a manner that the interests of the plaintiffs were injuriously affected. A long hearing was held in the spring of 1913, and early in November of last year the complainants filed a supplemental bill setting up the financial situation of the Central Union Telephone Company as they contended it then appeared to be from the books of the company. The plaintiffs alleged that on Aug. 31, 1913, the deficit of the company was $3,335,587. In the course of the hearing copies of a number of interesting letters exchanged between F. P. Fish, Theodore N. Vail, B. E. Sunny, L. G. Richardson and others were read. The complainants alleged that these letters contained evidence of fraudulent conduct toward the stockholders of the Central Union Telephone Company. On Dec. 29, 1913, the court entered an order for the appointment of three receivers, the understanding being that the defendants should have the privilege of naming one of the receivers, the complainants another, and the court the third. Under this arrangement it is understood that an agreement has been reached by which the three receivers will consist of Edgar S. Bloom, of St. Louis, vice-president Bell Telephone Company of Missouri, representing the Bell interests; Frank F. Fowle, of New York, a consulting electrical engineer familiar with telephone practice, representing the minority stockholders, and David R. Forgan, president National City Bank of Chicago, representing the court. After the receivers are put in possession of the property and business of the Central Union Telephone Company, the next step will be to bring the cause on for final hearing. On this hearing the court will be asked to decide, first, whether the holding of $5,200,000 of stock (par value) by the American Telephone & Telegraph Company in the Central Union Telephone Company is illegal, and, second, as to the general principles to be followed in the accounting to be had between the American Telephone & Telegraph Company and the Central Union Telephone Company.

Business Notes

The Dyer Flaming Arc Company, Inc., formerly of 225 North Tenth Street, Philadelphia, Pa., has moved to 1714 Sansom Street in the same city.

The Automatic Electric Washer Company, of Newton, Ia., has appointed J. F. Kinder, 526 Yeon Building, Portland, Ore., as its representative in Washington and Oregon.

The Utilities Service Company, of St. Louis, Mo., has announced its removal on Feb. 1 from the La Salle Building to 2082-84 Railway Exchange Building, that city.

The Beck Electrical Construction Company, of 204 Andrus Building, Minneapolis, Minn., has recently secured local territory rights as representative of the American-Ball engine and the Rice & Sargent Corliss engine.

Walton & Beer, formerly at 1166-1184 Bedford Avenue, Brooklyn, N. Y., have arranged for quarters in the Long Acre Building, Broadway and Forty-second Street, New York, where they have their present office.

V. M. Nussbaum & Company, of Fort Wayne, Ind., have bought out the electrical department of the Hanna-Brackenridge Company and is carrying on the business of the latter. The new concern deals in electrical machinery and does electrical contracting and repair work.

Williams, Dunbar & Coleman is the name of the firm recently formed by George Williams, J. T. N. Dunbar and L. G. Coleman to continue the business formerly carried on under the firm name of Williams, McConnell & Coleman at 60 Wall Street, New York City. The concern handles public utility securities and does a general brokerage and investment business.

The Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., has announced the fact that the H. B. Squires Company, of San Francisco, Cal., and Portland, Ore., its Pacific Coast agent, has acquired the additional territory of southern California and established a branch office in the San Fernando Building, Los Angeles. C. W. Yerger, who has been connected with the engineering department of the Cutler-Hammer company for several years, will be in charge of the Los Angeles office.

New Industrial Companies

The Robbins-Putnam Company, of Boston, Mass., has been incorporated by A. M. Robbins, of Cliftondale, Mass., and S. V. Putnam, of Melrose, Mass.

The Economic Power & Product Company, of Philadelphia, Pa., has been incorporated with a capital stock of $10,000,000 by George H. B. Martin, of Camden, N. J.

Bayley & Sons, of Brooklyn, N. Y., have been incorporated by G. W. Bayley, M. S. Bayley and L. S. Bayley, all of Brooklyn. The firm is capitalized at $30,000 and proposes to manufacture and deal in lighting fixtures, etc.

The Industrial Electric Company, of Cleveland, Ohio, has been incorporated with a capital stock of $25,000 to manufacture electrical equipment. The incorporators are Samuel Austin, Wilbert J. Austin, Harold Ferguson, C. W. Kinnison and W. B. Stewart.

The Konary Electric Company, of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 by C. F. Schultz, M. E. Evans, C. S. Bechberger, M. E. Schultz and H. M. Krauss. The company proposes to manufacture and deal in electrical apparatus.

P. W. Brooks & Company, of New York, N. Y., have been chartered with a capital stock of $1,000,000 for the purpose of doing an electrical construction business. The incorporators are E. S. Hodgman, of Bridgeport, Conn.; L. M. Symmes and E. H. Van Wyck, of New York, N. Y.

The Northern Electric Company, Ltd., of Montreal, Que., Can., has been incorporated with a capital stock of $10,000,000 for the purpose of manufacturing and dealing in all kinds of electrical machinery and equipment; also to carry on a general electrical and mechanical engineering business and to acquire and operate telephone, telegraph, light, heat, power and hydraulic plants.

Trade Publications

Wiring Devices.—P. & S. Bulletin 835—Schedule XA—comprises the latest list of some new handy electrical wiring devices manufactured by Pass & Seymour, Inc., Solvay, N. Y.

Pole Reinforcement.—A folder on the Orr reinforcing process, entitled "Making Old Poles Good as New," has been issued by the Pacific States Electric Company, San Francisco, Cal.

Alternators.—Bulletin No. A4143, recently issued by the General Electric Company, is devoted to Form B belt-driven alternators and supersedes the company's previous bulletin on this subject.

Wireless-Telegraph Instruments.—An illustrated catalog of its "Halcun" wireless-telegraph instruments has been published by the Haller-Cunningham Electric Company, 428 Market Street, San Francisco, Cal.

Railway Motor Gears and Pinions.—The General Electric Company has just issued Bulletin No. A-4199, which illustrates and describes its railway motor gears and pinions and contains curves and data concerning them.

Cranes.—Bulletin 401, published recently by the Pawling & Harnischfeger Company, Milwaukee, Wis., refers to its type H crane. It contains a good general description of this apparatus and its various parts, fully illustrated.

Second-Hand Machinery.—The Arthur Jones Electric Company, 223 South Clinton Street, Chicago, Ill., has issued No. 15 of its "Book of Bargains," in which are listed for sale used dynamos, motors, engines and other electrical machinery.

Chain Drives.—The Morse long-service chain drive is the subject of Publication No. 12, recently issued by the Morse Chain Company, Ithaca, N. Y. It contains short, illustrated descriptions of typical Morse silent-chain drives, showing their durability and efficiency for long periods of time.

Portable Meters.—"Westinghouse Portable Meters" (Circular 1104) is the title of an elaborate publication just issued by the Westinghouse Electric & Manufacturing Company describing its complete line of portable instruments. A number of photographs are shown, together with various diagrams.

Lighting Units.—A large variety of semi-indirect lighting units manufactured by the Gleason-Tiebout Glass Company, 93 Commercial Street, Brooklyn, N. Y., are illustrated in a recently issued catalog. Many beautiful designs are shown. Supplements A and B have also been published, in which some artistic bowls are illustrated.

Magneto Generator.—The Holtzer-Cabot Electric Company, Brookline, Mass., has issued a twelve-page booklet on the subject of automobile lighting and battery charging with the Holtzer-Cabot magneto generator, with special reference to its "JS" type. A full description is given accompanied by diagrams showing how the generator is connected.

Conveyor Scales.—The Electric Weighing Company, 180 Thirteenth Avenue, New York, in a recent bulletin refers to its conveyor scales for belt and pan conveyors and duplex scales for pivoted bucket carriers. These are self-registering scales for weighing materials while in motion on conveyors. The pamphlet will interest all who handle material in bulk.

Meters.—Engineering Leaflet No. 16 issued by the Harrison Safety Boiler Works, Philadelphia, Pa., has for its title "A Hot-Water Meter Is Essential to the Economical Management of a Boiler Plant." The subject is comprehensively treated and well illustrated. The publication will be found useful to engineers interested in improving the efficiency of their plants.

Fuses.—In its Catalog No. 22, the Detroit Fuse & Manufacturing Company, Detroit, Mich., illustrates and describes its induction-motor starters, sealable entrance switches, ironclad fused switches, indicating inclosed fuses, automobile fuses, cut-outs, terminals, contact clips and lugs. Numerous diagrams and illustrations serve to give an excellent idea of the construction of these devices.

Personal Mention

Mr. L. A. Ramsay, for some time manager of the new-business department of the Fremont (Neb.) Gas, Electric Light & Power Company, has been transferred to the accounting division.

Mr. W. B. Elliott, for eighteen years works manager at the plant of the C. & C. Electric Company, Garwood, N. J., has resigned. Mr. Elliott is succeeded by Mr. A. H. Mosher, of Westfield, N. J.

Mr. George B. Tripp, vice-president and general manager of the Harrisburg (Pa.) Light & Power Company, was recently elected president of the Harrisburg Chamber of Commerce, the new commercial body of the capital city of Pennsylvania.

Mr. A. J. Marshall, for some time identified with the lighting world as a consulting illuminating engineer and more recently connected with the General Motors Truck Company in the Northern New Jersey territory, has been appointed executive secretary of the Electric Vehicle Association of America.

Mr. W. E. Boileau has resigned as general manager of the Chattanooga (Tenn.) Railway & Light Company. Mr. Boileau was appointed manager of the Chattanooga Electric Company in 1907 and following the consolidation of the company with the corporation operating the street-railway system he was made general manager of the Chattanooga Railway & Light Company.

Mr. William Williams has been appointed commissioner of the Department of Water Supply, Gas and Electricity of New York City. Mr. Williams, who was appointed immigration commissioner by President Roosevelt, was born in New London in 1862 and was graduated from Yale in 1884 and from the Harvard Law School in 1888. He received the degree of M. A. from Yale in 1906 because of his work as immigration commissioner.

Mr. Leonard A. Busby, president of the Chicago City Railway Company, has also been appointed president of the Chicago Surface Lines, which is the name given to the unified organization operating all the surface street railways of Chicago, including those of the Chicago Railways Company as well as those of the Chicago City Railway Company. The unified organization is under the supervision of a board of operation of which Mr. Henry A. Blair is chairman, Mr. Busby being one of the seven members of the board.

Mr. Winthrop More Daniels has been nominated by President Wilson for appointment to the Interstate Commerce Commission. Mr. Daniels is chairman of the Board of Public Utilities Commissioners of New Jersey. He was serving as professor of political economy at Princeton University in 1911 when President Wilson, then Governor, appointed him to the Board of Public Utility Commissioners of New Jersey for a term of six years. He had held the chair of political economy at Princeton since 1892. Mr. Daniels was born in Dayton, Ohio, in 1867.

Mr. Norman McD. Crawford has recently been elected president and general manager of the Reading (Pa.) Transit & Light Company, vice-president and general manager of the Metropolitan Electric Company, vice-president and general manager of the Neversink Mountain Railway and vice-president and general manager of the Oley Valley Railway. Mr. Crawford succeeds Mr. W. S. Barstow in the Reading Transit & Light Company and Mr. W. A. Rigg in the other companies. He was formerly president of the Mahoning & Shenango Railway & Light Company, of Youngstown, Ohio, and was for several years vice-president of the Ohio Electric Railway of Cincinnati, Ohio.

Mr. W. R. Garton has resigned as vice-president and general manager of the Lord Manufacturing Company, of Brooklyn, N. Y., manufacturer of protective and economizing devices. Mr. Garton has been active in the electrical field for many years. He began with the construction and operation of telephone, electric light and railway properties and has given much time to the supply and manufacturing business. Mr. Garton is an associate member of the American Institute of Electrical Engineers and a member of the American Electric Railway Association, the New York Railway Club, the Keystone Electric Railway Club, the New England Street Railway Club and the New York Electric Railway Association.

Mr. King G. Kellogg, who has been chief engineer of the E. E. Brownell Engineering Company for the past four years, has tendered his resignation to take effect March 1, 1914, and will thereafter devote his entire time to consulting work, specializing in matters pertaining to the electrolytic corrosion of underground metallic structures from stray electrical currents. Mr. Kellogg has made electrolysis tests and examinations in more than fifty different cities in this country. He held various positions in the engineering department of the People's Gas, Light & Coke Company, Chicago, where he was employed for sixteen years. He was educated in the Chicago public schools and is an alumnus of the University of Illinois. His office is at 1836 South Fifty-fifth Street, Philadelphia, Pa.

Mr. W. H. Bancroft, president Utah Light & Railway Company, Salt Lake City, Utah, vice-president and general manager of the Oregon Short Line Railroad and vice-president of the Salt Lake Route, has been relieved of his duties as general manager of the Oregon Short Line, at his own request. He will still continue as president of the Utah Light & Railway Company and vice-president of the Salt Lake Route. Mr. Bancroft is seventy-four years of age. He entered the railroad service in 1856 as telegraph operator and ticket clerk for the Michigan Southern Railroad, and has been continually in that service to the present time, rising through the various grades to be the executive head of all of the Harriman interests in the intermountain territory. When the Harriman interests acquired control of the Utah Light & Railway Company in November, 1906, Mr. Bancroft was elected president of the company.

Mr. E. T. Munger, who resigned about a year ago from the office of general superintendent of the Hudson & Manhattan Railroad, New York, N. Y., has accepted the position of general manager of the Cumberland County Power & Light Company, Portland, Maine. This company operates the local railway system in Portland and several interurban lines and electric lighting properties. Previous to his work on the Hudson & Manhattan Railroad, Mr. Munger held a number of responsible engineering positions, such as master mechanic and later superintendent of motive power and equipment of the Metropolitan West Side Elevated Railway, Chicago, and superintendent and later president and general manager of the Havana (Ill.) Telephone Company. He was graduated from the University of Wisconsin in 1892. On Jan. 17, 1914, a farewell luncheon was tendered to him at the Railroad Club by the Deportation Club of New York. Between thirty and forty of Mr. Munger's most intimate friends were present and wished him all success in his new venture. Mr. W. C. Fisk, of Harvey Fisk & Sons, New York, was toastmaster, and before the conclusion of the luncheon a handsome silver loving cup was presented to Mr. Munger.

THOMAS H. YAWGER

Mr. Thomas H. Yawger, one of the best-known operating men in the business, has just rounded out twenty-five years of continuous service with the Rochester (N. Y.) Railway & Light Company. Mr. Yawger began service with the Edison Illuminating Company of Rochester on Dec. 1, 1888, as a helper, when he served as the medium of communication between the foreman and his men or ran errands to other departments. Whatever spare time he had was used in reading the available literature dealing with electricity, and at the end of his first three years Mr. Yawger entered the Mechanics' Institute and began a course of mechanical engineering. In 1890 Mr. Yawger was made foreman of station No. 2, and in 1901, following the consolidation of the gas and electric properties, he was appointed assistant superintendent of electrical distribution. In 1904, when Mr. J. T. Hutchings was made superintendent, Mr. Yawger continued as assistant superintendent, and when two years later Mr. Hutchings succeeded Mr. R. M. Searle, present vice-president, as general manager, Mr. Yawger was made superintendent. Possessed of a quiet and unassuming disposition, Mr. Yawger is very popular not only with the employees of the Rochester Railway & Light Company but with the patrons of the company as well. Having grown up with the electric-light industry in Rochester, his experience has become invaluable alike to the company and to the community. Not a little of the good will of the citizens of Rochester which the Rochester Railway & Light Company enjoys is due to the frank diplomacy of its superintendent.

Mr. M. S. Sloan has been appointed manager of the railway and electric departments of the New Orleans (La.) Railway & Light Company, to succeed Mr. D. A. Hegarty, resigned. Prior to 1906 Mr. Sloan was connected with the General Electric Company. On July 1, 1906, he was made chief engineer of the Birmingham (Ala.) Railway, Light & Power Company. Later he was made assistant superintendent of the lighting and power departments of that company, and in 1907 he was appointed superintendent of power of the company. A year later he was appointed superintendent of the electric department of the company, with jurisdiction over the operation and commercial sales of that department. In 1910 he was made assistant to the president of the company, in which capacity he had supervision over all departments of the company, with full executive power. He continued in that capacity until his recent appointment as manager of the railway and electric department of the New Orleans Railway & Light Company.

M. S. SLOAN

Mr. Harry B. Ivers, general manager of the Cumberland County Light & Power Company, Portland, Maine, for the last three years, has tendered his resignation to take effect Feb. 15. He has purchased an interest in the Frank Ridlon Company, Boston, Mass., and will become connected with that company. Mr. Ivers has long been connected with railway and lighting work in New England. His experience dates from the spring of 1893, when he entered the employ of the Hyde Park (Mass.) Electric Light Company. Mr. Ivers was connected with the railways and lighting companies later acquired by the Massachusetts Electric Companies and assisted in consolidating the accounts and in operating the railways which were organized as a division of the Old Colony Street Railway. He subsequently acted as superintendent of one of the divisions and later was transferred to Brockton and assisted in consolidating and systematizing the accounts of the separate companies in and around that city. After being connected with the property for nine years, he was elected treasurer and manager of the Westerly (R. I.) Railway & Lighting Company. Four years later he accepted the position of assistant to Mr. J. R. Graham, president and general manager of the Bangor (Me.) Railway & Electric Company, and a few months thereafter was elected treasurer of that company and of the Bar Harbor & Union River Power Company, which constructed the hydroelectric plant upon the Union River at Ellsworth, Maine. In March, 1908, Mr. Ivers was appointed general manager of the Lewiston, Augusta & Waterville Street Railway of Lewiston, Maine, and in June, 1912, was appointed general manager of the Cumberland County Power & Light Company, which controls and operates the Portland Railroad, the Portland Electric Company, the Portland Lighting & Power Company, the Consolidated Electric Light Company and the Lewiston, Augusta & Waterville Street Railway. Mr. Ivers is an ex-president of the Maine Electric Association and is now a member of the executive committee of that association and vice-president of the New England Street Railway Club and the New England Section of the National Electric Light Association.

Obituary

J. M. Oram, who was connected with the public utilities at Dallas, Tex., died at Dallas, Tex., Jan. 17. Mr. Oram was born near Bloomington, Ind., April 29, 1845, and moved to Lancaster, Tex., with his parents in 1857. He was at one time general manager of the Dallas Electric Light & Power Company, the Standard Electric Light Company and the Dallas Ice Factory Light & Power Company. During the late eighties and early nineties Mr. Oram was city electrician of Dallas. He invented numerous telephone devices and was manager of an independent long-distance telephone company established in Dallas some years ago. He is survived by his widow, three sons, two of whom are electrical engineers, and three daughters.

William H. Woolverton, of New York, president of the Gamewell Fire Alarm & Telegraph Company, died in Augusta, Ga., Jan. 21, at the age of seventy. Mr. Woolverton became a telegraph operator with the Pennsylvania Railroad at the age of fifteen years. Among his co-workers were Messrs. Andrew Carnegie, Thomas T. Eckert and David H. Bates. Mr. Woolverton was also president of the *Official Railway Guide.* He was one of the pioneers of the first telephone company in New York City and served as a director of the Metropolitan Telephone Company and the New York Telephone Company for more than thirty years. He was elected vice-president of the Gamewell Fire Alarm Company in 1890 and was made president in 1909. His widow, a son and a daughter survive him.

John Walker Wilkins, the last surviving telegraph pioneer of Great Britain, died at Kingston-on-Thames Dec. 18, in his eighty-seventh year. Mr. Wilkins was born at Hampstead March 25, 1827, and at the age of thirteen was an accomplished draftsman. He subsequently qualified for the profession of civil engineering. A remarkable predilection for electricity, however, soon brought Mr. Wilkins into prominent notice in another direction, when he became associated with Mr. William Fothergill Cooke in the erection of railway telegraphs. He was appointed resident superintendent of the Northampton & Peterborough telegraphs in July, 1845. In 1846 the Queen's speech on the opening of Parliament was for the first time telegraphed to about a dozen towns in the Midlands and north of England for publication in the local evening papers. The arrangements were in the hands of Mr. Wilkins, who was then just nineteen years old. An account of his researches and experiments in the region of wireless telegraphy was published in the *Mining Journal* March 31, 1849, and is referred to at some length in Fahie's "History of Wireless Telegraphy." In connection with his wireless apparatus Mr. Wilkins invented a delicate form of detector or galvanometer identical in principle with Lord Kelvin's apparatus for long cable working. This relay was put in use in the United States in 1851, when Mr. Wilkins came to America to assist Henry O'Reilly, of New York, who had a concession from the patentees of the Morse system for the erection of telegraphs at a stated royalty per mile. Owing to disputes between the contractor, O'Reilly, and the patentees of the Morse system, the telegraph construction work in which Mr. Wilkins was engaged came to an abrupt end, and he entered the service of contractors for the Ohio & Mississippi Railroad as a civil engineer. From 1852 until 1869 he was engaged in railroad construction work with the late Thomas Brassey, of Europe. In 1873 he became resident engineer to the contractors for the Cuxhaven docks on the North Sea. Mr. Wilkins paid a second visit to the United States in 1874, during which time he was chiefly occupied in prospecting silver mines. In returning to England in 1878 with the object of forming a syndicate for acquiring several valuable mining properties in Alabama, he found the economic conditions unfavorable, and he became associated with Sir Henry Doulton, a celebrated potter of Lambeth, visiting many countries in Europe and South America in the interest of that firm. On his return from Buenos Aires in 1893, his active service on behalf of the Doulton firm ceased. Mr. Wilkins was a frequent contributor to technical publications in England. His last visit to the United States was in the summer of 1908.

Construction

New England

YARMOUTH, MAINE.—Within the next six months the Yarmouth Ltg. Co. expects to erect [illegible] miles of transmission line between Freeport and Lisbon Falls and to purchase material for same, including poles, transformers, insulators, wire and lightning arrestors. Herbert H. Berry is general superintendent.

HOLYOKE, MASS.—The contract for the new 4000-kw turbine for the electric-light station has been awarded to the Westinghouse El. & Mfg. Co., at $35,000. The Deane Steam Pump Co., 115 Broadway, New York, was awarded the contract for condenser at about $11,000.

SPRINGFIELD, MASS.—The city supervisors are considering the question of establishing a central power plant in the municipal heating plant building, to furnish electricity for lamps and motors for the municipal buildings and possibly the high-school buildings.

PROVIDENCE, R. I.—At the annual meeting of the Narragansett El. Ltg. Co., of Providence, to be held Feb. 8, the proposal to issue $1,500,000 in additional stock will be submitted to the stockholders.

BRIDGEPORT, CONN.—Preparations are being made for improving the lighting system in the business district. It is proposed to erect 152 arc lamps in the district where now 19 arc lamps are in service. An appropriation of $16,000 has been asked for this improvement.

EAST HADDAM, CONN.—The East Haddam El. Lt. Co. expects to begin work on the erection of a transmission line to Colchester, when the line between Tylerville and Higganum is completed.

Middle Atlantic

BROOKLYN, N. Y.—The Public Service Commission has decided upon the location for the power plant to be used in the construction of the two new East River tunnels, the Whitehall-Montague Street tunnel of the Brooklyn Rapid Transit Co., and the Old Slip-Clark Street tunnel of the Interboro Rapid Transit Co. A lease has been effected of the old Jewell Mills property at the foot of Fulton Street, where air-compressor plants and other equipment for the work on both tunnels will be built.

BUFFALO, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 24 for changes in the conduit and wiring and lighting fixtures at the United States post office in Buffalo, N. Y., in accordance with drawings and specifications, copies of which may be obtained at the above office or at the office of the custodian, Buffalo. O. Wenderoth is supervising architect.

CHURCHVILLE, N. Y.—At a special election held recently the taxpayers voted to authorize the trustees of the village to purchase the street-lighting system of the Churchville Lt. & Htg. Co., at a price not to exceed $1,200.

LONG ISLAND CITY, N. Y.—The New York & Queens County El. Lt. & Pwr. Co., it is reported, is planning to enlarge its plant in Flushing and has purchased a plot 146 ft. by 300 ft. on Lawrence Street, between Broadway and Pine Street.

LYONS, N. Y.—Plans are being prepared, it is reported, by the Central New York Gas & El. Co. for enlarging and improving its power plant in this village, which when completed will double the output of the plant. As this station can be operated by water as well as steam and is situated on the banks of the barge canal, it will be made the chief distributing point in this district, which includes Clyde, Newark, Lyons and Palmyra.

MORAVIA, N. Y.—Plans are being considered by L. C. Reynolds, of Auburn, who recently acquired control of the Moravia El. Lt., Ht. & Pwr. Co., for improvements to the system. A day service, it is said, will be established within a short time.

RANSOMVILLE, N. Y.—A committee has been appointed by the Men's Club to make investigations in regard to securing electrical service for the village.

SAG HARBOR, N. Y.—Within the next 12 months improvements will be made to the Sag Harbor electric-light plant including the erection of 5 miles of transmission lines. New equipment will be purchased, including one tubular boiler, meters, transformers, etc.; also a small quantity of incandescent lamps, arc lamps, posts, etc. E. J. W. Meller is manager.

WATERLOO, N. Y.—The Tracy Devel. Co., which has acquired the principal water rights in Waterloo, has leased the premises which it is now occupying to the Empire Gas & El. Co., of Geneva, for a period of 50 years. The Empire company, it is stated, is contemplating erecting a large power plant upon the site. A joint petition has been filed with the Public Service Commission by the Tracy Development Co., the Central New York Gas & El. Co. and the Empire Coke Co. for the approval of the lease, etc.

WEEDSPORT, N. Y.—The property of the Weedsport El. Lt. Co. has been purchased by the Empire Gas & El. Co., of Geneva. It is understood that preparations will begin at once for the installation of a 24-hour service in Weedsport. Henry L. Coleman, of Geneva, is manager of the Empire Gas & El. Co.

WEST STOCKHOLM, N. Y.—Within the next six months George N. Gibson & Co., owners of the local electric-light plant, expect to purchase one 50-hp turbine to operate under a 10-ft. head.

YONKERS, N. Y.—The Board of Aldermen has practically decided to extend the ornamental lamp standards on Warburton Avenue to Glenwood Avenue, on South Broadway to the city line; on Ashburton Avenue and on Palisade Avenue to Ashburton Avenue.

CONEMAUGH, PA.—Within the next six months the East Taylor Lt. & Pwr. Co., of Conemaugh, expects to purchase transformers, poles, insulators, distribution cable, wire and meters, tub transformers, rectifiers and incandescent lamps (quantity not yet decided). C. B. Custer is secretary and treasurer.

DELTA, PA.—The Delta Wtr. Pwr. Co. expects to erect within the next few months about 4 miles of three-wire (No. 6) line, 6600 volts, and to purchase some lightning arresters and transformers. J. Howard Stubbs is president and manager.

HARRISBURG, PA.—Bids will be received by the board of school directors of the school district of the city of Harrisburg until March 20 for the construction of a 12-room building at the corner of Seventeenth and Catherine Streets, Harrisburg; also for heating, ventilation, plumbing and electric wiring, in accordance with plans and specifications prepared by C. Howard Lloyd, architect. Plans and specifications can be seen at the office of the architect, 701A Telegraph Building, Harrisburg. D. D. Hammelbaugh is secretary.

INTERCOURSE, PA.—The Intercourse El. Lt., Ht. & Pwr. Co. expects to erect within the next six months 4 miles of three-phase, 2300-volt transmission line (using 30-ft. poles); also to purchase within the next six months three dozen 2200-volt line arresters (pole type). Enos L. Zimmerman is secretary and treasurer.

JOHNSTOWN, PA.—The Citizens' Lt., Ht. & Pwr. Co., of Johnstown, is contemplating extending its transmission lines to Echo next Spring.

LANSFORD, PA.—Within the next three months the Panther Valley El. Lt., Ht. & Pwr. Co., of Lansford, expects to erect a substation and a 10,000-volt, 60-cycle transmission line; three 300-kva load, connected to transformer. Electricity is purchased from the Lehigh Coal & Navigation Co. The company also expects to purchase within the next 12 months about 300 meters (installed 250 meters during 1912 and added 25 arc lamps to line); also, within the next three months, to purchase rectifiers, 200 arc-lamp equipment and 200 magnetite arc lamps. W. Drumshekker is manager.

McKEESPORT, PA.—The business men on Market Street between Fourth and Sixth Avenues have asked the city commissioners for permission to erect 24 ornamental standards for cluster lamps. The cost is estimated at about $3,000.

PHILADELPHIA, PA.—Bids will be received by A. F. Hammond, superintendent of supplies, at the office of the board of education, school district of Philadelphia, Room 392, City Hall, Philadelphia, until Feb. 24, for lighting fixtures (gas and combination) for the wings to the Commodore John Barry Public School at Fifty-ninth and Race Streets; also for three speed lathes for the Central High School Annex, Seventeenth and Wood Streets. Further information, specifications, etc., may be obtained upon application to the above office.

SOUTH BETHLEHEM, PA.—A committee has been appointed to secure data as to the advisability of establishing a municipal electric-light plant in South Bethlehem.

ELIZABETH, N. J.—Bids will be received until Feb. 12 by the board of education, Elizabeth, for the installation of a complete electric power plant, consisting of engines, generators, foundation therefor, switchboard, etc., for the Bettin High School. Plans and specifications may be seen at the office of Richard D. Kimball, engineer, 15 West Thirty-sixth Street, New York, N. Y., or may be obtained from Thomas F. Mackessy, business manager, board of education, City Hall, Elizabeth, upon deposit of $10, which will be refunded upon return of same.

JERSEY CITY, N. J.—Bids will be received by the Board of Commissioners until Feb. 10 for furnishing 2000-cp arc lamps (4-amp, magnetite type) and metallic flame-arc or 6.6-amp magnetite arc lamps. Specifications and estimates of quantities may be obtained at the office of the chief engineer, Room 23, City Hall. Michael I. Fagen is city clerk.

NEWARK, N. J.—Bids will be received by the Board of Education of Newark, N. J., until Feb. 17 for the construction of the addition to the West Side School House, to be completed by Sept. 12, 1914. Bids may be submitted for the whole or one or more items as follows: Masonry, steel and iron, roofing and sheet metal, carpentry, painting, plumbing, heating and ventilation, electric work and lighting fixtures. Blank proposals may be obtained at the construction department of the board, fourth floor, city hall, where drawings and specifications, etc., may be examined. R. D. Argue is secretary of board.

PERTH AMBOY, N. J.—The Board of Aldermen is considering the advisability of establishing a municipal electric-light plant in connection with plans for the installation of an ornamental street-lighting system on State Street.

BALTIMORE, MD.—Plans are being considered for converting the western pumping station in Druid Hill Park into a power plant to furnish electricity for lighting the water department, including the new dam, the filtration plant at Lake Montebello and the different pumping stations. The new high-service pumping station provided for in the ordinance estimates for 1914, which is to be situated near the high-service reservoir in Druid Hill Park, will be operated by electricity and will cost about $50,000. E. B. Whitman is water engineer.

WILLIAMSPORT, MD.—The proposal to establish an electric-light plant and water-works system in Williamsport either under municipal ownership or by a private company will be submitted to voters at the annual election to be held in March.

WASHINGTON, D. C.—The Potomac El. Co., of Washington, is reported to be contemplating remodeling its power plant at Fourteenth and B. Streets N. W., to cost about $2,500.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Feb. 16, for furnishing, under Proposal No. 688, one 1-kw, 500-cycle radio set (quenched-spark type, complete), with sending and receiving equipment, for installation in land station, in accordance with Specification 566, motor to operate on 110 volts, direct current.

WASHINGTON, D. C.—Bids will be received at the Engineer Depot, United States Army, Washington Barracks, D. C., until Feb. 9 for furnishing water-tight electric-lighting fixtures and accessories of special engineer department design, including 21 junction boxes, three snap switch boxes, 12 platform lamp fixtures and 69 type X outlet couplings. For further information address Lt. Col. Joseph E. Kuhn.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 24 for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 6340—10,000 ft. rubber-insulated, lead-covered, single-conductor copper cable; Schedule 6351—five electrically operated meat and food choppers, trolley hoist for 5-in. gun; Schedule 6348—3550 lb. miscellaneous weatherproof wire; Schedule 6355—1965 lb. miscellaneous soft sheet copper, 5300 lb. ½-in. (outside diameter) seamless drawn copper tubes; Schedule 6356—38,000 lb. 1½-in. class C steel boiler plates. Norwalk, Va., Schedule 6340—20,000 ft. special portable lamp wire (98 per cent pure copper). Bids will also be received until March 3 as follows: Mare Island, Cal., Schedule 6360—200 ft. flexible copper No. 1 metallic steam hose (in 20-ft. lengths). Mare Island, Cal., and Puget Sound, Wash., Schedule 6347—seven portable testing sets. Eastern yards, Schedule 6347—13 testing sets (portable motor end, 125 volts). Brooklyn, N. Y., Schedule 6358—miscellaneous rudder transmitters and indicators, complete, etc. Applications for proposals should give the schedule desired by number. T. J. Cowie is paymaster general, U. S. N.

North Central

EAST LANSING, MICH.—We are informed that the city of East Lansing is not contemplating the installation of a municipal electric plant, but may install street lamps, etc., in which case electricity for operating same would be purchased from a private company. The Michigan Pwr. Co., of Lansing, furnishes electrical service to private residences, etc., here. Reported in the issue of Jan. 24 to be considering the installation of a municipal street-lighting system. B. A. Faunce is city clerk.

HARTFORD, MICH.—Preparations are being made by Anderson Brothers, owners of the local electric-light plant, to change its system from single-phase to three-phase at once; they also expect to purchase within the next three months one generator, exciter and switchboard. A 24-hour service will be established and they will sell all electrical appliances that will be used in connection with a day service. M. J. Anderson is manager.

IDA, MICH.—Application has been made to the Village Council by Amory Kolb, of Monroe, Mich., promoter of the Raisinville dam project, for a franchise to supply electricity in this town and the territory between the Raisin River dam and the village. Other franchises covering nearby towns and the rural districts will be asked for.

KALAMAZOO, MICH.—Bids will be received until Feb. 16 by C. L. Miller, city clerk, for the purchase of machinery and equipment to replace those now in the municipal electric-light plant, as follows: One 450-hp tandem compound Russell engine, one 250-hp compound Russell engine, two Union Steam Pump jet condensers, one 500-hp Cochrane heater, one Burnham boiler-feed pump, one Dean boiler-feed pump, two 150-hp Stirling boilers and one 225-hp Stirling boiler, one four-panel marble switchboard and instruments for series arc-lighting system, line shafting, pulleys, belts, etc.

MANISTIQUE, MICH.—The Manistique Lt. & Pwr. Co. is planning to change its system from 133 cycles, single-phase, to 60 cycles, three-phase, and expects to purchase waterwheels, generators, motors, meters, etc. The present equipment of the plant consists of one 360-kw Stanley two-phase, 133-cycle generator, one 250-kw Warren, one 150-kw Warren and one 60-kw Fort Wayne generator (all 133 cycles), which is to be changed to 60 cycles, three-phase; also two new 62-in. waterwheels with a 300-kw generator. The company proposes to furnish electricity for power purposes, heating, etc., as well as for lighting. Benjamin Gero is general manager, and V. X. Lyon is superintendent.

MONROE, MICH.—The city commission contemplates improvements to the municipal electric-light plant, including the installation of a 250-hp boiler and a smokestack 125 ft. high and 66 in. in diameter. For further information address John S. McMillan, commissioner of public utilities.

WAKEFIELD, MICH.—The contract for installing the municipal electric-light plant in Wakefield was awarded to the M. & S. El. Co., of Flint, at $4,500.

YPSILANTI, MICH.—Estimates, it is reported, will be received by Smith, Hinchman & Grylls, of Detroit, until Feb. 14 for an electric elevator to be erected in the auditorium in Ypsilanti.

CELINA, OHIO.—The Board of Public Affairs expects to purchase within the next few months a 300-hp boiler and deep-well pump. George A. Petrie is clerk.

CINCINNATI, OHIO.—Bids will be received at the office of the clerk of the board of education, City Hall, Cincinnati, Ohio, until Feb. 23 for furnishing material and labor necessary to complete the electtrical work and fireproof windows and doors in the new Bloom School, at the corner of Bank and Bayliller Streets, Cincinnati. Plans and specifications are on file in the office of C. W. Handman, business manager, at 511 West Court Street, Cincinnati.

CLEVELAND, OHIO.—The directors of the Cleveland El. Ry. Co. have authorized the purchase of 50 more motor cars.

CLEVELAND HEIGHTS, OHIO.—Bids will be received by the Village Council at the office of the clerk, at the town hall, 2982 Mayfield Road, Cleveland Heights, until Feb. 16, for furnishing electricity and maintaining the arc-lamp street-lighting system in the village for one year; also furnishing such additional lamps as may be put into service during said period, in accordance with plans and specifications now on file in the office of F. A. Pease, engineer, the Marshall Building, Public Square, Cleveland. Cleveland Heights has not a post office. H. H. Canfield is clerk.

DEFIANCE, OHIO.—Within the next two months the Auglaize Pwr. Co., of Defiance, expects to purchase four sets of three-pole, 33,000-volt disconnecting switches, lightning arresters and 25-kw, single-phase, 33,000/2300-volt, 23-cycle transformers. W. P. Wallace is general manager.

DRESDEN, OHIO.—The Council has appointed a committee to negotiate with the owners of the Dresden electric light plant regarding the question of furnishing electrical service here. The company has announced that it will shut off the electric street lamps in the village if a franchise is refused.

FREEPORT, OHIO.—Bids will be received at the office of H. E. West, clerk of Freeport Corporation, until Feb. 16 for furnishing electricity to light the village of Freeport; also to furnish energy for commercial lighting. The contract is to provide for not less than thirty 60-watt Hardy tungsten lamps for street-lighting.

HURON, OHIO.—The Board of Public Affairs will receive bids until Feb. 24 for one 125-kva and one 75-kva, three-phase, 60-cycle, 2300-volt generator, with exciters and switchboard to control same; also one 20-kw series regulator unit (primary 2200 volts, secondary 6.6 amp, 60 cycles). J. C. Britton is superintendent of electric-light plant and water-works.

JUNCTION CITY, OHIO.—Within the next three months the Guinsler El. Lt. & Pwr. Co., of Junction City, will rebuild its lines. The company is now changing its street-lighting system, 13 arc lamps being replaced with 39 tungsten lamps of 80 cp. W. E. Guinsler is general manager.

KENTON, OHIO.—The Hardin-Wyandot Ltg. Co., it is reported, will not build a new plant on the site which it owns in the southeastern part of the city, but will remodel its old plant located between South Main and South Detroit Streets, work on which has already begun. The cost of the improvements, including new machinery, is estimated at $40,000. P. M. Magly is local manager.

TROY, OHIO.—Within the next two months the director of public service expects to purchase 2000 lb. of weatherproof wire for the municipal electric-light system. The construction of a new power house and water-works pumping plant in the near future is under consideration. The proposal to issue $75,000 in bonds for same will be submitted to the voters. L. A. Pool is superintendent.

XENIA, OHIO.—The Xenia Gas & El. Co. is contemplating the installation of substation equipment at its present gas-engine generating station within the next three months, to receive energy from the Dayton Pwr. & Lt. Co.; also the purchase of material for extending and rebuilding its lines. F. C. Barr is superintendent.

LOUISVILLE, KY.—Crutchers & Starke, of Louisville, have leased the Equitable Building and will remodel the same. Among the improvements contemplated is the installation of two electric elevators.

ANDERSON, IND.—The superintendent of the municipal electric-light plant has submitted a report to the Board of Public Works, recommending the installation of two new boilers and new generators at the municipal electric-light plant. The board is also considering the installation of an ornamental street-lighting system (cluster lamps).

INDIANAPOLIS, IND. — The Park Board is contemplating lighting the boulevards with electricity. For further information address James H. Lowey, secretary of board.

LAWRENCEBURG, IND.—An additional engine and generator will be installed in the municipal electric-light plant to provide electricity for a day service.

RICHMOND, IND.—The Indiana Public Utilities Commission has authorized the Richmond Lt., Ht. & Pwr. Co. to issue $850,000 in bonds, to be sold at not less than 90.

SCOTTSBURG, IND.—The Indianapolis & Louisville Trac. Co., of Scottsburg, has applied to the Town Board for a franchise to furnish electricity for lamps and motors here. The company now furnishes energy to operate the municipal electric-light system.

BELVIDERE, ILL.—The Illinois Northern Utilities Co. has acquired a site on the Kishwaukee River at Main Street, for its proposed central power station, from which it will supply electricity to cities and towns within a radius of 25 miles of Belvidere. W. B. Shearman is local manager.

CHICAGO, ILL.—Bids will be received by the city of Chicago until Feb. 11, Room 406, City Hall, Chicago, for furnishing and installing cables in elevators Nos. 1, 2, 3, 6 and 7 in the City Hall Building, according to plans and specifications on file in the office of the Department of Public Works, Room 406, City Hall. L. E. McGann is commissioner of public works.

CHICAGO, ILL.—Bids will be received until Feb. 9 by the commissioner of gas and electricity, Room 614, City Hall, Chicago, until Feb. 9, for furnishing to the Department of Gas and Electricity of the city of Chicago electrical supplies in accordance with specifications as follows: 100,000 ft. No. 14 twin wire, or its cost equivalent in other sizes; 40,000 ft. ½-in. rigid conduit, or its cost equivalent in other sizes; 1000 ft. ½-in. "T" type outlet boxes, or their cost in other types and sizes. Proposals to be made out upon blanks furnished by the commissioner of gas and electricity. Ray Palmer is city electrician.

SPRINGFIELD, ILL.—At a special election held Jan. 27 the proposal to amalgamate the municipal electric-light plant with the city water-works on the banks of the Sangamon River was carried. The immediate proposition voted upon was the installation of an electric generator, to cost $20,000, in the water-works station.

SPRINGFIELD, ILL.—Plans and specifications have been completed for the erection of an auxiliary plant to increase the heating facilities of the Springfield Lt., Ht. & Pwr. Co. The station will be erected on Third Street, between Adams and Monroe Streets, and will furnish heat for residences in outlying districts as well as downtown.

BALDWIN, WIS.—The Baldwin El. Co., it is reported, is planning to install a generator and establish a 24-hour service.

JUNEAU, WIS.—The installation of a municipal electric-light plant in Juneau is under consideration.

MENASHA, WIS.—Within the next six months the electric light commissioners expect to establish an exclusive power service on present pole lines; also to purchase within the next six months lightning arresters, incandescent street-lighting fixtures, and to establish a department to sell heating and cooking appliances. John H Knester is city electrician.

WEST SALEM, WIS.—The Wisconsin Railroad Commission has given the Neshonac Lt. & Pwr. Co., of West Salem, three weeks in which to submit plans and specifications for the construction of a hydroelectric power plant, which will permit additional units to be installed.

DASSEL, MINN.—An electrical construction company, it is reported, has been formed by W. R. Rutledge, of Howard Lake, and Ernest Johnson, of Dassel, with headquarters in this city. The company will have charge of all the wiring and erecting the service lines of the Pwr. Distribution Co.

DULUTH, MINN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 27 for construction of mailing platform extension, including mechanical equipment, lighting fixtures and changes in approaches, at the United States post office at Duluth, Minn., in accordance with plans and specifications, copies of which may be obtained at the above office or from the custodian of site. O. Wenderoth is supervising architect.

MINNEAPOLIS, MINN.—Plans, it is reported, are being prepared by Long, Lamoreaux & Long, architects, 830 Hennepin Avenue, Minneapolis, for the erection of a 14-story hotel, which, it is said, include an electric plant.

RED WING, MINN.—The Red Wing Gas Lt. & Pwr. Co. has entered into a contract with the city of Red Wing to furnish power to operate the water-works pumping station.

ST. CLOUD, MINN.—The Pwr. Distribution Co., of Minneapolis, it is reported, has made arrangements to finance its project and work will soon begin on its system. Electricity will be generated in St. Cloud with auxiliary stations at Howard Lake and Eden Valley. W. Baer Ewing, of Minneapolis, is president.

STEWARTVILLE, MINN.—A movement has been started to call an election to vote on the proposal to issue $15,000 in bonds to establish a municipal electric-light plant in Stewartville.

WABASHA, MINN. — The Minnesota-Wisconsin Pwr. Corpn., of Wabasha, has closed contracts with the municipalities of Lake City, Prescott and Hastings, Minn., to furnish electrical service in those towns.

WEST ST. PAUL, MINN.—Bids will be received by the board of education of Special School District No. 2, of Dakota County, and the city of West St. Paul until Feb. 14 for the erection of a graded school building, according to plans and specifications on file in the office of the city clerk of West St. Paul, for which separate bids are to be submitted as follows: (a) general construction, (b) heating and ventilating, (c) plumbing and sewage disposal, (d) electric wiring. Plans may be seen at the residence of the city clerk, 862 Deepe Avenue, West St. Paul, Builders' Exchange, St Paul, and at the office of Alfred H. Wheeler, architect, 416 Globe Building, St. Paul. M. P. Boege is secretary of school board.

CENTERVILLE, IA.—The Centerville Lt. & Trac. Co. is reported to have purchased the entire interest of the Southern Iowa Trac. Co., a steam railroad, operating between Centerville and Albia, a distance of 30 miles. It is understood that the road will be equipped for electrical operation (overhead trolley system). Two electric passenger cars and one combination baggage and express car will be purchased.

EAGLE GROVE, IA.—Bids will be received by the City Council until Feb. 19 for the construction of a city hall and fire station, building to be 50 ft. by 88 ft.; also for electric wiring, plumbing and heating. Samuel Middleton is city clerk.

LOHRVILLE, IA—At an election held recently the proposal to install an electric-lighting system in Lohrville was carried.

MERRILL, IA.—Bonds to the amount of $3,500, it is reported, have been voted, the proceeds to be used for an addition to the municipal electric-light plant.

OTTUMWA, IA.—The Ottumwa Ry. & Lt. Co., it is reported, contemplates erecting a transmission line to Bloomfield to furnish electricity for lamps and motors in that city.

RED OAK, IA.—The City Council has entered into a new contract with the Red Oak El. Co., under the terms of which a new street-lighting system will be installed. The contract provides for the installation of 50 five-lamp electroliers on and near the square and 30 single-lamp electroliers on the street leading to the railway station. In addition to these there will be 200 tungsten lamps of 60 cp erected throughout the town.

WILLIAMSBURG, IA.—As soon as a franchise has been granted and other matters settled the Williamsburg El. Co. will install an electric-light system in Williamsburg. To start with transformers only will be needed; later on a switchboard will be required. Frank D. Gue is interested in the company.

ALBANY, MO.—The city of Albany has just completed the installation of a 150-hp boiler, one 100-kw and one 125-kw generator, together with heater pumps, switchboard and auxiliaries; also an ornamental street-lighting system, consisting of 30 posts. W. E. Noonan is superintendent.

DE SOTO, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 13 for construction, complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at De Soto. Drawings and specifications may be obtained from the above office or from the custodian of site. O. Wenderoth is supervising architect.

ST. LOUIS, MO.—The St. Louis Southwestern R. R. Co., it is reported, will put into use eight gas electric cars in the passenger service on its short lines during the approaching season. The company has recently obtained permission from the State Public Service Commission to issue notes to the amount of $340,000, part of which will be used to purchase the new cars.

HUNTER, N. D.—The Hunter Lt. & Pwr. Co. expects to purchase within the next eight months a small generator and gas engine and material for distribution system; also electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. M. P. Branden is manager.

LA MOURE, N. D—Contracts will be awarded by the La Moure Lt. & Pwr. Co. for construction of an electric-light plant. The equipment will include a Smitn gas producer, Bruce-Macbeth gas engine, generators (2300-volt), Northwestern El. Co. switchboard equipment, Peerless transformers and Westinghouse meters. M. A. Erickson, of La Moure, is engineer in charge.

LINTON, N. D—The installation of an electric-light plant is under consideration by the business men of Linton

MINOT, N. D.—Bids will be received by the board of education of Minot until March 2 for the erection of an eight-room school building, in accordance with plans and specifications prepared by R. T. Frost, architect, which may be seen at the offices of the clerk of the board of education and of the architect, Minot, and at the Builders & Traders' Exchange in Minneapolis and St Paul, Minn., and Fargo and Grand Forks, N. D. Separate bids to be submitted as follows: (a) general construction of building, (b) heating, plumbing and ventilating; (c) electrical wiring. S. W Nicodemus is clerk of board.

WALHALLA, N. D.—The Walhalla Roller Mill Co., of Walhalla, expects, within the next 12 months, to build a dam across the Pembina River for power purposes, also to purchase some wiring supplies. The old dam of the company has been washed out. W A. Andrews is secretary and treasurer.

WHITE EARTH, N. D.—Within the next six months the White Earth Electric Association expects to purchase a storage-battery system (either a 240-amp-hr. or 300-amp-hr. or a 6-hp auxiliary generating outfit). Fred Hermanson is manager.

ELK POINT, S. D.—A special election will be held to vote on the proposal to issue bonds for the installation of an electric-light plant.

PARKER, S. D.—A special election will be called to submit the proposal to issue $20,000 in bonds for the installation of a municipal electric-light plant in Parker.

ANSELMO, NEB.—The Anselmo El. Lt. & Pwr. Co. is planning to install an electric light and power plant in Anselmo, to cost from $4,000 to $5,000. The equipment will consist of a 25-hp Fairbanks-Morse engine and Fairbanks-Morse compound, direct-current generator, switchboard (type L. B.) with storage batteries; 1½ miles of overhead distribution lines using from 25-ft. to 40-ft. poles, about six arc-lamps and 20-cp tungsten lamps. S. Lowritzen, of Grand Island, Neb., is engineer in charge. David Christen is interested in the company.

DECATUR, NEB.—Preparations are being made for the installation of a municipal electric-light plant in Decatur, for which bonds have been voted and plans and specifications prepared.

FRANKLIN, NEB.—The city of Franklin expects to purchase within the next 12 months material for distributing and lighting systems and electrical appliances and supplies for the municipal electric-light system as the demand requires. A. S. Creighton is superintendent.

KEARNEY, NEB.—The City Council has decided to submit the proposal to issue $12,000 in bonds for a municipal electric-light plant to the voters.

NORTH PLATTE, NEB.—The property of the North Platte Gas & El. Co. has been purchased by William Tood and J. W. Parrish, of Omaha. The new owners, it is said, are interested in the Birdwood water-power project, and electricity generated on Birdwood Creek will be used to operate the local system.

OVERTON, NEB.—A petition has been presented to the Village Council to call a special election to submit the proposal to issue $5,900 in bonds to purchase the local electric-light plant or install a new plant to the voters.

RED CLOUD, NEB.—Sealed proposals will be received by the board of commissioners, Red Cloud, Neb., until Feb. 24, for the construction and equipment of a county court house building, in accordance with plans and specifications prepared by W. F. Gernandt, architect, Karbach Building, Omaha. E. W. Ross is county clerk. Plans and specifications will be furnished upon deposit of $50 for contract "A" for general contract, which includes wiring, etc.

WILBER, NEB.—The town of Wilber has recently completed the installation of a new alternating-current system in connection with the municipal electric-light plant. Within the next two months electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, etc., will be purchased as the demand requires. E. E. Dundee is superintendent.

OSAGE, KAN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 11, for construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Osage City, Kan. Drawings and specifications may be obtained at the above office or from the custodian of site at Osage City. O. Wenderoth is supervising architect.

OSBORN, KAN.—The City Council is considering plans for remodeling the municipal electric light and power plant.

Southern States

FAYETTEVILLE, N. C.—The city of Fayetteville has engaged the J. B. McCrary Co., of Atlanta, Ga., to supervise the installation of a new municipal electric-light plant. The cost of the plant complete is estimated at about $50,000.

LONG ISLAND, N. C.—We are informed that the Long Island Cotton Mills do not contemplate any extensive improvements this year. Reported to be contemplating the construction of a hydroelectric plant at Buffalo Shoals in the issue of Jan. 24.

TARBORO, N. C.—The city of Tarboro expects to purchase within the next ten months one 400-hp water-tube boiler for the municipal electric-light plant. C. P. McClun is light commissioner.

CAMDEN, S. C.—Contracts have been awarded for the construction of a municipal electric-light plant and water-works system, to cost approximately $125,000. Tucker & Laxton, of Charlotte, N. C., were awarded the contract for general construction at $61,976. The street-lighting system will consist of 215 tungsten lamps of 100 cp. In the business section cluster lamps will be erected. Plans and specifications were prepared by Gilbert C. White, of Charlotte, who will supervise the work.

BAINBRIDGE, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 14, for construction, complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Bainbridge. Drawings and specifications may be obtained at the above office or from the custodian of site at Bainbridge. O. Wenderoth is supervising architect.

EASTMAN, GA.—The Eastman Lt. & Ice Co. is reported to have awarded contract for a 12-ton ice plant. The company will erect a 22-ft. by 66-ft. building. Electrical equipment will also be installed. W. E. Davidson is manager.

MELBOURNE, FLA.—An election will soon be held to vote on the proposal to issue $5,000 in bonds to construct an electric-light system.

OCALA, FLA.—Within the next 10 months the managers of the municipal electric-light plant expect to erect a new power station and amalgamate with the water-works system just taken over by the city; also to purchase two generators, from 250 kw to 300 kw each, two water-tube boilers and switchboard to control above equipment; also two 50-lamp transformers for street-lighting system. J. C. Caldwell is superintendent.

SOUTH PITTSBURG, TENN.—Arrangements have been completed by the South Pittsburg Lt. & Pwr. Co. for the erection of a transmission line from the hydroelectric power plant at Hale's Bar, Tenn. The company will, it is said, furnish electricity in Jasper, Whitwell, Bridgeport and other Tennessee towns.

BAY MINETTE, ALA.—A special committee, consisting of W. D. Stapleton, F. E. Bartmess and E. Edmundson, has been appointed by the Bay Minette Agriculture and Civic League to make arrangements to secure a lighting system in Bay Minette.

ARAPAHO, OKLA.—The Arapaho Lt. & Wtr. Co. expects to purchase within the next six months wiring supplies to the amount of $200. W. H. Bell is superintendent.

CUSHING, OKLA.—The Cushing El. Lt. & Pwr. Co. is erecting 2 miles of three-phase, 60-cycle, 2300-volt transmission line to furnish electricity to operate a 60-hp pumping outfit. Within the next two months the company expects to purchase one switchboard feeder panel (three-phase, 60-cycle), an oil switch and two 60-kw transformers. H. Askin is secretary and manager of the company.

KINGFISHER, OKLA.—The Water and Light Department expects to purchase within the next two months one carload of poles (for general repair work only). The department is contemplating installing three blocks of curb lamps, to replace the present arc-lamp system within the next year. A. E. Fiimf is superintendent of the water and light department.

NORMAN, OKLA.—The Norman Milling & Grain Co. expects to install a 200-kva generator within the next 30 days; also to purchase a 225-hp Diesel oil engine.

SHATTUCK, OKLA.—Within the next 12 months the Water and Light Department expects to purchase a motor-driven pump. A. F. Breunnecke is superintendent.

STRATFORD, OKLA.—The City Council has engaged the Benham Engineering Co., of Oklahoma City, to make investigations, prepare plans, etc., for the installation of a municipal electric-light plant and water-works system. An election will soon be called to vote on the proposal to issue $35,000 in bonds for same.

COTULLA, TEX.—The City Council has granted E. B. Zachry a 25-year franchise to construct and operate an electric-light plant in Cotulla. Work on the plant is to begin within 90 days.

WINTERS, TEX.—The capital stock of the Winters Lt. & Pwr. Co. has been increased from $10,000 to $15,000. The company, it is understood, will enlarge its plant here.

Pacific States

KALAMA, WASH.—The power house of the Washington-Oregon Corpn., including three generators and all electrical machinery, was destroyed by fire on Jan. 20, causing a loss of about $45,000. The plant is located at the falls of the Kalama River, 6 miles east of Kalama, and furnishes electrical service to the towns between Vancouver and Centralia. It is understood that the company will rebuild on a larger scale.

SEATTLE, WASH.—The Board of Public Works has awarded the contract for furnishing and installing machinery in the steam auxiliary plant of the Cedar River lighting system on the east shore of Lake Union to C. C. Moore & Co., of Seattle, at $154,500. This installation will add 5000 kw to the municipal electric system.

TACOMA, WASH.—The City Council has passed an ordinance authorizing an issue of $75,000 in bonds for the construction and equipment of a municipally owned street-car line from the business section to the Tide Flats. The proposed line will be built at once and will be about 1 mile long.

ALBANY, ORE.—The Oregon Pwr. Co. is planning to increase the output of its local hydroelectric plant at a cost of from $7,000 to $10,000. This is one of the many improvements contemplated by the company. A. Norman is local manager.

Canada

WINNIPEG. MAN.—Tenders will be received by the Commissioners of the Greater Winnipeg Water District, 901 Boyd Building, Winnipeg, until Feb. 11, for furnishing all tools and material, excepting rails and sundry steel, and for building of grade and laying track for 85 miles (more or less) of standard gage railway; also for supplying tools and material, except poles, and for building a telephone line between Shoal Lake and Transcona. Information for bidders, specifications and form of tender will be on file at the office of the commission, S. H. Reynolds is chairman of commissioners.

KERROBERT, SASK.—Tenders will be received by J. W. Lauman, secretary and treasurer, for construction of water-works system, including pumping machinery. Plans and specifications may be seen at Kerrobert, Sask., or at the offices of Chipman & Power, consulting engineers, in Winnipeg, Man., and Toronto, Ont.

Miscellaneous

SYDNEY, NEW SOUTH WALES, AUSTRALIA.—Tenders will be received by the New South Wales Government Railroad Department until March 25 for furnishing and delivering to the tramway substations at Sydney five 1000-kw converters, 15 365-kw single-phase transformers, four blower sets and accessories. Copies of specifications, etc., may be obtained at the office of the electrical engineer, New South Wales Government Railways and Tramways, 61 Hunter Street, Sydney, upon payment of $2.44 each.

New Incorporations

PHILADELPHIA, PA.—A charter has been granted to the Fairmont Park Lt. & Pwr. Co. to construct and operate an electric-light plant. C. E. Platt, Pennsylvania Building, Fifteenth and Chestnut Streets, Philadelphia, is president of the company.

CHATTANOOGA, TENN.—The Tennessee Valley Lt. & Pwr. Co. has filed articles of incorporation with a capital stock of $1,100,000. The company has offices in Worcester and Chattanooga, Tenn. The incorporators are F. S. Stranahan, of Providence, R. I., and W. E. Wardinel, of Worcester, Mass.

WATERTOWN, MINN.—The Crescent El. Co. has been incorporated by Guy E. Halgren, James J. Ponsford and Arthur C. Halgren, all of Watertown, Minn., and George E. Hanscom, of St. Cloud, Minn.

Directory of Electrical Associations, Societies, Etc.

Alabama Light and Traction Association. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala. Semi-annual meeting, Mobile, Ala. May, 1914.

American Association for the Advancement of Science. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

American Electric Railway Accountants' Association. Secretary-treasurer, E. B. Burritt, 29 West 39th St., New York.

American Electric Railway Association. Secretary, E. B. Burritt, 29 West 39th St., New York.

American Electric Railway Engineering Association. Secretary, E. B. Burritt, 29 West 39th St., New York.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Electro-Therapeutic Association. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

American Institute of Consulting Engineers. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Prof. A. D Cole, Ohio State University, Columbus, Ohio.

American Society of Refrigerating Engineers. Secretary, William H. Ross, 154 Nassau St., New York City.

American Society for Testing Materials. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, Edwin A. Scott, 29 West 39th St., New York.

American Water Works Association. Secretary, J. M. Diven, 47 State St., Troy, N. Y. Annual meeting, May.

Arkansas Association of Public Utility Operators. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, May.

Association of Edison Illuminating Companies. Secretary, Geo. C. Holberton, Pacific Gas & Electric Co., San Francisco, Cal.

Association of Iron and Steel Electrical Engineers. Secretary, W. T. Snyder, McKeesport, Pa.

Association of Railway Electrical Engineers. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, New Orleans, May 19-22.

California Electrical Contractors' Association. Secretary, W. S. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

Canadian Electrical Association. Affiliated with N. E. L. A. Secretary-treasurer, J. H. Larmonth, 610 Confederation Life Bldg., Toronto, Can.

Colorado Electric Club. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

Commercial Section, N. E. L. A. Secretary, J. F. Becker, 1170 Broadway, N. Y.

Eastern New York Section, N E. L. A. Secretary, C. S. Van Dyck, Schenectady, N. Y.

Electric Club of Chicago. Secretary, Fred M. Rosseland, Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

Electrical Contractors' Association of Greater Boston. Secretary, R. S. Hale, 39 Boylston St., Boston.

Electrical Contractors' Association of Massachusetts. Secretary. H. D. Temple, 30 Foster St., Worcester, Mass.

Electrical Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

Electrical Contractors' Association of the City of Chicago. Secretary, M. N. Blumenthal, 179 West Washington St. Meets at noon on the second and fourth Wednesday of each month at 424 South Wabash Ave.

Electrical Contractors' Association of State of Missouri. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

Electrical Contractors' Association of Wisconsin. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

Electrical Credit Association of Chicago. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

Electrical Credit Association of Philadelphia. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa.

Electrical Salesmen's Association. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

Electrical Trades Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

Electric Vehicle Association of America. Secretary, Harvey Robinson, 124 West 42d St., New York.

Electric Vehicle Association of America, New England Section. Secretary, L. L. Edgar, 39 Boylston St., Boston.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

Faraday Electrical Association. Secretary, W. J. Collins, 1129 Masonic Temple, Chicago. Meets at noon on the first and third Wednesday of each month at Planters' Hotel.

Gas, Electric and Street Railway Association of Oklahoma. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual meeting, May, 1914.

Hydroelectric Section, N. E. L. A. Secretary, S. A. Sewall, 29 West 39th St., N. Y.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

Independent Electrical Contractors' Association of Greater New York. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

Independent Telephone Association of America. Secretary, W. S. Vivian, Grand Rapids, Mich.

Indiana Electric Light Association. Secretary, Thomas Donahue, Lafayette, Ind.

Institute of Operating Engineers. Secretary, L. Houmiller, 29 West 39th St., New York.

Institute of Radio Engineers. Secretary, E. J. Simon, 81 New St., New York.

Internal-Combustion Engineers' Association. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex.

International Electrical Congress. Secretary, Dr. E. B. Rosa, Bureau of Standards, Washington, D. C. San Francisco, Sept. 13-18, 1915.

International Engineering Congress. Secretary-treasurer, W. A. Cattell, Foxcroft Building, San Francisco, Cal. Congress, San Francisco, September, 1915.

International Electrotechnical Commission (International body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 6-11, 1915.

Iowa Electrical Association. Affiliated with N. E. L. A. Secretary, H. B. Maynard, Waterloo, Ia.

Iowa Street and Interurban Railway Association. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, Cedar Rapids, April 23, 1914.

Jovian Order. Jupiter (president), W. N. Matthews, St. Louis, Mo.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

Kansas Gas, Water, Electric Light and Street Railway Association. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan.

Louisiana Electrical Contractors' Association. Secretary, J. J. Ziegler, 227 Bourbon St. Meeting every Wednesday, Audubon Building, New Orleans.

Maine Electric Association. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

Michigan Electric Association. Affiliated with N. E. L. A. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

Minnesota Electric Association. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn. Annual meeting, Minneapolis, March, 1914.

Mississippi Electric Association. Affiliated with the National Electric Light Association. Secretary-treasurer, Frank J. Duffy, Natchez, Miss.

Missouri Electric, Gas, Street Railway and Water Works Association. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis. Annual meeting, May.

National Arm, Pin and Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Association of Electrical Inspectors. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

National District Heating Association. Secretary, D. L. Gaskill, Greenville, Ohio.

National Electric Light Association. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, Philadelphia, May, 1914.

National Electrical Contractors' Association of the United States. Secretary, George H. Duffield, 41 Martin Building, Utica, N Y

National Electrical Credit Association. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago. Annual meeting, June, 1914.

National Fire Protection Association. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass. Open meeting, New York, March, 1915.

National Independent Telephone Association. Secretary-treasurer, J. B. Earle, Waco, Tex.

Nebraska Section, N. E. L. A. Secretary-treasurer, S. J. Bell, David City, Neb.

New England Electrical Credit Association. Secretary, Alton F. Tupper, 60 State St, Boston, Mass. Directors meet first Wednesday of each month.

New England Street Railway Club. Secretary, H. A. Faulkner, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New Orleans Electrical Contractors' Association. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

New York Electric Railway Association. Secretary, Charles C. Dietz, 598 Broadway, Albany, N. Y.

New York Electrical Credit Association. Affiliated with the National Electrical Credit Association. Secretary, Franz Neilson, 80 Wall St., New York.

New York Electrical Society. Secretary, G. H. Guy, 33 West 39th St., New York. Annual meeting, New York, June, 1914.

Northwestern Cedarmen's Association. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

Oregon Electrical Contractors' Association. Secretary, F. C. Green, 291 East Morrison St., Portland, Ore. Annual meeting, April.

Pennsylvania Electric Association (State Section N. E. L. A.). Secretary-treasurer, S. C. Pohe, Bloomsburg, Pa.

Railway Signal Association. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

Society for Electrical Development, Inc. General manager, J. M. Wakeman, 29 West 39th St., New York.

Society for the Promotion of Engineering Education. Secretary, Prof. H. H Norris, Ithaca, N. Y. Annual meeting, Princeton, N. J., June.

Southeastern Section, N. E. L. A. Secretary-treasurer, A. A. Wilbur, Columbus, Ga. Annual meeting, Isle of Palms, Charleston, S. C., Aug. 19-21, 1914.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. Annual convention, Galveston, Tex., May 20-23.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill.

Western Society of Engineers, Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

Wisconsin Electrical Association. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATE PATENTS ISSUED JAN. 27, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,085,102. Insulating Compound; L. E. Barringer, Schenectady, N. Y. App. filed Aug. 7, 1907. Dense machinable compound of linseed oil, zinc oxide and sulphur.

1,085,108. Pedal Operator; J. C. Cake, Chester, Pa. App. filed Jan. 12, 1911. For operating pedals of piano-player.

1,085,116. Dynamo-Electric Machine; F. H. Ford, Milwaukee, Wis. App. filed July 3, 1913. Babbitt metal poured in coincident grooves in the frame and in the laminated core within the frame to lock parts together.

1,085,124. Printing-Telegraph Receiver; G. S. Hiltz, New York, N. Y. App. filed April 8, 1912. "Stock-ticker."

1,085,142. Selective Signal Transmitter; M. Levison, Chicago, Ill. App. filed Jan. 3, 1913. For transmitting electrical impulses indicating different number signals.

1,085,151. Induction-Motor Control; M. Milch, Budapest, Austria-Hungary. App. filed Sept. 12, 1911. Has alternating-current commutator machine and a frequency changer.

1,085,163. Electric Meter; P. Rose, Berlin, Germany. App. filed Sept. 1, 1911. Oscillating armature type.

1,085,215. Push-Button: A. Lungen, New York, N. Y. App. filed Sept. 7, 1912. Flush type for mounting in a desk top, etc.

1,085,266. Switching Device for Electric Circuits: M. Kallmann (deceased), Berlin, Germany. App. filed June 26, 1906. Iron or other high temperature coefficient resistance inserted at breaking point of circuit to weaken current and so reduce sparking.

1,085,282. Mower; F. D. Mercer, Toronto, Ontario, Canada. App. filed Feb. 3, 1913. Electrically heated flexible cutter bar, pulled through the grain or grass to cut the same

1,085,309 Leakage Indicator and Connections. E. B. Wedmore, Rugby, England. App. filed March 8, 1911. Employs another coil acting in opposition to each series coil of the relay.

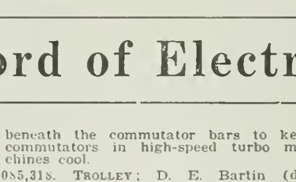
1,085,316. Dynamo-Electric Machine: T. S. Allen, Milwaukee, Wis. App. filed Feb. 28, 1910. Air-circulating passages beneath the commutator bars to keep commutators in high-speed turbo machines cool.

1,085,318. Trolley; D. E. Bartin (deceased), Milwaukee, Wis. App. filed Sept. 16, 1909. Contact shoes as auxiliary to the trolley wheel; oil reservoir in hub of trolley, into which the contact brush extends.

1,085,340. Apparatus for Electric Ignition; G. Honold, Stuttgart, Germany. App. filed March 29, 1911. Advances and retards the effect of the explosion by varying the number of sparks employed for igniting the mixture.

1,085,347. Electromagnetic Lock; L. L. Leduc, Paris, France. App. filed Nov. 29, 1912. Current reverser employed for changing the polarity of a sliding soft-iron bolt operating as the core of a solenoid.

1,085,375. Sectioning Means for Electric Stations; E. Branderburg, Brussels, Belgium. App. filed Oct. 2, 1911. Sectioning interrupters are made automatic in their action.



1,085,316—Dynamo-Electric Machine

1,085,393. Apparatus for Reducing Electric Currents; R. J. Ward, Dunton, N. Y. App. filed July 22, 1912. For reducing high-voltage current to lower voltage for ringing bells, etc.

1,085,398. Electric Switch; F. Barr, New York, N. Y. App. filed Oct. 5, 1911. Rotary contacts and oscillating operating button; wall and socket types.

1,085,412. Electric Alarm Clock: F. Goss, Millicent, South Australia. App. filed Dec. 5, 1912. "Program clock" for sounding series of alarms at predetermined times.

1,085,433. Electrical Signal Apparatus. W. Kepler, Allenville, Ill. App. filed June 23, 1913. Push-button having contact spring which may be rotated to bring it into register with any one of a series of circuit terminals.

1,085,440. Method of and Furnace for Securing Products of Reaction by Electric Discharges in Gases; C. F. R. von Koch, Stockholm, Sweden. App. filed Sept. 11, 1912. Gases pass from heating chamber through narrow passage into cooler, and electric discharge takes place through said narrow passage.

1,085,454. Automatic Switch; F. R. McBerty, Antwerp, Belgium. App. filed Dec. 26, 1912. Radially and axially displaced contacts arranged around a rotating contact-making shaft.

1,085,485. Automatic Switch for Traction Lines; F. Rice, Dayton, Ohio. App. filed April 14, 1909. Switch under control of motorman and operated by the car as it approaches the switch.

1,085,496. Apparatus for Typewriting at a Distance; H. E. M. Schnürer, Berlin, Germany. App. filed April 20, 1911 May be operated either as a transmitter or a receiver.

1,085,497. Connector for Electric-Current-Carrying Conductors; H. Schroeder, Sollitt, Ill. App. filed April 22, 1913 Coupling between the cars in a train telephone system.

1,085,511. Graphic Recorder: C. B. Thwing, Philadelphia, Pa. App. filed Aug. 27, 1911. For making a single record from a plurality of sources.

1,085,514. Dynamo-Electric Machine, R. B. Williamson, Milwaukee, Wis. App. filed Nov. 21, 1910. Air-circulating system for cooling high-speed turbo-alternators.

1,085,523. Heat Treatment of Metal Bodies: J. H. Barker, Birmingham, Eng. App. filed June 4, 1913. For annealing the ends of metal cartridge cases.

1,085,546. Disinfecting Device; J. G Cory, Coffeyville, Kan. App. filed March 11, 1913. Attachment interposed between the telephone mouthpiece and the body of the transmitter.

1,085,579. Ozone Generator: S. Held, Chicago, Ill. App. filed May 26, 1913. Embodies concentrically spaced dielectric hollow bodies forming an ozone chamber between them.

Electrical World

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Vol. 63 NEW YORK, SATURDAY, FEBRUARY 14, 1914 No. 7

The Recent Period of Slackness Two or three months ago there settled down on this country an atmosphere of gloom and depression, the effects of which are felt even in these brightening and more cheerful days, when every industry appears to be feeling the stimulus of large orders and new hope. But back in October and November things looked pretty bad, for nobody wanted or dared to buy anything he could do without, and current statistics have shown how wretchedly dull trade was. The exports of electrical apparatus, which up to that time had been gaining by notable strides, fell off also, it appears, so that the figures of November, 1913, were not quite equal to those of the corresponding month in 1912. The total for the month in 1913 was only $2,243,460, as compared with $2,270,553 in 1912, thus exhibiting the first decline, though very slight, in many months. It is certainly curious how sympathetic one branch of an industry can be with another, but it is a fact that electrical export trade is rarely active unless domestic conditions are equally prosperous. Here is certainly an example of it, for electrical men were in general feeling blue last November, and many of them have scarcely yet recovered their equanimity. However, this year all are looking for better times and offsetting continued despondency by a determined effort to "ring them in."

Tone-Wheel Radio-Telegraph Detector The tendency of radio-telegraphic sending stations on shore for long-range transmission is toward the production of sustained forced oscillations in the sending-mast wire, such as may be produced by a high frequency alternating-current generator, in contradistinction to wave-trains of damped free oscillations, such as accompany ordinary spark discharges. The received signals are therefore sustained alternating-current impulses in the receiving-mast wire. Such signals, if taken through a telephone, are not directly detected, because the frequency is necessarily inaudibly high. Fessenden was the first to make such signals audible in the receiving telephone, by using an alternating current, slightly out of synchronism, in a local receiving circuit and creating differential low-frequency or beat tones in the telephone, by interference between the incoming high-frequency tones and the local high-frequency tones. By this means an incoming frequency of 50,000 cycles per second can produce telephone signals of say 1000 cycles per second, that is, in musical tones near the most sensitive part of the ear's range, to the suppression of atmospheric and other similar disturbances. In the Digest in this issue is described a variation of this frequency-reducing process devised by Mr. Rudolf Goldschmidt. A high-frequency commutator is driven at the receiving station, slightly out of synchronism with the incoming signals, in such a manner as to produce differential low-frequency tones in the telephone, free from ordinary atmospheric disturbance. The commutator is actually a toothed wheel, like a Fizeau disk, driven at a high peripheral velocity, so as to be slightly out of synchronism with the incoming waves. By this means the usual rectifier is rendered unnecessary. Although the relative simplicity of spark radio-telegraphy will probably enable it to hold its place on board seagoing stations, it would seem that in the development of radio-telegraph engineering long-range shore stations will employ machinery at both the sending and the receiving plants.

Glare in Illumination Of late no small amount of attention has been devoted to the bad effects of glare in illumination, and a committee of the Illuminating Engineering Society is preparing to deal actively with the subject. Glare has been described rather aptly as "light out of place," on the same principle that dirt is "matter out of place," but there are other considerations than this to determine glare in the condemnatory sense in which the word is generally used. The quantitative relations of the subject are usually entirely forgotten or misunderstood. The point to which attention should be particularly directed in any investigations on glare is that at which the phenomenon begins to be troublesome under ordinary circumstances. It is probably quite impossible, for instance, to secure a paper which will give perfect diffusion, but, on the other hand, it is very easy indeed to obtain paper good enough to reduce the trouble from specular reflection to a quantity which is practically negligible. In a similar way nothing is more exasperating than the glare of an unshielded arc lamp well within the field of view and a few yards off. The same lamp in the same part of the field a couple of blocks away is not in the slightest degree disturbing to the normal eye. Indeed, it takes some little experience to tell at that distance whether the lamp is equipped with a diffusing globe or not. Likewise the question of direction is relative and not absolute. A sufficient quantity of light may become very annoying although its angular position in the field be such that were it trivial in amount no one would pay any attention to it. It is these quantitative relations of things that we wish to impress on the people who are working with the best of intentions toward improving the conditions of illumination. And, incidentally, we should like to suggest, very gently and with due deference to those possessed of a sensitive epidermis, that no discussion more readily lends itself to commercial axe-grinding than the discussion of glare. Any pronouncements on the matter should be very judiciously made lest they should appear in large caps, not to say as scare-head lines, for advertising purposes only. The public seldom realizes the quantitative value of things, and when these are important should be made to realize them as quickly as it does the qualitative values. By all means, let us work toward the reduction of glare, but first let us find out from a practical standpoint what is really to be desired.

Transmission at Constant Current

Our readers will welcome the account of recent advances in long-distance transmission by the constant-current system to be found elsewhere in our columns. The scheme is so foreign to our usual practice that it has hardly received even respectful attention from American engineers, yet it is perfectly obvious from the facts here exhibited that it is not only operative but possesses certain very characteristic advantages which are conspicuous in some classes of transmission work. An admirable example of a situation in which constant-current transmission proved desirable is its recent introduction for supplying energy for lighting and motor service in London and its environs. Here the supply corporation had to cover a very large and rather thickly settled territory with underground distribution involving an extent of cable which certainly would have represented a formidable undertaking for high-voltage constant-potential work. Instead of being a system of distribution as too commonly imagined, the Thury system is really one which finds its best application in large transmission work in which, particularly if underground, difficulties with regard to the line multiply as the distance is increased and the voltage raised.

For instance, on Jan. 3 and 10, 1914, we published an account of the Big Creek three-phase system for transmitting energy at 150,000 volts 240 miles into the city of Los Angeles. In order to maintain the intended pressure of 150,000 volts at each end of the line, use will be made of two 12,300-kva synchronous condensers running idle from the system. The requirement of the two synchronous machines of this outfit to insure proper voltage regulation is evidence enough that three-phase transmission systems have reached a point of development at which factors ordinarily of modest import become somewhat formidable. Fancy the situation if one were attempting to work a line of similar length with underground cables at any voltage for which cables have yet been manufactured. It was the recognition of this state of affairs that led to so serious a consideration of the Thury system for the long-distance project for several years contemplated for the supply of energy to Paris from the upper waters of the Rhone.

Similarly the switchboard construction in three-phase work has become very burdensome. One of the triple oil switches in the great California plant just referred to, for example, occupies 1200 cu. ft. and weighs 14 tons, including the oil filling. The series constant-current transmission requires practically no switchboard at all and the machines are put into and out of action with barely more than a turn of the wrist and in an astonishingly short time. In reckoning, then, upon the undeniably high cost of the commutator machines one must remember that the comparison should include not only the generators but the switchboard at the generating stations, and at the substations one may fairly compare the motor-generators and their switching apparatus with the transformers of the three-phase system plus their high-voltage switches, and perhaps an equipment of synchronous converters together with apparatus for their control. Taking all these things into consideration, the difference in cost for the two kinds of equipment becomes very much less than would at first seem likely, even with an overhead line. With a project for the line underground a very serious addition would have to be considered in the relative cost of the cables for the two systems for which exact data are not yet available. While no conservative engineer would be prepared to abandon our customary methods of transmission in an outburst of enthusiasm for something relatively new, yet it is evident that the constant-current system is one which must at times be considered with due seriousness as an economical possibility.

The Silver Voltameter

Certain ancient philosophers, in giving graphical form to their ideas on cosmogony, used to represent the world as carried on the back of an elephant, who, in his turn, rested his feet on the back of a large tortoise. There the sequence ended, and no one seemed to be perturbed as to the lack of a suitable substructure for the tortoise. Subsequent discoveries in gravitation, with the changes in philosophical opinion resulting therefrom, rendered the question superfluous by relegating both tortoise and elephant to the limbo of exhausted expedients.

The modern electromagnetic system of units, and with it the whole structure of electrical engineering, as well as the world-wide industrial superstructure of electric energy distribution, all rest upon Ohm's law, which is an experimentally observed relation between voltage, resistance and current in any simple closed circuit. In the international system of electrical unit standards defined by the Chicago congress of 1893, and built into the laws of most civilized countries since that time, the international ohm, volt and ampere were each and all concretely specified. The whole system of international electrical standards was thus ordained to depend upon three fundamental standards—the international ohm, volt and ampere. From these the coulomb, the henry, the joule, the watt, the watt-hour and various other secondary units of the electrical industry could be regularly derived, so that the electrical universe of practical quantitative relations was legislated to rest, tripod fashion, on three tortoises in parallel. But, from Ohm's law, there being given any of the specified standards among the three quantities, resistance, voltage and current, the third is immediately deducible, Consequently only two of the three fundamental tortoises are really needed to support the superstructure, the third being merely thrown in for auxiliary purposes, as a sort of reserve pedestal for the edifice.

At first, the extra tortoise gave no trouble, and merely provided an additional facility in establishing electrical standards, until demands came for increased precision. It was then discovered that small but distinct discrepancies arose in the laboratory electrical standards of different countries, according to whether these were prepared from the international ohm and volt or from the international ohm and ampere; that is, as to which pair of the three fundamental tortoises was selected. In order to eliminate this source of discrepancy, the International Electrical Conference of 1908, in London, agreed to select the ohm and ampere as fundamental specified standards, thus reducing the number of fundamental tortoises from three to two, the volt being derived by a gentlemen's agreement from the other two and no longer being independently established. This procedure threw a considerable extra burden of importance and weight on the international ampere, as defined by the use of the silver voltameter.

As a result of the work of an international committee, conducted to a great extent in the Bureau of Standards at Washington, using the conventionally established electrochemical equivalent of silver as 1.11800 mg per international coulomb, it was decided to take the emf of the normal Weston cell, at 20 deg. C., as 1.0183 volts. This establishes the volt as a secondary standard, through the medium of the Weston cell, to five significant figures, and to a precision of the fourth order, which is amply sufficient for all ordinary engineering purposes.

Nevertheless, the Bureau of Standards has been steadily continuing its researches, with a view to determining one more digit and precision order, if possible, on the wise principle that the precision of comparison between fundamental standards in national laboratories should be one order greater than that needed in regular industrial calibration standards. The article by Messrs. Rosa, Vinal and McDaniel which we publish this week discusses the refinements that are necessary in the technique of the silver voltameter in order to arrive at uniform results of the fifth precision order. It is interesting to notice that a correction formula has been deduced for the influence of minute degrees of acidity in the silver-nitrate solution, and that porous pots are indicated as being preferable to porous envelopes of either paper or silk.

International Standardization of Machinery

The work of the International Electrotechnical Commission has hitherto been directed into two main channels, the standardization of terms and the standardization of ratings of machinery and apparatus, whereby a machine may have its output internationally defined. In a paper by Mr. A. R. Everest recently presented at Birmingham, England, and abstracted in *The Electrician*, it is pointed out that the I. E. C.was able to reach a satisfactory international agreement at Berlin last August upon the maximum temperatures that electrical machines should reveal under service conditions. This is a long step toward international standardization, and an advance over which all countries may well congratulate each other. Thus, it was agreed that the temperature observed in impregnated cotton coverings forming the insulation of machines up to 4 kv emf should not exceed 90 deg. C. at any time. It was not found possible to reach an agreement at Berlin as to what the international ambient temperature of reference should be, and perhaps it is just as well that agreement could not be reached, because it allows more time for careful consideration in all countries before coming to a decision.

Most of the countries represented at Berlin desired the international reference temperature to be 40 deg. C., which would mean that the international rating of such machines for continuous service should be that output which would ultimately effect a measured temperature elevation of 50 deg. A few countries, however, preferred 35 deg. C. for the reference ambient temperature, which would mean increasing the international rating to one that would effect a final temperature elevation of 55 deg. C. Mr. Everest points out that meteorological records taken in many countries situated within the temperate zones show at least occasional shade temperatures in the open air exceeding 35 deg. C. in the summer. If the outdoor temperature exceeds 35 deg. C., the indoor temperature of a dynamo room will certainly exceed 35 deg. at such times, unless expensive refrigeration is resorted to. This means that if the international rating were based on 55 deg. C rise, machines would exceed 90 deg. in their observed temperatures, at least occasionally during the year, at nearly all places in the temperate zones. On the other hand, if 40 deg. C. be taken as the reference temperature and the international rating on 50 deg., the derating of machines below the international value would rarely occur in the temperate zones, except where the dynamo rooms were hot and not easily ventilated. In other words, the international rating could be safely maintained all the year round, except in special cases. In winter the international rated output might often be exceeded at the owner's risk, but it is better to have a considerable margin of safety available in a machine for winter use, at the owner's risk, than to have to tell the owner that he cannot expect to carry the international-rating output during the summer. Let us hope that an agreement satisfactory to all countries can be reached at San Francisco in 1915.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Mechanical Refrigeration

Mr. J. B. Joyce, Jr., of the Public Service Electric Company, gave a talk on "Mechanical Refrigeration" in the company's Jersey City (N. J.) auditorium Feb. 6, pointing out that in some cases savings amounting to half the customer's ice bill have been made by the installation of motor-driven refrigerating outfits. In three or four years such a machine will therefore virtually pay for itself. Mechanical refrigeration insures cleanliness and a uniform degree of cold impossible with the use of ice. At the present time the Public Service Electric Company is testing a small refrigerating machine at its Newark laboratory. If the results of the experiment are satisfactory, the outfits will be put on the market for residence use.

Mining Engineers to Discuss Electrical Topics

At the convention of the American Institute of Mining Engineers to be held at New York, Feb. 16 to 19, a number of papers will be presented on electrical topics. On Tuesday afternoon the subject of electricity in mining will be discussed and the following papers will be read: "Use of Electricity at the Penn and Republic Iron Mines," by Messrs. William Kelly and F. H. Armstrong; "The Application of Electric Motors to Shovels," by Mr. H. W. Rogers; "Electric Traction in Mines," by Mr. Charles LeGrand; "Safeguarding the Use of Electricity in Mines," by Mr. H. H. Clark, and "The Safety of Underground Electrical Installations," by Mr. C. M. Means.

On Wednesday morning Mr. Albert Sauveur will read a paper on "Heating and Cooling Curves of Professor Carpenter's Electrolytic Iron," and on Wednesday afternoon Mr. Robert M. Keeney will present a paper on "Pig Steel from Ore in the Electric Furnace."

More Electric Trucks for Mail Service in New York City

The Postal Transfer Service, Inc., of New York City, has purchased twenty 2-ton General Vehicle electric trucks which will replace an equal number of gasoline trucks in the work of transferring mail matter between railroad stations, docks and post office substations in the district south of Forty-second Street. The Postal Transfer Service, Inc., of which Mr. H. Rowley is president and Mr. J. J. Cassidy is vice-president and operating head, was organized in the spring of 1913, and early in September the Post Office Department accepted the bid of this corporation for what is known officially as Route 407,012. Broadly speaking, this route involves the moving of all mail south of Forty-second Street, New York City. The service is divided into three classes—"mail-messenger" service between the general post office and railroad and steamship terminals; "transfer" service between depots, and "station" service between post office stations.

The firm started business with eighty 2-ton and twenty 1-ton gasoline trucks and will soon have 150 machines in all. The twenty electric trucks just purchased are to displace an equal number of gasoline trucks which have been put out of commission by the arduous service. The electric cars will be housed in the transfer company's own garage at Forty-second Street and First Avenue, New York.

The endurance of the electric vehicle under the peculiarly exacting conditions of metropolitan mail service has already been well demonstrated in the case of the Motor Delivery Company of New York (see *Electrical World*, Jan. 10, page 76). This company has had as many as twenty-eight electric cars in service since 1909. These machines in 1913 made 336,000 miles in 304 days. The Motor Delivery Company originally had the contract for what is known as the up-town section, extending north of Forty-second Street to 180th Street on the West Side, and to Fordham on the East Side. It hauled collections from one substation to another, and from these to the Times Square station. Since its inception the delivery company has used electric vehicles exclusively, and, as cited in the issue above mentioned, this firm at present has fourteen such machines engaged in parcel-post delivery alone.

Joint Meeting of Empire State Gas and Electric Association and Eastern New York Section, N. E. L. A.

A joint mid-winter meeting of the Empire State Gas and Electric Association and the Eastern New York Section of the National Electric Light Association was held at the Edison Club Hall, Schenectady, N. Y., on Feb. 6 and 7. Dr. William McClellan, of New York City, formerly connected with the Public Service Commission, Second District, spoke on "Various Matters Affecting Public Opinion with Respect to Gas and Electric Companies." Among the points brought out in his talk were the following: The desirability of maintaining intimate relations between the corporation and the public by keeping all of the officers in close personal contact with the patrons; the necessity of giving employees considerable leeway and responsibility to keep them interested in their work; the importance of training employees to secure and maintain the good will of patrons; the desirability of prompt and adequate settlement of complaints and the establishment of self-explanatory systems of rates, affording no opportunity of being classed as discriminatory, and the responsibility of corporations in fostering public welfare work and in clearing up public-utility questions brought before the legislatures.

A discussion ensued in which the following men took part: Messrs. H. W. Peck, James O. Carr, D. B. Rushmore and C. J. Witherwax, of Schenectady; T. H. Yawger, Rochester; A. R. Beal, Poughkeepsie, and A. D. Dudley, Syracuse.

Mr. C. W. Stone, of the General Electric Company, read a paper on the "Commercial Aspects of New Lamp Developments with a Retrospect as to the Effect of the Tungsten Lamp on Central-Station Revenue." The advisability of central stations making lamp renewals was dealt with at length both in the paper and in the general discussion which followed.

Mr. C. H. B. Chapin, secretary of the association, made a report on the calorimeter situation. About 100 persons attended the meetings. Visits were made to the American Locomotive Works and to the General Electric Company's factory. A dinner was served at the Mohawk Golf Club, with Mr. R. M. Searle, of Rochester, past-president of the association, acting as toastmaster.

Government Investigating Electrical Jobbers' Association

Mr. George Carroll Parke, assistant to the Attorney-General, has set on foot in New York City an investigation of the affairs of the Electrical Jobbers' Association, based upon a complaint which came to the Department of Justice some time ago.

This statement was made to a representative of the *Electrical World* in Washington by Mr. Parke, who said he prefers for the present to withhold the exact details of the complaint.

"I have not as yet made any special study of the case, which is under my charge," Mr. Parke said, "and until the papers come back from New York I can say nothing about it, except that the complaint is of a routine nature, concerning the jobbers' association and having nothing to do with the electrical manufacturers, against whom, as I understand it, there has not been any complaint.

"We are not devoting any special attention to the matter in Washington. It was referred to New York for investigation. There may not be anything in the complaint, for all I know."

It is pointed out at the Department of Justice that complaints of all sorts are constantly being received, and that most of them are investigated in the usual routine of the office.

Co-operation Between Contractors and Fire Prevention Bureaus

Speaking before the regular weekly meeting of the Jovian Lunch League, St. Louis, on Feb. 3, Mr. Ernest McCleary, of Detroit, past-president of the National Electrical Contractors' Association, said that it is the duty of the contractor to co-operate not only with fire-prevention bureaus but with the jobbers and all others in the electrical business as well. To my mind, said Mr. McCleary, the jobber who distributes one piece of material which is below standard is a menace to the entire electrical industry. An accident caused by the failure of low-grade electrical material reflects upon the reputation of the central station, the manufacturer, the contractor and the local distributer. Only whole-hearted co-operation of all of these interests with inspection departments of municipalities and of insurance companies can produce the general widespread results desired.

The code committee of the National Electrical Contractors' Association, of which Mr. McCleary has been an active member since 1902, has recently welcomed Mr. Franklin Overbagh, secretary of the Electrical Supply Jobbers' Association, to its ranks with the hope that the jobbers of the country will become more in sympathy with the work of the code committee. By the system of appeals which has been adopted by the code committee a dissatisfied contractor may appeal from a decision of an electrical inspector which he judges is unfair. These cases when filed with Mr. Ralph Sweetland, secretary of the electrical committee of the National Fire Protection Association, are considered and passed upon by the code committee and their decision when given becomes as binding as a code ruling. Five appeals have thus far been filed in 1914.

In a short discussion following the talk Mr. James H. Fenton asked whether a general feeling in favor of municipal inspection was prevalent among contractors where an inspection bureau was maintained by insurance interests. Mr. McCleary answered by saying that he did not favor municipal inspection.

Business Regulation, Competition and Price-Cutting

In a paper by Mr. Frederick P. Fish, former president of the American Telephone & Telegraph Company, presented before the second annual meeting of the Chamber of Commerce of the United States at Washington, D. C., Feb. 12, the regulatory effect of the Sherman anti-trust law was commented on in the following terms:

"Our modern business organization and business methods have developed automatically under the economic theory which so long prevailed, that in business there should be free play for individual intelligence, individual activity, individual initiative and individual effort. Every man was encouraged to build up as large an enterprise as he could, to get for himself as much trade as he could, and within the limits imposed by law and the principles of fair dealing was entirely free to exercise his ingenuity, intelligence and business skill by advertising, by organization, by adopting improved methods of manufacture and of sale and in every other way, so as to get and to do as large a business as possible. Other things being equal, the greater his success the more he was respected and the higher was the regard of the community for him. He who made two blades grow where one grew before was looked upon as a public benefactor. No one doubted that national prosperity and the prosperity of the people as a whole were promoted by securing and maintaining the utmost freedom of individual effort.

"But the Sherman law and all that has grown out of it illustrate an absolute reaction from this principle. Business men are no longer free, within the limits of honesty and fair dealing as generally understood, to work out their own salvation by strenuous enterprise and strenuous individual effort. They are hampered on every side by restrictions which a generation ago would have seemed inconceivably foolish and absolutely inconsistent with sound development.

"Even if the new view is correct, we should be very careful that it is not carried so far as to suppress individual effort and paralyze progress more than the public interest requires.

"It is a very serious thing to suppress individual enthusiasm. To force men not to work on the lines which the times themselves have established as those upon which alone great work can be done must lead to this result. Such a policy should surely not be adopted unless the loss is sure to be more than made up by gain in some other direction."

Concentration of Industry in the United States

In his discussion of the concentration of industry in the United States President Charles R. Van Hise of the University of Wisconsin, Madison, said that while the Sherman act has been useful in preventing unfair practices its most important effect up to the present time has been the acceleration of concentration of industry by driving organizations from the trust to the holding corporation, and from the holding corporation to complete merger, an effect the very opposite of that intended by those who favored the passage of the law.

No advantage has been shown, he added, resulting from dissolution of public utility corporations under the Sherman act which are already under the control of the commissions, state and national. On the contrary, there is every likelihood that the public will suffer from dissolutions of organizations of this class.

President Van Hise therefore recommends that interstate and state trade commissions be created having powers in regard to those industrial organizations so large as to be affected with a public interest similar to those which the national and state utility commissions have in regard to the public utilities.

The Sherman act, he continued, should be supplemented by another act, forbidding all combinations and contracts in restraint of trade which are detrimental to the welfare of the people and making the presumption that all such combinations and contracts are thus detrimental, but permitting trade commissions to allow such reasonable contracts and combinations in restraint of trade as are not inimical to the welfare of the people.

Protection from Price Juggling

The dangerous effects of price-cutting and price-juggling were pointed out in a paper by Mr. William H. Ingersoll, of Robert H. Ingersoll & Brother, New York, which was read on Friday afternoon.

When a well-known article is sold at a cut price, said Mr. Ingersoll, the first effect is a stimulated demand, if the offer is bona fide. The second effect is that people are led to believe that they ought to get the goods regularly at the reduced price, and that those who charge more are exacting extortionate profits. The goods are cheapened in their estimation; they are no longer satisfied to pay former prices, so that the good will of the maker is seriously impaired. Other dealers in the community are unwilling to handle the goods at higher prices than are quoted elsewhere and in fact would have a very limited sale if they tried, and it would endanger their future patronage, so they find it better business policy to meet the cut price and close out the goods and not to carry them thereafter, or to carry very limited stocks, which are sold only upon urgent demand after the customer has declined the "something else" which the dealer, in the preservation of his very existence, finds it necessary to recommend, because even though it is unknown it pays him the necessary profit to meet his expenses.

In community after community these practices go on, and it might not be so bad if those who originally offered the goods at cut prices would continue them at the price and meet the demand for them. The sales, however, are sporadic, and the original cutter, after the sensation of the bargain offer has lost its pulling power, drops the goods and the market is lost to the maker through no fault of his own, and the goods are unavailable to the public conveniently and freely.

It is for these reasons that the manufacturers of the country are appealing for the recognition of their right to exercise control over the manner in which their own goods are sold after they have been intrusted to the market, and for the further and equally important reason that they see their smaller customers, who generally handle their merchandise fairly, being undermined and their own future market reduced to the fewer large retail institutions, which would then have them more fully in the latter's power.

Besides the ill effect of price cutting upon the goods, the trade and the public, one should not miss the point that these practices are not open to the small man, because he cannot advertise extensively, he cannot offer cut prices on one thing and recoup on other things, for his lines are limited and his capital small. Plainly such price cutting is an abuse for which some remedy must be found.

New York Requirements for Switchboard Wiring

In an effort to secure a standard interpretation of the switchboard wiring requirements contained in Rule 2-b, third and fourth paragraphs of the Electrical Code of the City of New York, the commissioner of water supply, gas and electricity has established the following ruling:

"Where a tight, non-combustible outer cover is required, compliance with Rule 2-b will be deemed to have been secured if asbestos tape is wound helically over the inflammable outer braiding, then wrapped with light twine or heavy pack thread and then painted with soluble glass, or if a braided asbestos tubing is drawn over the insulated wires and secured in place at the ends by means of twine or pack thread and then painted with soluble glass.

"It should be noted that in either case care must be taken to leave about 2 in. of the inflammable braiding free from this fireproofing covering at lugs and terminal connections, and also to keep the flameproofed wires away from all live metal parts."

Report of New York Conservation Commission

The third annual report of the State of New York Conservation Commission was sent to the Legislature recently. Mr. James W. Fleming, one of the commissioners, differs from his colleagues, Messrs. George E. Van Kennen and John D. Moore, on important questions of policy.

Mr. Fleming, in a memorandum in the report, states that he is in hearty accord with the general policy of conserving and utilizing the water-powers of the State, but he does not agree with his associates upon the plan of utilization and the places at which the policy shall be initiated. It is proposed to inaugurate the policy of generating electric current by the State by constructing power plants at Crescent and Vischer Ferry on the Mohawk River, operated by the surplus waters of that river, and its distribution to the municipalities in what is known as the Capital District. At these points and for many miles to the west the enlarged Erie Canal will be in the Mohawk River. It is conceded by all that during certain portions of the year there will be no surplus waters which could be used for power plants. Therefore auxiliary steam plants must be constructed and kept ready for use.

Mr. Fleming says that the future alone can demonstrate whether there will be surplus water sufficient in quantity and for sufficient length of time to make it worth while for the State to embark upon an expenditure of hundreds of thousands of dollars in the erection of power plants. It seems to him that the view of those who advocate the canal system and think that the installation of such plants on the theory of surplus waters in the canal would impair the navigation of the canal, or at least be a mistake until the canal is in actual operation, should receive the highest consideration.

Mr. Fleming adds that any one who will look at the Cohoes Falls and the Mohawk River during the dry seasons of the year, and particularly in years of drought, will be justified in entertaining very serious doubts whether there will be any surplus waters in the

Erie Canal at the time of the year when the greatest demand for navigation will be made upon that canal. If such should prove to be the case, it means that the auxiliary steam plant will be a very large, if not the principal, factor in creating and distributing the electric current. Mr. Fleming says he has yet to learn that the State can operate steam plants commercially with any special advantage to itself or to its citizens. His conclusion is that it would be the part of prudence to postpone embarking upon this enterprise until facts and experience shall show what waters are available at these points.

The general report of the commission declares that it is physically and economically practical to loop together the water-powers of the State by electrical conductors which, while serving practically every municipality, will be required to transmit electrical energy much less distances than other systems in daily operation. It adds that the State of New York must either develop its natural resources for the benefit of the many or else surrender them to be exploited by private monopoly for the enrichment of the few.

Recommendations for Water-Power Conservation in New York

The executive committee of the Empire State Gas & Electric Association, which is composed of seventy companies manufacturing and distributing electricity or gas or both in the principal cities and villages of New York State, has submitted to Governor Glynn a plan which it feels will accomplish the conservation of natural resources in the most satisfactory manner possible and with the greatest benefit to the State as a whole. Its conclusions are as follows:

1. The right to develop and use water-power now owned by the State or created by it in connection with the construction of any public works shall be leased in such a manner and at such prices as shall assure the State an adequate yearly revenue therefrom.
2. Such lease or grant shall in the first instance be for a definite period of sufficient length to warrant the investment of capital in the development.
3. At the expiration of such period the grant shall automatically become an "indeterminate" grant. That is, it "may be terminated by the proper authorities at any time upon the payment of a fair compensation for the value of the property thus taken," which shall include such appurtenances installed by the lessee as are necessary for the development of power.
4. At the expiration of the original term of the grant and at recurring intervals thereafter the amount of rental to be paid to the State, together with other necessary terms and conditions, shall automatically come up for determination.
5. A grant shall be unassignable except with the consent of the proper State authorities.
6. The grant shall be on condition of development of the whole capacity of the power site as rapidly as may from time to time be required with due consideration to market conditions and demands and also on condition that continuous power to the amount of the required development is available.
7. No person, corporation or municipality shall, in consideration of any contract or lease with the State under this plan, be relieved of any obligations now imposed upon it by law, and every person, corporation or municipality becoming a grantee under this plan shall, if the power is developed for sale, be subject to the jurisdiction of the Public Service Commission.

The committee maintains that the existing companies are the logical distributers for any power the State may have to dispose of, inasmuch as they have the distributing facilities and the steam reserve necessary for reliable service, so that no duplication of investment of any kind is required. These companies are, therefore, in a position to furnish the public with the best quality of service at the lowest possible cost, and the Public Service Commission law provides the means by which the consumers will benefit by any saving resulting from the purchase of power from the State by existing companies.

A. I. E. E. Midwinter Convention

The second annual midwinter convention of the American Institute of Electrical Engineers, which is to be held in the Engineering Societies Building, New York, Feb. 25 to 27, will be under the auspices of the electric-power committee, each of the six technical sessions being devoted to the subject of one of the latter's sub-committees. The convention will open Wednesday morning with an introductory address by President C. O. Mailloux, after which the following papers and reports will be presented: "Electric Power," by Messrs. D. B. Rushmore and E. A. Lof; sub-committee report, "Scope of the Engineering Data Sub-Committee," Mr. P. H. Thomas chairman; sub-committee report, "The Feasibility of an A. I. E. E. Handbook," Dr. Harold Pender chairman.

Power Station Session, Wednesday Afternoon.—"Protective Reactances in Large Power Stations," by Messrs. James Lyman, Allen M. Rossman and Leslie L. Perry; "Outdoor Versus Indoor Substations," by Mr. Alexander Macomber; "Indoor and Outdoor Substations in Pennsylvania," by Mr. H. L. Fullerton; "Outdoor Substations in New England," by Mr. Fred L. Hunt; "Outdoor Substations in the Middle West," by Mr. Leslie L. Perry, and "Suggestions for Discussion on Electrical Features of Power Station Design," by Mr. A. H. Kruesi.

Transmission Session, Thursday Morning.—Report of sub-committee, Mr. P. W. Sothman chairman; "Problems of High-Tension Transmission," with four appendixes: Appendix 1, "Deterioration of Porcelain Insulators in Service," by Mr. J. A. Brundige; Appendix 2, "Radius of Influence of a Direct Lightning Stroke," by Mr. L. C. Nicholson; Appendix 3, "Transmission-Line Problems in the West," by Mr. P. M. Downing; Appendix 4, "Switching," by Mr. G. Faccioli; "Practical Operation of Suspension Insulators," by Mr. H. W. Buck.

Power Generation Session, Thursday Afternoon.—"The Economical Capacity of a Combined Hydroelectric and Steam Power Plant," by Dr. C. T. Hutchinson.

Distribution Session, Friday Morning.—Report of sub-committee, Mr. P. Junkersfeld chairman; "Distribution of Electrical Energy," with nine appendixes: Appendix 1, "Three-Wire Direct-Current Distribution," by Mr. Philip Torchio; Appendix 2, "Alternating-Current Distribution," by Mr. H. B. Gear; Appendix 3, "Effect of Consumers' Apparatus and Wiring on Distribution," by Mr. H. Goodwin; Appendix 4, "Direct-Current Distribution for Surface Railways, Urban Service," by Mr. R. H. Rice; Appendix 5, "Direct-Current Distribution for Underground and Elevated Railways," by Mr. E. J. Blair; Appendix 6, "Direct-Current Distribution for Interurban and Steam Railroads," by Mr. W. G. Carlton; Appendix 7, "Alternating-Current Distribution for Interurban and Steam Railroads," by Mr. W. S. Murray; Appendix 8, "The Relations of Distribution Problems and Switching Equipment," by Mr. E. B. Merriam, and Appendix 9, "Distribution for

Street-Lighting Service," by Mr. Paul M. Lincoln.

Friday Afternoon, Protective-Apparatus Session.—"Recording Devices," by Dr. C. P. Steinmetz, and "High-Frequency Relays," by Mr. E. E. F. Creighton.

I. E. C. Dinner-Dance and Publicity Meeting

On Wednesday evening in the grand ballroom of the new Hotel Biltmore a dinner-dance will be held under the auspices of the Institute and the committee on organization of the International Electrical Congress, 1915. The purpose of this meeting is to enable members and the ladies of their families and other guests to meet and become informed of the plans for the San Francisco congress. During the dinner brief reports will be made on the organization of the congress.

On Thursday evening in the auditorium of the Engineering Societies Building there will be a general publicity meeting devoted to the coming electrical congress. Ladies are invited, and it is expected that the session will be of general as well as technical interest in connection with the congress, the exposition and the scenic and electrical features of the transcontinental journey. Following is the program for the evening: "The International Electrical Congress," by Dr. C. P. Steinmetz; "The Panama-Pacific International Exposition," by Dr. William Rader; "The Lighting of the Panama-Pacific International Exposition," by Mr. W. D'A, Ryan; "Scenic Features of a Trip to San Francisco," by Mr. James A. Cruikshank, and "Some Electrical Features of a Trip to San Francisco," by Mr. P. M. Lincoln.

Joint Meeting of Mechanical and Electrical Engineers in Philadelphia

The February meeting of the Philadelphia Sections of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, held on Feb. 9, was devoted to a discussion on the business training of the engineer. The principal speakers were President Alex C. Humphreys, of the Stevens Institute of Technology, and Mr. Theodore I. Jones, of the Brooklyn Edison company. The papers and the animated discussion which followed their presentation brought out two facts prominently—that the technical student must be taught that a knowledge of fundamental principles is only a means to an end, namely, their intelligent application to industrial conditions, and that in so applying them the foundation of success is sterling and uncompromising honesty.

President Humphreys devoted most of his paper to demonstrating the necessity for a knowledge of the principles of accountancy by the engineer. The engineer has too often fought shy of the business side of his problems and as a result has been unable to occupy an authoritative position when his solutions come to be tested by the ultimate standard of financial practicability. This is one reason why so few engineers are appointed on public service commissions. An engineer who assumes to guide an investor cannot avoid responsibility for the return on the investment, and no engineer who cannot check up estimates, made by himself or others, with the cost of carrying out the construction is competent to solve engineering problems. He cannot make such comparisons correctly for two reasons: First, he is likely to omit from them items of cost for which he assumes himself not responsible, either wholly or in part; second, he is not sufficiently familiar with the language of accountancy to be sure of the value of the comparisons made by others for him.

President Humphreys then proceeded to illustrate the need for a knowledge of accountancy in connection with estimates of depreciation, repairs, extensions and renewals, and with valuation work in general. He explained what he has been trying to do to meet the educational need in this direction.

Mr. Jones viewed the business training of the engineer from quite a different angle. He stated that engineers view business, and particularly salesmanship, with disdain, and yet it affords a most attractive and lucrative field for the engineer, who has not only his work but also his skill and analytical ability to sell.

The recital of the above fundamentals of the two papers does not indicate the causes of the lively discussion which was immediately precipitated. In fact, the discussion hinged on the connotation of the topics rather than upon the direct statements as outlined, with which all would agree. The discussion was opened by Prof. H. H. Norris, of the editorial staff of the *Electrical World*, who pointed out that students should be taught to avoid mechanical methods in study as well as in solving engineering problems. He was followed by Mr. Henry Hess, who struck the note which aroused a general and inspiring response that dominated all following discussion. This was the necessity for absolute honesty in all business and engineering dealings. There is no place for opportunism in this field. He made a clear distinction between the "designer" and the "engineer," holding that much of the confusion in the minds of the public regarding engineers is due to labeling as engineers men who are merely designers. The test is this, engineers hire designers, but never designers engineers. Mr. Walton Clark, of the United Gas Improvement Company, took up the cudgels for the technical graduates, who had on the whole been no disappointment to him. He echoed Mr. Hess' plea for honest work and urged that no school can hope to make an engineer or an accountant in the limited time available. Prof. George C. Hoadley, of Swarthmore College, protested vigorously against the prevailing habit of criticising college training as if colleges were not doing their work properly. Employers expect too much of young graduates and are largely responsible for the apparently prevalent criticism.

Thus one speaker after another, including Mr. W. C. L. Eglin, of the Philadelphia Electric Company, and others prominent in various fields of engineering, reiterated the fundamental principles cited at the beginning of this outline. So high was the ethical tone of the meeting that if the speakers had been ministers instead of lay preachers it could not have rung more true. In fact, the audience left with their best impulses stirred in a manner quite unusual in meetings of engineers, where the human element is sometimes submerged in the critical analysis of technicalities.

Factors Determining a Reasonable Charge for Service

Dean M. E. Cooley of the University of Michigan read a paper on "Factors Determining a Reasonable Charge for Public-Utility Service" at the annual meeting of the Western Society of Engineers in Chicago. Substantially the same address was made by Professor Cooley a short time before at a meeting of the Detroit-Ann Arbor Section of the American Institute of Electrical Engineers. The author listed the several elements as follows:

I. Capital Investment.

1. Preliminary costs covering investigations as to feasibility of project. (Note.—Organization, promotion, administration and legal expenses, engineering

and superintendence during construction, which are distributed over the whole period of construction, are more conveniently placed further along in the schedule.)

2. The physical property, the several items making up the whole arranged in order, each with its proper allowances to cover contingencies, special engineering and other costs peculiar to the item; land first, followed by clearing and grubbing, then the various structures and equipment; sub-contractor's profits included with the separate items.

3. General contingencies applicable to the property as a whole as distinguished from special contingencies applicable to particular items.

4. General contractor's profits, or the profits to an engineering firm building the property on the "cost plus a percentage" plan.

5. General engineering and superintendence during construction.

6. Insurance and taxes.

7. Organization, administration and legal expenses.

8. Cost of promotion and promoter's profits.

9. Interest during the construction period.

10. Office furniture and fixtures.

11. Stores and supplies.

12. Working capital.

II. Operating Expenses.

13. Operating expenses *per se;* that is, salaries, wages, fuel and other supplies, repairs and upkeep; all expenditures required in rendering the service of the utility, including insurance and taxes.

14. Interest on the capital investment (the actual cost of the property); i. e., interest on securities which must be paid regularly.

15. Interest on floating debt. This may include the discount on bonds and the cost of financing, if these have not been incorporated with the capital.

16. Cost of establishing the business; the sums of money required to be borrowed, with interest on the same, to make good the differences between the earnings and expenditures up to the time the earnings become sufficient to meet all expenditures. This may be made a capital charge or carried as a floating debt to be paid out of future earnings.

III. Depreciation Fund.

17. The regular contribution to the depreciation fund, out of which the integrity of the property is to be maintained.

IV. Sinking Fund.

18. The annuity required to retire such portion of the securities as may be necessary at the expiration of the franchise life of the property, in order that the investor may receive back his entire principal when the business is closed out.

Professor Cooley said that an examination of the various percentages mentioned in discussing the elements of cost, omitting items 1, 4, 8, 15 and 16, will disclose that if the individual contingencies of construction, special engineering charges and contractor's profits be assumed to be embraced in item 2, the total percentage of overhead charge may vary from 12 per cent to 25 per cent; and if these inside percentages be added to the outside, or general, percentages, the total percentage may vary from 30 per cent to as much as 60 per cent.

The speaker expressed his regret that engineers and others who have had experience in building properties and valuing them afterward have not done more toward disseminating knowledge of the actual conditions found in such work. Engineers have hesitated many times to use the larger percentages, fearing to be accused of favoring the corporation. They have preferred instead to secure the equivalent of them by using larger units of costs, or have used the smaller percentages, influenced by the feeling, unconsciously perhaps, that, all things considered, the results were fair enough. In combining the judicial with their engineering function, they have unwittingly only obscured the issue. All too frequently engineers have felt obliged to exert themselves to the utmost in favor of their client, leaving the interests of the other side to be fought for with equal solicitude by an opposing engineer. Thus they have become advocates. This is not the best way to handle these momentous problems. It would be far better in these troublesome times to throw open the blinds and let in all the light possible, the motto which should be adopted being, *Veritas vincat.*

Public Service Commission News

Maryland Commission

An appeal from the order of the Maryland Public Service Commission fixing schedules for the Edison Electric Illuminating Company of Cumberland, Md., has been filed in Circuit Court No. 2 by the company through its attorneys, Messrs. W. Calvin Chestnut, James A. McHenry and Benjamin A. Richmond. Judge Ambler signed an order granting an injunction to restrain the carrying out of the Public Service Commission's order, with leave to the commission to move to have the injunction rescinded by giving five days' notice. The Edison Electric Illuminating Company of Cumberland was incorporated in 1884. It furnishes electrical energy and operates a steam-heating system in Cumberland. On June 18, 1912, the company filed with the commission a new schedule of rates, effective June 30. On July 1 a number of residents of Cumberland followed with a petition alleging that the rates were unfair and asking for an investigation. The result was finally that the Public Service Commission fixed a schedule from which the electric company is now appealing.

Whether electrical energy for moving-picture shows comes under the schedule of "power" or "light" is a question that has been up for decision before the Public Service Commission of New Hampshire, and the Maryland Commission was recently asked to give an opinion on the subject. After a consultation with the officials of the Consolidated Gas, Electric Light & Power Company, the commission wrote to the New Hampshire officials that energy furnished Baltimore moving-picture houses is looked upon as "power" in arranging classifications for rates.

New Jersey Commission

The Board of Public Utility Commissioners of New Jersey has granted the application of the Phillipsburg Light, Heat & Power Company for approval of a franchise to operate at Phillipsburg, which territory is now served by the Eastern Pennsylvania Power Company of New Jersey. In approving a franchise to a competing company the board emphasizes the fact that any company furnishing inadequate or improper service will not be protected in the territory it serves, holding that the Eastern Pennsylvania did not furnish proper service. In its decision the board also cites an objection to an ordinance which requires a company to furnish certain public service without charge. The board is not satisfied that it has not the power to rescind such conditions should such be shown to be unjust and unreasonable. In this case the board, while not eliminating such provisions from the franchise, places the town on record as to taking the risk of their possible annulment by the courts or later by the board.

New Hampshire Commission

The Public Service Commission has denied the petition of the Grafton County Electric Light & Power Company for authority to issue $300,000 stock and bonds to purchase the central stations doing business in Lebanon and Hanover, N. H., and Hartford, Vt. The board points out that the properties to be merged under the petition are capitalized for $113,000 and states that the profits which would accrue to individuals from the transaction must come ultimately from the public, the proposition being inimical to the public welfare, in the board's opinion.

The commission was scheduled to give a hearing this week on the expediency of 4-cent fares on the Manchester Traction, Light & Power Company's lines, in accordance with a recent statute ordering the board to investigate the physical value of the property, the cost of operation and revenues derived from trolley service.

Nevada Commission

An explanatory statement has been issued by Mr. H. F. Bartine, chief commissioner, and Mr. W. H. Simmons, associate commissioner, constituting the majority of the Nevada Public Service Commission, in regard to the Ely Light & Power Company case. This case was mentioned in the *Electrical World* of Dec. 20, 1913, page 1254. The statement says that the minority dissenting opinion contains, in the judgment of the majority, errors both in figuring and in reasoning that are well calculated to mislead and convey a false impression of the merits of the case, as well as of the propriety of the action of the majority in modifying the original order.

The order was modified solely because further investigation disclosed the fact that the original order would have reduced the earnings of the company to the very line of confiscation if not actually crossing it. The explanation states that in the proceedings based on the original complaint by the city of Ely practically no testimony was offered going into the question of the excessive character of the rates as a whole. There was almost no attendance at the hearing and not a single witness was placed upon the stand to give testimony going directly and specifically to the point of the alleged excessive character of the rates. In reaching its original conclusion that the rates were excessive, the commission was compelled to draw its own deductions from the testimony, which went chiefly to the question of discrimination, together with the official records of the commission and the investigations of its own engineer. The result of the hearing was the elimination of the class "A" rate, which was the chief cause for complaint, and a heavy reduction in the "B" rate.

A subsequent investigation through an informal hearing disclosed the fact that the rates as prescribed would leave the company practically nothing in the way of net return. Suit had been brought by the company in court and the enforcement of the order had been restrained. It was obvious to the majority of the commission that, upon the showing as made, the court in Nevada would not sustain the order. Therefore the order was modified. The majority "fully recognized the fact that they owe a solemn duty to the public, but that duty carries us no farther than to see to it that justice is done to the public without injustice to the corporation."

The figures of earnings show the following net return on the value determined for the property in the last three years: In 1911, 7.35 per cent; 1912, 13.72 per cent; 1913, 13.41 per cent; average for the three-year period, 11.4 per cent. At the prescribed schedules of rate in 1913 the return would be 8.8 per cent. The majority opinion took $57,000 as the value of the property engaged in the service. This was the engineer's estimate of what it would have cost to reproduce it new. The dissenting opinion took present value, $41,000. The majority referred to the decision of the United States Supreme Court in the Minnesota rate cases, declaring that the court nowhere lays down the rule that in the actual work of rate-making the body which is invested with such power must consider only the depreciated value. It does not follow that when such a body makes a reduction in rates it must cut to the very lowest point at which the rates as prescribed would be sustained by a court. As a general rule the rates as prescribed might be made still lower and still be upheld by the court in which the validity of the order was contested. When there are no strictly legal questions involved, a court will hold that an order reducing rates is void only when the point of confiscation is reached. The reason why public service commissions usually stop considerably short of a confiscatory point is that investors are not as a rule willing to engage in business projects of any kind with the prospect before them of just barely escaping confiscation at the hands of a public service commission.

The majority thinks that it is not sound doctrine to hold that a public-service corporation shall be tied down to the construction of a plant no larger than is actually needed for the service immediately to be performed Every company has the right to look into the future and provide for increased business which seems reasonably in prospect. Some years ago the company constructed in the city of East Ely what is known as the "new plant," at a cost of $162,000. This was done because of the belief that Ely was destined to become in the near future another Butte. The majority still adheres to the opinion that the comparatively small population of Ely should not be made to bear the burden of the mistakes of the company arising from the fact that the district did not develop in accordance with the prevailing popular expectation. Nevertheless, as a matter of equity, the majority thinks that this matter should receive some consideration. The company had invested altogether $242,000 in its electric-light and power plants in the district. It claimed that the old plant alone, which is now serving the people of Ely and vicinity, actually cost $80,000. As stated, this valuation was cut by the engineer of the commission to $57,000.

The majority realizes that if it is too drastic in its action, if the cuts are made too deep and public service corporations are left with less than a fair return upon their investment and less than a fair compensation for the service rendered, which is also an element to be considered, it is more than probable that any court in which the case is tried will hold the order void. In such a case the commission suffers in prestige and loses the confidence of the court, which expects a commission to act in a spirit of absolute fairness.

The majority also considers the matter in the light of public policy. No state needs the introduction of capital for the development of resources more than does Nevada. It has a vast territory and less than one inhabitant to the square mile. It has great natural resources but they are latent and nothing but capital will lead to their development. The State is one of high general price levels, perhaps the highest in the United States. The wage scale is high by comparison with that which exists in any other state. It is not to be supposed that a condition can exist in Nevada whereby business men can be held down to the 5, 6 and even 7 per cent of profit which are the prevailing rates of interest east of the Rocky Mountains and at the same time pay men who work for wages double the Eastern scale. High wages and good profits of business must of necessity travel hand in hand.

Current News Notes

MR. GRAHAM AND MR. BELL.—According to a Paris letter in the New York *Sun*, Mr. Hanin, a French architect, is responsible for the statement that "the telephone was invented by two Americans, Graham and Bell, in 1876, and the phonograph by an American, Edison, in 1877." Further information about the Mr. Graham mentioned might be of considerable interest.

* * *

ULTRA-VIOLET RAYS AS AID TO DIGESTION.—According to a cablegram to the New York *Times*, Prof. Daniel Bertholet, of Paris, claims to have reproduced artificially the processes of digestion on food substances by the action of the ultra-violet rays from a mercury-vapor lamp. The food was placed in a quartz container and the reactions proceeded without the aid of the usual ferments.

* * *

COLD SNAP PUTS LISBON IN DARKNESS.—The first days of January were extremely cold at Lisbon, Portugal, and considerable excitement was caused by the freezing of the ponds in the public gardens, a phenomenon without local precedent, although Lisbon is in the same latitude as Philadelphia. Incidentally the cold snap froze up the reservoir of the electric-power station, plunging the city in darkness after nightfall.

* * *

CHICAGO COMMISSION ON DOWNTOWN IMPROVEMENTS.—Mr. Louis R. Dumond has been appointed secretary and engineer of the Chicago Commission on Downtown Improvements. Mr. Dumond has been secretary of a similar committee of the Chicago Association of Commerce. He has been instructed to gather data in relation to underground pipes and sewers and the feasibility of utility galleries in connection with subways.

* * *

YOUNG MEN AS TELEPHONE OPERATORS.—A Pittsburgh dispatch says that seventy-five young men have entered the operators' school of the Pittsburgh & Allegheny Telephone Company, and that in due time most of them will receive work as telephone operators, manning the switchboards after 9 p. m. They will displace girls, who are prohibited under a new law from working as telephone operators after the hour named.

* * *

FREE ELECTRICITY FOR MANUFACTURERS WHO LOCATE AT LOMAX, ILL.—The founders of the pre-planned manufacturing city of Lomax, Henderson County, Ill., have adopted unique plans for factory encouragement, inasmuch as they are offering to furnish power upon the following basis: To each manufacturing plant they will give free power for at least ninety years on the basis of 1 hp for each male employee, charging for additional power at the rate of $20 per hp-year.

* * *

"TESTED FIRST."—In a recent paper Mr. Edward W. Jones, of the testing department of the Commonwealth Edison Company, said that fifty-two men are necessary to conduct the work of the department. It might be added that the company has adopted as a slogan the words "Tested first." Mr. Otto A. Witte, of the same department, said that since the Fisk Street turbo-generators have been equipped with protective reactances burn-outs have become simply a tradition.

* * *

COLLUSION OF WIRE MANUFACTURERS IN BIDDING CHARGED.—The local Hydro-Electric Commission of Hamilton, Ont., at a meeting on Jan. 31 charged that a combine exists among Canadian manufacturers of copper wire and asked for an immediate investigation. Inviting tenders from every wire manufacturing concern, the board discovered that all the bids received were exactly alike. This it took as evidence that an agreement exists between the various companies to maintain a fixed price.

* * *

FIFTIETH ANNIVERSARY, COLUMBIA SCHOOL OF MINES.—One of the greatest gatherings of engineers in the history of New York City is promised for May 28, 29 and 30, when the Columbia University School of Mines will celebrate its fiftieth anniversary on Morningside Heights. The general program provides for a reception in the gymnasium on the first day and meetings at the university on the second day, when eminent scientists will speak, followed by a banquet at the Waldorf-Astoria in the evening at which Prof. James Furman Kemp will preside.

* * *

THE ALL-SUFFICIENT ALARM CLOCK.—Manager Cox, of the Riverside (Cal.) electric department, is reported to have constructed an ingenious device which apparently solves the servant problem by elimination. Mr. Cox is wakened each morning by a Big Ben alarm clock, which at the same time throws a switch at the back of the cabinet on which it is mounted, connecting in a circuit of four flush sockets. In one socket is a small lamp furnishing light to dress by, while the other three are connected to a toaster, percolator and grill. By the time Mr. Cox is dressed breakfast is ready.

* * *

ELECTRIC, STEAM AND OIL DRAINAGE PUMPING.—At the annual meeting of the Illinois Society of Engineers and Surveyors in Peoria on Jan. 30 Mr. Jacob A. Harman, consulting drainage engineer of Peoria, said that at the prevailing prices for electrical energy in the valley of the Illinois River and on the Mississippi River near Rock Island it is economically impracticable to use electricity to operate drainage pumps. Mr. Harman mentioned the case of the drainage district at Keithsburg, Ill., where electric motors used for drainage pumping are being supplanted by oil engines. He said that steam-driven drainage-pumping engines are not economical in the smaller installations, under 500 hp.

* * *

SMOKED GLASSES AND THE EARLY ARC LAMPS.—A recent historical exhibit of arc lamps and electrodes at Cleveland, Ohio, has brought out a bit of interesting history in connection with the pioneer arc-lamp system built by Mr. Charles F. Brush. The first demonstration of these lamps was made in the public square at Cleveland during the summer of 1876, and afterward in the fall of the same year the apparatus was set up at the Centennial Exposition at Philadelphia. The exhibit at Cleveland was extensively advertised in the newspapers, and on the evening it took place thousands of people assembled, most of whom carried pieces of smoked or colored glass to protect the eyes from the arc lamp's rays, which were expected to rival those of the sun.

* * *

PROPOSED RADIO STATION AT GREAT LAKES, ILL.—Preliminary plans and estimates are being prepared for a radio station at the Naval Training Station, Great Lakes, Ill. The erection of this station has not been definitely approved, however. If it is built, it will be used for instructional purposes at the training station and to afford means of communication between the Great Lakes Training Station and the naval radio station at Arlington, Va., near Washington, and possibly with some of the naval radio stations on the Pacific Coast. The plans under consideration provide for a "wireless" plant of sufficient size to operate with the Arlington station. Two steel towers, each probably 300 ft. or more in height, will be required, together with the necessary operating buildings and equipment.

Subway Proposals in Chicago.—The project of building passenger subways continues to be an active topic of discussion in Chicago. It is probable that the voters at the election of April 7 will have an opportunity to express themselves for or against an "initial subway," to cost perhaps $30,000,000 and to be constructed principally in Clark Street and Madison Street underneath the central business district, or what is termed the "comprehensive subway," to be built beneath 70 miles or 80 miles of city streets and to cost from $130,000,000 to $150,000,000. The Board of Supervising Engineers, Chicago Traction, of which Mr. B. J. Arnold is chairman, favors the initial subway as practicable. The Mayor is believed to favor the larger plan, although no one appears to have any definite idea as to how it may be financed.

* * *

Organization of Electrical Engineering Department of Chicago Surface Lines.—Mr. J. Z. Murphy, electrical engineer of the newly organized Chicago Surface Lines, has announced bureau heads and assistants as follows: Electrolysis and electrical distribution, Mr. H. M. Wheeler, engineer in charge; testing, Mr. V. E. Thelin, engineer in charge, and Mr. L. O. Mellor, assistant engineer in charge; substations and power houses, Mr. William Jones, superintendent, and Mr. M. Callahan, assistant superintendent; electrical installation of equipment of substations, Mr. H. Richter, superintendent, and Mr. William Wurth, engineer; lines and transmission, Mr. A. A. Thurlby, superintendent, and Mr. R. M. Patterson, assistant superintendent; tunnels, Mr. J. W. Harris, engineer. Electrical energy is purchased from the Commonwealth Edison Company.

* * *

Electrification Proposal Postponed in Chicago.—By a vote of six to four, on Jan. 29, consideration of the proposed smoke-abatement ordinance introduced in the City Council of Chicago by Alderman Long, and commonly known as the electrification ordinance, was postponed for several months. The ordinance would provide that the railroads within the limits of Chicago should operate their locomotives by some means other than steam so as not to produce smoke, cinders and noxious gases. On motion of Alderman Utpatel further consideration of the ordinance was postponed until after the Chicago Association of Commerce committee has made its report on railroad electrification. This report is not expected until midsummer. Representatives of switchmen and other steam-railroad employees have been very active in opposing the ordinance, alleging that the electrification of railroad terminals would mean death or injury to the yardmen and trainmen, and it is possible that the majority of the committee realized that it would be a good political move to postpone consideration of the pending ordinance until after the spring election.

* * *

Electrification Investigation in Chicago.—On behalf of the Chicago Association of Commerce it is announced that the concluding stages of the work of the committee on smoke abatement and electrification of railway terminals are in sight. The work was begun in the summer of 1911 and the investigation made has been most elaborate. Within the zone of investigation there are 4500 miles of railroad track, 100 railroad yards and the industries of a great manufacturing city. Exhaustive researches have been made into the questions of feasibility and practicability of electrification, as well as the problem of smoke production and suppression. A large staff of engineers, inspectors, accountants and clerks has been employed on the work, which was for a considerable period under the direction of the late Horace G. Burt as chief engineer. Mr. Burt was succeeded by Dr. W. F. M. Goss, dean of the College of Engineering of the University of Illinois, who obtained leave of absence for the purpose of acting as chief engineer of the committee, of which he is also a member. The exact time for the appearance of the report has not been fixed, but it is hoped that it will be early in the present year.

* * *

"Safety First" at St. Louis.—The Union Electric Light & Power Company, St. Louis, Mo., has recently organized a central safety committee composed of the various department heads of the company. The work of the committee, as outlined at its first meeting, has been divided into four sections, namely, analysis and discussion of accidents that have happened with the object of preventing their repetition; analysis and discussion of circumstances and conditions under which accidents might happen in order to keep down the number of preventable accidents; recommending installation of safety devices with a view to preventing accidents; passing upon features of standard practice with safety objects in mind. The central committee will appoint other committees in their various departments and, co-operating with these sub-committees, will receive suggestions from the men actually engaged in the operating and plant departments of the company. Printed suggestion cards will be distributed among the men as a means of gathering their ideas. The personnel of the central committee is as follows: Messrs. John Hunter, H. Spoehrer, J. L. Fay, F. C. Brooks, J. E. Hillemeyer, C. S. Ruffner, H. W. Eales, E. S. Wills and G. S. Hessenbruch.

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SOCIETY MEETINGS

Jovian Activities in Chicago.—At the meeting of the Chicago Jovian League on Feb. 9 Mr. A. N. Fox, advertising manager of the Benjamin Electric Manufacturing Company, gave an interesting talk on "Advertising." The next rejuvenation in Chicago will be held at the Hotel Sherman on March 5.

* * *

Institute of Radio Engineers.—At the meeting of the Institute of Radio Engineers, New York, Feb. 4, Vice-president John Stone Stone read a paper contributed by Mr. C. Tissot on "The Influence of Alternating Currents on Certain Melted Metallic Salts." These salts when subjected to a direct potential became materially better conductors and maintained their conductivity after a removal of the potential, but the application of radio or audio-frequency alternating potential materially decreased their conductivity. At the Washington Section of the Radio Institute on Feb. 5, Mr. Frederick Kolster contributed a paper on "The Measurement of Logarithmic Decrements," including a description of his latest decremeter.

* * *

St. Louis Company Section of N. E. L. A.—The monthly meeting of the Union Electric Light & Power Company Section of the National Electric Light Association in St. Louis was held on Jan. 30. There was a general discussion of the best methods to be adopted in increasing the membership of the association. Messrs. Hunter, Wills, Hutch, Haddaway, Spoehrer, Scullin, Drabelle and Clarkson participated, Mr. Hunter's contribution being written. Mr. Spoehrer called attention to the fact that one-half of the dues are paid by the company. Mr. C. E. Brenton, auditor of the company, read a paper on "Maintenance and Investment of Public Utilities," which was discussed by Messrs. Einstein, Fay, Clarkson, Gamp and Worthington. The Union Electric orchestra made music and a motion-picture show was given by Mr. D. Scullin.

Recent Developments in Constant-Current Transmission

Operating practices of the series, high-tension direct-current system developed by M. Thury in Europe, with notes on efficiency. By Dr. Louis Bell

ANYONE who examines with an open mind one of the big constant-current direct-current series transmission systems such as have been installed by M. Thury in various parts of Europe inevitably comes away with a realization that, whether he thoroughly approves of the system or not, it works remarkably well. Most American engineers have an ingrained opinion that whenever long-distance work is to be done three-phase transmission is the only thing to be seriously considered. The writer may fairly claim to be the original three-phase "rooter" on the western side of the Atlantic, but he must honestly admit that after having gone over some of the recent work abroad in constant-current transmission and having examined some of the beautiful machinery developed for the purpose he has acquired a disposition to take the system seriously and to admit that it has some exceedingly strong points when working under favorable conditions.

An examination of the workshops of M. Thury and records of the machines made there is absolutely convincing as to the operative character of the Thury system. Perhaps the hardest thing for the average engineer to realize, if he has not investigated the system, is the fact that the Thury method is not in the least intended for miscellaneous distribution of transmitted energy, but as now worked out is fundamentally for long-distance and high-voltage transmission, leaving to the more familiar methods the work of distribution.

Specifically, the strongest point of series transmission is its ability to deal with enormously long lines—underground if need be—with a maximum factor of safety and a minimum likelihood of interruption. Whatever may be the effective maximum of working pressure necessary, it can always be reached by direct current within about 70 per cent of the maximum voltage stress necessary with alternating current, which means, in principle at least, materially easier insulation whether the lines are overhead or underground, besides in the latter case avoiding the dielectric hysteresis which is liable to become serious in cables at high pressure. The average insulation stress, instead of always being equal to the maximum as in the three-phase system, is merely the maximum working pressure multiplied by the load-factor. On the other hand, the line loss on the series system is constant so that the high load-factor is particularly desirable.

Construction of the High-Tension Machines

One of the points of greatest interest to the investigating engineer lies in the construction of the high-tension generators and motors. The writer examined with much interest the large machines such as are used in the Moutiers-Lyons transmission and studied their construction in the shops. They are 1500-kw units generating approximately 150 amp at 10,000 volts, and, as shown in Fig. 2, have twin armatures with three bearings. This construction immediately suggests the

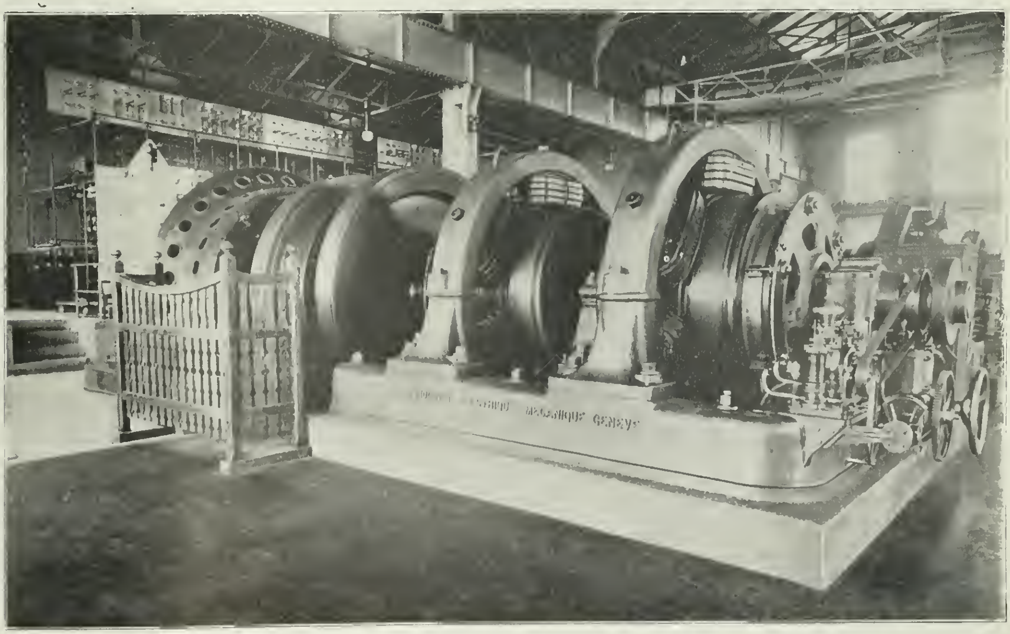


FIG. 1—HIGH-TENSION MOTOR-GENERATOR SETS IN VAULX-EN-VELIN SUBSTATION

limited output of a high-voltage direct-current machine, and it may be pertinent here to investigate the real facts in the case. The fundamental point is, however, the fact that the limitation to the voltage which can be derived from a single armature turns out to be the peripheral speed of the commutator. These big machines of whatever amperage carry about 25 volts per bar with one armature turn per bar. The winding used, as may be judged from the illustration, is a series drum with straight overhanging ends, the diameter being 1.5 m (59.1 in.). The commutator diameter measures 1.2 m (47.3 in.). The collecting surface of each bar is about 3 mm (0.118 in.) wide, and it may be said that up to these dimensions, at all events, the commutation is beautiful. The mica used as insulation has been selected with a view of giving uniform wear, which it certainly does. Bearing in mind that the winding is limited to one turn per bar, it is clear that the chief constructional question is how fast the commutator surface can be run since the bars cannot with advantage be narrowed and the voltage on them cannot be much increased. The machine shown has a commutator speed at its surface of about 27 m (88.8 ft.) per second. This could be raised by 10 per cent or 15 per cent easily, but perhaps not very much more, although exactly how much remains to be seen. The present limit of pressure, then, is about 5000 volts per commutator.

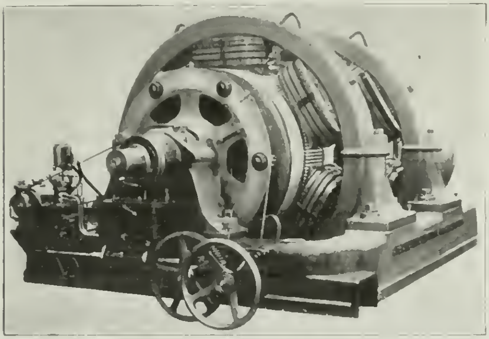


FIG. 2—A 2000-HP, 2 × 4565-VOLT CONSTANT-CURRENT GENERATOR, 428 R.P.M.

As to the output per armature available, that is quite another matter. Fig. 1, which shows one of the motor-generators in the substation of Vaulx-en-Velin, displays to advantage the commutator of one of these big machines. The brush surface is scarcely 100 mm (3.9 in.) wide and it takes care of 150 amp. While, therefore, one cannot much raise the voltage, it is superlatively easy, in case a large amount of energy is to be transmitted, to increase the amperage, so that while the machines in the Moutiers-Lyons plant take only 150 amp no difficulty is to be apprehended in building machines of similar voltage for 400 amp or 500 amp. Indeed, the great transmission scheme from the upper Rhone to Paris was actually laid out for 400-amp machines. One may, therefore, say roughly that the single armature can be pushed to nearly or quite 2500 kw—that is, 10,000 kw for a duplex machine of the type here considered.

Regulation by Servo-Motor Governors

A word next as to regulation. All machines, both generators and motors, of the Thury system are now controlled by a beautifully sensitive type of governor operated by a servo-motor worked by air or oil pressure. The mechanism is quite similar in construction regardless of whether it operates for constant speed, constant current or constant voltage, and whether it controls a waterwheel or shifts the brushes. The general appearance of the governor is shown at the left in Fig. 1. The detail of the governor is worked out with wonderful ingenuity, particularly the provisions against hunting, and its sensitiveness can be made extraordinarily great. On these particular big motors the governing is duplex. On one side the servo-motor is controlled by a delicate centrifugal governor set for constant speed of the motor. The mechanism as actually tested is sensitive to 0.2 per cent variation in the speed. On the other side it is equipped for amperage control by means of a solenoid for use on occasions when the machine may be driven as a generator by the three-phase unit to which it is coupled, making a convenient provision for mutual service between substations. The current control is of about the same degree of sensitiveness, although in point of fact the speed regulation is usually set at about 2 per cent, as a little leeway tends to check the small hunting which might otherwise occur. All the working parts of the governor are automatically kept free and in play so that there seems to be no chance of failure to function through sticking.

The problems of insulation of these high-voltage machines are interesting ones. To begin with, the machines themselves must be thoroughly insulated from earth on account of their series connection and also from a reasonable probability of their being worked with a grounded line as an emergency measure. In earlier plants this was done by mounting the machine itself on insulating blocks on its foundation. In the later and larger plants the insulation is applied between two layers of the foundation, so to speak. Little trouble has been experienced with this insulation, which apparently is one of the things much easier in actual practice than it perhaps seems from a casual glance.

Fig. 3 shows the insulated couplings between the waterwheels and the big generators. The particular plant illustrated here is that at La Bridoire, in Savoy, a station auxiliary to the main plant at Moutiers and containing four 1500-kw generating sets as shown in the illustration. The coupling referred to lies between the generating unit and the flywheel attached to the waterwheel. It is in the neighborhood of 1.5 m (6 ft.) in diameter and consists essentially of two massive face plates each provided with a ring of heavy steel pins parallel to the shaft. One ring lies radially within the other with about 30 cm (12 in.) intervening, and a continuous leather belt is woven in and out between the two sets of pins. Thus there is formed a flexible coupling with the belt spans as insulation, making a connection both highly effective as an insulation and very flexible. These big three-bearing units are separately excited by directly connected exciters and have an efficiency of about 95 per cent at full load, which compares favorably with that of other machines of similar size.

The regulation of this particular plant at La Bridoire as well as that of a still more recent station of about half its rating operating at Bezil, Savoy, is interesting from the standpoint of being regulated for constant speed. The current control is accomplished by shifting the brushes. The main plant at Moutiers is operated at a varying speed of the generators to secure uniformity of current. The reason for the difference is very simple. At both the later plants the water supply is somewhat scant, and especially is this true at Bezil, where Pelton wheels are operated under high head. It is therefore far more desirable to conserve water by keeping the wheels always at their most efficient speed; hence the method of governing by shifting the brushes instead of adjusting the speed.

Simplicity of Control Equipment

One notes in Fig. 3 that little in the way of a switchboard is visible. This is because of the exceedingly simple reason that there is not any, except for a few devices associated with the control of the regulators and the necessary instruments for the outgoing line. On the base of each generator, however, will be seen a square column, better shown in Fig. 4. This is the operating switch for short-circuiting or throwing into action each machine together with the voltmeter and ammeter which serve as guides, and this panel comprises all there is in the way of a working switchboard. If the reader will but stop and think of the difference between this and the fortifications of concrete which surround the multifarious switches of an ordinary three-phase plant, he will come to a sudden realization of one of the conspicuously strong points of series operation. While the generating equipment itself is obviously somewhat expensive, M. Thury holds, and has the figures to justify his belief, that compared kilowatt for kilowatt, including switchboard and buildings, the constant-current system can fully hold its own in high-tension operation.

It may be interesting to see how a typical long-distance line would work out for a series constant-current connection. Take, for instance, the transmission of 75,000 kw over a 250-mile line at 150,000 volts working pressure. With 10 per cent loss in the line this would require cables of about 1,000,000-circ.-mil. cross-section. This copper could perhaps be divided into two circuits each of 500,000-circ. mil cable, each circuit being strung on an independent pole line. The total weight of cable would be about 4000 tons. This would mean at ordinary prices of copper an investment of less than $20 per kw for the conductor, which certainly is not excessive. A duplex line of this kind would allow working at a pinch on one circuit, or with two cables on one leg and one on the other; and, what is perhaps more important, it is as a matter of fact perfectly feasible to work these constant-current circuits grounded. The resistance of the ground return depends, as was well shown in the experiments made with reference to the proposed Paris transmission and reported in the *Electrical World* a few years ago, on the extent and proper installation of the ground plates. The ground resistance can be easily made less than the resistance of the return wire would be, thus giving very great additional security against accidents to the line. Practically all the high-tension plants on this system have actually been worked commercially with ground return for considerable periods, so that use of this method is not in the least a matter of theory but of actual experience. The maximum voltage on a 150,000-volt line using direct current is about 60,000 volts less than in the case of an alternating-current line of any kind, giving a large additional security to the insulation and this also without counting the abnormal rises in potential to which alternating-current lines are subject. The generating station of such a system would depend largely on the character of the hydraulic development, but, given favorable conditions such as exist in some alternating-current plants, the equipment need consist of only eight water-wheel units, each driving a pair of 10,000-volt three-bearing machines such as have been described, while at

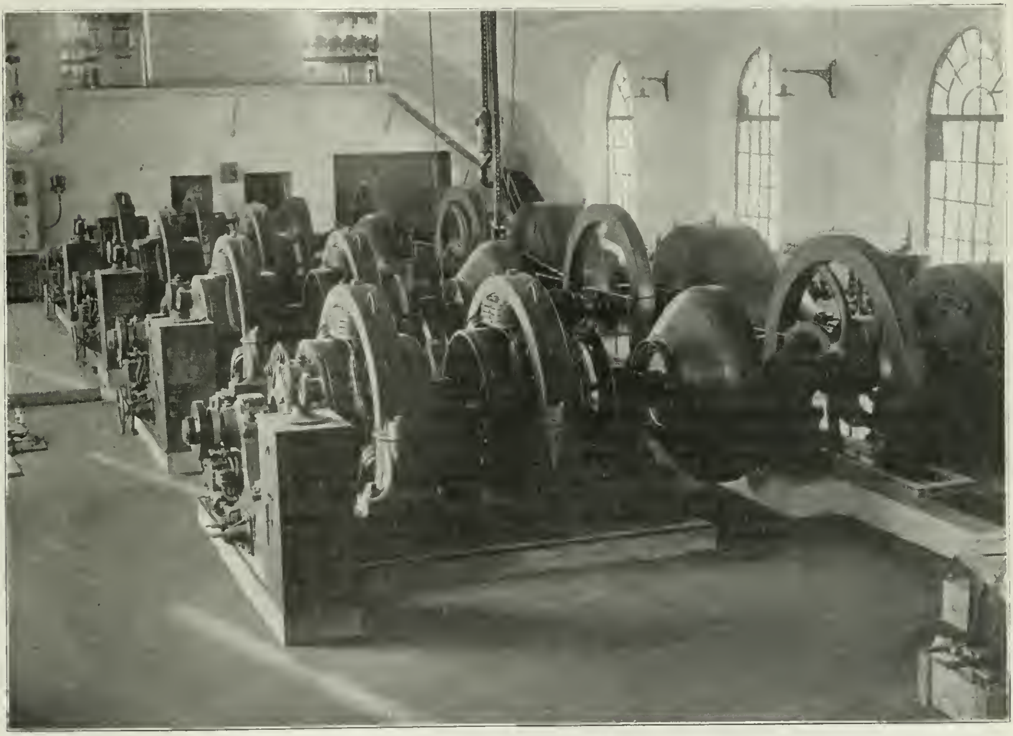


FIG. 3—2000-HP CONSTANT-CURRENT GENERATOR SETS IN THE PLANT AT LA BRIDOIRE

the receiving end a similar group could be connected in pairs to three-phase generators for ordinary distribution. The efficiency of the substation equipment from high-tension line to three-phase distributing buses should be slightly over 90 per cent at full load. The weak point of series working lies in its lowered efficiency at part load, owing chiefly to extra line loss. But the actual showing in efficiency made should be on the whole good. This outline merely indicates how the system would work out on a large scale.

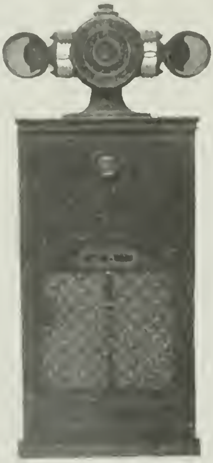


FIG. 4—CONTROL PEDESTAL FOR A 2000-HP GROUP

Possibilities in Underground Transmission

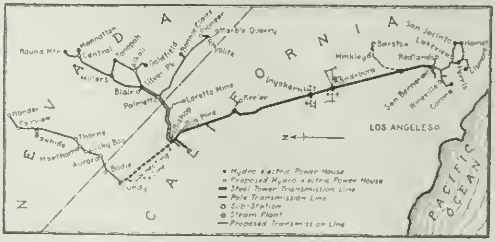
A far more favorable case for the series system is that in which the transmission lines are underground. Nobody yet knows exactly what are the relative difficulties to be met with in high-tension direct-current and alternating-current cables, but there is every indication that the direct-current cable even at moderate voltages has a great advantage in insulation strength, perhaps in the ratio of 2 to 1 or 3 to 1 at 25,000 volts or 30,000 volts, and in much greater ratio as the voltage rises. It is probably well within bounds to say that 150,000 volts direct current is as easy to put underground as 60,000 volts alternating current, which is at present about the highest figure that has been tried. It is this feature of the constant-current system that recommended it so strongly in the transmission system for the supply of London, for which it was recently adopted. Here the situation required transmission wholly underground over a large territory with here and there substations for distribution, a condition to which series operation at constant current is particularly adaptable, and showed, according to the figures of the engineers, so large an advantage as fully to justify its choice. More data on this cable problem are necessary but cannot be taken as really reliable until competitive estimates are made on the basis of tests for both alternating-current and direct-current working—tests more extensive and covering a wider range of construction than are yet available. From what has here been set forth it must not be understood that series transmission should be regarded as a general competitor of three-phase working for high-tension and long-distance work. It is rather a thing which under certain circumstances has been found to have certain conspicuous advantages and which on its record must be taken seriously as a possible recourse when conditions are favorable. The plants actually in operation are doing excellent and reliable work, and there is no reason why they should not continue to do so. Even with overhead circuits the series scheme possesses elements of security, especially with respect to lightning, which are not to be despised, as reactance coils may be used with the utmost freedom. At all events, the constant-current system of series transmission is one of extreme interest to the engineer, and even if it should not be advisable to undertake such work in this country under present conditions its features of simplicity in operation are such as should stimulate the improvement of three-phase transmission in the direction of simplicity of switch gear and adaptability to underground working.

Providing for Exchange of Surplus Energy

To provide for the exchange of surplus energy generated by the Pacific Power Company, the Nevada-California Power Company and the Southern Sierras Power Company, a tie line is being erected between Bishop and Lundy, Cal., to connect the three systems. Normally it is not proposed to operate the Pacific system in synchronism with the other pair, the two groups of circuits being segregated except when energy is being transferred. The tie line, a single circuit, is about 65 miles long and is now strung on wooden poles which will eventually be replaced by steel towers. When completed the line will connect six hydroelectric plants and two steam plants having a total rating of over 46,000 hp.

At present the Pacific company generates its energy by steam power at Bodie, Cal., and has a transmission system about 125 miles long. The Nevada-California company operates five hydroelectric plants near Bishop, Cal., and transmits over duplicate lines the energy thus generated to seven transformer substations in Nevada. Two more hydroelectric plants are in preparation at Bishop which will supply energy to new territory remaining undeveloped at present. In the vicinity of the new tie line on the Owens River and on Silver Lake there is considerable unexploited mining country.

A double-circuit steel-tower transmission line already connects Bishop with San Bernardino, where the steam generating station of the Southern Sierras company is located. This line is about 236 miles long and, while it is now being used for sixty-cycle, 55,000-volt transmission, it was designed for pressures up to 143,000 volts. The Bishop-San Bernardino line is installed to allow synchronous operation of the two systems, but the steam station at its southern end is normally held in reserve and used only when the water supply at Bishop is insufficient for generating all of the energy required.



TRANSMISSION LINES IN VICINITY OF LOS ANGELES, CAL.

As the Southern Sierras company now has a distributing system about 225 miles long, further extensions or large increases in load will warrant a higher transmission voltage than is now used. The first increase contemplated will be from 55,000 volts to 90,000 volts.

Alternating-Current Supply in New York City—II

New station of the United Electric Light & Power Company at 201st Street and Harlem River—Generation and control of the electrical energy

IN the *Electrical World* of Feb. 7 was published a history of the growth of the alternating-current system in New York City with a brief mention of the features of the United Electric Light & Power Company's new 201st Street generating station, which will carry the entire sixty-cycle load in that city for some time to come. In the same article were also described the coal-handling and boiler-room equipment. The present article contains a description of the remaining mechanical equipment and goes into detail concerning the electrical installation.

Cinder Catchers

Besides setting the boilers extra high above the grates to prevent smoke when the boilers are forced, additional preventive measures have been taken by employing cinder catchers and gas cleaners. As the boilers are set back to back with three firing aisles, one cinder catcher suffices for two boilers. The cinder catcher consists of a rectangular steel tank connected with the boilers adjoining it by two horizontal flues and with the smokestacks by a vertical pipe. The bottom of the tank is kept covered with water about 2 ft. deep, and adjustable baffles deflect the gases from the boiler against the water, at the same time causing them suddenly to change their direction and pass out the vertical pipe. The centrifugal force of the moving cinders causes them to be thrown into the water, from which they are drained periodically through a pipe at the bottom. The speed of the gases as they strike the water can be regulated by adjusting the baffle plate. If the gases from the boilers are filled with finely divided solid material which will not be entrapped in the pool of water, a curtain of finely divided water can be run over the baffles to clean the gas. This apparatus was installed by the Metropolitan Engineering Company of Brooklyn.

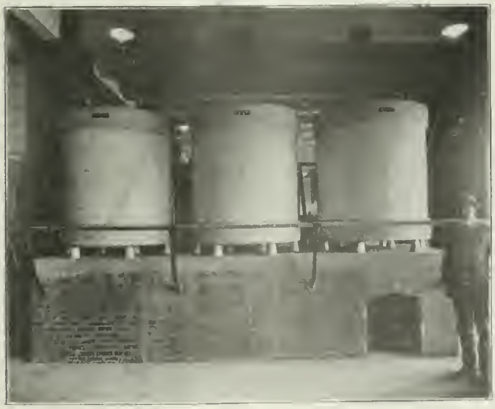


FIG. 10—PORCELAIN-CLAD BUS-TIE REACTORS

Ash-Handling and Electric Locomotives

Ashes and cinders can be dumped from the separate downtakes directly into cars in the basement. Two trolley-type 220-volt, 10-hp General Electric locomotives are provided to haul the loaded ash cars to a hopper, from which the ashes are conveyed in motor-operated skip-hoists upon an inclined track to a large concrete ash bunker supported between the coal towers. The skip-hoist will dispose of 40 tons of ashes per hour. From the concrete bunker the ashes can be discharged by gravity through chutes into ash scows or freight cars. The electric ash locomotives are operated by two 5-hp direct-current motors, energy being supplied through sliding-contact shoes from an overhead conductor.

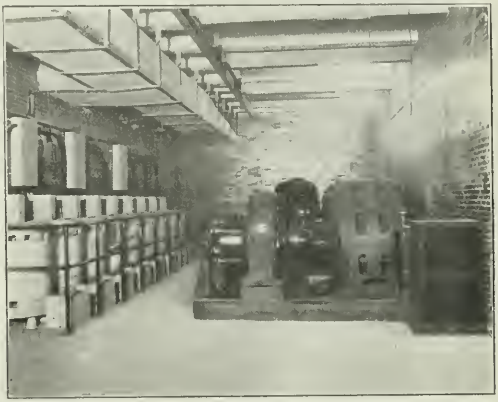


FIG. 11—REACTORS IN 7500-VOLT EXCITER-MOTOR LEADS

Piping

Four parallel boiler headers connect the boilers in each row with the main steam headers stretching across the east and west ends of the boiler room, as was shown in the isometric drawing published last week. U-bend cross-overs connect the boiler-superheater outlets with the boiler headers. A gate valve operated from the floor is connected in each boiler lead. Expansion of the headers is provided for by supporting the pipes on rollers and dividing the headers into sections joined by U-bends. Steam leads are run from the main header down below the engine-room floor level and thence to the turbines, first passing through 14-in. steam separators capable of passing 240,000 lb. per hour.

Below the main header and connected to it is an auxiliary header feeding circulating, hot-well and air pumps. Two atmospheric exhaust stacks connecting with a 25-sq. ft. longitudinal tunnel in the engine-room floor are at opposite sides of the building. All condensers are connected with the exhaust tunnel through automatic relief valves.

Feed-Water Heaters

The boiler-feed water consists of condensate and about 10 per cent make-up from the Croton Aqueduct. Two Cochran feed-water heaters and a dividing box are installed to care for the present installation. The make-up water and condensate from the main turbines and auxiliaries is measured separately before going to the condensers by Lea V-notch recording meters. The dividing box used with the condensers equalizes the water delivered to each heater so that neither is overworked. Three centrifugal turbine-driven pumps receiving water from the heaters by gravity deliver water to the boilers.

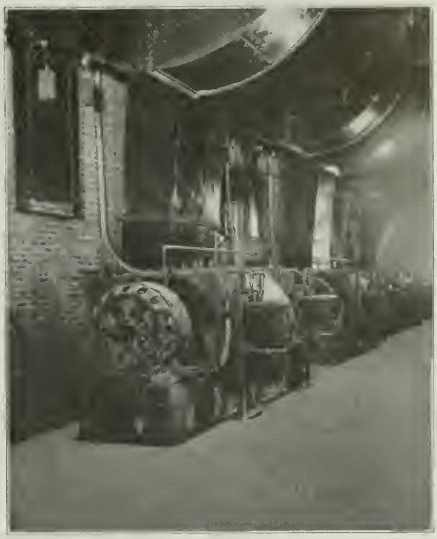


FIG. 12—MOTOR-DRIVEN BLOWERS FOR TURBO-GENERATORS

Test Room

A test room containing condensers, weighing tanks, Venturi meters, etc., is located in the ash basement and can be connected with all turbines, auxiliaries and condensers by auxiliary headers to measure the steam consumption, economy, etc. In addition, a reciprocating air pump is installed for testing the air leakage of any condenser.

Turbo-Generator Equipment

While designed to accommodate eight 19,000-kva horizontal turbo-generators, the turbine room now contains only three three-phase, sixty-cycle units. These are Westinghouse horizontal double-flow machines and will develop 7500 volts when operated at 1875 r.p.m. With a steam pressure of 185 lb., a superheat of 125 deg. Fahr. and a 28.5-in. vacuum, the turbines will develop a maximum of 22,500 brake hp. The turbines are arranged in a single row with their longitudinal axes parallel and are supported on plate girders resting on steel columns. Each turbo-unit has an over-all measurement of 41 ft. by 14 ft. by 9.5 ft. Below them in the basement are arranged in units the condensers, auxiliary pumps and motor-driven blowers. Westinghouse two-pass surface condensers are employed having 20,000 sq. ft. of cooling surface. They are supported on steel-girder platforms directly below the turbines so there is no friction loss in exhaust piping.

Condensing water is conveyed to the building from the Harlem River through a 83-sq. ft. suction tunnel which connects with a cross-tunnel extending the length of the auxiliary-room floor. An 89-sq. ft. discharge tunnel superposed upon the latter empties into Sherman Creek.

Water from the suction tunnel is forced through each condenser by a turbine-driven Westinghouse Leblanc centrifugal pump. The pump operates at a maximum speed of 1000 r.p.m. and is connected to a variable speed turbine through a 3-to-1 double helical floating frame gear. Gear reduction is employed so that the pumps and turbines will operate at their highest efficiency, and the economy afforded by its use has warranted its installation. The turbo-gear drive is a feature throughout the station, there being fifteen such outfits. Each circulating pump is capable of delivering 24,000 gal. per minute, so that when the ultimate equipment of eight turbines and auxiliaries is installed the pumps will be able to deliver over 103,000,000 gal. per day. The air pumps are of the rotary-turbine type directly connected to 75-hp turbines running at 3500 r.p.m. Horizontal single-stage, double-suction centrifugal pumps directly connected to 15-hp turbines are used to deliver water from the hot-wells to the feed-water heaters.

Each turbine has its individual oil-circulating system. When starting up a turbine a small reciprocating engine starts the oil circulation, which is normally maintained by a centrifugal pump geared to the turbine shaft when the latter is running at full speed.

Generator Ventilation

Sufficient space is not available for ventilating blades on the rotors of the main generators as they are designed for a relatively high speed. Consequently individual motor-driven double-width blower units are provided to cool the generator windings. A 110-hp motor is directly connected to each end of the individual blower shafts, one motor serving as an emergency reserve. Separate circuits are run from the power board to each motor, thus insuring independent operation.

Electrical Equipment

All control and switching apparatus is installed in the west section of the station. The high-tension remote-control and main-generator-control boards are placed on the third gallery in a room overlooking the engine room. Both switchboards are semi-circular in plan, the high-tension board consisting of two concentric semi-circular sets of boards with conduit

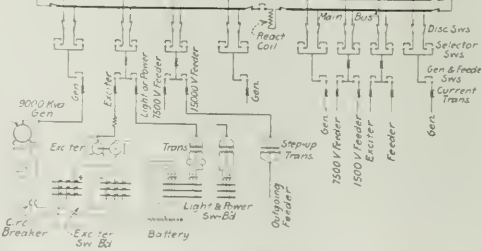


FIG. 13—FOUR-SECTION BUS WITH REACTORS AND TIE SWITCHES

space in between. On the larger-radius board are mounted watt-hour meters connected to all generator and feeder circuits. Switches are also located on these boards which permit of testing any meter, series or shunt transformer without erecting special apparatus. Installed in this room are also static detectors employed to indicate grounds on any one of the four high-tension bus sections, and indicators to show the particular feeder circuit grounded. An elaborate signaling device is installed for transmitting orders to the boiler room and for governing the movements of turbine operators. The signal installed in the boiler room is of the carriage-call type and indicates the number of boilers which will be required to carry the load. The indicator control device automatically records on a tape the signal transmitted, the time it is sent, and the time it is acknowledged. Another board containing pilot lamps also shows the position of all oil switches (open or closed) in the station. A similar board connected with it gives the same information to the load dispatcher at Waterside station.

Electric Galleries

The high-tension bus and switch compartments are distributed over the floors of the electrical galleries, of which there are seven. The arrangement of the switching apparatus and the connection of the generators and feeders to the buses is shown in the accompanying diagram.

On the sixth gallery are located the bus-tie switches and air-cooled, porcelain-clad, pancake-type reactors connected in series with them. These reactors are designed to carry 2000 amp and have a reactance of 18 per cent. The coils are supported on porcelain insulators resting on concrete bases, and all metal bracing of bus compartments used in conjunction with the coils is made of brass to prevent magnetic leakage. Short-circuiting switches are installed in compartments near each reactor to shunt the coils in case they are out of order.

Main and auxiliary high-tension buses, each of which consists of four copper strips in parallel, are supported in compartments on the fifth floor. These buses are divided into four sections as indicated in the bus diagram and can be connected in two loops through the bus-tie switches and reactors on the floor above. Only two sections are completely installed now, the others not being required until more turbo-generators are put in. Each bus section is fed by two generators through oil disconnecting switches installed on the third gallery with the feeder switches.

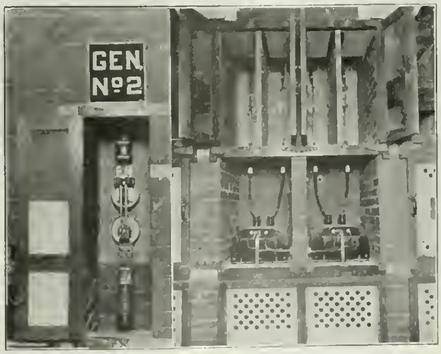


FIG. 14—DISCONNECT-SWITCH COMPARTMENT AND AIR-COOLED SHUNT-TRANSFORMER COMPARTMENTS

The bus and oil-switch compartments are built of red brick, each phase of a circuit being separated by alberene barriers. Removable alberene floor panels are installed in front of each high-tension compartment to facilitate pulling of cables.

In the second gallery are located the shunt and series instrument transformers connected to each feeder and generator circuit. Separated transformers are used to operate instruments and relays, the series transformers being arranged in one row of compartments and the shunt transformer in an adjoining row separated only by a brick partition. Space has been provided below the shunt transformers for a future installation of feeder reactors. Only two will be installed in each circuit and these will be designed to carry 300 amp and have 4 per cent reactance. In the compartments on this floor there are also special series transformers which are clamped around the three-phase, three-conductor feeder cables. When a feeder circuit is unbalanced the vector sum of the currents is no longer zero and the transformer will operate a relay in the high-tension switching room indicating the unbalanced condition.

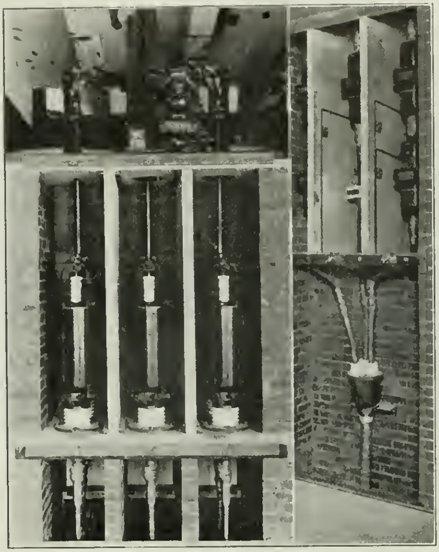


FIG. 15—BUS-TIE OIL SWITCH AND COMPARTMENTS CONTAINING INSTRUMENT AND RELAY SERIES TRANSFORMERS

Selector switches are installed on the fourth floor to connect the feeder and generator switches to either the main or auxiliary bus.

The feeder-switch relays are designed to open when 800 amp flows after an interval of two seconds, and in case the overload exceeds 2000 amp the selector switch will open in the same length of time. Instead of the generator switches being tripped on overloads, however, a signal lamp is lighted on the machine-control board. To safeguard men working on oil switches special grounding devices are placed at several points in each high-tension gallery. This apparatus consists of an insulated rod with a metal tip connected to a flexible cable, one end of which is grounded through an expulsion fuse. Before discharging the static from a switch the continuity of the testing circuit is tested by touching the tip of the rod on a metal plate which is connected to the ungrounded conductor of a grounded lighting circuit through an incandescent lamp. The lamp will light if the cable is grounded, and the high-tension switch to be worked upon may then be discharged. After discharging the static separate flexible cables may be fastened to the switch and the other ends connected to a grounded copper strip extending along the base of the switch compartment. All oil switches in the electrical galleries are motor-operated and were made by the General Electric Company.

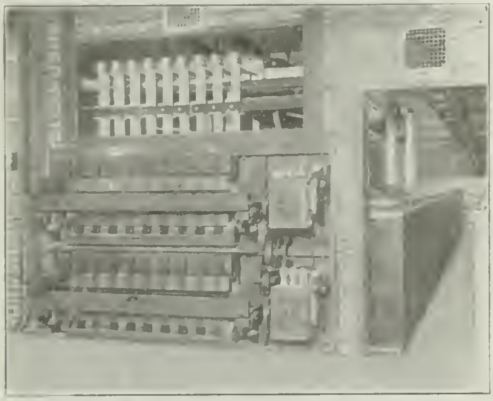


FIG. 16—AUTOMATIC END-CELL-SWITCH AND BATTERY ROOM

Exciters and Control

Field exciting current for the 19,000-kva generators and energy to charge a 142-cell storage battery on the first gallery is furnished by three 200-kw, 250-350-volt exciters located in the first basement. These exciters are driven by 7500-volt, sixty-cycle induction motors having 15-amp, 3.33 per cent reactances in series with their leads. The motor-starting controllers are installed near them and are operated by the low-tension switchboard operator. The exciters deliver energy to the low-tension switchboard and can be connected to any one of three buses. Different bus voltages can thus be maintained by segregating the exciters, and the entire 142 cells of the storage battery may be charged from one exciter while the others deliver exciting current to the generators. Normally, however, the storage battery is floated on the exciting bus.

The exciter control board consists of three separate sections, the positive and negative panels at opposite ends, with a control board in the center. The switch contacts are on the front of the positive and negative panels while the buses on the rear are protected by alberene barriers and asbestos-wood doors. The wiring in back of the boards is run in iron conduit, making a construction that is completely fireproof. The exciter and generator field switches, which are of the Van Vleck knife type, are spaced so as to prevent any accident which might result from arcing at the switch contacts. At the top of the exciter panels are mounted circuit-breakers equipped with reverse-current relays. The field current of the 19,000-kva generators is controlled entirely from the high-tension switchboard room; the remote-control switches located there operate field circuit-breakers and rheostats on the first gallery.

Storage Battery

The storage battery, consisting of 142 thin-plate Exide cells (3500-amp-hr. at one-hour discharge rate), is at the south end of the first gallery. The cells are arranged in three rows and each one is supported on six glass oil-ring insulators which in turn rest on a plate supported by four porcelain insulators. The end-cell connections which are coated with acid-proof paint are supported from the ceiling by porcelain insulators. An auxiliary bus extends over each row of cells and is connected to a 5-volt, 1000-amp motor-driven direct-current generator so that any cell can be charged individually. This generator is designed to operate as a booster, should it be required to do so. The battery room is ventilated by exhaust fans, and the air is washed to remove the acid before discharging it through the ventilating ducts.

The number of cells connected in series across the exciter bus is regulated by an automatic remote-control end-cell switch placed on the exciter control board. An illuminated shutter on the remote-control switch indicates the number of the cells in series, as well as the direction in which the end-cell switch is operating. A red light means that the number of cells is being increased, a green light indicates a decrease, and a white light shows that the switch has connected the number of cells indicated on the shutter. It is only necessary to turn the switch handle until the number of cells desired is indicated on the shutter and the end-cell switch performs the operation automatically.

30,000-Volt Testing Set

Installed in the room with the exciters is an induction-motor-driven testing generator which supplies energy to a 30,000-volt testing transformer. The testing generator is controlled from a switchboard in the third gallery and 30,000-volt cables connect the transformer with testing stations on the different galleries, there being from two to four stations on each floor.

Power and Lighting Distribution Room

The station lighting system and motor equipment is supplied with energy from transformers in the sub-basement. Two banks of 7500/440-volt transformers deliver energy to the motor feeder board in the exciter room and two other banks of T-connected transformers deliver two-phase energy to the lighting board, also in the exciter room. Expulsion-type switches made by the Metropolitan Engineering Company, Brooklyn, are used on all of the feeder and distributing switches of both motor and lamp circuits. Two single-phase 7500/220-110-volt lighting transformers are employed with their primary windings T-con-

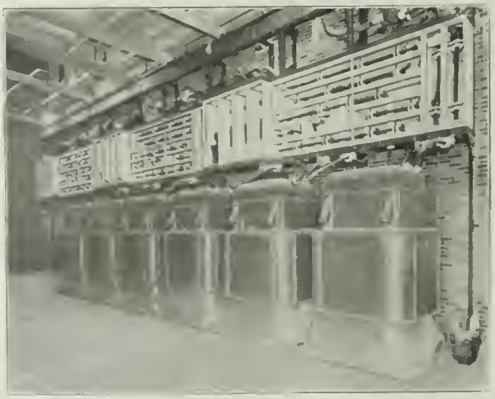


FIG. 17—WALL COMPARTMENTS CONTAINING 15,000-VOLT TRANSFORMER CONNECTIONS

nected, and 220-110-volt taps are led from their secondaries to the lamp feeder board. Both secondary circuits from the lighting transformers are run to each distributing box in the station so that in an emergency a polyphase motor may be operated temporarily on the two-phase energy. Voltage regulators are in series with all of the lamp circuits in the station. Emergency lamps connected directly to the exciter bus are also distributed throughout the station. Later a system will be installed whereby the lamps can be connected to the storage battery should the alternating-current buses become de-energized.

Transformers Feeding Substations and Tie Lines

As the feeders to the outlying substations and the tie lines to the Waterside station operate at 15,000 volts, six banks of 2000-kw, 7500-15,000-volt transformers have been installed to step-up the generated voltage. Three of these deliver energy to the Waterside station and the remainder to substations. Each bank of transformers is air-cooled by an individual motor-driven blower which starts to operate as soon as the transformer bank is energized. The motors are supplied with energy from special windings on the transformer cores. The air ducts supplying each bank may be connected if one motor fails to operate, as the other blowers will supply sufficient air. No connections between transformers are exposed. They are inclosed in asbestos compartments on the walls above the transformers. The transformer disconnecting switches are also installed in wall compartments, while pilot lamps indicating when their respective transformer banks are energized are fastened to wall panels.

The station was designed under the supervision of Mr. Thomas E. Murray, first vice-president of the company, and the construction has been under the direction of Mr. W. E. McCoy, electrical engineer. The other officials of the United company are: President, Mr. Nicholas F. Brady; second vice-president and general manager, Mr. Frank W. Smith; secretary, Mr. Lewis B. Gawtry; assistant secretary, Mr. Lawrence A. Coleman; treasurer, Mr. Benjamin Whiteley. The sales department is under the direction of Mr. Joseph F. Becker, sales manager, the 201st Street station being under the immediate direction of Mr. H. W. Leitch, electrical superintendent, and Mr. William McDonald, chief engineer. All feeder and distributing panels for both motor and lamp circuits were furnished by the Metropolitan Engineering Company, Brooklyn, while the conduit work for these circuits was installed by L. K. Comstock & Company, New York City.

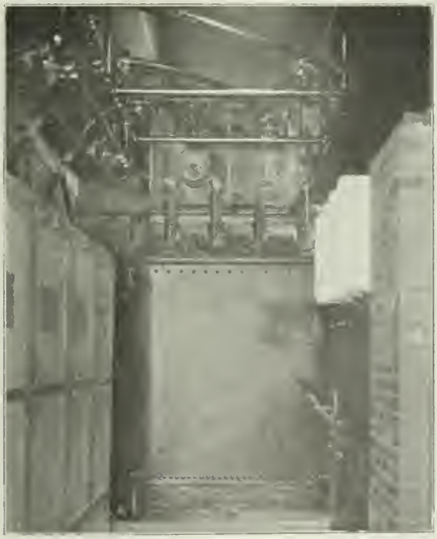


FIG. 18—30,000-VOLT TESTING TRANSFORMER

The New Edison Building in Chicago

The Commercial National Bank Building, at the northeast corner of South Clark Sereet and West Adams Street, Chicago, which was purchased some time ago for the Commonwealth Edison Company, will be known as the Edison Building after May 1 of this year. At that time, or about that time, a large portion of the officers and office employees of the Commonwealth Edison Company will transfer their offices from the present offices at 120 West Adams Street to the new building. The Commonwealth Edison Company will occupy nearly all the space in the building from the ground floor up to and including the seventh floor, and also space in some of the upper floors. A considerable proportion of the building will be rented to tenants, including a number of electrical concerns. The building has a large ground area and is eighteen stories high.

Power Equipment of the Robert B. Brigham Hospital at Boston

Although the Robert B. Brigham Hospital, Boston, Mass., is situated on the summit of Parker Hill, the power plant is placed under the brow of the hill out of sight and hearing of the main buildings, the high smokestack being the only part visible. Communication between the plant and the hospital is obtained through a long tunnel which runs nearly horizontally from the upper part of one building to the basement of the other. This tunnel is large enough to contain all the necessary heating pipes and the mains for the distribution of electrical energy, and it provides a passage for the various attendants of the mechanical department.

The equipment of the power house consists of three Babcock & Wilcox boilers, fired by automatic stokers, which supply steam to three 62.5-kva Terry turbo-generators. The generators are three-phase, sixty-cycle, 220-volt machines made by the Allis-Chalmers Company. The turbines are non-condensing and deliver their exhaust directly to a Warren-Webster vacuum-heating system. In severe weather, when the exhaust from the turbines is not sufficient for heating, live steam is added to the system through a reducing valve. The turbo-generators supply energy to the laundry and kitchen motors, the refrigerating apparatus, two motor-driven pumps which raise water from the city mains to the pressure tanks supplying water to the entire hospital, individual motors for special purposes, and for lighting all the buildings.

On account of the lack of easy means of communication between the plant and the structure it serves, everything possible was done to insure continuous service in the equipment. The boiler capacity is generous and a spare generating unit has been provided. In order not to disturb the hospital patients by smoke, the stack was placed 100 yd. away from the power plant and at a much higher elevation. The foot of the stack is reached by underground ducts. Densmore & Le Claire were the architects and engineers.

Parallel Operation of Transformers—II

Methods of increasing the output of a group of transformers and a numerical problem to determine the current in each unit. By Waldo V. Lyon

A THEORETICAL discussion of the operation of transformers in parallel was given in the *Electrical World* of Feb. 7. The conclusion of the theoretical exposition, together with a numerical example, is given herewith.

The final step in the analysis is to determine the effect that the components have on the total output of the transformers. It is probable that no simple statement can be formulated for the general case in which the ratios of transformation are unequal. If the ratios are equal, however, the solution is readily determined. In this case, the current in any transformer, n, is:

$$I_n = \frac{y_n}{Y_o} I_o$$

Assume that the condition of load is such that this transformer is taking its maximum allowable current, I_n', and that all of the other transformers are not fully loaded. The common equivalent impedance drop through the transformers is then equal to $\frac{I_n'}{y_n}$ and the total load current is:

$$I_o = \frac{Y_o}{y_n} I_n' \qquad (9)$$

Therefore the greatest current that can be safely supplied by a group of transformers connected in parallel is equal to the maximum allowable current of the transformer which has the least equivalent impedance drop at full load multiplied by the ratio of the combined parallel equivalent admittance of all of the transformers to the equivalent admittance of this particular transformer. This is true for any case except where the ratios of transformation are not the same for all of the transformers.

It often happens that the ratios of equivalent resistance to equivalent reactance are nearly alike. If this is the case a very good approximation to the permissible output as given by equation (9) is:

$$I_o = \Sigma y (I_n' z_n)$$

The greatest permissible current output is equal to the algebraic sum of the equivalent admittances multiplied by the smallest full-load equivalent impedance volts.

The combined output of a group of transformers connected in parallel can be increased in two ways: first, by adding reactors in series with each transformer circuit so that the resultant equivalent impedance drops are the same for all of the transformers when they carry their maximum allowable currents, and, second, by modifying the equivalent impedance of each transformer so that the ratios of the equivalent resistance to the equivalent reactance are the same for all of the transformers. The latter is, of course, only a hypothetical change.

Assume that, in order to increase the permissible output of the group, reactors are added in series to all of the transformers but one so that each will have the same equivalent impedance drop with the maximum allowable current. The one which has no added reactor is obviously that with the greatest equivalent impedance volts for maximum allowable current.

$$\frac{I_1'}{y_1'} = \frac{I_2'}{y_2'} = \quad . \quad . \quad . \quad \frac{I_p'}{y_p}$$

I_1', I_2', etc., are the maximum allowable currents as before. y_1', y_2', etc., represent the resultant admittances of the transformers and added reactors. The transformer p is the one whose admittance has not been changed.

Under this new condition the total current output is:

$$I_o' = \frac{Y_o'}{y_p} I_p'$$

Y_o' is the combined admittance of the transformers and reactors under the new condition. The ratio of this current to its original value—see equation (9)—is:

$$\frac{I_o'}{I_o} = \frac{[Y_o']}{[Y_o]} \; \frac{[I_p' z_p]}{[I_n' z_n]} \qquad (10)$$

In practice it is sufficiently exact to say that the transformers will deliver their total output if reactors are added to all but one of them so as to make their resultant full-load-equivalent impedance volts the same. If this is so, a good approximation to equation (10) is

$$\frac{\Sigma I'}{\Sigma y \, (I_n' z_n)}$$

n denotes the transformer with the smallest equivalent impedance volts.

The second method of increasing the combined output of a group of transformers is by making the ratios of the equivalent resistance to the equivalent reactance the same for all of the transformers without altering the numerical value of any equivalent impedance. This is of course practically impossible, and it is only stated in this way to separate the results accomplished by the two methods. The value of the greatest load current is given in equation (9). If now the ratio of equivalent resistance to equivalent reactance is made the same for all of the transformers without changing the actual value of any equivalent impedance, the sum of the admittances in complex notation is numerically equal to the sum of their numerical values, that is, Σy. Therefore by making the ratio of equivalent resistance to equivalent reactance the same for all of the transformers their combined output is multiplied by the ratio of the algebraic sum of the equivalent admittances to the numerical value of their sum in the complex notation.

It is interesting to estimate the amount by which the combined output of a group of transformers may be increased by each of the methods mentioned. In order to separate the effects it will be assumed that in the case where the equivalent impedance drops are not the same for all of the transformers the ratios of equivalent resistance to equivalent reactance are the same for all, both before and after impedance units are added to some of the transformers. In the second case it will be assumed that the equivalent impedance drops at full load are the same for all and that only the distribution between equivalent resistance and equivalent reactance is altered.

Where it is a question of the equivalent impedance drops not being equal at full load, the worst condition that can arise is when they are the same for all but one transformer and for that one the drop is less than in the others. If this be so, all of the transformers but one will be carrying a certain fraction, $\frac{1}{K}$, of their maximum allowable current when this one is fully loaded. If the rated output of the transformer which has the low value of equivalent impedance drop is small compared with the combined outputs of the others the total output will be increased approximately K-fold if the impedance of this one is properly adjusted. As the equivalent impedance drop may vary from, say, about 3 to 9 per cent of the rated voltage, it might be possible to increase the total output by as much as about 200 per cent by making the equivalent impedance drops the same for all of the transformers.

NUMERICAL DATA RELATING TO GROUP OF TRANSFORMERS

	(1) Core Type	(2) Shell Type	(3) Shell Type
Rating, kva	500	500	1,000
Rated voltage:			
High-tension	11,000	11,000	11,000
Low-tension	2,300	2,300	2,300
Turns:			
High-tension	746	344	278
Low-tension	156	72	58
Short-circuit data:			
Volts	345	288	539
Amp	45.5	45.5	91.0
Watts	3,375	4,680	7,490

In the case of equal equivalent impedance drops but of unequal ratios of equivalent resistance to equivalent reactance the maximum amount by which the load can be increased is very small. The worst condition that can arise is where transformers with a combined rated output equal to one-half of the total have the same ratio of equivalent resistance to equivalent reactance, which ratio is a minimum, and the other half likewise have the same ratio of equivalent resistance to equivalent reactance, which ratio is a maximum. In transformers of large sizes the ratio of equivalent reactance to equivalent resistance may vary from about 2:1 to about 6:1. In this case the total current will be divided into two equal components, one of which makes an angle of $\tan^{-1} 2$ and the other angle of $\tan^{-1} 6$ with an axis of reference. Thus the angle between these two components is approximately 17 deg. The fractional increase in the total load that can be carried by readjusting the equivalent resistances and the equivalent reactances so that they are in the same ratio for all of the transformers is

$$\frac{1}{\cos\left(\frac{17^\circ}{2}\right)} - 1 = 0.011$$

In transformers of small rated output the ratio of equivalent reactance to equivalent resistance may vary from about 1:2 to about 2:1. In this case the angle between the components is

$$(\tan^{-1} 2. - \tan^{-1} 0.5) = 37 \text{ deg.}$$

The maximum fractional increase in the load that could be obtained would then be

$$\frac{1}{\cos\left(\frac{37^\circ}{2}\right)} - 1 = 0.05$$

Thus, compared with the effect of unequal equivalent impedance drops, the effect of unequal ratios of equivalent resistance to equivalent reactance is negligible.

It only remains to give an illustration of how this method of analysis would be applied in practice. The transformers which are used for this purpose are hypothetical ones but their constants are within the limits of what is met in practice. In fact, they have the same per cent equivalent impedance volts and the same ratio of equivalent resistance to equivalent reactance as do some actual transformers. They have been chosen to show what will be the result if dissimilar transformers are operated in parallel.

The problem is to determine the current in each transformer when they take a combined load of 2000 kva at 0.90 power-factor from an 11,000-volt circuit. The load will be considered inductive. The ratios of transformation are given by the ratios of turns and are:

$$a_1 = 4.781$$
$$a_2 = 4.778$$
$$a_3 = 4.794$$

The numerical values of the equivalent admittances are given by $\left(\frac{I}{E}\right)$ at short circuit. The equivalent conductances are given by $\left(\frac{P}{E^2}\right)$.

$$y_1 = 0.1318 \qquad g_1 = 0.02835$$
$$y_2 = 0.1580 \qquad g_2 = 0.05642$$
$$y_3 = 0.1688 \qquad g_3 = 0.02578$$

The equivalent susceptances are given by $\sqrt{y^2 - g^2}$, which in this case can be approximated by the formula

$$b = y - \frac{1}{2}\frac{g^2}{y}$$

$$b_1 = 0.1286$$
$$b_2 = 0.1480$$
$$b_3 = 0.1668$$

The complex expressions for the equivalent admittances may now be written:

$$y_1 = 0.02835 - j\,0.1286$$
$$y_2 = 0.05642 - j\,0.1480$$
$$y_3 = 0.02578 - j\,0.1668$$

From these expressions the joint parallel equivalent admittance is found by addition.

$$y_0 = 0.1105 - j\,0.4434$$

In order to find the value of the expression Σay, each equivalent admittance is multiplied by the corresponding ratio of transformation and the results added.

$$a_1y_1 = 0.1355 - j\,0.6150$$
$$a_2y_2 = 0.2696 - j\,0.7072$$
$$a_3y_3 = 0.1236 - j\,0.8000$$
$$\Sigma ay = 0.5287 - j\,2.122$$

The total current, I_0, is $2{,}000{,}000 \div 11{,}000 = 182$ amp. It is preferable to take this current as along the axis of reference so that its complex expression is:

$$I_0 = 182 + j0$$

If the current is taken along the axis, the complex expression for the primary coltage, V_1, is

$$V_1 = 9900 + j\,4795$$

In the equation (3) for the complete value of the current there are the expressions $\left(\frac{I_0}{\Sigma ay}\right)$ and $\left(\frac{V_1Y_0}{\Sigma ay}\right)$ that are constant.

$$\left(\frac{I_0}{\Sigma ay}\right) = \frac{182 + j\,0}{0.5287 - j\,2.122} = 20.14 + j\,80.9$$

$$\frac{V_1Y_0}{\Sigma ay} = \frac{(9900 + j\,4795)\ (0.1106 - j\,0.4434)}{0.5287 - j\,2.122}$$
$$= 2067 + j\,1002$$

We can now calculate the currents in each of the transformers by equation (3)

$$I_1 = (0.1355 - j\,0.6150)\,(20.14 + j\,80.9) + (0.02835 - j\,0.1286)\,(9900 + j\,4795 - 4.781\,(2067 + j\,1002))$$

$$I_1 = 53.1 - j\,1.9$$
$$= 53.1 \text{ amp}$$

$$I_2 = (0.2696 - j\,0.7072)\,(20.14 + j\,80.9) + (0.05642 - j\,0.1480)\,(9900 + j\,4795 - 4.778\,(2067 + j\,1002))$$

$$I_2 = 64.3 + j\,6.3$$
$$= 64.6 \text{ amp}$$

$$I_3 = (0.1236 - j\,0.800)\,(20.14 + j\,80.9) + (0.02578 - j\,0.1668)\,(9900 + j\,4795 - 4.794\,(2067 + j\,1002))$$

$$I_3 = 65.4 - j\,4.5$$
$$= 65.6 \text{ amp.}$$

The sum of the currents is

$$182.8 - j\,0.1$$

The errors in the calculation thus amount to about 0.5 per cent, but considerable care must be exercised in finding the value of the second term in the equation for the current in order to check as closely as this.

Assume now that the ratios of transformation are equal. The currents are then determined by equation (1).

$$I_1 = \frac{(0.02835 - j\,0.1286)}{(0.1106 - j\,0.4434)}\,(182 + j\,0)$$

$$I_1 = 52.4 - j\,1.5$$
$$= 52.4 \text{ amp}$$

$$I_2 = \frac{(0.05642 - j\,0.1480)}{(0.1106 - j\,0.4434)}\,(182 + j\,0)$$

$$I_2 = 62.6 + j\,7.5$$
$$= 63.1 \text{ amp}$$

$$I_3 = \frac{(0.02578 - j\,0.1668)}{(0.1106 - j\,0.4434)}\,(182 + j\,0)$$

$$I_3 = 66.9 - j\,6.1$$
$$= 67.2 \text{ amp.}$$

In this case a variation of about 0.2 per cent from the average ratio of transformation makes an average difference of about 2 per cent in the currents. Such variations in the ratio of transformation are not important, as the variations in the current that they produce are about within the error of the method of calculation.

The components, B, in the several transformers are

$$B_1 = 0.7 - j\,0.4$$
$$B_2 = 0.7 - j\,0.8$$
$$B_3 = -1.5 + j\,1.6$$

The sum of these components is not zero, owing to the errors in the calculations. The greatest error that would be introduced by assuming equal ratios of transformation is in the case of the third transformer, where the current would be about 2 per cent too large. If the ratios of equivalent resistance to equivalent reactance had been the same for all the transformers, the currents would have been given by equation (4) as:

$$I_1 = \frac{0.1318}{0.4586}\,(182 + j\,0)$$

$$I_1 = 52.5 + j\,0$$

$$I_2 = \frac{0.1580}{0.4586}\,(182 + j\,0)$$

$$I_2 = 62.9 + j\,0$$

$$I_3 = \frac{0.1688}{0.4586}\,(182 + j\,0)$$

$$I_3 = 66.5 + j\,0$$

$$\Sigma y = 0.1318 + 0.1580 + 0.1688$$
$$= 0.4586.$$

The components C in the several transformers are given by equation (5) as:

$$C_1 = -0.1 - j\,1.5$$
$$C_2 = -0.3 + j\,7.5$$
$$C_3 = +0.4 - j\,6.1$$

The greatest error introduced by making the assumption of equal ratios of equivalent resistance to equivalent reactance is about 1 per cent in the current in the third transformer.

If the transformers had had equal equivalent impedance drops at their rated output, the currents in the several transformers would have been given by equation (6) as:

$$I_1 = \left(\frac{45.5}{182}\right)(182) = 45.5$$

$$I_2 = \left(\frac{45.5}{182}\right)(182) = 45.5$$

$$I_3 = \left(\frac{91}{182}\right)(182) = 91$$

The components D in the several transformers are given by equation (7) as:

$$D_1 = 7.0$$
$$D_2 = 17.4$$
$$D_3 = -24.5$$

These then are the components of the currents which are most important and are the only ones that need serious consideration. For this load the first two transformers are considerably overloaded, while the third is operating at only 73 per cent of its rated output.

The maximum total load that these transformers will deliver is determined by the second one, since it has the smallest equivalent impedance volts at full load. This maximum load is given by equation (9) and is

$$I_0 = \left(\frac{0.4571}{0.1580}\right)(45.5)$$
$$= 131.6 \text{ amp}$$
$$[0.4571 = Y_0]$$

This is 72.2 per cent of their combined rated outputs. If the equivalent impedance volts at full load are made equal by adding reactors to the first and second transformers, their combined permissible output can be increased by about 550 kw.

If the ratios of equivalent resistance to equivalent reactance had been the same, the output would have been

$$\frac{0.4586}{0.4571}\,131.6 = 132.$$

This makes a negligible change in the output.

In general, it appears that a good degree of approximation will be attained if it be assumed that the ratios of transformation are equal and that the ratios of equivalent resistance to equivalent reactance are the same for all of the transformers.

Versatile Electrical Devices

To the member of the Philadelphia Electric Company Section of the National Electric Light Association naming the greatest number of electrical devices and the greatest number of practical uses to which these appliances could be put an award known as the John Meyer prize was recently offered. At the close of the contest Mr. R. L. Lloyd was named winner, having enumerated 193 appliances, of which seven have twenty-four practical applications. Honorable mention was accorded to Mr. R. B. Ely, who enumerated 116 appliances, of which ten have twenty practical uses, and to Mr. Daniel A. Fitzgerald, who presented a list of 175.

The Silver Voltameter—Part IV

BY E. B. ROSA, G. W. VINAL AND A. S. MCDANIEL

In the three papers preceding this one[*] the course of the work has been traced from its beginning in 1908 until the International Technical Committee met in Washington in April, 1910, to carry out a joint investigation of the voltameter and to determine the voltage of the Weston normal cell in terms of the international ohm and the international ampere, the latter being derived from the silver voltameter. The object of the present work was to make a further comparison of the porous cup and Smith forms of voltameter, since these had been found the most reliable forms during the committee's work, and to make such other experiments as might afford data for the voltameter specifications not yet adopted.

The international committee fixed the voltage of the cell to five significant figures (1.0183 volts at 20 deg. C.), but it is desirable to reach an accuracy sufficient to justify recording six figures, since the voltameter is a primary standard. Results are expressed as the voltage of the normal Weston cell at 20 deg. computed from the defined electrochemical equivalent of silver, 1.11800 mg per coulomb.

The procedure was according to the best methods learned from previous work. In all cases the electrolyte was carefully tested for its purity and the acidity determined. The voltameters used were chiefly the porous pot and Smith's form, but on several occasions the siphon form was used as well as the modified ring-shaped siphon and the Poggendorff form.

Since it was learned from previous work that the effect of acid in pure electrolyte is to lower the deposit, the authors sought to find, if possible, a quantitative relation between the amount of acid expressed in equivalents of HNO_3 per million (X) and the decrease in deposit also expressed in parts per million (Y). As a result of a large number of comparisons of neutral voltameters with others made acid by varying amounts, the following relation has been found

$$Y = -4.5\,X + 0.02\,X^2$$

which, it is thought, is justified by the figures given in the complete paper.[†]

For acidities below ten parts per million the square term is of course unnecessary. The above equation was used in computing a correction to each deposit, but this correction was very small in all cases for the results given below. The result of 156 deposits in the porous cup form is 1.01826_7 volts. The average deviation of a single observation from the mean is 0.00003_0 and the computed probable error of a single observation is 0.00002_5. The probable error of the mean result is 0.00000_2.

The result of fifty-five deposits in the Smith form is 1.01827_4 volts. The average deviation of a single observation from the mean is 0.00004_0 and the computed probable error of a single observation is 0.00003_4. The probable error of the mean result is 0.00000_5.

The mean of the porous-pot form and the Smith form is therefore 1.01827 volts, which is given as the final result. The electrolyte was so pure that no volume effect was observed in either form of voltameter.

With other forms of voltameter the following results have been obtained: Siphon form (relative experiments, five observations), 1.01832; modified siphon (seven observations), 1.01835; Poggendorff form (nine observations), 1.01830. The results with five forms of voltameter all confirm the decision of the international committee, but the difficulties arising from the anode slime in the last two make them more uncertain and difficult to use. The siphon voltameter requires so much electrolyte that the presence of the slightest trace of impurity increases the "volume effect" noted previously in several other forms.

A number of miscellaneous observations were made on the effect of various impurities, but mention need only be made here of the excessive deposits obtained when considerable CO_2 is present in the atmosphere above the voltameters. Two possible theories are given in the complete paper to account for the slight difference occasionally appearing in the deposit between the Smith form and the porous-cup form.

A further study of the effect of acid on solutions known to be impure has shown the effect to be quite variable, depending on the nature of the impurity. This fact, it is believed, accounts for much of the conflicting opinion found in the literature on this subject. The authors have endeavored to find just what the action of acid is by which it reduces the deposit from pure electrolyte, but the results obtained by them are chiefly negative. It seemed possible that in the case of an electrolyte appreciably acid the decrease might be due to a depositing out of the hydrogen ions before the silver begins to deposit, since there is probably at the instant the current begins to flow a greater difference of potential at the cathode than obtains later, as the discontinuous character of the deposit indicates that the potential difference must break through a sort of surface film and establish outlets for the current to the platinum cathode. If this were possible, by making deposits of about 1 mg each from solutions containing acid and without acid the difference ought to be apparent. This the authors have done for varying lengths of deposit, measuring the silver by titration with ammonium sulphocyanate. The results showed always an agreement of both deposits between themselves and with the computed value for the silver within the experimental error. But when oxygen was electrolyzed into the platinum cathode for four hours previous to making a deposit a loss of about 0.2 mg was observed. This was not again found on subsequently using the bowl unless it had been oxygenated as before.

A careful study was made of the effect of various septa other than filter paper on the voltameter. First raw silk was investigated. In extracting raw silk in neutral double distilled water it was found that the extract was distinctly basic toward iodeosine and the concentracted extracts will restore the color to a magneta solution previously decolorized by sulphurous acid, thus indicating the presence of an aldehyde. The approximate turning point of iodeosine in ether water solution has been determined to be at $[H+] = 10^{-6}$. The colloidal character of the solutions was ascertained by the ultra-microscope. After prolonged washing or use in the voltameter the so-called "silk glue" which probably gives rise to the above effect is eliminated and a hydrolytic process into amino acids becomes predominant, causing a reverse action in the voltameters. The authors have never claimed that these two actions are evident at the same time, as implied recently by von Steinwehr, and think that silk like filter paper should be excluded from use in the silver voltameter.

The experimental evidence indicates that porous pots, if properly prepared, are without influence on silver nitrate. A new pot or one that has been baked may contain free alkali which must be washed out with nitric acid and water until perfectly neutral and then several portions of silver nitrate filtered through the pores until the equilibrium between the pot and solution is obtained, since at the beginning the pot may act as a catalyzer, to reduce a very small amount of solution. After being properly prepared there is no evidence of stenolysis or other abnormality in the ordinary use.

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[*] "The Silver Voltameter," Part I, *Electrical World*, Dec. 14, 1912, page 1261; Part II, Dec. 14, 1912, page 1262; Part III, Jan. 11, 1913, page 84.

[†] Von Steinwehr's recently expressed opinion to the contrary (*Instrumentenkunde*, November, 1913) was based on earlier work which was not so conclusive as our recent work.

The question of the purity of the deposited silver is an important one, but the conflicting evidence in the literature does not enable one to decide even whether inclusions are present or not. The uniformity of the results obtained in three series of experiments suggests that the inclusions must be very small or surprisingly constant in amount. It seems that inclusions, if present, would be between crystals rather than in a crystal perfectly formed according to the cubic system, and hence greater inclusions are to be expected in deposits which are less crystalline because of the action of colloids.

An endeavor has been made to detect the presence of $AgNO$ in the deposits by amalgamating them with mercury, then washing the amalgam and testing for nitrates by phenol sulphonic acid. The blank experiments, adding $AgNO_3$ to the amalgam after precipitating any mercury and silver salts present, worked satisfactorily, but no appreciable $AgNO_3$ in the best deposits has been detected, although a trace was found in striated deposits. If considerable filter paper was used, some organic matter was visible after amalgamating the deposit. The authors tried to determine the water content of a striated deposit having an excess weight over a normal deposit of 0.56 mg by alloying the deposit to the platinum crucible in which it was made over an alcohol blast, and found a loss of 0.53 mg which previous experiment showed was not due to the change in the platinum crucible alone. Inasmuch as no further experiments were made the result is not considered conclusive.

The reactions in the voltameter have not generally been considered as reversible—that is, an equivalence of the loss in weight at the anode and gain at the cathode—but since previous work had shown that the supposed complex reactions at the anode do not probably exist, the possibility of reversibility was examined. For an anode a heavy deposit contained in a large platinum bowl was used and the electrolyte connected in this through a siphon to a second bowl serving as cathode. First, the progressive change in acidity of the anode solution was measured as electrolysis took place and it was found that practically no change of acidity occurs until the silver on the anode was reduced to about 0.5 gram, after which it rose very abruptly. Next the potential difference between the anode and an intermediate electrode was measured, and this was also found to be constant until about 2.5 grams of silver remained. The question was then examined quantitatively, with the results shown in the accompanying table.

The results show a surprising agreement. These were made using a pure crystalline deposit for the anode. With a striated deposit made from a filter paper contaminated solution the result was very different. The anode turned dark and had a very large amount of slime, all of which was collected and added to the bowl. The results from using a pure solution and this impure anode are as follows:

Anode lost	2095.43 mg
Cathode gained	2092.21 mg
Standard voltameter	2091.83 mg

The conclusion leaves no room for doubt that the purity of the anode is essential in such an experiment, and this should be considered in voltameter work in general.

The authors have added to the complete paper a further discussion of the volume effect (see Part III) in reply to von Steinwehr's criticisms (*Zeit. f. Instr.*, November, 1913) and have shown that this phenomenon of excess deposit in large bowls over small bowls, when impure electrolyte is used, is not confined to the porous-cup form, as von Steinwehr asserts, but has been observed in the filter paper form by Schuster and Crossley and in the siphon and Smith forms by ourselves. This troublesome volume effect has been overcome by purifying the electrolyte. Great stress is placed on the purity of the electrolyte used in obtaining the results recorded. This question of the purity of the electrolyte has received less attention from previous observers than it deserves. The methods for purifying silver nitrate have been described in Part III of this series of papers.

QUANTITATIVE RESULTS OF EXPERIMENT

Weight of Silver on Anode Bowl, Grams	Current, Amp	Loss at Anode, Mg	Gain at Cathode, Mg	Deposit in Standard Voltameter, Mg
8	0.500	2164.81	2164.78	2164.81
9	0.500	2092.12	2091.92	2091.83

Moderate Power Requirements of Automobile Lighting Outfits

At the meeting of the Detroit-Ann Arbor Section, A. I. E. E., held at Detroit, Mich., recently Prof. Benjamin F. Bailey, University of Michigan, read a paper on "The Electrical Equipment of the Gasoline Automobile," describing types of electric generators and cranking motors used on automobiles and comparing their characteristics of efficiency, reliability and limitations in design. Data were also presented to disprove assertions which have been made that electric-lighting outfits increase the fuel consumption of automobile engines from 10 to 12 per cent.

On a road test conducted by Professor Bailey it was found that the mileage per gallon of gasoline of a 1700-lb. automobile was reduced only 2 per cent at the most by connecting a lighting generator to the engine. Another experiment made by alternately connecting and disconnecting the automobile engine to a fully loaded lighting generator while the car was running at a definite speed failed to show any appreciable change in the speed of the car.

Several members of the Society of Automobile Engineers took part in the discussion which followed.

Mr. A. H. Knight assistant engineer Packard Automobile Company, Detroit, corroborated Professor Bailey's findings by saying that the Packard company was unable to detect any change in mileage per gallon of gasoline even after making 200-hour tests on gasoline engines with and without the lighting equipment attached. Experiments conducted on the Indianapolis (Ind.) Motor Speedway also failed to reveal any appreciable increase in fuel consumption due to the generator load.

Mr. H. L. Connell described briefly a new electric gear-shift which is just being placed on the market. With this new device, it is declared that about forty-five gear movements can be made with an expenditure of only 1 amp-hr. of electricity at 6 volts.

Mr. W. H. Conant, Gould Storage Battery Company, New York City, discussed battery life and explained how it may be increased. He said that prolonged overcharging at high rates causes rapid deterioration of a battery by overheating the plates.

Messrs. J. O. Heinze, chief engineer Northway Motor Company, and J. G. Vincent, Packard Automobile Company, also took part in the discussion.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Growth of Electric Service in Muskogee, Okla.

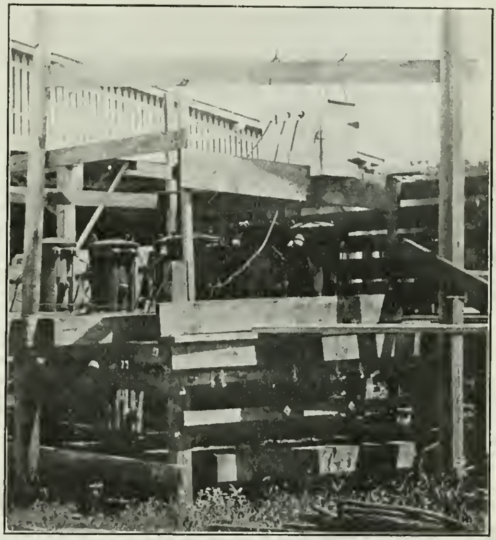
In the period of seven years that elapsed from Jan. 1, 1907, to Jan. 1, 1914, the population of Muskogee, Okla., increased about 50 per cent, whereas the number of electric-service customers of the Muskogee Gas & Electric Company increased 173 per cent. The lighting load increased from 949 kw to 4021 kw in the seven years, showing a growth of 323 per cent. The motor load increased from 478 hp to 2453 hp, a growth of 413 per cent. The total connected load of all kinds was slightly over 6000 kw at the end of 1913. There were seventeen inhabitants per electric-service meter in 1907, compared with nine and one-third inhabitants seven years later. It is interesting to note that the number of inhabitants per gas meter on Jan. 1, 1914, was five and two-fifths. The Muskogee property is managed by H. M. Byllesby & Company.

Selling Electrically Irrigated Farms in California

From Mr. A. J. Rosborough, general manager of the California-Oregon Power Company, San Francisco, Cal., an interesting account has been received of the application of electric pumping to the irrigation problems of the neighboring country. Mr. Rosborough's letter reads in part as follows: "One great factor in the development of electricity on the Pacific Coast is its use for electric pumping and other farm service. During the year 1913 two projects were started in northern California for the subdivision of large tracts of land, formerly used for stock grazing, into farms of from 40 acres to 140 acres each. The company undertaking these projects set about them in a very businesslike manner. First the land was plowed and sown to alfalfa; then two large electrically driven pumps were installed, one of sufficient size and capacity to lift the water 85 ft. into a main ditch, which with laterals fed an area of over 3000 acres, the other pump being employed to lift water another 65 ft., supplying irrigation to an additional 1500 acres. After this the company purchased blooded hogs and began breeding them, and the farms were opened to settlement. The settler had his choice of location and the company fenced in the section selected, built a house and barn, wiring both for electricity, delivered the required number of hogs, and took a small initial payment, selling the land at a moderate price. The farmer was thus put on a paying basis at the start and furnished with a possible source of steady income. This year the same company intends to put 8000 acres under irrigation and to sell it in a similar manner. In one of the adjoining valleys 20,000 acres are being cleared and subdivided and will be sold on a like plan, and there are other projects of this nature under way." The California-Oregon Power Company supplies the energy for much of this summer pumping and, according to Mr. Rosborough, it plans to build up a corresponding load for the winter months, consisting of electrical heating and the operation of agricultural machinery.

Prompt Emergency Service Secures New Business

The accompanying illustration shows a temporary bank of six small transformers hastily collected and installed by a Southern central-station company to furnish 275 hp of emergency motor service to a local lumber mill when the latter's isolated plant burned. As a result of the prompt emergency service thus rendered the central-station company shortly afterward secured a contract for supplying all of the energy used in the lumber mill, and the burned isolated plant was never replaced.



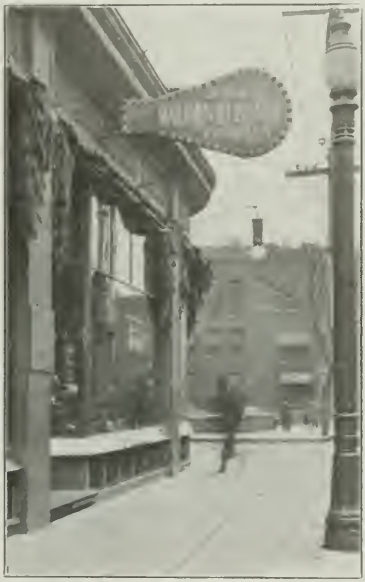
TEMPORARY BANK OF SMALL TRANSFORMERS FURNISHING SERVICE TO LUMBER MILL

What One Information Bureau Does

At a recent meeting of the Commonwealth Edison Company Section of the N. E. L. A. Mr. W. R. White gave some rather interesting information about the work of the information bureau of that company. This department answers both inquiries at the information window on the ground floor of the company's headquarters building and questions that come over the telephone. It also handles the incoming and outgoing United States mail and maintains a messenger service between the various office buildings, stations, substations, garages, warehouses, etc., of the company scattered all over the city. About 600 inquiries are answered each day. The outgoing mail is put through a motor-driven machine called the "mailometer," by which letters are sealed, stamped and counted. An average of about 6000 pieces of outgoing mail are thus handled daily, although as many as 9000 have been sent out in one day. The incoming letters are opened by a motor-driven machine which saws off the ends of the envelopes. Often 5000 or more of the incoming letters handled daily contain checks. About 6000 pieces of inter-department mail are handled by messengers each day.

An Appropriate Central-Station Office Sign

Before its main office and pay stations the Malden (Mass.) Electric Company employs an appropriate form of electric sign which, as illustrated in the accompanying photograph, emphasizes the company's readiness to supply lighting service. At the main office the sign of incandescent-lamp shape used measures about 6 ft. long and 30 in. high, and is bordered with forty-six 5-watt, 11-volt frosted lamps on each side. Signs about half this size are suspended over the entrances of the company's collection agencies. This similarity of emblems employed in the various localities served by the company has been found to be of excellent advertising value.



CENTRAL-STATION SIGN USED BY MALDEN (MASS.) ELECTRIC COMPANY

Municipal Plant to Purchase Energy

The Minnesota-Wisconsin Power Corporation, a subsidiary of the American Public Utilities Company, of Grand Rapids, Mich., has closed a contract with the municipality of Lake City, Minn., for furnishing the local municipal plant with energy for light and motor service. The Minnesota-Wisconsin Power Corporation has also completed arrangements to furnish the towns of Prescott and Hastings, Minn., with electricity.

The Red Wing Gas, Light & Power Company, a subsidiary, has contracted for the city pumping at Red Wing. The pump installed will supply approximately 2,000,000 gal. of water a day.

Methods of Displaying Fixtures in Electric Shop

The new salesrooms just opened at Jackson, Mich., by the Commonwealth Power Company have been specially equipped to display the merits of individual fixtures. Where formerly only two rooms were devoted to the exhibit of appliances and fixtures, three connecting rooms are now used, each having about 400 sq. ft. of floor area. One room is employed exclusively for the exhibition of ceiling and wall fixtures, while the other two contain cooking utensils and other electric household appliances in addition to pendent fixtures.

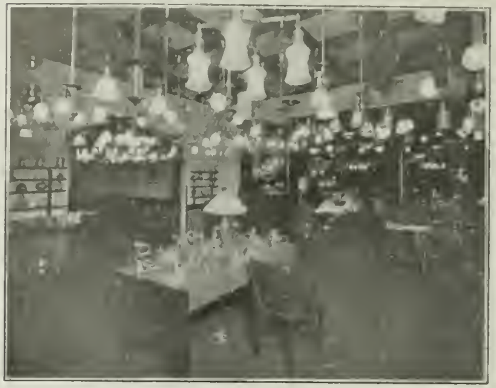


FIG. 1—FIXTURE DISPLAY ROOM, SHOWING HOW CEILING PIECES ARE SUPPORTED

The two last-mentioned rooms, as shown in Fig. 1, are separated from each other by only a low oak partition which is capped on each side of the connecting passage by columns of the same material. The rest of the woodwork is also a dark-stained oak. Around the sides of the two appliance rooms are open wallcases. The heavy oak slabs forming the top of these cases support various appliances which are demonstrated in action by connecting them with plug receptacles in the wall. Beneath the slabs are spaces which are open to the view and are used to hold apparatus which does not ordinarily require to be demonstrated in order to be sold.

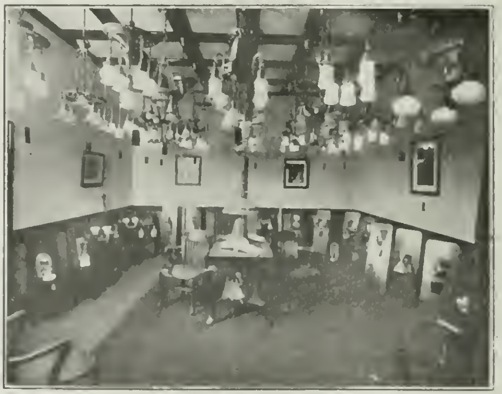


FIG. 2—FIXTURE DISPLAY ROOM, SHOWING PORTABLE DISPLAY PANELS

The ceilings of each room are divided by heavy oak strips into bays 33 in. wide and 44 in. long. At each intersection in this lattice-work are ceiling outlets and hooks for supporting pendent fixtures. The fixtures are fastened to the hooks by insulating joints and are connected with the service outlets through split-plug connectors. With this method of suspension a fixture can be easily removed from its support for examination or for replacement. Although 107 fixtures are suspended from the ceilings, the crowded appearance usually existing in appliance rooms is absent here.

Special pains have been taken to give the rooms a homelike appearance by the proper choice of furnishings. In the center of each room is a library table and on it a table lamp. Care is taken in choosing the central ceiling fixture as it is kept lighted all the time and is therefore most prominent. Plenty of chairs are available in each room for the use of prospective customers who may remain seated while the fixtures are being shown. Luminous heaters are kept burning where they are in full view of persons entering the rooms, and give a warm, homelike glow to the place.

For displaying wall fixtures eighteen portable panels like the one shown in Fig. 3 are used. A detailed description of one of these appeared in the issue of the *Electrical World* for Nov. 29, 1913. These display boards, it is declared, have brought better results in disposing of old stock than any other scheme which the company has tried in the last few years.

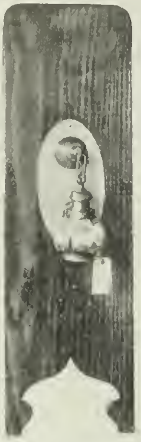


FIG. 3—PORTABLE DISPLAY PANEL

Opening off from the salesrooms are a stockroom and a fixture-assembling room which adjoin. The storeroom is spacious and the stock is stored systematically so that extra fitings may be obtained readily. When an order for a large number of fixtures is to be furnished by this company they are ordered in parts from the manufacturer and assembled in the room adjoining the stockroom.

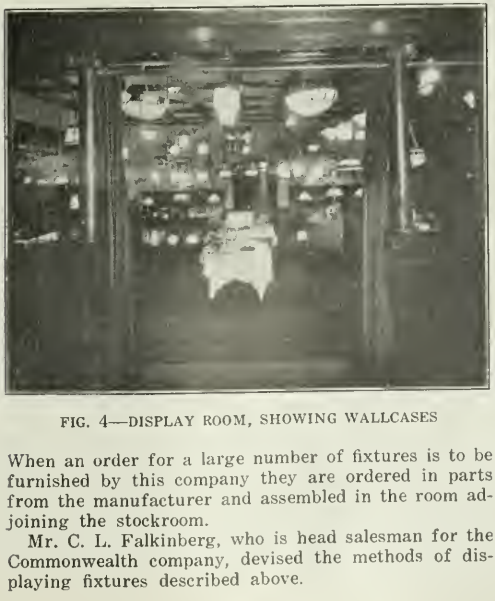


FIG. 4—DISPLAY ROOM, SHOWING WALLCASES

Mr. C. L. Falkinberg, who is head salesman for the Commonwealth company, devised the methods of displaying fixtures described above.

Merchants' Associations Install and Operate Ornamental Lighting at Davenport, Ia.

When ornamental street lighting is to be installed, some scheme of co-operation among the merchants of the district to be improved can usually be carried out with considerable success. At Davenport, Ia., the electric-service company has gone even a step further with this policy, and after the merchants' associations have been formed for the purpose of erecting ornamental lighting units and have accomplished their purpose the organization is kept intact to maintain the installations. Officers of the associations are elected regularly, the principal official being the secretary. Through him the electric company deals with the organization, and thus ornamental street lighting is billed from the company's books in portions no smaller than one city block.

As rapidly as a group of merchants in any block of the city is ready for ornamental lighting, associations are formed to deal with the company. Under contracts now in force the lamps are lighted from dusk till 10 o'clock six nights of the week, and on Saturday until midnight. The charge for energy and maintenance of five-lamp clusters, where there are sixteen posts to the block, averages 8 cents a front foot.

More "White Way" Lighting at Kansas City, Mo.

For many years the streets of the business district of Kansas City, Mo., have been well lighted by tungsten and arc lamps, and now the popularity of this "white-way" lighting has spread outside the intensified business center to districts where the streets were formerly illuminated by gas. Among these new installations is one comprising several blocks of street lighting on East Fifteenth Street. These units are of a type similar to the four-lamp brackets carried by the trolley poles in the main part of the city. The lamps will be arranged on two circuits, the one over the sidewalk being operated all night and the other three until midnight.

The illustration herewith shows one of Kansas City's business thoroughfares lighted by the early incandescent bracket clusters. These units, each consisting of a cluster of lamps beneath a shade and a single frosted-globe lamp above, were among the first "white way" standards to be erected in the city about eight years ago. Practically all of the early installation are still intact.

ORNAMENTAL AND SIGN LIGHTING, KANSAS CITY, MO.

Illumination and Wiring

Economical Garage Sign

At a Newton (Mass.) garage the electric sign shown herewith has lately been installed, its chief features being its equal effectiveness both by day and by night and the low energy consumption required in consideration of its size. The sign is about 4 ft. 6 in. long and 30 in. high, and consists of two sections, one of which is transparent and the other reflecting in operation. The upper section contains on each side a panel of blue glass with white letters, behind which are mounted three 25-watt tungsten lamps in the center of the sign box. Depending from the center of the sign is a double-faced panel 12 in. high, carrying the word "Garage" in blue letters on a white background. The interior lamps suffice to illuminate both sides of this panel at once, and in a like manner both transparencies are lighted. The bottom of the lower panel is carried about 9 ft. above the street and the sign box is 15 in. in width. Flexible conduit carries the wiring and the lamps are controlled by a single switch mounted just inside the garage. As the establishment is situated on a narrow side street, the economical sign illustrated has been a decided factor in bringing business to its door.

GARAGE SIGN AT NEWTON, MASS.

Tables of Wire Sizes and Starting Fuses for Induction Motors

The committee on the installation and operation of induction motors of the Western Association of Electrical Inspectors has prepared a number of tables giving the rating, full-load current, size of starting fuses and wire sizes with rubber and other insulation for induction motors of all frequencies and standard speeds and for standard voltages. The two principal rules which govern the size of wire to be used in connection with alternating-current motors are Rule 23 e and Rule 68 h. The accompanying tables, in the preparation of which these rules were taken into account, are based on the assumption that induction motors are started under 100 per cent load and that starting devices are used on motors larger than 5 hp. The question of drop is not taken into consideration at all.

It will be noted that provision is made for insulations other than rubber, since there seems to be no rule for the fusing of wire having slow-burning weatherproof or slow-burning insulation which makes any concession for this class of work. Owing to the fact that such wire is always exposed, is never installed in conduit and permits greater radiation, in the estimation of the committee it should be permissible to make the same reduction from Table B as is made between Tables A and B of the Code rules governing the allowable current-carrying capacities of wires. In determining the proper size of fuses to protect any apparatus, the overload time element should be considered in connection with the smallest current likely to prove dangerous to the apparatus. Where induction motors require at starting current several times more than a full-load value, fuses which will carry the starting current will not give much protection to the motor except against a short-circuit. The American Motor Manufacturers' Association has adopted a standard guarantee of 25 per cent overload for two hours, and the motor leads and auxiliary apparatus should be designed for this overload. Certain motors used for intermittent service such as valves, cranes, hoists, etc., require an overload capacity of 200 per cent for short periods of time, and the overload protection should be rated accordingly. For ordinary service, motors should be protected by a fuse rated at 25 per cent more than the normal full-load current of the motor, which will insure the fuse opening of the circuit at approximately 50 per cent overload. For motors of intermittent rating, such as variable-speed motors, fuses rated at 60 per cent more than the normal thirty minutes current rating of the motor should be used, which will insure that the fuse will open the circuit on a continued overload of 200 per cent.

TABLE I—SINGLE-PHASE, 110-VOLT INDUCTION MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins.
1	13.3	35	8	10
2	24.8	65	6	8
3	36.	90	4	6
4	47.2	125	2	3
5	58.4	160	0	2
7½	85.2	225	00	0
10	110.	300	Circ. Mil 200,000	00
15	162.	400	300,000	0000

TABLE II—SINGLE-PHASE, 220-VOLT INDUCTION MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins
1	6.65	25	12	14
2	12.4	30	10	12
3	18.	50	8	8
4	23.6	65	6	8
5	29.2	80	4	6
7½	42.6	120	2	3
10	55.	150	1	2
15	81	220	00	0

TABLE III—TWO-PHASE, 110-VOLT, FOUR-WIRE MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins.
1	6.04	20	14	14
2	11.2	35	10	12
3	14.7	50	8	8
4	21.6	70	6	8
5	28.6	90	4	6
7½	38.8	100	3	5
10	50.2	130	1	2
15	73.4	190	0	1
20	95.	250	000	0
25	118.	310	0000	00
			Circ. Mil	
30	138.	360	300,000	000
35	162.	430	350,000	0000
				Circ. Mil
40	182.	480	400,000	250,000
50	224.	590	500,000	350,000
60	268.	700	650,000	450,000
75	332.	890	900,000	600,000

TABLE IV—TWO-PHASE, 220-VOLT, FOUR-WIRE MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins.
1	3.02	10	14	14
2	5.6	20	14	14
3	7.35	25	12	14
4	10.8	30	10	12
5	14.3	40	8	10
7½	19.4	50	8	8
10	25.1	60	6	8
15	36.7	90	4	6
20	47.5	125	2	3
25	59.	150	1	2
30	69.	180	0	1
35	81.3	200	00	1
40	91.	240	000	0
			Circ. Mil	
50	112.	300	200,000	00
60	134.	350	250,000	000
				Circ. Mil
75	166.	440	350,000	250,000
100	218.	580	500,000	350,000
125	268.	700	650,000	450,000
150	320.	850	850,000	550,000
200	418.	1100	1,200,000	800,000

TABLE V—TWO-PHASE, 440-VOLT, FOUR-WIRE MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins.
1	1.51	5	14	14
2	2.8	10	14	14
3	4.6	15	14	14
4	5.4	20	12	14
5	7.15	25	12	14
7½	9.7	25	12	14
10	12.5	30	10	12
15	18.35	45	8	8
20	23.75	60	6	8
25	29.5	80	5	6
30	34.5	90	4	6
35	40.5	100	3	5
40	45.5	120	2	3
50	56.	135	1	2
60	67.	180	0	1
75	83.	200	00	0
			Circ. Mil	
100	109.	290	200,000	00
125	134.	370	300,000	000
150	160.	420	350,000	0000
				Circ. Mil
175	183.5	490	400,000	300,000
200	209.	550	450,000	350,000

TABLE VI—THREE-PHASE, 110-VOLT INDUCTION MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins.
1	7.	25	12	14
2	13.	40	8	10
3	19.	60	6	8
4	25.	80	5	6
5	30.8	100	4	5
7½	44.8	120	2	3
10	58.	150	1	2
15	85.	225	00	0
			Circ. Mil	
20	110.	300	200,000	00
25	136.	360	250,000	000
30	160.	430	350,000	0000
				Circ. Mil
35	188.	500	400,000	300,000
40	210.	560	450,000	350,000
50	260.	680	600,000	400,000
60	310.	820	800,000	550,000
75	384.	1000	1,000,000	700,000

TABLE VII—THREE-PHASE, 220-VOLT INDUCTION MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins.
1	3.5	10	14	14
2	6.5	20	12	14
3	9.5	30	10	12
4	12.5	40	8	10
5	15.4	50	8	10
7½	22.4	60	6	8
10	29.	75	4	8
15	42.5	100	3	6
20	55.	140	2	4
25	68.	175	0	2
30	80.	200	0	2
35	94.	250	00	1
40	105.	275	000	0
			Circ. Mil	
50	130.	350	250,000	000
				Circ. Mil
60	155.	400	300,000	200,000
75	192.	500	400,000	300,000
100	252.	650	600,000	400,000
150	368.	1000	1,000,000	700,000
200	484.	1200	1,400,000	900,000

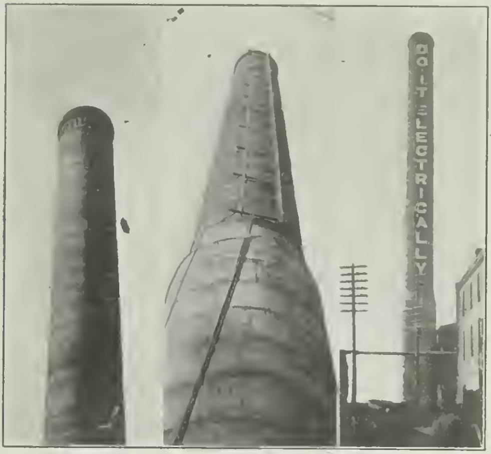
TABLE VIII—THREE-PHASE, 440-VOLT INDUCTION MOTORS

Hp	Full Load, Amp	Starting Fuse, Amp	Wire Sizes, B. & S. Gage	
			Rubber Ins.	Other Ins.
1	1.75	5	14	14
2	3.25	10	14	14
3	4.75	15	14	14
4	6.25	25	12	14
5	7.7	25	12	14
7½	11.2	30	10	12
10	14.5	40	8	10
15	21.2	50	8	8
20	27.5	65	6	8
25	34.	90	4	6
30	40.	100	3	5
35	47.	125	2	3
40	52.5	150	1	2
50	65.	175	0	1
60	77.5	200	0	1
75	86.	250	000	0
100	126.	325	0000	000
			Circ. Mil	Circ. Mil
150	184.	500	400,000	200,000
200	212.	640	550,000	400,000

Putting a 140-Ft. Sign Aloft with a Parachute

A parachute borne up through the stack interior by the flue gases and carrying with it a messenger cable made possible the erection of a 140-ft. electric sign, illustrated herewith, on the concrete chimney at the plant of the St. Joseph (Mo.) Railway, Light, Heat & Power Company. When the stack was originally finished no means were left for getting to the top, so that at first sight it seemed out of the question to place the sign without expensive scaffolding. The difficulty was finally solved, however, by the use of the parachute, which was sent up through the stack and allowed to fall back on the outside, bringing with it the line with which heavier cable was pulled into place. The steel framework was then placed in position and the sign erected as shown.

The display presents the slogan of the Society for Electrical Development, "Do it electrically," and is controlled by a flasher which successively turns on one letter after another. As the stack stands at the end of the town's principal business streets, the illuminated legend is particularly effective.



FIGS. 1, 2 AND 3—THE PARACHUTE, THE STEEL FRAME AND THE FINISHED SIGN

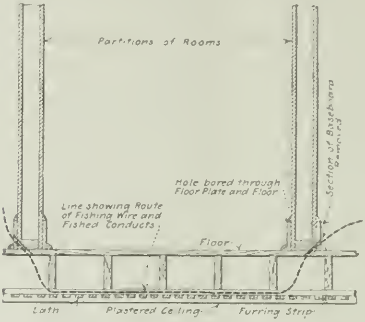
Fishing Conductors in Ceilings Laid on Furring Strips

By George Blackman

Where a ceiling is plastered on laths nailed to furring strips and it is desired to run conductors parallel to the direction of the furring strips (at right angles to the beams), the scheme outlined in the cut can often be adopted. With this method the removal of floor boards is unnecessary. The space provided by the furring strips between the tops of the laths and the bottom edges of the joists is sufficient to permit the conductors to be drawn through.

In installing conductors in such cases a section of baseboard is removed from a partition as indicated, and a 1-in. hole is bored for each conductor through the floor plate and floor into the space between the floor and ceiling. Where more than one conductor is to be drawn in, the holes should be spaced about 4 in. horizontally apart. A fish wire having a hook on its end is fed into each of the holes and worked along from opposite ends until the hooks engage each other, after which one of the fish wires can be used for pulling in a line to which is attached the conductor, either in circular loom or in flexible armored conduit.

If difficulty is experienced in pulling in the conductors, draw a length of steel-armored cable back and forth a number of times. This will produce a carving action and will cut away the plaster causing the interference.


Partitions of Rooms
Section of Baseboard Removed
Hole bored through Floor Plate and Floor
Line showing Route of Fishing Wire and Fished Conducts
Floor
Lath
Plastered Ceiling
Furring Strip

METHOD OF FISHING CONDUCTORS IN A FURRED CEILING

Concrete Lamp Posts for De Kalb's "White Way"

De Kalb, a city of 10,000 inhabitants in the north central portion of Illinois, has recently placed in operation on its main thoroughfare a "white-way" lighting system which puts the city once again on an equal footing with its rival, Sycamore, not many miles to the north. Sixty-four lamps have been installed in the heart of De Kalb's business district, lighting six squares of the city's busiest street. The lamps are of the 6.6-amp luminous-arc type and are supported on concrete-granite ornamental posts. Each post is equipped with a Ludin cut-out and the lamps are wired on two separate circuits so that at 11 p. m. all but the lamps at the street corners can be extinguished. The latter are continued in operation all night. Both circuits are controlled from the station.

STREET LIGHTING, DE KALB, ILL.

The system was installed and is now being operated by the De Kalb & Sycamore Lighting Company, merchants in the business district co-operating with the city and paying for the installation. The posts were supplied by the Pettijohn Concrete Post Company, Terre Haute, Ind., and the lamps were furnished by the General Electric Company.

Recent Telephone Patent

A system of telephoning and signaling for lines where the telephone must not be directly inserted because of other current on the line has been patented recently. The transmitter is associated with the line through an induction coil with a low-wound coil in the line circuit and normally shunted by a knife switch. The receiver is similarly connected through another coil shunted by a condenser. A condenser is in series with the receiver and an adjustable retardation device is shunted across the receiver to adjust for different volumes. The receiver circuit is normally open; a connection can be made, through a switch provided, to a high-frequency diaphragm-type relay which in turn controls the signal-bell circuit. This patent is assigned to the Globe Telephone Company.

Letters to the Editors

Ozone Machines and Public Health

To the Editors of the Electrical World:

SIRS:—In the letter of Mr. H. A. Fee which appeared in your issue of last week the writer asks whether ozone in concentrations that may be borne readily by human beings will kill such bacteria as cause diseases of the respiratory tract. It has been shown that ozone is capable of destroying practically all species of disease germs when in the presence of moisture, with sufficient duration of contact and when the ozone is in adequate concentration.

Referring to only the most recent experiments with ozone in concentrations suitable for ventilation—viz., to those of Kukuck, Olsen, Jordan and Carlson and of the present writer—it may be said that such concentrations result in a marked and consistent lessening in the aerial bacterial content. In no case, however, were the bacteria of any specific species experimented on, or the precise amount of ozone recorded. The results show lessening in the numbers of bacteria ordinarily found in the air, but not complete sterilization.

Experiments with moist and with dried cultures show much less action on the latter than on the former, and experiments with various bacteria in water show a greater susceptibility to ozone on the parts of the disease germs than on those of non-pathogenic species.

It is probable therefore that the tiny globules of mucus—i. e., the "droplets" of Fluegge, Esmarch, and Winslow and Robinson—present the bacteria to the action of the ozone in air in their most vulnerable condition, and that when coughed or sneezed into the air they should be among those first destroyed.

It is questioned by such authorities as Chapin, Winslow and Robinson, Doty and others whether diseases are ever air-borne. Contact infection is now generally credited with causing most infectious disease transmission, and contact by "droplets" is undoubtedly an important factor in this. From the data available, therefore, it is reasonable to assume that ozone will prove of value in lessening the number of disease germs in the air.

Much of the discussion of ozone as an aid to ventilation has been inspired by misunderstanding of what it is intended to accomplish. Efforts at the destruction of plated or dried cultures or the combustion of solid carbon at ordinary temperatures are, of course, bizarre and useless. No method of room disinfection may be practised in the presence of the occupants, but this circumstance has never been used as an argument against room disinfection by any method other than ozone.

On the therapeutic applications of ozone much has been written, but it is not probable that it will find any considerable employment as a universal "home cure." Among expert medical practitioners it might prove of interest and value, but in the hands of the uninformed laity little need be expected along curative lines.

Ozone when intelligently applied is a valuable aid to ventilation. It imparts a freshness to the air which may not be obtained by other means, and it destroys odors and organic emanations arising from the presence of people and animal matter even when the latter is in an advanced condition of decay. The most persistent and painstaking efforts have failed to disclose the least harmfulness of ozone properly used, and on the other hand numberless practical demonstrations of its beneficial effects exist in the installations which have been in operation for several years on both sides of the Atlantic.

East Orange, N. J. MILTON W. FRANKLIN.

The Edison Battery

To the Editors of the Electrical World:

SIRS:—Referring to the protest of Mr. R. A. Bachman on page 158 of the *Electrical World* of Jan. 17 concerning the concluding paragraph of my review of the storage-battery situation in your New Year's number, I feel that the sole merit of Mr. Bachman's comment lies in the inalienable right of any American citizen to protest against anything regardless of facts or logic. In my review no comparison was drawn between the nickel-iron and the lead-lead cell, and none was implied. If that had been the purpose of the article, there would have been occasion for the protest.

It is a business axiom that if two devices serve practically the same purpose and one costs three times as much as the other, the higher cost is a handicap on the more costly article regardless of the comparative merits of the two. Protest against the statement that this obvious fact is true, scarcely calls for comment.

New York, N. Y. LAMAR LYNDON.

Combined Synchronous and Induction-Motor Loads

To the Editors of the Electrical World:

SIRS:—In his interesting article under the above title in your issue of Nov. 22, 1913, Mr. H. L. Wallau gives advice on methods of counteracting poor power-factors, and he recommends the use of over-excited synchronous motors and converters. It is regrettable, however, that such apparatus is not always applicable. In many plants employing individual drive the primary cause of low power-factors may be traced to the presence of a large number of induction motors, each of small individual rating. For example, in a certain factory, distinguished as an example of individual drive, each of its three hundred looms was driven by a 0.45-hp motor, with the result that at the busbars the power-factor measured was only 62 per cent. For a group-drive arrangement corresponding to this condition the power-factor would be much improved and would never be below 80 per cent. This interesting fact shows one of the most important disadvantages of individual drive as compared with group operation, and should never be neglected in the layout of motor installations.

Zwickau, Germany. G. W. MEYER.

Field of the Operating Engineer

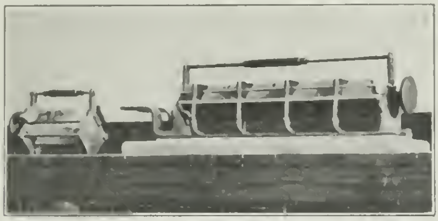
A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Overloading Grid Resistors

In determining the starting characteristics of large electrical machines under test the grid resistors in the starting circuit are often called upon to carry exceptionall heavy overloads for short periods. On the test floor of a large electrical manufacturer, to avoid the use of an extra bank of resistors for this purpose, one man is provided with an air hose and nozzle from which he plays a constant stream of air on the grids. The air currents set up carry away the heat much more quickly than would be accomplished by ordinary convection alone, so that the resistors may be worked at current values which would otherwise raise them to a red heat.

Portable Resistor Outfits for Meter Testing

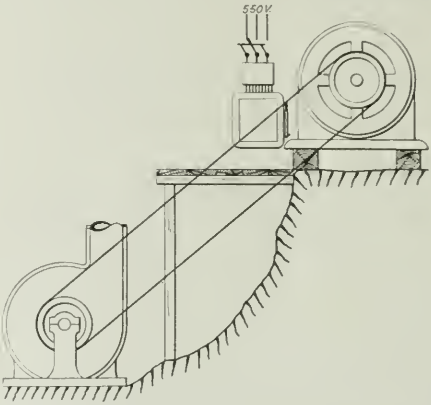
Every possible reduction in weights is of course desirable in portable resistors used as loads for meters under test on consumers' premises. A compact form of resistor for such service has recently been designed by Mr. Harry Amundsen of the Boston Edison company's meter department and is illustrated herewith. The larger resistor shown has a current-carrying capacity of from 25 amp to 600 amp and is 21 in. long over all, 5 in. wide and 6.375 in. high. The smaller outfit, seen at the left, measures 7 in. by 3.5 in. by 5 in. and has a carrying capacity of from 15 amp to 300 amp. Both are of the carbon-plate type and are adjusted by mechanical pressure applied through a handle and setscrew. In the larger resistor there are eight sections of carbon blocks each 1.5 in. square and 0.125 in. thick, while the smaller apparatus is made up of the same-sized blocks but contains only three sections. Thirteen blocks are used per section. The 600-amp resistor is provided with two copper buses 0.25 in. thick and 1 in. wide, set 2.125 in. apart on centers. The carbon blocks are carried in a V-shaped trough of 0.1875-in. asbestos board held in position by two 0.3125-in. brass rods. At the top of the frame is a 0.125-in. brass rod with a rubber handle in the center. The extreme travel of the setscrew in the larger outfit is only 0.1875 in. between 25 amp and 600 amp. Two of these units connected in multiple will safely give a load of 1400 amp. The smaller resistor unit is designed to be clamped directly on the battery and in series with it. The larger resistor weighs 131 lb. 10 oz. and the smaller one 3 lb.



RISISTOR UNITS FOR METER TESTING

Improper Location of Motor Starter Near Belt

The conditions shown in the accompanying sketch contributed to what might have been a serious accident and should serve as a warning against the careless placing of motor starters near moving belts. A second-class electrician had been employed on the night shift of a large contracting firm to look after six 250-hp induction motors belted to drive centrifugal pumps used for drainage purposes. The whole installation was a temporary one. The motor shown was mounted about 15 ft. higher than its pump, the belt ran down at a slope of 45 deg., and the compensator and main switch were mounted on the wall beside the motor. One night the attendant got an order from the master mechanic to shut down this pump. He proceeded as usual and pulled the compensator handle to the neutral position, but the motor continued running and refused to stop. After looking about to see if something was wrong, he finally pulled out the main switch and the motor stopped. Then the attendant went elsewhere to look after some other matters, but shortly remembered the motor trouble, and again set out to investigate its cause. He moved the compensator handle first to the starting and then to running position, but because of a lack of mechanical skill he failed to notice that some of the contact fingers were welded to the contacts on the revolving drums. In thinking to move the compensator handle to the neutral position, he had moved only the drum-shaft handle, while the compensator itself still remained on the running side. He then threw in the main switch, an operation which was followed by a blinding flash, and at the same time he was thrown down from the wood platform and fell into the 48-in. belt. The motor was running clockwise and, fortunately, the belt speed was not so high as to bring him more than half way up to the motor pulley, where he would certainly have been killed. As it happened, he was simply thrown back and forth on the belt a couple of times, finally being rolled



MOTOR AND TURBINE PUMP WITH STARTER IMPROPERLY PLACED out on one side, and thus luckily escaping without serious injuries.

To repeat the lesson taught by this accident, motor switches and starters should never be installed in locations where a sudden shock or flash may surprise the attendant and cause him to fall into moving machinery or belts.

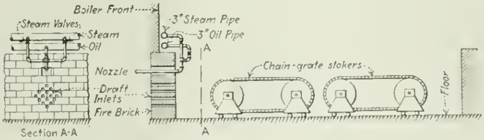
Improving Operating Performance of Mercury Rectifier Tubes

Improved operating records for mercury-arc rectifier tubes have recently been secured in the municipal power plant at Springfield, Ill., which supplies the local street and park lighting. These tubes, operating on fifty-lamp rectifier sets supplying 4-amp lamps, formerly gave considerable trouble after having been in service for a few days. It was not an infrequent occurrence for a tube to drop its lead several times during an evening's operation.

A tight double-walled box containing 0.5-in. steam coils was then constructed under the direction of Mr. James E. Dolbey, chief engineer at the station, and the tubes were taken from the rectifier outfits each day and baked for two or three hours in the dry heat of the steam oven. The tubes in operation in January showed records of 4215 hours and 2740 hours respectively and were still giving service the quality of which was much more satisfactory than that of the comparatively new tubes which were operated without the baking process.

Oil-Fired Furnaces for Peak-Load Operation

In the Metropolitan plant of the Kansas City (Mo.) Railway & Light Company ten out of the entire bank of forty boilers, aggregating 24,000 hp, are now being operated with oil burners, and, according to Mr. John Fritts, general superintendent for the company, the normal rating of the steam-generating equipment of the station has been increased about 20 per cent by the change. These ten boilers were formerly equipped with chain-grate stokers, but the latter have been moved back to the center of the firing aisle and the openings walled up with firebrick. The accompanying sketch shows the present position of the idle coal-stoking apparatus and the arrangement of the piping for delivering the fuel oil and the steam used to atomize it.



OIL-BURNING FURNACE

One of the main reasons for the installation of this oil-burning equipment was the need for steaming apparatus which could be brought up to operating pressure quickly in times of peak load, without the necessity of maintaining several banked fires. With the present arrangement the oil-burning boilers may be "steamed up" and made ready for action more quickly than those coal fires of the plant which formerly were banked. For this reason the number of banked fires is kept at a minimum, the majority of coal-burning furnaces being operated throughout the twenty-four hours, while the oil-burning units are kept as reserves to carry the peaks. In this way the greatest economy in fuel is obtained, since only the boilers which are actually furnishing steam to the mains are supplied with fuel.

Before the stack equipment of the station was doubled the oil-fuel boilers were of great value in plant operation, as they did not require a high degree of draft for their efficient operation. Since, however, two new stacks, measuring 15 ft. in inside diameter and 265 ft. in height, have been erected this consideration has become of minor importance.

Two types of burners, the Roup and the Billows, are being employed. Oil is fed at 40-lb. pressure from six tanks in the basement of the station, being atomized by live steam from the mains running along the front of the boilers. The pressure at the nozzles, after the oil and steam have been mixed, is approximately 80 lb. per sq. in. For storing the fuel oil seven tank cars are kept on the station spur track at all times, and as the fuel is needed it is fed to the six storage tanks in the basement. These tanks have a capacity of 100,000 gal. About 180 gal. per hour is consumed by each 600-hp Babcock & Wilcox boiler.

Ordinarily the time required for changing one of these large units from a coal burner to an oil burner is about forty-eight hours. For an emergency service, however, the chain-grate stokers are left in place so that a change back to coal firing can be made in a night.

A drawback in the use of oil as fuel lies in the fact that it has been impossible for the central-station companies to secure contracts for oil at stated prices. Hence when a station has fitted its steaming equipment for operating with oil it has no assurance that the price of the liquid fuel will remain within a figure that will make its use an actual economy.

Electrical Uses of Tungsten

Can you advise me of other electrical uses for tungsten besides its application to the filaments of incandescent lamps? I understand that it has been employed to form the sparking contacts of gasoline engines. F. M. H

Although a chemistry textbook issued only a few years ago refers to compounds containing tungsten as being "numerous, complex and not of any commercial importance," a number of applications have been found for this metal since it became generally used in the filaments of incandescent lamps. Tungsten has been utilized with advantage in the anodes of X-ray tubes, its high melting point enabling it to withstand the cathode bombardment and to undergo temperatures which make present high-speed skiagraphy possible. It is also used in electric furnaces, both in the form of strips for winding coils and in tubular form. At high temperatures it is recommended that the metal be kept in a vacuum or surrounded by hydrogen, nitrogen or some other gas which does not act upon it. Tungsten has been widely used for sparking points and other electrical contacts. Some automobile manufacturers have even adopted tungsten throughout for all electrical contacts. Wrought tungsten has been hardened to such a point that it scratches glass yet remains ductile. Tungsten gauze is used successfully for separating solids from acid liquids, and tungsten metal should be in demand for acid baths in manufacturing processes. An important property of the metal is its insolubility in most common acids, including hydrochloric and sulphuric acid, although hydrofluoric acid and nitric acids will attack it. The melting point of tungsten is 3100 deg. C. and its tensile strength is approximately 500,000 lb. per sq. in. It is a very heavy metal, having a specific gravity of 20. The principal ore of tungsten is wolframite, a combination of tungsten and iron salt. This ore, when heated with sodium carbonate, produces tungstic acid, which is later reduced to tungstic oxide. Pure metallic tungsten is gray in color.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Three-Phase Commutator Motor.—H. K. Schrage.—Fig. 1 shows a three-phase commutator motor built according to the designs of J. L. La Cour by a Swedish company. *P* is the primary winding in the stator, *R* is the regulating winding, also placed in the stator, and *S* is the rotor winding which is constructed as a direct-current winding with a commutator. Speed regulation is obtained by impressing a variable voltage upon the rotor. For this purpose the regulation winding is provided with several contact points. *T* is a small transformer which supplies to the rotor the voltage required for its compensation. The speed of these three-phase commutator motors can be regulated within much wider limits than the single-phase commutator motors of the same design. Nevertheless, they have not been very successful commercially on account of their expense, which is chiefly due to the great complication and cost of the controller. The present author has largely reduced this expense by employing speed regulation by means of brush displacement so that no controller is used. The new motor is cheaper and simpler and the regulation is not in steps but continuous. The connections are shown in Fig. 2. Here *P* is the primary winding, *R* the regulating winding and *S* the secondary winding, but in this case *P* and *R* are placed in the rotor and *S* in the stator. The primary winding is supplied with current through slip-rings. The regulating winding is constructed as a closed direct-current winding with a commutator, and the secondary winding consists of three phases separated from each other, connections being made between the different brushes as shown in the illustration. The brushes a_1, a_2 and a_3 are mounted on one brush bridge and the brushes b_1, b_2 and b_3 on a second brush bridge. The effect which the position of the brushes has on power-factor and overload capacity is discussed. Concerning its commutation the motor is compared with the well-known three-phase shunt motor with controller.—*Elek. Zeit.*, Jan. 22, 1914.

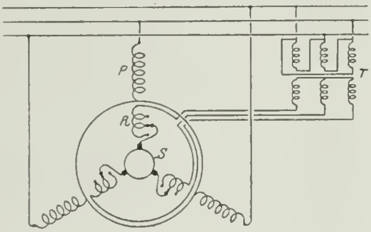


FIG. 1—DIAGRAM OF CONNECTIONS, THREE-PHASE COMMUTATOR MOTOR

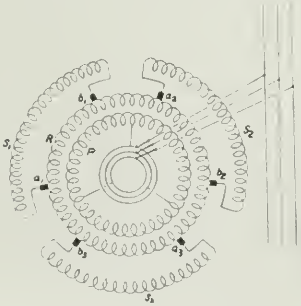


FIG. 2—THREE-PHASE COMMUTATOR MOTOR WITH SELF-CONTAINED REGULATING WINDING

"Condenser Machine."—H. Wommelsdorf.—An illustrated article on the author's "condenser machine," describing the gradual evolution of its design, with notes on its operation and uses. It is especially adapted for electro-therapeutic and Roentgen-ray work. With this machine it is possible to produce high-tension direct current, the output being very much greater than with ordinary influence machines. The construction of such a condenser machine is shown in Fig. 3. Sets of stationary disks and rotating disks are arranged in the form used in condensers so that every rotating disk *a* receives an induced charge on both sides. The charge is taken off the rotating disks *a* by means of steel wires *d* sliding and pressing against the rim of the rotating disks. A second important feature is the use of bakelite. It is stated that the machine could not have been perfected until a technically useful insulating material was found. This was found in bakelite, with which the hard-rubber disks were coated; "thereby the condenser machine was rendered durable and technically useful."—*Elek. Zeit.*, Jan. 15, 1914.

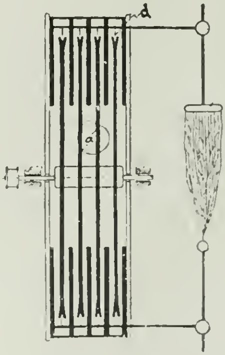


FIG. 3—"CONDENSER MACHINE"

Mercury-Vapor Rectifiers for Speed Regulation of Motors.—F. W. Meyer.—The conclusion of his illustrated mathematical article on the subject.—*Elek. Zeit.*, Jan. 8, 1914.

Polyphase Commutator Motors.—H. Meyer-Delius.—An article illustrated by diagrams in which the theory of the direct-current motor is first outlined, and it is shown that the same principles apply to the polyphase motor, the only difference being that by reason of the alternating nature of the current a reactance drop has to be added to the ohmic polyphase drop. Making use of elementary geometrical relations of vectors, the author develops a diagram for the polyphase series motor, by means of which the current, power-factor, speed, torque and efficiency can be determined for different values of load. It is shown how this diagram can be drawn after the reactance and the resistance of the motor have been determined either by test or calculation. The diagram is finally applied to the brush-shifting series motor invented by Goerges, the commercial application of which has only recently become possible as a result of a better understanding of alternating-current commutation.—*Gen. Elec. Rev.*, February, 1914.

Synchronous Converters.—J. L. BURNHAM.—When the first sixty-cycle synchronous converters were brought out they were regarded as rather sensitive pieces of apparatus. The improvements which have been made in recent designs have, however, placed them on a par with their twenty-five-cycle prototypes. The author describes salient features of the changes which have been made, why they were made and their effects on the characteristics of the machines.—*Gen. Elec. Rev.*, February, 1914.

Armature Reaction.—R. H. TABER.—An article illustrated by diagrams of armature reaction in direct-current machines. The author discusses the principles of action, the distortion of the main field, the effects of distortion on commutation, armature magnetization, effects on brush displacement, effects of armature reaction and means for reducing reaction effects.—*Elec. Journal*, January, 1914.

Lamps and Lighting

Stage Lighting.—C. MICHALKE AND A. GRILLMAYR.—An illustrated article on arc-lamp systems for producing different sky effects on the stage, as, for example, a blue sky, a clouded sky or a night sky with stars. On account of their richness in blue rays arc lamps are especially adapted for this purpose.—*Mitt. Siemens & Halske*, December, 1913.

Instantaneous Candle-Power of Alternating-Current Lamps.—J. SAHULKA.—The author describes a new method for measuring the instantaneous candle-power of alternating-current lamps and the fluctuation of this candle-power during one cycle of the wave. Fig. 4 shows the results for an alternating-current arc lamp with the carbons perpendicular, one above the other, the upper carbon being positive. There are two curves shown in this diagram, of which the upper curve shows the fluctuations of the candle-power measured at an angle of 45 deg. against the vertically downward candle-power. The lower curve gives the fluctuation of candle-power in a horizontal direction during one cycle. The abscissas represent current in amperes; the ordinates the instantaneous candle-power. Fig. 5 shows an analogous candle-power curve for a tungsten incandescent lamp.—*Elek. u. Masch.* (Vienna), Jan. 4, 1914.

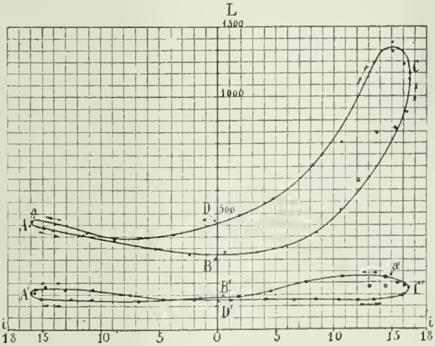


FIG. 4—CHANGE OF CANDLE-POWER OF ALTERNATING-CURRENT ARC LAMP DURING ONE PERIOD

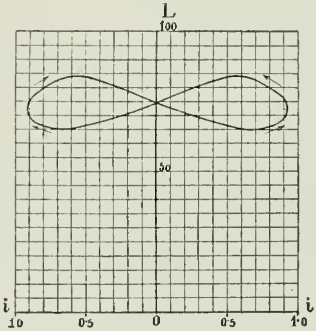


FIG. 5—CHANGE OF CANDLE-POWER OF TUNGSTEN LAMP DURING ONE PERIOD

Ductile Tungsten for Drawing Filaments.—A note on a recent British patent (No. 26,800, 1912) of C. Trenzon. To make tungsten or other non-ductile or slightly ductile metals ductile by mechanical working, hydraulic pressure is applied to the amorphous metal (which must contain no crystalline particles or oxide) when for the first time heated to a temperature at which it tends to become crystalline. Thus, increase of density is brought about at the moment when, as the result of heating, the change from the amorphous to the crystalline would tend to occur.—London *Elec. Eng'ing*, Jan. 22, 1914.

Lamp Substitution Resistances.—A note on two recent British patents (Nos. 9530, 1913, and 10,018, 1913) of W. Heins. A small disk of carborundum with convex sides is placed in parallel with the lamp or lamps and is found in case of failure of the lamps to assume the same resistance as the lamp, whereas as soon as the lamp circuit is completed through a new lamp the carborundum reverts to its normal high resistance. A substitute lamp may be brought into circuit by arranging that the heating of the carborundum shall operate a contact in the emergency-lamp circuit.—London *Elec. Eng'ing*, Jan. 22, 1914.

Double-Electrode Arc Lamps.—J. SCHMIDT.—A full description of the "Excello" double-carbon arc lamp. When one pair of carbons has burned out the other pair is automatically connected to the circuit. The total life obtained is about thirty-two and thirty-six hours respectively for direct current and alternating current. The specific consumption is 0.2 watt to 0.17 watt per hefner-candle.—*Zeit. f. Beleucht.*, Jan. 10, 1914.

Generation, Transmission and Distribution

Electricity Supply of Large Cities.—S. KLINGENBERG.—The author's paper on the subject, which was recently presented in London and noted in the Digest from abstracts in the British papers, is now printed in full in German with numerous diagrams. The first instalment appears in *Elek. Zeit.*, Jan. 22, 1914.

Electricity Supply in Great Britain.—Some further statistical tables. The first gives a list of the sixty towns which take their electricity supply "in bulk."

The second table gives a list of 141 central stations supplying energy both for lighting and tramways. For each station a number of tables are given on management, equipment, etc.—Supplement to London *Electrician*, Jan. 23, 1914.

Power from Mercury Vapor.—W. L. R. Emmett.—In a continuation of his former article the author describes some of the first experiments he made on the application of mercury vapor as a means of generating power. He especially describes the development of design for a mercury boiler to produce the vapor with practical methods of firing.—*Gen. Elec. Rev.*, February, 1914.

Motors in the Leather Industry.—A. E. Rickards.—A statistical article outlining the salient features of the leather industry along with its motor requirements and methods of application.—*Elec. Journal*, January, 1914.

Motors in the Cement Industry.—P. N. Harrison.—An article giving statistical data on motors required in cement plants, their energy consumption, etc.—*Elec. Journal*, January, 1914.

Traction

Electrification of Swiss Railways.—J. Reyval.—A continuation of his account of the report of a special committee which investigated the problem of electrifying the railways of Switzerland. In the present instalment different electrical systems are compared. A conclusion is reached in favor of the fifteen-cycle, single-phase system operated at a pressure of 15,000 volts to 10,000 volts, and it is pointed out that this view is identical with the conclusions of the commissions which have studied railway electrification in Prussia, Bavaria, Austria and Sweden.—*La Lumière Elec.*, Jan. 17, 1914.

Installations, Systems and Appliances

Electric Cooking.—An illustrated article on the cost of electric cooking at Romano's restaurant in the Strand in London. From the figures given it appears that to grill by gas costs $365 per annum, with gas at 62 cents per 1000 cu. ft., while to grill by electricity costs something less than nothing, for, in fact, there is a profit of $10.87 on the sale of fat, with current at 2 cents per kw-hr. At Romano's the fat drops, not into the fire, as is the case with a coke grill, but into a special drip tin which is protected from the heat. Here it coagulates and is collected, being afterward sold at a market price of 16 cents per lb. Thus not only is much unpleasant smell and noise, inseparable from other methods, avoided—one of the features of this grill being the quietness of its operation—but the operating costs are actually less than nothing, even after standing charges and meter rent have been allowed for. This particular equipment is in use in the aggregate for nearly twelve hours a day.—London *Electrician*, Jan. 23, 1914.

Wires, Wiring and Conduits

Overhead-Line Construction.—A. P. Trotter.—An abstract of an illustrated paper read before the (British) Institution of Post Office Electrical Engineers on overhead-line construction for medium and low voltages. Several special designs of poles and insulators are illustrated.—London *Electrician*, Jan. 23, 1914.

Electrophysics and Magnetism

Wheatstone Bridge.—R. Neumann.—To find the values of the currents and voltages in a Wheatstone bridge by arithmetic a number of calculations are necessary. The author describes a graphical method which solves the problem in a very convenient way.—*Elek. u. Masch.* (Vienna), Jan. 18, 1914.

Electrochemistry and Batteries

Oscillation Transformer for Insulator Tests.—S. Thomson.—An article giving a description of the various parts of an oscillation transformer, an explanation of the electrical factors entering into its design, information relating to the materials to be used and data for its calculation. Oscillation transformers have recently come into use for testing insulators, as they offer a cheap means of obtaining a very high voltage. Experience shows that the high-frequency discharge can find defects in insulators which have passed the standard sixty-cycle tests.—*Gen. Elec. Rev.*, February, 1914.

Units, Measurements and Instruments

Absolute Measurement of Resistance.—F. E. Smith.—A note on a paper read before the Royal Society in London on the absolute measurement of resistance by a method based on that of Lorenz. The instrument employed differs, however, from all other forms of apparatus based on the Lorenz method inasmuch as two disks are employed instead of one. The disturbing effect of the earth's magnetic field is thus practically eliminated. The magnetizing coils are four in number; they are wound in single layers on marble cylinders, and the disposition of the coils with respect to the disks is such that the resulting magnetic fields through the disks are opposed in direction and the intensity of the field at points in the neighborhood of the edge of a disk is of zero value, or nearly so. Each of the two disks supports ten insulated bronze segments placed at equal distances round its circumference, and the ten segments on one disk are connected to those on the other disk by ten conducting wires passing through the center of the shaft. When the wires rotate a difference of potential is produced between their ends. These differences of potential may be placed in parallel or in series and balanced against that on a standard resistance R through which the same current flows as through the coils. The resistance R can thus be found in terms of the mutual inductance of the coils and brush-contact circles and the rate of rotation of the conductors. The brushes consist of thin phosphor bronze wires stretched by spiral springs and resemble violin bows. Petrol is employed as a lubricant for the brushes. The speed is maintained constant by an electrical method. The result of the experiments shows that a resistance of 1 international ohm is equal to 1.00052 ± 0.00004 ohms (10^9 cm./sec.)—London *Electrician*, Jan. 9, 1914.

Meter.—An official communication from the Reichsanstalt by which a mercury-motor meter for direct current by H. Aron is admitted for calibration. Its construction and operation are described and illustrated.—*Elek. Zeit.*, Jan. 15, 1914.

Telegraphy, Telephony and Signals

Telegraphy in Germany.—O. Arenet.—An illustrated article on the development of telegraph operation in the large underground cable systems of Germany. The first telegraph cables were laid in Germany in 1876. The author describes in detail how, especially through the work of the telegraph experiment station of the Post Office Department, various improvements have been made so that reliability of operation by the Hughes system has been made possible on lines up to 400 km (240 miles) and by the Morse system up to 500 km (300 miles). The present arrangement permits utilizing each cable conductor to an extent ten times that which was possible in 1888.—*Elek. Zeit.*, Jan. 22, 1914.

Tone-Wheel for Wireless Telegraphy.—R. Goldschmidt.—A mechanical detector for electrical waves is described, by which undamped continuous waves can be received as a musical note and the pitch of the note adjusted at will at the receiving station. The author makes use of Fessenden's idea to apply a high-frequency current generated at the receiving station and uses a modification of Le Blanc's "commutatrice" for the reduction of the high-frequency currents. In order to construct the latter device in as simple a way as possible, the commutator is replaced by a toothed-wheel disk. This apparatus does not commutate but simply interrupts the alternating-current once for every wave. It is not at all difficult to obtain the necessary number of interruptions. If, for instance, a current of 40,000 periods per second is to be commutated and the tooth pitch at the circumference of the toothed wheel is 1 mm, a synchronous rotation is obtained with a circumferential velocity of 40 m per second, which is quite within the limits of possibility; but practically it is not possible to maintain the synchronous rotation of the tone wheel. Therefore the number of revolutions is chosen to be non-synchronous. If the alternating current has a frequency of 40,000 cycles per second, the number of interruptions is made, say, 39,000 or 41,000. The commutated current then is a "notched" alternating current with a frequency of 40,000 — 39,000 = 1000 cycles. It is not necessary, however, to choose the speed of the wheel so that it is near synchronism; any uneven fraction of the synchronous number of revolutions may be employed. The wheel is driven by a small motor, with which is coupled an automatic regulator (with a centrifugal contact-making arrangement) and an eddy-current brake. Damped waves, such as those emitted from spark stations, are not heard as a note but only as a noise. Stations with only small differences in wave-length are heard with very different notes. If the tone wheel, for instance, is giving 39,000 interruptions and the station to be received is sending with 40,000 periods, this station will be received with a note of 1000 periods. Another station using, for instance, a 2.5 per cent shorter wave (that is, 41,000 cycles) gives a note of 41,000 — 39,000 = 2000 cycles. It is, therefore, very easy to distinguish one station from another. The tone is clearly distinguished from atmospheric disturbances. As always a certain note is best suited for a certain telephone, and as it is possible at the receiving station to adjust the pitch of the received note, the pitch may be regulated according to the telephone used so as to obtain the maximum effect. This advantage is, perhaps, the most important. Intensifications up to about ten times may in this way be easily obtained—London *Electrician*, Jan. 16, 1914, and *Elek. Zeit.*, Jan. 22, 1914.

Electrolytic Detector.—Paul Jegou.—An illustrated article describing the principles of the electrolytic detector, the practical forms in which it has been carried out and the various methods employed for connecting it with the antenna. The author defines what he calls the "critical tension" of an electrolytic detector and gives values for certain electrolytes and electrodes. He finally distinguishes between two kinds of critical tensions, namely, the anodic tension and the cathodic tension.—*La Lumière Elec.*, Jan. 17, 1914.

Miscellaneous

Arc Welding.—E. S. Zuck.—There are two methods of electric arc welding, namely, the carbon-electrode arc process of Benardos and the metallic-electrode process of Slavianoff. Their features and differences are discussed. The author describes the application of the electric arc method for the welding of flues in locomotive boilers in steam railway shops, for building up mud rings, for repairing broken motor frames, etc. Some notes are added on overhead welding.—*Elec. Journal*, January, 1914.

Book Reviews

Die Theorie Moderner Hochspannungs-Anlagen. By Dr. Ing. A. Buch. Munich: R. Oldenbourg. 360 pages, 118 illus. Price, 14 marks.

A carefully prepared textbook on the theory of high-voltage conductors and systems from the electrical-engineering standpoint. A number of numerical examples are given and worked out in the text. The eight chapters of the book relate to the following subjects: Dielectric strength; design of high-tension conductors; corona; high-tension insulators; high-tension cables; over-voltages; lightning protectors; protectors against abnormal current strengths. The treatment is mathematical, but is also of a distinctly engineering type. A number of curves and tables are distributed throughout the book, which will commend itself to advanced students of high-tension cables and systems, if acquainted with the German language.

Les Surtensions dans les Distributions d'Energie Electrique et les Moyens d'en Prévenir les Inconvenients. By I. Van Dam. Amsterdam, Holland: Van Mantgem & de Does. 272 pages, 109 illus., paper covers. Price, $2.40.

An engineering textbook on the subject of overvoltages in power-transmission lines and of methods for preventing them. It deals largely with American practice and experience, although the book is directed mainly toward European electrical engineering. The treatment is clear and well selected. Examples are taken from a number of actual installations. The book will be of interest to all students of high-tension electrical engineering. The thirteen chapters into which the work is divided relate to the following topics: Rupturing voltage; corona; high-tension insulators; self-induction and capacity of lines; harmonics in alternating-current waves; resonance; overvoltages at the distant ends of lines; overvoltages due to changes in load; overvoltages due to atmospheric disturbances; lightning protectors; grounding; crosses between high-tension and low-tension systems; factor of safety in high-tension distributions.

Descrizione di una Macchinetta Elettro-magnetica. Dr. Antonio Pacinotti. Bergamo, Italy: Instituto Italiano d'Arti Grafiche. 95 pages, frontispiece of Pacinotti.

A very interesting little book from the historical point of view. It is published by the Associazione Elettrotecnica Italiana, which corresponds, in Italy, to our American Institute of Electrical Engineers. It reproduces the text of Dr. Antonio Pacinotti's "Description of a Small Electromagnetic Machine," which was written in June, 1864, and was published May, 1865, in *Il Nuovo Cimento*. This article clearly describes a bipolar dynamo-electric machine with a gamma-ring toothed armature. The machine was operated both as a generator and as a motor. As a motor it had a torque of 215 meter-grams when operated by a battery of four small Bunsen cells. This article manifestly established the reversibility of the dynamo machine in 1865, but at the time it attracted hardly any attention. The discovery had to be made all over again at a later date, in order to stir the electrical engineering intelligence. The article is translated into French, English, German and Latin by well-known writers—a distinct enhancement of its historical literary value. As the frontispiece appears an excellent portrait of Dr. Pacinotti, who received an ovation at the International Electrical Congress of Turin in 1911, one year before his death.

Sale of Electrical Appliances on a Proper Basis

Shortcomings of supply dealers, contractors, jobbers and central stations in marketing goods and in their relations with one another

Retail Electrical Merchandising

Retail electrical merchandising was poorly conducted in the early days of the electrical business because its importance was not realized, it being considered as merely incidental to the sale of electricity. No attempt was made to educate employees of light and power plants in the fine art of retail salesmanship. An evil of the business has been the tendency and actual practice by many operating companies to sacrifice the legitimate profit on a sale as an inducement to customers to use energy-consuming devices. Houses have been wired at cost and in some cases without charge. Motors, fans, fixtures, heating and cooking devices, etc., have been sold at cost or given away. The effect of such practices is to create in the mind of the public the impression that electricity is hard to sell upon its merits, or at least to impress upon people that in dealing with an electric-light plant something can be had for nothing; and if one can get something for nothing he is inclined to consider it of little real value.

It is fair to say that managers of electric-light plants, as a rule, have a good knowledge of the electrical business from a practical standpoint. They know how to construct power plants and pole lines and provide service to consumers and are well qualified to pass upon the quality of electrical appliances of all kinds. They know how to make rates and furnish electricity to their customers. All of this is part of their vocation, and is so different from retail electrical merchandising that electric-light company managers have not given the latter consideration from a good business basis.

The Primitive Storeroom

In the earlier days of the lighting business it was the usual practice of operating companies to establish a storeroom for electrical goods at the power plant, oftentimes in one corner of the engine room or in a shed adjoining the coal bin. Contracts were made for furnishing service, and these usually included the wiring of the premises. A wagon was loaded with a coil of wire, some lamp cord, a few sockets and a couple of ladders, and a trip was made from the storeroom at the plant. The delivery of the material accomplished, the wiremen installed the job. If, however, the job happened to be in a residence of a citizen who wanted fixtures or other elaborations, the foreman or possibly the superintendent would tuck a catalog under his arm

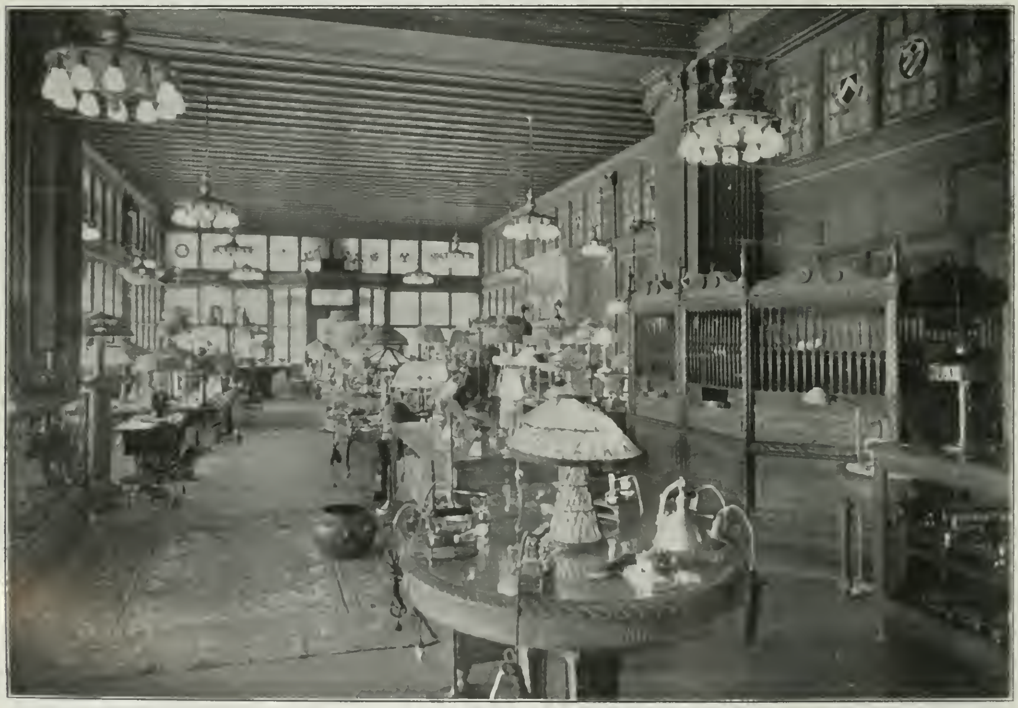


FIG. 1—INTERIOR OF ELECTRIC SHOP OF COMMONWEALTH EDISON COMPANY, CHICAGO, ILL.

and visit the lady of the house, granting her the privilege of selecting what she wanted from the catalog, after which an order was placed with the jobber or manufacturer. Eventually the goods were received at the storeroom, unpacked and installed, after which the lady of the house had an opportunity to decide whether or not she liked the goods. If so, well and good; if not, she was reminded that they were just what she selected and ordered.

FIGS. 2 AND 3—CONGESTED AND UNINVITING APPEARANCE OF AVERAGE ELECTRIC SUPPLY STORES

After a while, electrical novelties and conveniences began to appear, such as fancy portables and reading lamps, ornamental and scientifically designed shades, dining-room domes, fans, flatirons, toasters, percolators, curling irons, vacuum cleaners, vibrators, etc. This seemed to call for some plan of exhibiting and advertising. So the light and power company either established a store or induced some of its good wiremen to establish a retail store and contracting shop. In either event the business was usually in charge of a man very competent to do electrical work but who had not the slightest conception of what went to make an attractive retail establishment. Usually a start was made

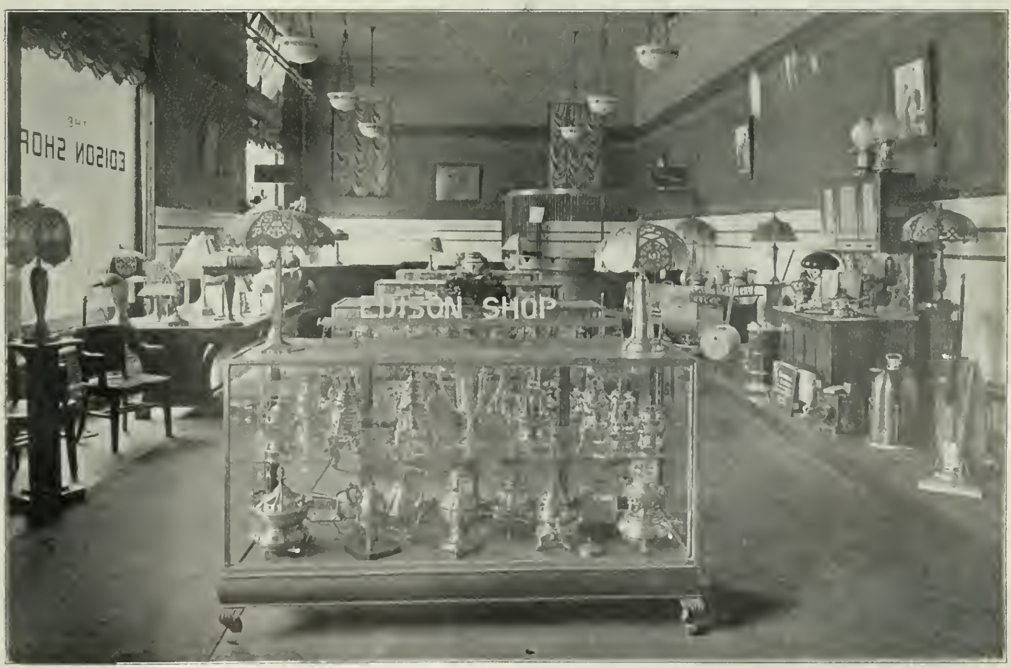


FIG. 4—BROOKLYN EDISON SHOP, WHERE MERCHANDISING IS CONDUCTED ON A MERCHANDISING BASIS

in the right direction by securing a room with a show window on the street, putting in good shelving and counters with a showcase on one side and a flat counter on the other. A small fixture room usually brought up the rear, and a shop for rough work was installed on the alley. At first great care was taken to keep everything clean and in order; ladders and material were carried in and out the back door, etc. But before ninety days the store became the hang-out of idle workmen, and cigarette smoke and tobacco juice were always in evidence. Showcase and counters became the catch-all for timers, tools, gloves, pipes, blow-torches and even overshoes and rubber coats. The show window was made the temporary resting place of half-unpacked breakable things to be delivered later; the space between counters was after a while the most convenient place to unpack fixtures and glassware, and the stepladder invariably was left resting against the counter bearing the showcase.

What an inviting place for a woman to shop! If one did come in, probably the man who knew how to wire houses would throw off his hat and appear behind the counter in his shirt sleeves, with a dirty collar or no collar at all and a Wednesday growth after a Sunday shave, and say, "Did you wish something?" Probably the lady did previously wish to buy something electrical, but at the moment wished that there was a more respectable place—at least, a more inviting place—where she could purchase electric appliances.

Effect of Slip-Shod Merchandising Methods

The slip-shod, careless, wait-for-the-dollar methods of most retail electrical business establishments have undoubtedly retarded the growth in popularity of electricity in meeting not only the luxuries but the comforts and necessities of every-day life. And had it not been for the intervention of progressive manufacturers, who forced electrical devices into other branches of the electrical trade, the business would have suffered more than it has.

Electric light and power companies have in most cities dodged the responsibility of supplying electrical appliances to their customers, leaving the field to poorly conducted electric supply stores, department stores, hardware stores, etc., the owners of which in many cases do not know the value or reliability of an electrical device. This has resulted in the sale of unreliable and in some cases hazardous appliances. A protection against such abuses would be the handling of the business by persons competent to pass upon the merits of the device before it is offered to the public. There is no good reason why a lighting company should operate a retail business at cost. Neither is there any good reason for abandoning the business to incompetent people. For the companies owe it to the people as well as to the electrical interests at large to see to it that well-conducted stores or electric shops are provided for the sale of safe, dependable electrical materials of quality to match the dollar paid.

Many of the greeds that have crept into the business have come as a result of ignorance on the part of the retail purchaser. In the purchasing of other things one can, in a measure, protect himself, for everyone has some knowledge of clothing, shoes, hardware, groceries, etc., and can tell when fish is bad by smelling it. But all the senses will not protect the layman against the purchase of inferior electric appliances or of improperly selected appliances for the purpose intended. He must depend upon the honesty as well as the knowledge of the man who sells the devices to him. The electric-light company knows its own system and the apparatus best suited to it and to the needs of the customer so far as reliability is concerned.

The Jobber's Relation to the Manufacturer and Contractor

So much has been said and written on co-operation that one almost forgets the reason for the inception of the thought which the word expresses. Co-operation represents the tendency of the times and in addition lends itself to blind imitation without regard to its real reason as a business tool. Co-operation should be selfish in its origin. There is nothing criminal in legitimate selfishness, since all real ideas are of this nature, and when judiciously applied they result in general benefits which are nothing but an amplification of the same idea.

The jobbers' association is justifiable just in so far as its acts for the good of its individual members and for the welfare of the jobbing trade. Any legitimate steps it has taken in this direction are admirable. There is little doubt that it has accomplished much, for there seems to be a betterment in the industry, more efficient methods are discernible and diminished friction generally obtains—the result of healthy businesses getting together and settling their differences. One cannot reflect on such an institution as the jobbers' association is or might be without realizing its great possibilities in the uplift of the entire field if it chooses so to act as an organization.

The jobber is so intimately connected with the manufacturer, the contractor, dealer and consumer that it is hard to think of one without the other. The improvement of any of these means the expansion of the jobber's business. Of the classes with which the jobber has relations the two most intimate are the manufacturer and the contractor. The former is basic to the industry and hence to the jobber, and the latter is at present the creative agent involved in all new operations having in view the utilization of electricity.

The Jobber and the Manufacturer

In cultivating the manufacturer further co-operation by the jobber seems possible. In this the jobber has his best chance to prove that he is a creative force in the industry, in producing business, rather than in merely handling it. The manufacturer is in business first to make and then to market his product. He must be convinced that there is an economical way to do the latter and that is through the jobber, who in his capacity as such can reduce financial risk, increase demand, fine-comb a local territory and cut sales costs. If the jobber can't or won't offer such service to the manufacturer, the latter must resort, naturally, to other channels of distribution because he is bound to sell his goods. The familiar complaint of the manufacturer that he is asked by the jobbing trade to create the demand for his goods before he can talk business is not the ideal condition. It looks as if one man were doing all the work. Yet present conditions make it hard for either to act differently if they are ultimately to do business. From the manufacturer's standpoint this treatment calls for a little patience and to the jobber it seems perfectly reasonable. The former believes that in making a good article, advertising it well and backing that up by good missionary work, he has completed the economic cycle and that its reception by the jobber should be automatic. The latter claims, on the other hand, that the cost of carrying many lines is prohibitive and risky. Buying conditions generally make a settlement on this score difficult because of broken and standard package prices, service charges on pick-up shipments, faulty deliveries and many other complications too numerous to mention. In effect, the present arrangement, while coercive and ultimately successful from the manufacturer's standpoint, defeats good feeling and incurs resentment. How much better if every line, new or old, were in a position to prove itself by orders coming over the jobber's counter and were backed up by the manufacturer until the goods were automatically purchased in bulk by the jobber as a staple product! Here is a chance for the jobbers' association to act with the manufacturer. Co-operation in this respect would eliminate to a great extent the substitution of an article other than that called for, which is the sorest spot in the manufacturer's anatomy, and result in much good for all. A few measures of this kind and the undesirable jobber, cut-throat, etc., would pass into history since the cause which gave them being would have disappeared. Alternatives are resorted to only when direct methods fail. If the same energy could be exercised in supplying what is asked for that is now expended in remembering what is on the shelf, business would gravitate to the place where complete service is to be had. The manufacturer would then be represented wherever the shingle "Electrical Supplies" is seen, and the jobber would become a creative and an indispensable institution. The manufacturer should know all about the jobber, what he is doing and how he does it. When such a condition obtains, mystery vanishes, doubt and fear are dispelled, and differences are thrashed out in the open.

Relations with the Contractor

The cultivation of the contractor will strengthen the jobber's position if worked out on a large scale, as local adoption of this policy in a few places has proved. The contractor has lately set about looking after his own interests and great things have already been done through the National Electrical Contractors' Association. As a class the contractor is working toward real issues and has much to be proud of in his association organ. The fact that the contractor is organized makes the jobber's problem all the easier, and it is well that this is so, for it is difficult at best.

Electrical contracting is a business of many troubles because it is harassed by vicious competition and destructive price-cutting. The contractor is continually fighting an estimate sheet and labor problems and is often compelled to sell material at cost and be satisfied to gamble on the labor and extras as a margin. But better things are in store for him, and the time is passing when he looks to the bank for his payroll, to the jobber for his credit and to Providence for his profits. He is entitled to a better price on material than the consumer, because he gets but one chance usually to sell, and he also assumes the responsibility for his purchases, often storing them and accepting the risk in handling and depreciation on unfinished work. So long as the handling of material means trouble and no pay, just so long will the contractor look on the source of trouble with tolerance and continue to speculate at the jobber's risk, talk price, and refuse to expand in a beneficial trade direction toward creative sales of things electrical. He is often in a position to recommend changes, improvements and expenditures at an opportune time, when the job is in construction and the customer's mind is open to suggestion. He could oftentimes sell many things at almost no expense to the jobber, but if there is not sufficient recompense he cannot be expected to extend himself. The jobbers' association and the contractors' association are so important in themselves and mutually that co-operation here can almost be said to be limitless.

The contractor is becoming more methodical and businesslike in his dealings. He appreciates more keenly than some jobbers what overhead charges mean and is also more willing to co-operate.

Shall Free Lamp Renewals Be Discontinued?

Supply dealers, jobbers and some few manufacturers of incandescent lamps are endeavoring to focus attention on the free-lamp-renewal policy of electric-light companies with a view to having the practice discontinued. The claim is made that lamps of inferior quality are no longer on the market so that central-station supervision over the lamp supply of customers is not now necessary. It is hoped to attack the policy on the ground that public service laws do not permit discrimination, and that inasmuch as the policy of free renewals of incandescent lamps is pursued at a loss so that those customers who do not use lamps have to bear the burden, discrimination is shown. Those who hold this belief maintain that the function of the electric-light company is to sell electrical energy, to disseminate information on the scope, use and desirability of electrical appliances, the proper method of installing and the economical use of electric lamps. In short, the lighting company, because the sale of its product is perpetual, should create business for those concerns legitimately engaged in the sale of electric lamps and appliances because such co-operative effort would give even greater returns. The hope is expressed that public service commissions will stamp out the practice.

Central-station managers, however, are not sanguine of such an outcome and insist that the day has not yet come when lighting companies should cease to exercise supervision over the lamps connected to their circuits. They deem it a part of the service to see that customers receive proper light at minimum cost so that central-station supply shall not fall into disrepute. Indeed, the movement is not taken seriously at all. One prominent central-station manager characterized the idea as preposterous. In the first place, he said, the Public Service Commission law gives the commission explicit supervision over the efficiency of the electric incandescent lamp supplied. Moreover, it is to the advantage of the public to receive the very best lamps of highest efficiency at minimum expense so that the cost of illumination shall be a minimum. With control of the lamps by the central-station companies they are responsible to the public that this shall be so. They have experienced the necessity of testing the lamps being supplied to their customers and would not be prepared to leave the consumer without this safeguard. They do not sell lamps except to customers taking energy from their circuits, and the supply of lamps, repairs, etc., is part of the service they render

Price-Cutting by Jobbers

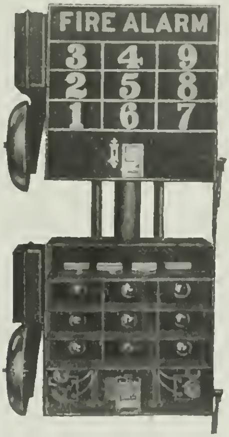
One subject which might be discussed by the electrical jobbers at their annual meeting in Washington next week relates to the cutting of prices by jobbers and jobbers' salesmen. Some of the large supply houses have been giving especial attention to this matter of late, and they feel that although they do a large volume of business the margin of profit is unsatisfactory. Even in the lines of electrical supplies bearing comparatively large margins of profit, a reduction in price of 5 per cent means an actual reduction in profit of from 20 to 33 1/3 per cent. Some of the large dealers are endeavoring to impress these facts on the minds of their salesmen, for some of the latter, particularly those less experienced, do not recognize the significance of these apparently small reductions in the price of electrical supplies unless the facts are brought forcibly to their attention. It is possible, too, that some of the jobbers themselves will receive no harm from devoting careful study to the arithmetic of the situation.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed
Manufactured Products of Interest to Electrical Readers

Fire-Alarm Sending and Indicating Apparatus

The Guide Fire Alarm Company, Brooklyn, N. Y., manufactures an electrical device for transmitting fire-alarm signals and automatically indicating the point from which the alarm is sent. These alarm boxes are especially adapted for use in industrial establishments and other places where it is desirable to have the location of the fire indicated at each alarm-sending station. When a fire-alarm system consisting of several of these devices is employed there is no possibility of the signals being confused when two alarms are sent simultaneously, as may occur with the single-stroke bell alarm.



INTERIOR AND EXTERIOR VIEWS OF FIRE-ALARM-SENDING AND GUIDE BOX

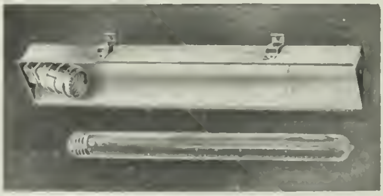
Illustrated herewith are two views of one of these boxes: The upper is an exterior view showing the alarm bell and annunciator numerals; in the lower view the cover is removed, showing the lamps within. On each box is a small glass door equipped with a lock which when opened or broken rings all of the alarm bells on the system, at the same time indicating the location of the sending box by lighting one of the red-glass figures on the front of the box. As the figure remains illuminated after an alarm is given, it is not necessary to understand a bell code to locate the fire. Signals can be sent simultaneously from several boxes without interference or confusion and are indicated by the lighted numerals. The lamps which illuminate the figures are wired in series with a closed-circuit relay which operates a trouble bell if a filament burns out or a connection becomes loose.

The sending stations can be installed separately from the guide boxes, and the latter may be placed near the ceiling where they can be readily seen from several directions. A guide box may also be located on the outside of the building near the entrance to inform entering firemen of the box from which the alarm was sent. Storage batteries may be used to operate these signals, but the manufacturers recommend connecting them to 110-volt electric-service wires.

Tubular Lamp for Showcase Lighting

A tubular showcase-lighting unit, illustrated herewith, has been placed on the market by the Holophane Works of the General Electric Company. The lamp is 1 in. in diameter, and the distance from the contact of the medium screw base with which it is equipped to the top of the lamp is 12 in. By means of the medium screw base the lamp can be fitted to an ordinary socket. A single drawn-wire tungsten filament extends practically throughout the entire length of the bulb, thus providing a running line of light. In order to make this length of filament of high enough resistance to be used on ordinary lighting circuits, the filament itself is twisted into a very fine spiral. The lamp is made in both 25-watt and 40-watt sizes.

The brass reflector, when in position in the upper front angle of the showcase, occupies a space 14 in. long, 2.5 in. wide and 2 in. deep. It has an interior finish of Cleanezy aluminum. The contour of the reflector is designed to present a neat appearance, to give the most effective distribution of light and to shield the eye from the high intrinsic brilliancy of the lamp filament. The unit is readily installed by raising the glass top of the showcase, supporting the reflector from the upper edge of the upright glass by means of two brass brackets, and then lowering the top. The two brass brackets are made to fit the thickness of the plate glass ordinarily used in showcases. The lamp socket is mounted on a hinge. This facilitates the removal or insertion of the lamp after the reflector is installed. In order that the lamp may not swing out of the reflector when in use, it is held rigidly by a wire clasp fixed to the reflector near the tip end of the lamp. A series of these reflectors can be used along the entire upper front edge of the showcase, close enough together for no open intervals to be left, or the units may be placed at certain intervals along the case. If placed close together, a sliding brass molding on the back of the reflector protects and conceals all the wiring. If the units are placed at intervals, short lengths of round brass tubing may be used to conceal the wiring between the units.

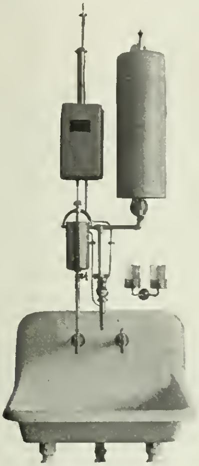


TUBULAR LAMP WITH BRASS REFLECTOR FOR SHOWCASE LIGHTING

Compact Water Ozonizer

In the accompanying illustration is shown a compact water ozonizer and filter manufactured by the Held Company, Chicago. The filter is an accessory which is furnished only when solid matter suspended in the water has to be removed. Sterilization is accomplished by automatically spraying ozone through the water as the latter traverses a mixing chamber attached to the faucet. The ozone generator may be supported on the wall as shown and operates only when water is being drawn from the faucet, being supplied with electricity from a lamp circuit or storage battery. Two tubes permitting a circulation of the ozone connect the ozone generator with the mixing chamber. At the prevailing electric service rates, it is declared that 200 gal. of water can be sterilized for 1 cent with this apparatus.

The effectiveness of this apparatus in destroying bacteria has been tested in several laboratories. Chicago city water containing from 150 to 270 bacteria per cu. cm. was rendered perfectly sterile with this apparatus, it is claimed. Later water containing over 1,000,000 colon and typhoid bacteria was also sterilized. The average of several tests on the ozone developed by the generator revealed 58 parts of ozone in 10,000 parts of air.



WATER OZONIZER

Other tests showed the following bacteria content before and after ozonization:

	No. of Bacteria per Cu. Cm. Before	No. of Bacteria Per Cu. Cm. After	Per Cent Reduction.
Unfiltered lake water inoculated with:			
Colon	2100	0	100.00
Typhoid	6800	1	99.99
Typhoid (second test)	5600	0	100.00
Dysentery	4100	0	100.00
Distilled water inoculated with:			
Colon	1900	0	100.00
Typhoid	4400	0	100.00
Dysentery	3800	0	100.00

The "Aero" Cable Car

The Aero cable car, described on page 280 of the *Electrical World* for Jan. 31, has been placed on the market by the Fairmount Electric & Manufacturing Company, Philadelphia, Pa.

Electricity in a Louisiana Sawmill

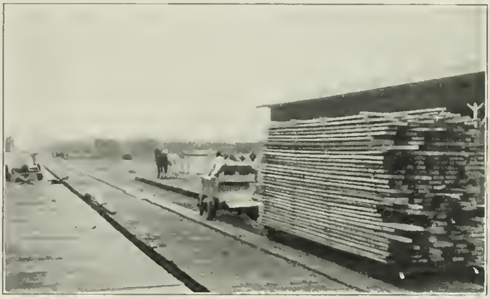


FIG. 1—ELECTRIC TRACTOR AND LOAD OF LUMBER

A number of interesting uses are made of electricity in the huge plant of the Industrial Lumber Company at Elizabeth, La., which has a daily output of 300,000 ft. of lumber, corresponding to the "cut-over" of about 20 acres of land per day. Bark and strippings from the sides of logs are in most mills carried to cupolas and burned. At Elizabeth, however, this material is run through "hogs" (large electrically driven, high-speed cutters) which shred the strippings, preparing them for the turpentine boilers or vats where turpentine is extracted from the wood by a process of steaming.

About 15 per cent of the output of the plant goes to the dry kilns, while, except for the rough stock, most of the remainder is piled in stacks and put through the planers. The matter of moving this lumber formerly required about twenty mules and a corresponding number of men, but the work is now performed with marked savings by the battery-driven tractors illustrated herewith. As will be noted from Fig. 1, the battery is mounted on the top of the 2-ton chassis, the driver's seat being at the rear. The lumber is first loaded on a standard two-wheel lumber "dolly" which is connected to the tractor by backing the latter under the lead. A chain is thrown across the lumber back of the first cross-bar, and by pressing a lever an electric hoist tightens the lumber to the "dolly" and holds it securely to the rear bolster.

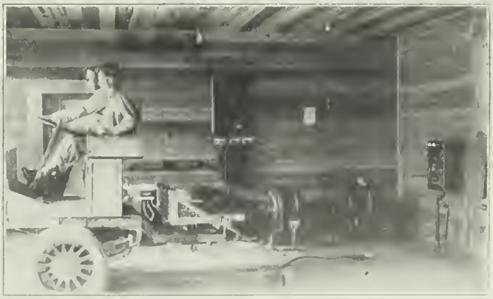


FIG. 2—BATTERY-DRIVEN TRACTOR AND CHARGING EQUIPMENT

In moving the lumber from the mill to the lumber stacks, the tractor has a capacity of seven and one-half round trips (2400 ft. each) per hour, towing an average load of 1500 ft. of lumber, or 3.375 tons. In this work one of these General Vehicle tractors displaces five mules and three men.

Connecting the mill with all parts of the yards are some 5 miles of wooden tramways, each 16 ft. to 20 ft. wide and floored with 3-in. lumber. When mules were used for haulage it cost about $25,000 to renew this flooring every three years, but the wear occasioned by the present rubber tires is, of course, negligible.

After the lumber has been dried it is removed to the planing machines. This work proved extremely hard on the mules, but with the present electrical equipment one tractor is able to displace seven mules and five men and can make thirteen 2000-ft. round trips per hour, carrying 1000 ft. of lumber per trip. The accompanying table gives comparative figures for the cost of operating three tractors, with six men, replacing sixteen mules and twenty men. In arriving at this result the cost of charging energy has not been included, as the amount required was considered negligible. Assuming that energy could be purchased at 4 cents per kw-hr., this item will not average over $200 per tractor.

COMPARISON OF OPERATING COSTS WITH MULES AND ELECTRIC TRACTORS

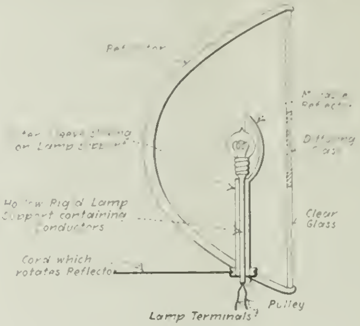
Investment	Mules	Tractors
Sixteen mules at $225 each	$3,600	
Twenty sets harness at $25 each	500	
Twenty two-wheel "dollies" with shafts, at $25 each	500	
Three electric tractors with batteries at $2,900 each		$8,700
Stable, grain, horse, blacksmith shop, etc	3,000	
Garage, charging apparatus, etc		1,000
Total	$7,600	$9,700
Fixed Charges		
Interest	$228	$291
Depreciation	1,140	1,020
Fire insurance	100	87
Total fixed charges per year	$1,468	$1,398
Operating Costs		
Renewals of batteries (every year)		$867
Renewals of tires (every year)		600
Renewals of chains, gears, etc		375
Feed, shoeing, stable help, etc., at $20 per month per mule (sixteen mules)	$3,840	
Labor, at $1.75 per day	10,500	3,600
Repairs to tramways	8,550	4,275
Total operating costs per year	$22,890	$9,717
Total costs per year	$24,358	$11,115
Saving per year by using electric tractors		$13,243

Electric Head-Lamps for Use in Country and City

To meet the requirements of city ordinances forbidding the use of dazzling head-lamps, and at the same time to furnish lamps with penetrating beams for use on country roads, C. & A. Matisse, New York, have brought out a head-lamp with an internal mechanism which eliminates the necessity of two lamps having different intensities.

The head-lamp consists of the ordinary inclosing case and a special reflector with a concentrated-filament lamp and a small-diameter reflector supported on a movable vertical rod passing through the focus of the large reflector. Supported on a rigid pedestal at the center of the flat-glass lens sealing the front of the fixture is a diffusing lens of small diameter. The arrangement of these parts is shown in the accompanying diagram. The lamp and small reflector can be simultaneously rotated through 180 deg. by pulling a flexible steel cord passing around a pulley at the base of the movable, vertical lamp-support. By so doing the light from the lamp can be directed against the large reflector for use on country roads, or it may be entirely shut off from the large reflector and softened by the small diffusing lens.

These head-lamps can be furnished with plain silvered reflectors or with specially prepared reflectors which reduce glare. By using this head-lamp on automobiles it is unnecessary to provide side-lamps, and the car wiring is simplified by having only one source of light in the head-lamp instead of two. In addition, it is not necessary to get out of the car when entering a city to put diffusing screens over the head-lamps.


Reflector
Movable Reflector
Diffusing Glass
Hollow Rigid Lamp Support containing Conductors
Clear Glass
Cord which rotates Reflector
Pulley
Lamp Terminals

AUTOMOBILE LAMP FOR PRODUCING TWO KINDS OF LIGHT INTENSITY

Arc-Lamp Bracket and Cross-Arm

The accompanying illustrations show the arc-lamp brackets and cross-arms which have been adopted by the Sanitary District of Chicago and which have been used thus far for the suspension of over 8000 lamps.

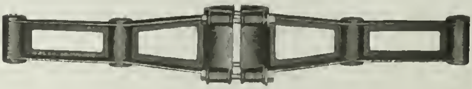


FIG. 1—MALLEABLE-IRON CROSS-ARM

The design of the brackets incorporates the inverted "Y" which is Chicago's municipal emblem. The cross-arms are made of malleable iron and are used to carry the arc-lamp conductors. The arms fit on the projections shown on the top of the brackets. Steel pins carrying porcelain insulators are used with these arms. The brackets and cross-arms are manufactured by the Line Material Company, South Milwaukee, Wis.

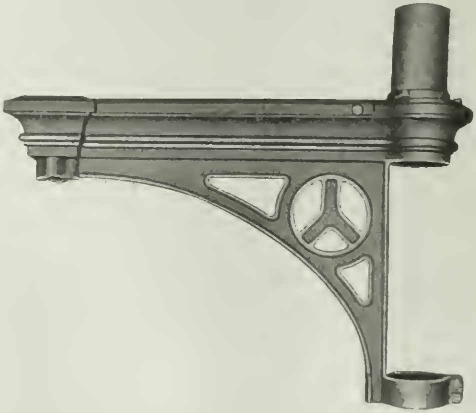


FIG. 2—ARC-LAMP BRACKET

Jobber, Dealer and Contractor

Detroit Contractors and Supply Men Organize

With elimination of certain trade abuses as one of the objects sought, a number of Detroit (Mich.) electrical contractors and supply men have organized the Detroit Improvement Association and elected the following officers: President, Mr. Alfred Moore; first vice-president, Mr. L. B. Reece; second vice-president, Mr. H. E. Ford; recording secretary, Mr. M. T. Green; financial secretary, Mr. F. A. Chapman; treasurer, Mr. W. F. Miller; sergeant-at-arms, Mr. Thomas Walters. The organization will endeavor to adjust trade differences, both general and individual, keep members informed of local conditions, raise the standard of electrical construction, promote a more friendly feeling among members of the trade and supply members with accurate information as to the standing of builders or others engaged in construction work.

St. Louis Jobbers' Outlook Bright

Territory tributary to St. Louis, Mo., harvested bumper crops in 1913, establishing basic prosperity in which the electrical jobbing interests of the city hope to share. Judging from the January business, Mr. Burt Crouch, of the sales department of the Western Electric Company, predicts that the supply business of 1914 will make a steady and substantial increase over that of last year. The company's business in St. Louis for 1913 was good and showed a comfortable increase over 1912, which rather indicated that the supposedly general financial depression had not reached the purchasers of electrical supplies in and near St. Louis.

Mr. Charles Scudder, of the Wesco Supply Company, in an interview with a representative of the *Electrical World* stated that the outlook for the coming year was bright. Everything seems to point toward the fact that the low point on the "financial-depression curve" was passed about Jan. 1, 1914, the general trend of that interesting graph now being markedly upward.

Responsible jobbers in St. Louis are co-operating with contractors and retail dealers respecting the interests of those concerns which sell to the general public, although there is no price agreement. Many jobers do no retail business at all.

Brooklyn Contractors Dined by Edison Company

The eighth annual dinner to Brooklyn electrical contractors by the Edison Electric Illuminating Company of Brooklyn was held at the Academy of Music on Feb. 7. More than 300 contractors drank to the toast of a bigger, better, brighter Brooklyn, and the occasion was the most successful and largest of the yearly love feasts given by the electric company. Mr. T. I. Jones, the general sales agent of the company, acted as toastmaster, and addresses were made by Mr. W. F. Wells, vice-president and general manager of the company, whose subject was "The Edison Company"; Mr. Louis Kalischer, president of the Electrical Contractors' Association of Long Island, on "Wiring Brooklyn"; Hon. L. H. Pounds, Borough President, who told of "The Borough's Future"; Mr. J. R. Strong, past-president of the National Electrical Contractors' Association, whose topic was "The Society for Electrical Development"; Mr. J. C. Forsythe, chief inspector of the New York Board of Fire Underwriters, who told of "The Work of the Board of Underwriters," and Mr. F. W. Conn, to whom was assigned the subject of "Industrial Brooklyn." During the dinner and between speeches songs were sung with a relish, and the whole occasion reflected the very cordial relationship existing between the electric-light company and the contractors of Brooklyn. The opportunities existing for the electrical contractors, the willingness of the electric company to relieve them of the financial responsiblity of carrying customers of good credit and its desire to help and co-operate in every way were outlined by both Mr. Wells and Mr. Jones.

DINNER OF EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN TO LOCAL ELECTRICAL CONTRACTORS

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Recent Sales of Gas Engines.—Among the larger gas engines sold recently by the Bruce-Macbeth Engine Company, of Cleveland, Ohio, an aggregate capacity of 615 hp was taken by the following concerns: The Ohio & Pittsburgh Milk Company, Pittsburgh, Pa.; the Odenweller Milling Company, Ottoville, Ohio; the Washington (Pa.) Milling Company; the Hoefler Ice Cream Company, Buffalo, N. Y.; A. H. Koughan, McKeesport, Pa., and the Consumers' Paint. Shale & Gas Company, Perry, Okla.

Ice Plants Using Central-Station Energy.—Ice plants aggregating 4841 hp are connected to the mains of the Commonwealth Edison Company, Chicago. Fourteen different plants owned by eleven companies have made contracts for energy with the electric-service company. The daily tonnage output for the various plants ranges from 60 tons to 140 tons, totaling 1245 tons. The largest electric ice plant in Chicago is that of the Consumers' Company, at East Sixty-first Street and University Avenue, where motors rated at 564 hp are installed.

Carnival Spring Buyers' Convention in New Orleans.—The Carnival Spring Buyers' Convention of the Merchants and Manufacturers' Bureau of New Orleans will be held in that city on Feb. 16 to 24, inclusive. It is understood that the Merchants and Manufacturers' Bureau of New Orleans will refund the round-trip railroad fare of any merchant who goes to New Orleans and purchases goods to the value of $500 or more from members of the bureau, provided the visitor registers at the bureau's headquarters upon arrival and has purchased a round-trip carnival-rate railroad ticket to New Orleans. The round-trip ticket is good returning until March 6. A program of entertainments for visiting merchants has been arranged, including the Rex parade on Feb. 24. The Jovian Order will give a "Jovian Night" celebration in New Orleans on Feb. 21, and entertainment will be provided for all visiting Jovians.

Diesel Engines to Be Made in Los Angeles.—According to the daily newspapers, the Union Tool Company, of Los Angeles, has acquired exclusive rights for the manufacture of Diesel engines of the type made by Baumeister & Wain, Copenhagen, Denmark. The contract is reported to have been made by the Los Angeles company with Andrew Weir and J. Tilden Smith, of London, representatives of Baumeister & Wain. It gives the exclusive right for the manufacture and sale of the Diesel engine of this type on the west coast of North and South America, the rights for the United States including all the territory west of the Mississippi River. It is said that the paid-up capital stock of the Union Tool Company will be increased at once from $1,200,000 to $2,500,000, and that $500,000 will be spent in enlarging the plant at Torrance. It is stated further that I. Knudson, of Copenhagen, the managing director of Baumeister & Wain, will oversee the installation of the new machinery in the Los Angeles factory.

Series of Lectures on Public Utilities Planned.—Through joint action of the Finance Forum of the West Side Y.M.C.A. in New York City and some of the leading banking, engineering and operating interests connected with public utility matters, a series of ten lectures has been arranged to cover the questions of public utility organization, management and financing, together with construction and operation. The lectures are designed to induce, through better knowledge, a rational public opinion concerning utilities, particularly as it may affect legislative and regulatory action, and to give a better idea concerning the stability and value of public utility securities. The lectures are to begin the latter part of the present month. C. B. Wilcox has been selected as permanent chairman of the general committee in charge of the course of lectures, and included in the membership of the committee are A. W. Burchard, A. H. Bickmore, H. F. Davison, H. L. Doherty, Lewis Franklin, R. H. Griscom, A. G. Hoyt, H. R. Hayes, W. M. Kingsley, A. L. Kramer, A. B. Leach, S. Z. Mitchell, Ray Morris, W C. Poillon, Seton Porter, J. H. Pardee, Calvert Townley, H. A. Viele, F. C. Walcott, J. C. Weadcock, G. C. White, R. K. Wilsey, C. B. Willcox, W. B. Dinsmore, F. T. Homer, J. H. Rhodes and James Sheldon. The lectures will be given in the auditorium of the West Side Y.M.C.A.

Electrical Tool Manufacturer Increases Capitalization.—An increase in the capital stock of the Eveland Engineering & Manufacturing Company, of Philadelphia, Pa., has been authorized by the board of directors for the purpose of extending its business. According to S. S. Eveland, president of the company, the new capitalization will be $2,000,000 in place of the present figure of $100,000. In the *Electrical World* of Aug. 9, 1913, note was made of an increase in the company's manufacturing equipment and of a large contract placed with the firm of Manning, Maxwell & Moore, involving the sale of an entire year's production of Eveland electric riveters.

Industrial Use of Electricity in Springfield (Mass.) District.—The Amherst Power Company, an organization affiliated with the Turners Falls Power Company and other Cabot properties in Massachusetts, has recently extended its service through the Connecticut Valley to include many industrial plants in the Springfield district. Among the company's customers are the Fisk Rubber Company, 3000 hp; Springfield Street Railway, 2000 hp; Chicopee Manufacturing Company, 750 hp, and the Page-Storm Company, 400 hp. The Amherst company has entered into a contract with the United Electric Light Company of Springfield whereby the latter will act as a distributing agency, handling a normal load of about 2000 kw. On the west side of the Connecticut River the local service is handled by the Agawam Electric Company, and energy is supplied to the West Springfield water-works pumping plant to the extent of 150 hp; to Lane's quarry, Westfield, 200 hp, and to the Ramapogue Ice Company, 300 hp. About 600 kw is utilized by the Northern Connecticut Light & Power Company in supplying service to Thompsonville, Windsor Locks and other local communities. When present power developments are completed on the Connecticut River, the company will be able to generate about 50,000 hp in its hydroelectric plants. The lines of the company are carried on about 500 steel towers and are designed for ultimate operation at 66,000 volts. The standard towers are 75 ft. high and are mounted on concrete piers. Important hydraulic developments are under way at Turners Falls, Mass., and allied companies in Greenfield and Easthampton are co-operating with the Amherst system in the distribution of electrical energy.

To Investigate South American Trade Possibilities.—On Feb. 7 thirty-seven members of the Illinois Manufacturers' Association sailed from New York, bound for South America, where an extended survey is to be made of the possibilities of that continent as a consumer of American goods. As stated in the Nov. 2 issue of the *Electrical World*, this delegation was headed by E. N. Hurley, of Chicago, president of the Hurley Machine Company, who was appointed by Secretary Redfield of the Department of Commerce as United States trade commissioner to South America. The party will visit Brazil, Argentina, Chile and Peru and will look into questions of financial as well as of industrial and commercial importance. It appears that a large part of the banking system in the above countries is controlled by English and German interests and, as the facilities provided by these banks are necessary to the carrying on of trade relations, this state of affairs immediately places the

American exporter at a disadvantage in competition with the English and German exporters. The following statement by Mr. Hurley, on the eve of his departure, is worth noting: "It is a mistake for American business men to think that England and Germany have the South American trade so closely in their grip that there is no opportunity for the business men of the United States to obtain a large share of it. The people are there and the money is there. The field is a tremendous one, but the conditions there have never been properly studied, nor have plans been put into operation that would make it possible to increase the commerce between those countries and the United States."

Electric Furnaces for Steel Manufacture.—In the Jan. 24 issue of the *Electrical World* a note appeared concerning the construction of a new plant at Indianapolis by the Electric Steel Company of Indiana. The plant at present under construction will have a capacity of about 14,000 lb. of finished castings per day. The furnaces now being installed and those proposed for the future are the latest type of Buckman arc smelter. The unit under consideration will draw about 300 kw. Energy will be purchased from the local public service company and will be stepped down from 4100 volts to 110 volts. Three-phase, sixty-cycle current will be employed. Three single-phase transformers of 200-kw rating each (allowing 100 per cent overload) will be used to step down the voltage. These will be furnished with tap regulation, so arranged that the current may be furnished to the furnace at practically any voltage from 5 to 110. This allows, with the mechanical devices of the furnace, absolute control of temperature. The Buckman smelter is especially designed to reduce losses from self-induction and is thus able to operate efficiently on sixty-cycle, 110-volt, three-phase current. This makes possible the economic use of the usual equipment of public service plants, which is a very important feature for both the producer of power and the foundryman.

Two Thousand Men at Banquet of Hawthorne Works Employees.—The fifth annual banquet of the Hawthorne Works men employees of the Western Electric Company was held at Medinah Temple, Chicago, on Feb. 4. The attendance was very large, numbering about 2100. As the attendance at the 1913 banquet was 980, the increasing popularity of this annual event is indicated. S. S. Holmes, president of the Hawthorne Men's Club, was toastmaster and the speakers at the dinner were H. F. Albright, general superintendent of the Hawthorne Works, and J. W. Bancker, assistant general superintendent. Medals were presented to the prize winners of last year's athletic contests in which the Hawthorne men participated. Following the dinner a vaudeville entertainment by professional talent was given in the main auditorium of Medinah Temple. The affair was attractively and persistently advertised in the various departments of the Hawthorne Works before the event, and it assumed such great proportions that the Hawthorne men styled it "our big night." Thirty-six special surface cars were provided to take those in attendance for the long ride from the Hawthorne Works to Medinah Temple. It was the ambition of the Hawthorne employees to make this annual dinner the largest and most successful affair of the kind ever attempted by any organization, and they may have succeeded. Nine hundred pounds of beef and 1200 lb. of chicken were needed. The banquet was held under the general supervision of the works central committee, of which C. J. Malmros is chairman, and was arranged and managed by the Hawthorne Men's Club, J. A. Dietz being chairman of the executive committee. F. J. Sheridan was chairman of the arrangement committee of the club and M. K. Roewade was chairman of the publicity committee.

Electrical Features of New Omaha Hotel.—Omaha is to have a fine, modern hotel in the Hotel Fontenelle, which is to be built by the Douglas Hotel Company at the northwest corner of Douglas and Eighteenth Streets. The excavation has been made, and the Selden-Breck Construction Company, of St. Louis, has the general contract for the building. Mr. Thomas R. Kimball, of Omaha, is the architect, and Neiler, Rich & Company, of Chicago, are the consulting electrical and mechanical engineers. The building will contain over 300 rooms and will consist of fifteen stories, besides the basement and attic. The ground plan is 132 ft. square. The building is well designed, both inside and out, and the hotel will be provided with all modern improvements, including some new features, such as lounging rooms on the two floors devoted to sample rooms for commercial travelers and key chutes by which keys to guest rooms can be returned to the clerk's desk if overlooked. There will be five electric elevators of the traction type, two of which will be for passengers. Electricity will be used exclusively for lighting and for many mechanical purposes. The lighting load will consist of about 250 kw and the motor load of about 223 hp. Central-station energy will be purchased, probably, from the Omaha Electric Light & Power Company, although space is provided for an electrical generating plant if one should be installed later. Direct current at 500 volts will be used for elevator and fan motors, and three-phase alternating current for general motor purposes, including laundry machinery. Electric signs will be a feature of the building and are incorporated in the general architectural plan, so that in daylight the signs will not give the appearance of something extraneous to the general building design. Fronting on each street there will be large roof signs giving the name of the hotel, the letters being 5 ft. 8 in. high. In addition there will be electric signs over the marquises or sidewalk canopies. Special illumination will be provided for these marquises, and another interesting feature in the illumination is a provision for lighting, by reflected light from above, the skylight over the main lobby, so that it will present a warm and pleasing appearance at night, obviating the cheerless effect often associated with skylights after dark. The corridor lighting will be provided by lamps supported on bracket fixtures, it being thought that ceiling fixtures have a tendency to magnify the apparent length and height of hotel corridors. In the dining room and palm room removable ceiling fans will be provided. Telephones will be installed in all the guest rooms.

Statement of the Copper Producers' Association for January

Marked increases in both domestic and foreign deliveries (the latter being the heaviest for any month on record) together with a decrease in production during January caused a falling off in the stocks on hand in the United States at the end of that month. The fact that no decided increase in foreign consumption has been noticed throws an interesting side light on the statistics, as given below:

	January, pounds		December, pounds	
Stocks on hand in the United States on first of month		91,438,867		47,929,429
Production		131,770,274		138,990,421
		223,209,141		186,919,850
Domestic deliveries	47,956,955		21,938,570	
Foreign deliveries	87,955,501		73,542,413	
		135,912,456		95,480,983
Stocks on hand at end of month		87,296,685		91,438,867

NEW YORK METAL MARKET PRICES

	Feb. 3			Feb. 9		
Copper:	Bid		Asked	Bid		Asked
Standard, spot*	....		14.75	....		14.75
	Selling Prices			Selling Prices		
	£	s.	d.	£	s.	d.
London, standard, spot*	66	7	6	65	0	0
Prime Lake	15.00	to	15.25	14.87½	to	15.12½
Electrolytic	14.75	to	14.85	14.65	to	14.75
Casting	14.55	to	14.65	14.45	to	14.55
Copper wire base	15.87½	to	16.00	15.87½	to	16.00
Lead	4.15			4.15		
Nickel	40.00	to	45.00	40.00	to	45.00
Sheet zinc, f.o.b. smelter	7.25			7.25		
Spelter, spot	5.50	to	....	5.45	to	5.47½
Tin, spot	40.25	to	40.50	40.12½	to	40.50
Aluminum:						
Prompt delivery	18.75	to	19.00	18.75	to	19.00
Future	18.60	to	18.75	18.50	to	18.75

*OLD METALS

Heavy copper and wire	13.75	13.75
Brass, heavy	8.87½	8.87½
Brass, light	7.87½	7.87½
Lead, heavy	4.25	4.05
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to Feb. 9 7,469

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*From daily transactions on the New York Metal Exchange

Corporate and Financial

Indiana Utility Planning Bond Issue.—The $200,000 of 5 per cent first mortgage refunding gold bonds of the Richmond (Ind.) Light, Heat & Power Company fell due on Jan. 1, 1914, and on March 15 the $500,000 three-year 6 per cent debenture notes of the company will fall due. In order to take care of these maturing issues permission has been granted to the company by the Indiana Public Service Commission to issue $850,000 first mortgage bonds, to be sold at not less than 90. In addition to providing for the retiring of the previous issues, the proceeds from the sale of these bonds will be used to pay for extensions and improvements to the company's properties.

Change in Federal Light & Traction Officials.—At the annual meeting on Feb. 4 the following officers were elected by the stockholders of the Federal Light & Traction Company, of 60 Broadway, New York: E. N. Sanderson, president; Francis Blossom and Craig Colgate, vice-presidents; C. C. Chappell, vice-president and general manager, and H. H. Porter, secretary. The entire board of directors was reelected with the addition of Francis Blossom in place of Parmely W. Herrick, resigned. The financial returns for 1913 were somewhat poorer than those for the preceding year, owing in large measure to the unfortunate fire at Hot Springs, Ark., last summer. Gross earnings came to $2,329,164 for the year ended Dec. 31, and net earnings amounted to $903,492, excluding the statement of the Deming (N. M.) Ice & Electric Company.

Sale of Utah Power & Light Bonds.—The Utah Power & Light Company has sold recently $10,000,000 of first mortgage 5 per cent thirty-year bonds, part of an authorized issue of $100,000,000. The bonds are dated Feb. 2, 1914, and are callable at 105 on or after Feb. 1, 1919. Proceeds of the sale of these bonds are to be applied to the retiring of a portion of the $22,000,000 issue of 6 per cent ten-year bonds of the Utah Securities Corporation now outstanding. The Utah Power & Light Company supplies electrical energy for lighting and power uses in the section centering around Salt Lake City and Ogden, Utah, and including a portion of Idaho. Through its subsidiary, the Western Colorado Power Company, the Utah company covers a part of the State of Colorado. In the Dec. 13, 1913, issue of the *Electrical World* there appeared a note on the status of the Utah Power & Light Company, abstracting a statement of S. Z. Mitchell, president of the Utah Securities Corporation, which is the holding company. A good idea of the extent of the company's properties was given in that note.

Kings County Electric Light & Power Company's Annual Report.—The Kings County Electric Light & Power Company's report for the year ended Dec. 31, 1913, made public this week, shows that the year just past has been one of increased activity and has been attended by satisfactory financial results. The gross earnings during that period amounted to $5,742,548, while net earnings of $2,079,920 and a surplus of $160,699 were realized. On July 1, 1912, the retail rate for energy was reduced from 12 cents per kw-hr. to a sliding-scale demand rate, beginning at 11 cents per kw-hr., and continuing at 8 cents and 4 cents for increased hours of use. Tungsten-lamp prices were greatly reduced, and sizes of 100 watts and over are supplied free to all retail customers. In 1913 a special effort was made to increase the business and more than 100 private plants, ranging in capacity up to 1000 hp, have been replaced by the service of the company. During the year 23,855 contracts were signed. In addition to the current supplied for lighting, 74,052 hp in motors is operated from the company's lines. On March 1, 1913, $2,500,000 of 6 per cent twelve-year convertible debenture bonds were offered to the stockholders at par, in proportion to their stock holdings, and were fully subscribed. On the same date the first issue of $4,000,000 similar debenture bonds became convertible into stock of the company at par, and up to the end of the year $2,942,900 of these bonds were converted. The plant and property of the company have substantially increased, the additions including a new boiler house, substation and station apparatus. The profit-sharing plan inaugurated in December, 1910, was continued, and on Jan. 1, 1914, $56,653 was distributed to 927 employees. The Brooklyn Edison investment fund, designed for the purpose of enabling employees to invest their savings in the securities of the company, achieved a wider usefulness, two-thirds of all employees being depositors in the fund. Three men who had served the company for over twenty years and who, owing to age and physical disability, were unable to perform further duty were pensioned. The company also reports a growing cordiality in relationship between its customers and its employees and notes that, despite the high cost of living and increase in cost of labor, materials and commodities generally, the adoption of substantial economies and increased efficiency have made possible continued first-class service at low rates with a continuance of the high standard of wages to employees. Indications are that the current year will compare favorably with 1913.

Bonds of United Light & Railways Company.—Chicago bankers and brokers are offering for sale the first and refunding mortgage 5 per cent gold bonds of the United Light & Railways Company, of Grand Rapids, Mich., and Chicago. The company owns all or a large majority of the outstanding capital stock of thirteen public service companies operating in Grand Rapids, Muskegon and Cadillac, Mich.; Chattanooga, Tenn.; Laporte, Ind.; Rock Island and Moline, Ill., and Cedar Rapids, Marion, Fort Dodge, Ottumwa, Davenport, Muscatine, Iowa City, Clinton and Mason City, Iowa. The 5 per cent bonds of the holding company, now offered for sale, are secured by a first mortgage on the properties of some of the subsidiary companies and by deposit with the trustee under the mortgage of outstanding stock or bonds of other of the companies. Mr. Frank T. Hulswit, the president of the company, in a letter dated Dec. 29, 1913, says that he believes that these bonds are thoroughly well secured. The brokers are offering them for sale at 86 and accrued interest, at which price they net 6.25 per cent. An extra dividend of 1 per cent in common stock was declared recently on the common stock of the company, putting it on a 5 per cent per annum basis. This dividend was explained to be an extra dividend out of surplus and not a quarterly payment.

Union Electric Light & Power Company's Annual Report.—Vice-president A. C. Einstein of the Union Electric Light & Power Company of Missouri, at the annual meeting of the stockholders on Jan. 29, presented the company's annual report, from which the following data are abstracted: Although the energy sold to residence and commercial customers during 1913 exceeded that in 1912 by 17.5 per cent, the gross revenue increased only 0.8 per cent, owing to the general rate reduction made in December, 1912. The financial operations of the company for the year resulted as follows: Gross revenue, $3,683,107.29; operating expenses, $2,145,241.32; gross income, $1,537,865.97; interest charges, $855,106.22; net income, $682,759.75. The following statistics were quoted in comparing the business of 1913 with that of 1911 and 1912: The average rate per kilowatt-hour for lighting purposes decreased 14.8 per cent as compared with 1912, and 23.9 per cent as compared with 1911. The average rate received from motor-service sales decreased 12.9 per cent and 21.7 per cent as compared with 1912 and 1911 respectively. During 1913 the greatest load carried was approximately 76,000 hp. Notwithstanding the fact that approximately one-third of the company's power requirements were supplied by the Keokuk station, almost 298,000 tons of coal were used at the Ashley Street station, St. Louis, Mo. The total pay roll of the company for 1913, covering an average of 1100 employees, aggregated over $889,000, an average of $2,435 per day. In the extensions and improvements of the system the company expended during 1913 the sum of $1,174,460 for new property and equipment, and in addition thereto $130,000 was expended in replacing obsolete or worn-out property and approximately $138,000 to maintain equipment. In extensions of the distribution system more than 2000 new poles were set, 411 miles of overhead wire were strung, 70 miles of underground conduit were laid and 30 miles of underground cable were installed. Taxes paid the city, state and federal governments in 1913 aggregated $293,500. This is equal to $6.85 per year for each customer served, 4.05 mills per kw-hr. sold for commercial light and power purposes. The following officers and directors were elected for the ensuing year: Breckinridge Jones, Benjamin Schnurmacher, H. Spoehrer, James Campbell, J. D. Mortimer, A. C. Einstein, C. S. Ruffner, H. N. Davis, H. H. Pierce and Julius Walsh.

Business Notes

C. J. Netting Company, Detroit, Mich., dealer in electrical fixtures, has increased its capitalization from $50,000 to $100,000.

Taylor & Miller is the name of a partnership formed recently by S. R. Taylor and E. A. Miller for the purpose of dealing in public utility securities. The office of the firm is at 49 Wall Street, New York City.

The American Ever-Ready Company, manufacturer of batteries and flash lamps, has appointed W. Covert Jones district sales manager of its Chicago offices. Mr. Jones was formerly sales manager of the Union Electric Company, Pittsburgh, Pa., about seven and one-half years.

A. Chaurette, who has been with the John D. Templeton Company, electrical contractors, for several years, has engaged in business for himself at 345 Woodward Avenue, Detroit, Mich., under the name of the Al. Chaurette Company. The company will design and manufacture lighting fixtures.

Hugh L. Cooper has opened an office at 101 Park Avenue, New York City, for the practice of hydraulic engineering, including design, construction and management of hydroelectric generating plants. Mr. Cooper is well known for his work on the hydroelectric developments at Keokuk, McCall's Ferry, Pa., and Niagara Falls, Ont.

New Industrial Companies

The Ad Electric System Company, of Dayton, Ohio, has been incorporated with a capital stock of $25,000 by James Stoops, H. M. Requarth and W. M. A. Huffelman.

The Royal Electric Heater Company, of Chicago, Ill., has been chartered with a capital stock of $10,000 by William V. Brothers, David M. Brothers and George A. McCarkle.

The King City Electric & Manufacturing Company, of King City, Mo., has been incorporated with a capital stock of $8,000 by George Ward, George P. Adams and Harry V. Forrest.

The Eleco Company, of Bayonne, N. J., has been incorporated with a capital stock of $2000 to deal in electric supplies. The incorporators are Norman Johnson, Mildred V. Stauffer and Joseph Bartlato, of New York, N. Y.

The Quick Charge Storage Battery Company, of New York, N. Y., has been incorporated by S. O. Sabel, R. Law and L. Reid, of New York, N. Y. The company is capitalized at $500,000 and proposes to manufacture storage batteries, electrical apparatus, etc.

The John L. Rossel Manufacturing Company, of Naugatuck, Conn., has been chartered with a capital stock of $15,000 by John L. Rossel, George W. Braun and Oscar Berg, all of 200 Broadway, New York, N. Y. The company proposes to manufacture lighting fixtures, etc.

The American Metal Moulding Company, of Newark, N. J., has been incorporated by C. A. Rubovitz and G. A. Johnson, of Newark, and C. Hanson, of Irvington. The company is capitalized at $50,000 and proposes to manufacture metal conduits for the conveyance of electric wire, etc.

The Removable Letter Sign Corporation has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $250,000 to manufacture and sell electrical advertising and display signs. The incorporators are W. M. Pyle, G. G. Steigler and L. W. E. McCarthy, of Wilmington.

The National Conduit Wiring Machine Company has been chartered under the laws of the State of Delaware with a capital stock of $250,000 for the purpose of manufacturing conduit wiring machines and other machinery. The incorporators are I. Hirshfeld, G. F. Stott and F. V. Stott, of New York, N. Y.

The National Motors & Manufacturing Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000 to manufacture and sell motors, fans, hydraulic appliances, etc. The incorporators are H. E. Latter, W. J. Maloney and O. J. Reichard, of Wilmington, Del.

Trade Publications

Centrifugal Pumps.—The Yuba Construction Company, of San Francisco, Cal., has issued a catalog describing its make of centrifugal pump adapted specially for irrigation pumping service.

Public Utility Securities.—Some interesting general information on the subject of public utility securities is contained in a pamphlet issued recently by E. W. Clark & Company, of Philadelphia, Pa.

Direct-Current Switchboards.—The General Electric Company recently issued Bulletin No. A4189, devoted to small-plant direct-current three-wire switchboards of 125 volts and 250 volts and 10 kw to 100 kw.

Electric-Lighting Specialties.—The sixteen-page booklet recently issued by the Harter Manufacturing Company, of Chicago, Ill., contains information on that company's product, which includes several new features, among them a special shade-positioning device.

Rubber Specialties.—Rubber disks, pump valves, packing, gaskets, tubing and other rubber specialties made by Jenkins Brothers of New York City, are illustrated and described in a sixteen-page pamphlet recently issued under the title "Mechanical Rubber Goods."

Ice-Making Machinery.—"Motor-Driven Refrigerating and Ice-Making Machinery" (Section 3133), a pamphlet issued by the Westinghouse Electric & Manufacturing Company, describes the process employed in this class of work and illustrates the application of electric motors thereto.

Waterwheels.—An exhaustive and well-illustrated catalog, recently published by the Pelton Water Wheel Company, of San Francisco, Cal., covers the field of turbine and tangential waterwheels interestingly and thoroughly. Some attention is paid to the questions of pipe lines, penstocks and governors, and the electrically driven turbine-pump is touched upon also.

Fans.—The General Electric Company is distributing its 1914 illustrated catalog of electric fans, known as Bulletin A-4197. While technical data have been intentionally omitted, the catalog contains sufficient information to enable customers to order intelligently. The publication is devoted to fans for table, wall and ceiling mounting and describes also small ventilating outfits. Among the first-mentioned are fans which are moisture-proof and have fittings which are non-corrodible, especially for use on shipboard.

Air Washers.—The Carrier Air Conditioning Company of America, 39 Cortlandt Street, New York, has issued Catalog No. 13, which contains a comprehensive illustrated description of three types of machines for air washing, cooling and controlling humidity in public or semi-public places. The catalog is interesting not alone for its contents but as reflecting the modern trend toward the purification of the air and the elimination of dust in public buildings, and the possibilities of its becoming of equal importance with the heating problem. Several humidity tables are given, as well as a very useful and interesting chapter on humidity by Messrs. Willis H. Carrier and J. I. Lyle and a section devoted to the physical laws of humidifying and cooling. The apparatus used in the various processes is electrically driven.

Heating.—"Heating and Ventilating a Large Factory" and "Heat Transmission Through Building Walls of Corrugated Iron" are the titles of two articles which the Green Fuel Economizer Company, Matteawan, N. Y., has had reprinted from the *Iron Age* and *Engineering News* respectively for gratuitous distribution. The first describes a hot-blast heating and ventilating outfit, utilizing exhaust steam, installed by the Green company in two large concrete and glass buildings, aggregating 2,400,000 cu. ft., of the Lee Tire & Rubber Company, Coshohocken, Pa. Full particulars of calculations are given. The second article describes tests made on the hot-blast heating equipment of the Green company's own fan shop, which is a steel-frame building covered with corrugated iron. The actual heat transmission found is compared with figures deduced from various data and formulas as given by Rietschel, Grashof, Woodbridge and others, with which it is found in substantial agreement.

Personal Mention

Mr. R. A. Lyons, for many years chief engineer of the London (Ont.) Electric Company, has resigned.

Mr. P. Wilkie has been appointed chief engineer of the London (Ont.) Electric Company, vice Mr. R. A. Lyons, resigned.

Mr. Kent Graham has been appointed manager of the new-business department of the Fremont (Neb.) Gas, Electric Light & Power Company.

Mr. Arthur Reid, formerly superintendent of electric railways and electricity in Lethbridge (Alta.), has been elected commissioner of public utilities for that city.

Mr. Page L. Nourse, local manager of the Southern Sierras Power Company at Elsinore, Cal., has been transferred to the main offices of the company at Riverside, Cal.

Mr. C. J. Johnson, who has been for ten years actively connected with the Capital Light & Power Company of Jackson, Miss., has been appointed general manager of the company.

Mr. B. D. Christian, formerly engineer with the sales department of the Merchants' Heat & Light Company, Indanapolis, Ind., has joined the Chicago sales staff of the Crocker-Wheeler Company.

Mr. James de Young, who recently resigned as superintendent of the Consumers' Power Company in Owosso, Mich., has announced his candidacy for the nomination of Mayor under the new commission charter.

Mr. George E. Quinan, operating superintendent of the Puget Sound Traction, Light & Power Company, Seattle, Wash., has been made superintendent of light and power, as successor to Mr. W. J. Grambs, who has been promoted to the position of assistant to the president.

Mr. G. H. Stevens has resigned from the Toronto (Ont.) Railway Company to accept a position with the Canadian Niagara Power Company. Mr. Stevens will have charge of the entire secondary distribution system in the districts of Fort Erie, Bridgeburg and Ridgeway. His headquarters will be at Fort Erie, Ont.

Mr. Victor E. Thelin, formerly testing engineer for the Chicago City Railway Company, has been appointed engineer in charge of the testing department of the Chicago Surface Lines. He did his scholastic work in electrical engineering at Lewis Institute. He will have charge of miscellaneous testing, substation metering and power statistics.

Mr. Joseph H. Brewer, vice-president and general manager of the American Public Utilities Company of Grand Rapids, Mich., was unanimously elected chairman of the board of directors at a meeting held on Feb. 4, as successor to Mr. Charles B. Kelsey, who stepped down from that position on account of his many other duties in public life. Mr. Kelsey continues, however, to retain his financial interests and will take an active part in the affairs of the company.

Mr. H. Almert, for the past five years manager of the department of examinations and reports for Messrs H. M. Byllesby & Company, of Chicago, has opened offices in The Rookery, Chicago, as a consulting engineer. Mr. Almert is completing his twentieth year of active work in the organization, financing, designing, constructing, operating and managing of public utilities, and for several years has valued or passed on investments for new projects, consolidations, reorganizations, etc. He has practised before many of the public service commissions, has served as arbitrator in several condemnation proceedings, and possesses legal training with accounting, backed by technical training and experience. Mr. Almert will have associated with him a staff of assistants in gas, electrical, mechanical and hydraulic engineering.

Mr. A. A. Thurlby, until recently superintendent of wires and cables of the Chicago City Railway Company, has been appointed superintendent of lines and transmission for the Chicago Surface Lines. Mr. Thurlby, who was born in Nottingham, England, in 1860, has had an interesting career. He came to America in 1868 and began active electrical work in 1877 with the Brush Electric Company, of Cleveland, with its erecting force. In this pioneer work Mr. Thurlby traveled extensively at home and abroad. In 1891 he resigned to become manager of the Battle Creek Street Railway Company, where he remained for one year, leaving to become engineer in the inside-wiring department of the Chicago Edison Company. In 1893 he returned to the Brush Electric Company, where he remained but a short time, having accepted a position with the People's Light, Power & Motor Company, of Chicago, as assistant superintendent in charge of overhead lines. He remained with that company when it was absorbed by the Commonwealth Electric Company, resigning in 1899 to be appointed manager of the Manistee (Mich.) Electric Railway Company. In 1902 he became associated with the late John R. Walsh in his electrical projects. He retained this connection until 1907, when he returned to Chicago. In that year Mr. Thurlby was appointed superintendent of underground and overhead wires and cables of the Chicago City Railway Company, which position he held until his present appointment.

Mr. W. J. Grambs, superintendent of light and power of the Puget Sound Traction, Light & Power Company, Seattle, Wash., has been promoted to the position of assistant to President Jacob Furth. Mr. Grambs engaged in the electrical business in Seattle in the spring of 1888 and established and organized the Northwest Electric Supply & Construction Company. This company installed the first incandescent electric lighting plant in the Northwest, and successively represented the Edison United Manufacturing Company, the Sprague Electric Railway & Motor Company, the Edison General Electric Company, the General Electric Company and the Northwest General Electric Company. In 1899 Mr. Grambs resigned his position with the General Electric Company to accept the position of purchasing agent of the Seattle Electric Company. In 1905 he was appointed contract agent of that company and two years later sales manager. In November, 1911, he was appointed superintendent of light and power. Between the years 1896 and 1899 Mr. Grambs acted as receiver for several of the street-railway lighting properties in the city of Seattle.

WILLIAM J. GRAMBS

Obituary

Walter Ambrose Pearson, consulting electrical engineer and brother of Dr. F. S. Pearson, died in New York City on Jan. 25. He was born in Putnam, Conn., in July, 1869, and was educated at Tufts College, Mass., and was graduated with the degree of B. A. in the class of 1890. Immediately upon his graduation he entered the employ of the West End Street Railway Company, of Boston, which was then going through the early stages of electric railway development. Mr. Pearson was employed first as a station operator. In 1893 he went to Brooklyn, N. Y., as electrical engineer in charge of the electric installation of the then Brooklyn Heights Railroad Company. In 1896 he became electrical engineer for the Metropolitan Street Railway Company, of New York City, and was particularly active in the development of the Lenox Avenue underground electric system, which was the first underground electric system to be developed in this country. Mr. Pearson remained with the Metropolitan Street Railway Company until 1906. He then went to Niagara Falls for the Electric Development Company of Ontario, in charge of the electrical installation and construction of this company's power house at Niagara Falls. In 1910 he went to Rio de Janeiro, Brazil, and there remained for two years as assistant general manager of the Rio de Janeiro Tramway, Light & Power Company. He returned to the United States in 1912, owing to poor health in the tropics, and became associated with the banking house of Bertron, Griscom & Company, with which he was connected at the time of his death, as consulting electrical engineer. Mr. Pearson was a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the New York Railroad Club and the Engineers' Club of New York.

Construction

New England

MALDEN, MASS.—Surveys are being made by the Malden & Melrose Gas Lt. Co. and the Malden El. Co. of the marsh land in the Wellington section of Medford with a view to removing the plants to that locality.

NEWPORT, R. I.—Steps have been taken by the committee on street lights for the installation of ornamental street lamps on Thames Street.

PROVIDENCE, R. I.—The stockholders of the Narragansett El. Lt. Co., of Providence, have authorized an increase in capital stock from $6,000,000 to $7,500,000.

Middle Atlantic

ALBANY, N. Y.—Bids will be received by Col. Franklin W. Ward, secretary State Board of Armory Commissioners, 174 State Street, Albany, N. Y., until Feb. 16, for construction of heating, plumbing and electric work for armory and stable at Albany for Troop "B," First Cavalry, National Guard, New York. Bids will be received for each division of the work and no combination of bids will be considered. Drawings and specifications may be consulted and blank forms of proposal obtained at the office of Lewis Pilcher, state architect, Capitol, Albany.

BUSTI, N. Y.—The Public Service Commission has granted the Western New York El. Co. authority to build an extension to its electric lines in this town. Post office address is Busti. R. F. D. Jamestown.

JAMESTOWN, N. Y.—The Public Service Commission has granted the Jamestown Ltg. & Pwr. Co. permission to extend its transmission lines in the town of Busti.

JAMESTOWN, N. Y.—Bids will be received by the board of electric light commissioners until Feb. 26 for furnishing labor and material for the installation of one return tubular boiler, two iron smokestacks and two underfeed stokers with forced-draft equipment, or other stokers, in accordance with plans and specifications on file in the office of the board. Copies of proposal blank, specifications, etc., may be obtained upon deposit of $10, which will be refunded upon return of plans.

NEW YORK, N. Y.—Bids will be received at the office of the depot quartermaster, United States Army, Army Building, New York, N. Y., until Feb. 16, for furnishing under Schedule 504 the following supplies: 150 pendent covers, 160 bracket fixtures, 48 keyless sockets, 120 holophane reflectors, 32 key sockets, 14 annunciators, 28 switchboxes, 600 outlet boxes, 14 panelboard boxes, 7 switch boxes, 14 panelboards, 2 panelboards, 1484 galvanized-iron bushings, 9940 ft. galvanized-iron conduit, 525 outlet-box covers, 105 switch-box covers, 42 galvanized-iron covers, 49 galvanized-iron elbows, 56 ceiling fixtures, 28 ceiling fixtures, 14 electroliers, 56 electroliers, 14 electroliers, 84 bracket fixtures, 28 bracket fixtures, 290 mica joints, 1624 lock nuts, 24 watt-hour meters, 28 receptacles, 16 gross brass screws, 6 gross machine screws, 56 holophane shades, 460 gas shades, 140 Hubbell shades, 18 dome shades, 290 fixture studs, 125 push-button switches, 95 switch plates, 175 porcelain key sockets, 15 treads, 35 lb. friction tape, and 12,200 ft. wire, etc. For further information address Lt. Col. M. Gray Zalinski, depot quartermaster.

NIAGARA FALLS, N. Y.—The report of City Electrician Donahue submitted to the Board of Public Works estimates the cost of extending the ornamental street-lighting at $29,700, including all station equipment.

WARSAW, N. Y.—Bids will be received by E. E. Charles, secretary, Warsaw, N. Y., until Feb. 24 for the construction of a high school building as follows: (1) general construction, including reinforced-concrete work, mason work and carpenter work; (2) heating and ventilating; (3) plumbing and gas-piping work; (4) electric wiring. Plans are on file in the office of the secretary of board and the office of Pierce & Bickford, architects, Elmira, N. Y.

FORD CITY, PA.—Within the next six months the managers of the municipal electric-light plant expect to erect a new power house and to install two 300-kw turbine-driven units; also to purchase two 200-hp boilers, two 300-kw, three-phase, 60-cycle, alternating-current generators, two 200-hp turbines, a three-panel switchboard, complete with street-lamp regulator for two circuits (100 250-watt tungsten lamps to each circuit), fifty 40-ft. poles (8-in. top), 20,000 ft. No. 4 weatherproof wire, 500 six-pin fir cross-arms. W. H. Ellis is superintendent and chief electrician.

NEW WILMINGTON, PA.—Improvements are contemplated to the municipal electric-light plant, including the installation of a 75-hp gas engine, a 70-hp steam engine, an 80-hp boiler, generator, ash-handling machinery, lightning arresters, wire, meters, poles, incandescent lamps, etc. J. B. Anderson is engineer.

SCRANTON, PA.—Within the next six months the United Service Co., of Scranton, expects to install coal-handling apparatus at three plants; also to install one 1250-kva turbine-driven unit and to remodel the distribution system in Warren, Pa.

WILKES-BARRE, PA.—Within the next three months the Wilkes-Barrs Co. expects to erect one coal-conveying line and coal-storage bins over top of boilers; also to purchase one 600-hp water-tube boiler and 3 miles of 0000 wire for transmission line from station No. 1 to station No. 2. E. A. Wakeman is manager.

MILFORD, N. J.—The town of Milford, it is reported, is contemplating the purchase of the electric-light plant of the Keystone Broom Co., to be owned and operated by the municipality.

PHILLIPSBURG, N. J.—The Board of Public Utility Commissioners has issued an order that the Phillipsburg Lt., Ht. & Pwr. Co. should be entitled to a franchise to operate in Phillipsburg. Application of approval of an issue of $125,000 in capital stock by the company was deferred until after an ordinance should be approved granting the company permission to do business in Phillipsburg.

SPRING LAKE, N. J.—The Borough Council has engaged P. H. Ogden, of Newark, civil engineer, to make investigations and prepare estimates of the cost of installation of a municipal electric-light plant. Edward White, superintendent, has been instructed to advertise for bids for the proposed cluster-lamp lighting system on the beach front, the bids to include wiring, conduits, standards, lamps, etc.

EASTON, MD.—A bill has been introduced to the State Legislature asking that the City Council be given authority to issue $30,000 in bonds to establish a municipal electric-light plant in Easton.

HAGERSTOWN, MD.—In a decision handed down by Judge Robert R. Henderson the injunction suit filed by the Mayor and Council is dissolved and the Hagerstown & Frederick El. Ry. Co. is given legal right to sell electricity for lamps and motors in Hagerstown in competition with the municipal electric-light plant. The questions in dispute have been pending since the municipal plant was established 15 years ago.

RISING SUN, MD.—The town of Rising Sun has petitioned the State Legislature for authority to issue bonds for the installation of an electric-light plant.

HARRISONBURG, VA.—J. M. Snell, chairman of the electric-light committee, has recommended to the Town Council the installation of an auxiliary plant, to cost about $12,000. It is proposed to install a large generator to be directly connected with one of the present turbine wheels or to a new wheel.

VICTORIA, VA.—A franchise for an electric-light system and also for telephones is being advertised by the town of Victoria. For further details address H. T Faison, town clerk.

WASHINGTON, D. C.—All bids received Jan. 9 at the Department of the Interior, Washington, D. C., for remodeling the power plant of the Government Hospital for the Insane at Washington, D. C., have been rejected and the work readvertised.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Feb. 24 for furnishing 11 miles of paper-insulated, submarine, armored type No. 324 cable, in accordance with Specifications 96-C and drawing 106 therewith, to be furnished in 1-mile lengths, under Proposal No. 689.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 3 for furnishing at navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 6390—15 portable electric drills (125 volts, two speeds); Schedule 6383—20 telegraph hand keys for radio transformers; Schedule 6382—two motor-driven wood lathes. Portsmouth, N. H., Schedule 6367—four electric sterilizers, copper nickel-plated, with tray. Brooklyn, N. Y., Schedule 6371—one 72-cell storage battery, complete, 20 gal. electrolyte; Schedule 6386—14,500 ft. rubber-covered, duplex lighting and power wire. Camden, N. J., and Quincy, Mass., Schedule 6371—four ringing dynamometers and two telephone motor generators, 30 miscellaneous telephone jacks, miscellaneous telephones and two telephone switchboards. Bids will also be received until March 10 as follows: Annapolis, Md., Schedule 6361—one electric dynamometer, with controlling panel and leading rheostate, one portable superheater, f.o.b. works, etc.; Schedule 6303—miscellaneous trolley track, with brackets and hangers; Schedule 6305—650 lb. 11/64-in. diameter aluminum wire. Applications for proposals should designate the schedule desired by number. T. J. Cowie is paymaster-general, U. S. A.

WASHINGTON, D. C.—L. B. Stillwell, consulting electrical engineer, 100 Broadway, New York, N. Y., has been engaged by Byron R. Newton, Assistant Secretary of the Treasury, to co-operate with the engineering force of the office of the supervising architect, Treasury Department, to prepare preliminary plans for a central plant to furnish light, heat and power to government buildings, for which Congress has appropriated $1,494,104 for buildings, equipment, machinery, etc., complete. The proposed plant will be located on the river front at Water Street, between Thirteenth and Thirteen and One-half Streets, and will provide heat, light and power to government buildings, old and new, west of the Peace Monument, including the Bureau of Engraving and Printing, the buildings of the Department of Agriculture, the Treasury building, the White House and buildings on the White House grounds, the State, War and Navy Building, the Winder and the Mills buildings, the Court of Claims building, the National Museum, the Smithsonian Institution, the Army Medical Museum, the Fish Commission, the Washington Monument, the District building and the Post Office Department, and the buildings when constructed on the sites acquired for each of the Departments of State, Justice and Commerce and Labor. The law contemplates a cross-connection between this central plant and the Capitol power plants, so that either plant may supply energy to the other in case of breakdown or other emergency.

North Central

DETROIT, MICH.—Bids will be received by Charles A. Gadd, secretary of school board, until March 10 for electric wiring in the Northeastern High School building, to be erected at Hancock and Warren Streets.

DETROIT, MICH.—The Mack Printing Co., of Detroit, is contemplating the erection of a power plant in connection with its new printing establishment at Elizabeth and John Streets, now in course of construction.

ESCANABA, MICH.—The Escanaba Trac. Co., it is reported, contemplates the construction of a new power dam on the Escanaba River at or near Chandler's Falls, 2 miles from the city limits at Gladstone. The company has applied to the State Railroad Commission for authority to issue $225,000 in bonds.

GRAND RAPIDS, MICH.—Owing to the engineering plans not being completed in time, the date for receiving bids for construction of South High School building has been extended from Feb. 16 to Feb. 23 Henry E. Crow is president of board of education.

IRONTON, MICH.—We are informed that the village of Ironton does not contemplate the installation of a municipal electric-light plant as reported in the issue of Jan. 10. Joseph W. Flanders is village clerk.

ARCANUM, OHIO.—The Board of Public Affairs expects to purchase within the next 12 months electrical supplies, consisting of lamps, general inside wiring material, line supplies and meters, amounting to from $600 to $800. C. C. McCool is superintendent.

BELLEFONTAINE, OHIO.—Bids will be received at the office of the Board of Control, Bellefontaine, until Feb. 21 for new equipment for the municipal electric-light plant. It is understood that the output of the plant will be doubled.

COLUMBUS, OHIO.—Proposals will be received by Samuel A. Kinnear, director of public service, Columbus, Ohio, until Feb. 24 for furnishing and installing an electric motor for the East Side sewage pumping station, in accordance with plans and specifications in the custody of the superintendent of water-works, City Hall, Columbus, from whom copies may be obtained.

GALLIPOLIS, OHIO.—The local electric-light plant is reported to have been sold recently at a sheriff's sale to J. F. Tanner for $6,585. A new company, it is said, will be organized to operate the plant.

MANSFIELD, OHIO.—The Mansfield Ry., Lt. & Pwr Co. expects to erect within the next eight months a new office building, 31 ft. by 90 ft., two stories high (brick and concrete). S. A. Foltz is secretary and manager.

SHILOH, OHIO.—The Village Council has passed an ordinance authorizing the purchase of the local electric-light system and equipment, together with the high-tension transmission line connecting Plymouth and Shiloh and contract for furnishing energy, from N. J. McBride, for $4,827.

HAZARD, KY.—The Hazard Lt. & Pwr. Co., it is reported, contemplates an expenditure of $10,000 for equipment for its plant. The company recently increased its capital stock from $15,000 to $30,000.

LOUISVILLE, KY.—Plans are being considered by the Swiss Cleaners & Dyers, of Louisville, for the construction of a plant, to cost about $50,000, which will be equipped for electrical operation. The company will install an electric plant, for which boilers and engine have been purchased. It is understood that orders have not yet been placed for a 60-kw generator and four motors ranging from 5 hp to 35 hp. Dr. H. E. Mechling is manager.

ATLANTA, ILL.—The Atlanta El. Lt. & Pwr. Co. expects to erect within the next three months 4 miles of transmission lines; also to purchase one car load of poles, 400 insulators and 12 lightning arresters (6600 volts); also within the next six months to purchase a 200-hp boiler. J. C. Robinson is manager.

MALTA, ILL.—A committee has been appointed to make investigations relative to the installation of an electric-light system in Malta.

SHELDON, ILL.—The installation of a municipal electric-light plant in Sheldon is reported to be under consideration.

DEERFIELD, WIS.—A company is reported to have been organized with a capital stock of $500,000 to furnish electricity in Deerfield and vicinity. Among the incorporators are O. A. Oestrich, L. A. Avery and Leora Westlake, all of Janesville.

LOWELL, WIS.—The Board of Village Trustees has granted the Lowell El. Lt. & Pwr. Co. a franchise to furnish electricity for lamps and motors in Lowell.

SHEBOYGAN FALLS, WIS.—Bonds to the amount of $49,000, it is reported, have been issued for the construction of an electric light and power plant and water-works system.

AURORA, MINN.—The report submitted by Emile B. Jackson, consulting engineer, of St. Paul, to the Village Council relative to the installation of a municipal electric-light plant, estimates the cost of a new plant at $25,000 and the cost of generating electricity at 3.45 cents to 3.88 cents per kw-hr. The cost of energy purchased from the Range Pwr. Co. would be about the same, and the cost of development of the water-power south of the town is estimated at $70,000. The Council has decided to install a steam plant at a site where trackage can be secured.

BELLINGHAM, MINN.—The installation of an electric-light system in Bellingham is under consideration. Electricity for operating the system may be secured from the plant in Madison.

BLUE EARTH, MINN.—Within the next few days the Board of Public Works expects to purchase underground conduit, distribution cable and wire for the municipal distribution system; also to purchase within the next 30 days 28 lamp-posts for five-lamp clusters, 24 lamp-posts carrying one lamp 8000 ft. underground cable and conduits for same. A motor-driven pump for deep well will also be installed. D. Fitch is superintendent.

EXCELSIOR, MINN.—Bids will be received by Harry E. Wistrand, village recorder, Excelsior, Minn., until Feb. 25 for the construction of a water-works system as follows: Division No. 1, distribution pipe line and accessories; division (2) furnishing and erecting a 75,000-gal. hemispherical tank on a 90-ft. steel tower; (2A) consisting of a 75,000-gal. elliptical steel tank on a 90-ft. steel tower; (3) for furnishing and installing complete with all accessories a 200-gal. triplex power pump directly connected to a 20-hp, three-phase, 220-volt motor; (4) construction of pumping station complete. Plans and specifications are on file at the office of village recorder, Excelsior, and at the office of J. F. Druar, of the Oscar Claussen Engineering Co., Commercial Building, St. Paul, Minn.

LISMORE, MINN.—Plans, it is reported, have been prepared by Earle D. J. Jackson, consulting engineer, Capital Bank Building, St. Paul, for an electric-light plant in Lismore. Through error this item appeared under Lismore, Mich., in the issue of Jan. 31.

LUVERNE, MINN.—Bids will be received by the City Council until Feb. 24 for the installation of an ornamental street-lighting system on Main Street, from Estey Street to Spring Street, in accordance with plans and specifications on file in the office of the city recorder. Plans and specifications may be seen and blank forms of proposal obtained at the office of L. P. Wolff, consulting engineer, St. Paul, Minn. S. C. Rea is city recorder.

WARREN, MINN.—Earle D. Jackson, consulting engineer, Capital Bank Building, St. Paul, is reported to have been engaged to prepare plans and estimates for the proposed improvements to the municipal electric-light plant and water-works system.

ESTHERVILLE, IA.—The City Council has engaged W. H. Grover, consulting engineer, of Ames, Ia., to make investigations and prepare plans and estimates for the entire reconstruction of the municipal electric-light plant.

LAKE VIEW, IA.—At an election held recently the citizens voted to secure electricity from the electric plant at Sac City.

MUSCATINE, IA.—It is reported that plans are being considered by the Muscatine North & South Ry. Co. for equipping its railway from Muscatine to Burlington for electrical operation. The Muscatine Ltg. Co. is reported to have offered to furnish energy to operate the railway and has prepared an estimate of the cost of same. The proposal to operate the railway with electricity is made jointly with the proposition to furnish electricity to operate the No. 3 drainage district pumping station, 25 miles below the city.

MUSCATINE, IA.—The City Council, it is reported, will engage an engineer to make investigations and submit a report on the cost of a lighting system or a municipal electric-light plant.

RIDGEWAY, MO.—The installation of a municipal electric-light plant in Ridgeway is reported to be under consideration.

ST. CHARLES, MO.—We are informed that the St. Charles El. Lt. & Pwr. Co. was recently granted a renewal of its franchise in St. Charles for a period of 20 years. Reported in the issue of Jan. 24 to have been granted a franchise to furnish electricity in St. Charles. W. G. Ghiselin is manager.

SHELDON, N. D.—We are informed that the village of Sheldon does not contemplate the installation of a street-lighting system as reported in the issue of Jan. 31. A. H. Lindemann is village clerk.

SIDNEY, NEB.—The Council, it is reported, has decided to engage an engineer to make surveys and prepare plans for a municipal electric-light and heating plant. J. J. McIntosh is chairman.

STERLING, NEB.—The installation of an electric-light plant in Sterling is reported to be under consideration. Mr. Marks, of Wymore, is said to be interested in the project.

GLEN ELDER, KAN.—The local electric-light plant, owned by A. J. Abrams, is reported to have been purchased by Charles Townsend, who will take charge of the plant at once.

PITTSBURG, KAN.—Petitions have been presented to the city commission asking for the installation of pedestal illumination system on Broadway and adjacent cross streets.

VERMILLION, KAN.—The installation of a municipal electric-light plant in Vermillion is reported to be under consideration.

Southern States

ASHEVILLE, N. C.—The Toxaway Pwr Co., organized about a year ago with a capital stock of $1,500,000, has been reorganized. The company owns or controls extensive water rights and property in Western North Carolina and proposes to develop water-power rights along the Toxaway River in Transylvania County, the Green River and other streams.

BEAUFORT, N. C.—The Board of Public Works expects to install a 150-hp tubular boiler in the municipal electric-light plant within the next six months; also to purchase one boiler-feed pump, about 100 35-ft. poles, cross-arms, etc. The installation of a meter system throughout the city (consisting of 125 meters, ranging from 5 amp to 100 amp) has just been completed. H. H. Lewis is superintendent.

CONNELLY'S SPRINGS, N. C.—It is reported that preparations are being made by the Connelly's Springs Knitting Mills Co. to build a hydroelectric plant, work to begin in 60 days. The work will include construction of concrete dam, power house and the erection of 4 miles of transmission line, to cost about $6,000. Arrangements have been made for machinery and material. D. B. Mull is manager.

ROWLAND, N. C.—Bids will be received by the commissioners of the town of Rowland, N. C., for the purchase of $30,000 thirty-year 6 per cent coupon bonds until March 10, the proceeds to be used for equipment and maintenance of an electric-light plant, water-works and sewerage system. For further information address O. P. Chitty, clerk of board of commissioners. J. McR. Bracy is Mayor.

BISHOPVILLE, S. C.—Within the next 30 days the managers of the municipal electric-light plant expect to purchase one 60-kw, 60-cycle, 2300-volt General Electric generator with exciter and switchboard for same; also within the next two or three months to purchase equipment for an ornamental street-lighting system. It is planned to rebuild the distribution system, which will require from 50 to 75 poles and other equipment. S. P. Sutton is superintendent.

WALHALLA, S. C.—The Walhalla Lt. & Pwr. Co. (recently incorporated), it is reported, has awarded a contract to Quartermus & McDonald for building of a dam at the shoals at the Rhett tract, about 4 miles from Walhalla. The proposed dam will be about 125 ft. long and 15 ft. high and will furnish power to generate electricity. The cost of the plant complete is estimated at $20,000. W. A. Strother and Dr. J. W. Bell are among the incorporators.

DRESDEN, TENN.—The city of Dresden is reported to have issued $27,000 water and light bonds.

MEMPHIS, TENN.—Bids will be received by the Mississippi River Commission, First and Second Districts, United States engineer's office, Memphis, Tenn., until Feb. 25, for furnishing 787,000 lb. galvanized wire, silicon wire, wire strand and staples and 30,000 wire rope clips. Further information may be obtained upon application to Major E. M. Markham.

OVOCA, TENN.—The trustees of the Widows and Orphans Home of the Knights of Pythias are reported to have authorized H. W. Stratton, superintendent, to install a water-power plant to generate electricity to light the buildings and grounds and operate the laundry, printing plant and other machinery. The work will include laying an 8-in. pipe to carry water from Lake Calanthe to a point below Cascade Falls, where a power house will be erected. The proposed plant will have sufficient output to maintain from 250 to 300 lamps. G. M. Whitson, civil engineer, of Tullahoma, Tenn., will have charge of the work. Post office address, Chattanooga, Tenn.

ARMSTRONG SPRINGS, ARK.—The management of the Armstrong Springs Hotel is contemplating the installation of an isolated electric plant at once and would like to receive catalogs and prices on 10-hp gas engines and 6-kw direct-current dynamos (belted). Tungsten lamps will be used. D. E. Harrison is manager.

NEW ORLEANS, LA.—Plans are being considered by E. E. Lafaye, commissioner of public property, for the installation of an electric-light plant in connection with a garbage disposal plant.

GRANDFIELD, OKLA.—The local electric-light plant, owned by J. A. Brabbam, is reported to have been destroyed by fire recently.

DALLAS, TEX.—The Phoenix Construction Co. is erecting a high-tension transmission line between Fort Worth and Dallas for the Texas Pwr. & Lt. Co., with branch lines from Irving to the large cement plants west of Dallas, and another to McKinney to a connection with the Sherman interurban line. The lines will be carried on steel towers.

FAYETTEVILLE, TEX.—Work, it is understood, will start on the new electric-light plant and creamery.

PECOS, TEX.—The City Council has decided to install ornamental lamps in the business section of the town, also extending the system to a portion of the residence district. Ornamental posts have been ordered, and an appropriation of $750 has been made to cover the first cost.

Pacific States

BELLINGHAM, WASH.—We are informed that the Puget Sound Trac., Lt. & Pwr. Co. does not contemplate any improvements to its power plant, as reported in the issue of Jan. 17.

OMAK, WASH.—The federal authorities at Washington have authorized the immediate installation of an electric power station on the Okanogan River and a large pumping plant just north of the city, to furnish an auxiliary supply of water for the orchards in the Robinson Flat section of the Okanogan irrigation project. Sufficient funds have been appropriated to complete the work. Calvin Casteel, of Omak, is manager of the project.

SEATTLE, WASH.—The committee on municipal affairs of the Commercial Club has unanimously voted in favor of the City Council increasing the capacity of the municipal lighting system, declaring that the amount of energy generated at the Cedar Falls plant is inadequate. The committee does not recommend or suggest what power site should be secured, although it is understood it favors the Lake Cushman site. The committee also recommends that the auxiliary steam plant be installed at once and that the city acquire sufficient power sites to care for the future needs of the city.

SEATTLE, WASH.—Upon the recommendation of Lighting Superintendent J. D. Ross, the Board of Public Works, on Jan. 27, reconsidered its action in awarding the contract for the equipment of a steam auxiliary lighting plant on the east shore of Lake Union to Charles C. Moore & Co., at $154,500, and made the purchase in two awards as follows: The machinery equipment, with the exception of a turbo-generator and exciter, was awarded to Charles C. Moore & Co., at $98,668, and for a 7500-kw turbo-generator and exciter to the Allis-Chalmers Mfg. Co., of Milwaukee, Wis., at $67,355. The contract for 53 posts for cluster-lamps, to be used in the Fifth Avenue district, has been awarded to the Westerman Iron Works, at $1,643.

CRESWELL, ORE.—The Creswell Lt. & Pwr. Co. expects to purchase within the next three months one waterwheel governor and one bevel mortise gear (1 in. to 11 4-36 in. in diameter). John Tunnell is owner.

HOOD RIVER, ORE.—Plans are now being made for the installation of a co-operative or a municipal hydroelectric power plant to furnish electricity for Hood River Valley. Filings have been made for water rights (capable of developing 2000 hp) along the Hood River. Mark Cameron, of Odell, Ore., is chairman of the committee appointed to carry out the project. J. C. Howland, R. F. D., 147, Hood River, is also a member of the committee.

LEBANON, ORE.—A petition has been presented to the Council asking that an election be called to vote on the proposal to grant a 20-year franchise to Scroggins & Washburn, owners of the lumber mill, to erect and operate an electric-light plant within the city limits.

McMINNVILLE, ORE.—The water and light commission has decided to erect a transmission line to Fairview to furnish electricity for lamps and motors there. The erection of the main line will be paid by this city, but the distribution lines will be erected at the cost of the patrons. The cost of the installation is estimated at $3,800.

PORTLAND, ORE.—The city commission has rejected all bids submitted for the installation of a new lighting system in the city hall and has instructed City Purchasing Agent Wood to readvertise for new bids for the work.

WALLOWA, ORE.—The City Council has engaged L. A. Reinaman, civil engineer, to make surveys and prepare estimates of cost of the installation of a municipal electric-light plant in Wallowa.

CALEXICO, CAL.—Plans are being considered to establish a municipal electric-light plant to furnish electricity for street-lighting in conjunction with the city water-works system.

COVINA, CAL.—Preparations are being made by the city trustees to light the streets of the city with electroliers.

FRESNO, CAL.—The San Joaquin Lt. & Pwr. Co., it is stated, will rebuild its transmission line between Dos Palos and Los Banos as soon as the weather will permit.

GLENDALE, CAL.—The City Council has instructed Harry B. Lynch, manager of the municipal electric-light plant, to secure bids for ornamental electroliers (for five-lamp clusters) to be erected on Brand Boulevard, between First and Third Streets.

HUGHSON, CAL.—Plans, it is reported, are being prepared for the installation of a street-lighting system in Hughson. Miles Shelly is interested in the project.

LODOC, CAL.—The State Railroad Commission has granted E. M. Wilson, Nettie B. Harris and Lawrence A. Wilson permission to operate an electric-light plant in Bieber, Lassen County, and Lodoc, Modoc County.

OCEANSIDE, CAL.—The Oceanside El. & Gas Co. has applied for permission to issue $25,000 in bonds, a portion of which will be used for refunding outstanding indebtedness and the balance for extensions and improvements to its system.

PORTOLA, CAL.—R. B. Young, of Loyalton, has applied for a franchise to furnish electricity for lamps and motors in Portola. The franchise will be sold to the highest bidder at the March session of the supervisors.

ST. HELENA, CAL.—Negotiations are under way between the Town Council and vintage festival committee in regard to placing electroliers on Main Street, from bridge to bridge. The cost of the installation is estimated at $2,700, of which the vintage festival committee offers to pay $1,600. H. J. Chinn is president of the Chamber of Commerce and chairman of the vintage festival committee.

SUSANVILLE, CAL. — Arrangements have been made by the Lassen El. Co., of Susanville, for the construction of a new plant, to be situated about ½ mile west of Susanville and to be known as plant No. 2. The equipment will consist of one Leffel turbine, one Woodward governor, one 50-kw, 60-cycle, 2200-volt General Electric generator, single-panel switchboard, three ammeters, one voltmeter, synchronizer, four-point plug switches, each phase connected. The company has disposed of its electrical contracting and supply business to the Electric Supply Co., which will carry stock and do an electrical contracting business. O. S. Paine is engineer in charge of construction of new plant, and L. R. Cady is general manager of the Lassen Co.

VAN NUYS, CAL.—Work has just been started for pulling wire for the ornamental lighting system on South Sherman Way and the State Highway. It is expected the work will be completed sometime in March. The completion of these stretches will close the gap in the 25-mile circuit of paved and lighted highway, encircling the entire western end of the San Fernando Valley.

GRAND CANYON, ARIZ.—Ten of the 40 platinum claims of Ralph H. Cameron in the Grand Canyon of the Colorado River near Bright Angel Trail have been taken by J. Bishop & Co., of Malvern, Pa., platinum manufacturers. The company, it is said, will erect an electric generating plant to furnish power to operate a 100-ton reduction plant to be erected near by.

BUTTE, MONT.—The City Council has awarded the Montana Pwr. Co., of Butte, the contract for the installation of the new ornamental street-lighting system. The contract calls for 306 General Electric 6.6-amp inverted magnetite arc lamps, erected on ornamental posts, maintained with underground wires, to cost $31,125. The work is to be completed by July 1, 1914. M. J. Flood is city engineer. A. von Dalhenhausen is commercial manager of the Montana Pwr. Co.

CORWIN SPRINGS, MONT.—The Electric Hot Springs Co., of Corwin Springs, expects to purchase generating equipment, to duplicate the present plant. James Shine is electrician.

WHITE SULPHUR SPRINGS, MONT.—Municipal improvements to cost approximately $100,000 have been decided upon by the City Council, including the installation of an ornamental street-lighting system, cement sidewalks and sewer system. The Gerharz-Jaqueth Engineering Co., of Billings, has been engaged to take charge of the work.

KREMMLING, COL.—F. I. Huntington is reported to have submitted an estimate on the cost of installing an electric-light and water plant for Kremmling. He states that a steam plant erected on the river near the railroad station (at a cost about $20,000) would furnish electricity for pumping water for town supply and for lighting the streets and residences here.

Canada

CHILLIWACK, B. C.—The City Council has entered into a new contract with the British Columbia El. Ry. Co., Ltd., of Vancouver, for lighting the city for a period of ten years. Under the terms of the new contract an entirely new system will be installed. The present 32-cp lamps will be replaced with 100-cp tungsten lamps.

SHOAL LAKE, MAN.—The town of Shoal Lake, it is reported, is contemplating the installation of a municipal electric-light plant, to cost about $15,000.

BROUGHTON, N. S.—The Broughton Coal & Iron Co. is considering the installation of an electric plant capable of taking care of 2000 tons of coal per day, the central plant to be located at Broughton.

BRANTFORD, ONT.—At a special election held Feb. 2 the by-law authorizing debentures to the amount of $70,000 for extensions to the hydroelectric system was carried. This provides for the distribution of electricity from the Hydro-Electric Power Commission for lamps and domestic use.

CREEMORE, ONT.—It is reported that plans are being prepared for the construction of a hydroelectric power plant in Creemore, to cost about $50,000, for which bids will soon be asked.

HESPELER, ONT.—A by-law has been passed authorizing an expenditure of $12.-000 for improvements to the municipal electric-light plant.

NICKELTON, ONT. — The Canadian Nickel Corpn., it is reported, is preparing plans to generate electricity to operate its works at this point. The reduction works of the company, it is understood, will have an initial capacity of 40,000 tons per month.

ST. CATHARINES, ONT.—The Niagara, St. Catharines & Toronto Ry. Co. is installing a new converter station at St. Catharines, to be equipped with two Canadian General Electric 500-kw rotary converters and necessary accessories, at a cost of about $35,000.

WESTON, ONT.—The electric-light and water-works commission has decided to repair the old steam-driven electric plant on Little Avenue and maintain it as an auxiliary in case of break-down in the hydroelectric service.

LAKE MEGANTIC, QUE.—New tenders, it is reported, will be called in a few weeks for the construction of the dam in connection with the municipal light and power plant.

LONGUEUIL, QUE.—The Armstrong Whitworth Co., of Canada, which is building a large plant in Longueuil on the St. Lawrence River, contemplates equipping its works with electrical operated machinery. Electricity will be supplied by the Montreal Lt., Ht. & Pwr. Co. at 22,500 volts, which will be stepped down to 2200 volts. The equipment will include synchronous motor connection to a three-wire, 500-volt direct-current generator. There will also be a large motor for the rolling mill.

TERREBONNE, QUE.—The plant of the Terrebonne El. Lt. Co. was damaged by fire recently, causing a loss of about $4,000.

DAVIDSON, SASK.—A by-law authorizing an appropriation of $8,500 for the purchase and installation of an electric-light plant was approved by the rate-payers.

Mexico

MEXICO CITY, MEX. — Applications have been made to the federal government for water-rights concessions to develop electricity as follows: Maria Guadalupe and A. de Garcia for water rights of Rio de la San Jeronimo, State of Jalisco, and José Julian Mendez for water rights on the Rio de San Jeronimo, State of Jalisco.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing agent, Isthmian Canal Commission, Washington, D. C., until Feb. 17 for wire chain, chain bolts, steel smokestack netting, brass tubing, engine lubricators, oil cups, side lamps for launches, glass packing, asbestos gaskets, etc. Blanks and general information relating to this circular (No. 827) may be obtained from the above office or from the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

New Incorporations

LANSING, MICH.—The Michigan Lt. Co has been chartered with a capital stock of $3,000,000 to operate in Bay City, Saginaw, Flint, Pontiac, Jackson, Kalamazoo and Manistee. The incorporators are: William H. Barthold, of New York, N. Y.; Frank A. Newton, C. Wilcox and James A. Brown.

GOWER, MO.—The Gower Lt., Ht. & Pwr. Co. has been incorporated with a capital stock of $10,000 by Curtis Poe, John R. Allen and S. A. Groom.

DUVALL, WASH.—The Duvall Lt. & Pwr. Co. has been incorporated with a capital stock of $16,000 by E. Milton and Stephens B. F Bird.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 3, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,085,598. Ozone Generator. W. O. Freet, Hackensack, N. J. App. filed May 20, 1912. For producing ozone in small quantities for use in apartments, etc.

1,085,615. Telephone System; P. Lavery Webster, and W. E. Bandlow, Dudley, Mass. App. filed Feb. 24, 1913. Listening by a third party is prevented on party lines.

1,085,616. Inductive or Transformer Bond; J. S. Lennox, Pittsfield, Mass. App. filed March 6, 1912. Inclosing casing or shell of magneto material serves as part of the magnetic circuit for the bond.

1,085,621. Telephone Signaling for Railways; M. Lutenberger, Blocton, Ala. App. filed Aug. 28, 1913. Telephone hood within which the trainman places his head to exclude external noise.

1,085,637. Galvanometer; R. R. Shay and M. C. Stoelting, Chicago, Ill. App. filed Sept. 9, 1912. Embodies a suspended coil.

1,085,707. Electric Storage-Battery Negative-Pole Plate; E. W. Smith, Philadelphia, Pa. App. filed May 19, 1905. Grid with a mask of non-fibrous powdered inert material capable of expanding ordinary oxides of lead.

1,085,718. Apparatus for Preparing Bleaching and Like Fluids; C. A. M. Buckley, London, Eng. App. filed Aug. 13, 1913. Electrolytic apparatus in which an improved circulation of the fluid is secured.

1,058,726. Railway Signal; J. P. Coleman, Edgewood Borough, Pa. App. filed April 14, 1913. Inductive holding device for holding a signal in one position against its normal bias.

1,058,742. Hood for Electroplating Tanks; C. E. Leffel, Niagara Falls, N. Y. App. filed April 16, 1913. For conducting away the fumes, gases and vapors arising from the electrolyte.

1,058,743. Anode Support; C. E. Leffel, Niagara Falls, N. Y. App. filed April 25, 1913. Supporting hook about which the anode plate is cast which can be unscrewed from the plate when the latter is worn out.

1,058,744. Electroplating Rack; C. E. and J. D. Leffel, Niagara Falls, N. Y. App. filed May 7, 1913. Rack carrying wire supports for the articles to be plated.

1,085,769. Spot-Welding Thin Sheets; E. Thomson, Swampscott, Mass. App. filed May 10, 1913. Clamps thin sheets together and then applies pointed electrode at an unclamped part of the plates.

1,085,802. Electrical Agricultural System; C. S. Doney, Wallace, Idaho. App. filed Feb. 13, 1913. For supplying electrical power to agricultural tractors or motor vehicles.

1,085,807. Alternating-Current Motor; V. A. Fynn, London, Eng. App. filed May 23, 1911. Single-phase self-excited series induction motor whose speed, starting torque, torque curve and power factor can be easily adjusted.

1,085,808. Alternating-Current Motor; V. A. Fynn, London, Eng. App. filed June 12, 1911. Conveys current conductively to the commuted winding along the axis of the main inducing winding.

1,085,813. Insulator and Current Distributer; E. H. Knutz, Arcata, Cal. App. filed March 6, 1913. Carries breakable insulators which may be broken out to enable the wire to be electrically connected with the arm.

1,085,826. Indicating Push-Button; W. R. Schlage, San Francisco, Cal. App. filed March 5, 1913. Indicator applied to push-button to give notice that the occupant is "out."

1,085,829. Trolley-Wire Ear; W. C. Starkey, Zionsville, Ind. App. filed Aug. 12, 1909. Made of "extruded" metal so as to be stronger and have higher elastic limit.

1,085,854. Controller Regulator; H. Elbe, Maspeth, N. Y. App. filed May 19, 1911 Has timing element which prevents full voltage being suddenly sent through the motor

1,085,916. Intercommunicating Telephonic Apparatus; M. R. Hutchinson, Summit, N. J. App. filed May 21, 1909. Head set applied to the cap and arranged to exclude external noise.

1,085,920. Electrical Switch; G. A. Knaak, Oshkosh, Wis. App. filed June 10, 1912. Circuit controller for electric-motor-driven fluid compressors.

1,085,937. Automatic Elevator Plant, C. O. Pearson and A. Sundh, Yonkers, N. Y. App. filed Sept. 21, 1908. Push-button system, including an internal-combustion engine started at will and automatically controlled.

1,085,951. Electric Fusion of Metals; A P. Strohmenger, Westminster, London, Eng. App. filed Sept. 25, 1913. Places fusible slag-forming insulating material between two rods of metal which are connected to source of current and collects the fused metal.

1,085,959. Terminal for Secondary or Storage Batteries; J. W. Achard, Philadelphia, Pa. App. filed July 19, 1912. Has a plate of higher specific conductivity and embedded in the leader bar which is connected to a group of electrodes.

1,085,960. Electric Connector; J. Berg, Chicago, Ill. App. filed Nov. 8, 1912. Embodies a double-ended socket which receives the terminal plugs.

1,085,974. Telephone System; E. R. Corwin, Chicago, Ill. App. filed Oct. 12, 1908. For enabling a station to call the exchange while connection is still maintained with another station.

1,085,981. Block-Signal System; L. A. Hawkins, Schenectady, N. Y. App. filed July 14, 1908. Embodies a slow-acting mutual relay and a quick-acting polarized relay in circuit with the line wire.

1,085,982. Electrical System of Distribution; H. Hazelton, Englewood, N. J. App. filed Sept. 20, 1909. Storage-battery system for supplying lamps in an electric-railway coach upon failure of the main current supply.

1,085,985. Keyboard Tape Perforator; E. E. Kleinschmidt, New York, N. Y. App. filed March 20, 1912. Punches operated in groups and controlled by selected keys, one for each group.

1,085,987. Reversal Regulator for Single-Phase Motors; D. L. Lindquist, Yonkers, N. Y. App. filed April 26, 1910. For use in connection with repulsion induction motor operating an elevator.

1,086,003. Manufacture of Steel; W. R Walker, New York, N. Y. App. filed May 4, 1911. Deoxidizes in an acid electric furnace.

1,086,028. Electrical Protective Device; F. B. Cook, Chicago, Ill. App. filed May 10, 1911. Improved means for mounting the fuse-holding spring members upon the base plate of the unit.

1,086,029. Indicating Ringing Key; E. B. Craft, Hackensack, N. J. App. filed Oct. 4, 1910. The ringing key last operated indicates by its position that it was the last one actuated.

1,086,041. Welding Machine; J. H. Gravell, Philadelphia, Pa. App. filed Jan. 30, 1913. Of the portable type, embodying primary and secondary coils on a core.

1,086,042. Welding Machine; J. H. Gravell, Philadelphia, Pa. App. filed May 17, 1913. Portable, embodying transformer and relatively movable gripping terminals connected to secondary of the transformer.

1,086,080. Snap Socket Shell. C. D Platt, Bridgeport, Conn. App. filed July 8, 1908. Interlocking joint between shell and cap.

1,086,083. Electric Bell; H. E. Reeve, New York, N. Y. App. filed Feb. 12, 1910. Adjustment of the bell with respect to the striker.

1,086,088. Manufacture of Filaments for Tungsten Lamps; G. P. Scholl, New York, N. Y. App. filed Oct. 6, 1908. Produces a paste or filament consisting of pure tungsten metal and casein.

1,086,096. Field-Coil Support, C. W Starker, Pittsburgh, Pa. App. filed March 13, 1911. Resilient means serve to exert a separating pressure between the supporting means for the field coils and the frame.

1,086,101. Means for Transforming Electrical Energy; E. Weintraub, Schenectady, N. Y. App. filed Feb. 26, 1902. Auxiliary electrode is momentarily brought into electrical connection with one of the main electrodes for starting.

1,086,102. Method of Transforming Electrical Energy; E. Weintraub, Schenectady, N. Y. App. filed Feb. 26, 1902 Agitates the liquid electrode so as to permit an ionic discharge in starting the arc.

1,086,103. Electric Lamp; E. Weintraub, Schenectady, N. Y. App. filed Feb. 26, 1902. Magnetic means vary the level of the liquid electrode to control a lamp automatically.

1,086,104. Producing Light by Electricity; E. Weintraub, Schenectady, N. Y App. filed Feb. 26, 1902. Vapor lamp with vaporizable cathode and co-operating anode formed of material containing graphite.

1,086,105. Vapor Electric Apparatus and Method of Operating the Same; E. Weintraub, Schenectady, N. Y. App. filed Nov. 17, 1902. Generates discharge between plurality of solid electrodes and thereby initiates discharge between electrodes, one of which is vaporizable.

1,086,106. Vapor Electric Apparatus; E Weintraub, Schenectady, N. Y. App. filed April 12, 1905. Path from the cathode to an anode reverses in direction.

1,086,107. Electric Lamp; E. Weintraub, Lynn, Mass. App. filed Feb. 26, 1902 Magnetic means for swinging the lamp to bring the electrodes into contact.

1,086,109. Rheostat; N. Wilkinson, Milwaukee, Wis. App. filed April 17, 1912 Water rheostat in which the insulating members between the electrodes are raised and lowered.

1,086,132. Process for the Industrial Manufacture of Electrolytic Iron; A. Boucher, Prilly-Chasseur, Switzerland App. filed March 22, 1913. Effects depolarization of a cathode by dissolved basic iron salts.

1,086,147. Electrical Connection for Telephones and the Like; J. A. Douglas, Waterloo, Ia. App. filed March 31, 1913. Telephone set is placed in circuit by the mere act of mounting it on its support.

1,086,164. Electric Furnace; B. Guthrie and J. P. Karch, Sewickley, Pa. App filed June 29, 1912. Produces heat by arc in combination with resistance; has electrodes shaped to inclose a crucible.

1,086,165. Electric Heating and Cooking Device; W. S. Hadaway, Jr., East Orange, N. J. App. filed May 1, 1909. Has a large number of readily replaceable heating units especially designed for oven.

1,086,171. Process of Treating Incandescent-Lamp Filaments; R. H. Henderson, East Orange, N. J. App. filed Dec. 5, 1910. Subjects the filament while heated in vacuum to an atmosphere of phosphorus.

1,086,185. Vapor Electric Apparatus; O O. Kruh, Schenectady, N. Y. App. filed Feb. 20. 1904. Alternating-current rectifier which is not subject to arcing between the anodes.

1,086,186. Vapor Electric Device; O. O Kruh, Schenectady, N. Y. App. filed April 15, 1907. Has a shield above the anode and a deflector below the anode and separated from the shield by an annular arc space.

1,086,196. Electric Whistle-Blowing Apparatus; F. C. McCaffrey, Burlington, Vt. App. filed Feb. 19, 1913. Embodies a plurality of circuits and a dash-pot for controlling the movement of a solenoid core.

1,086,249. Electric Switch and Locking Means Therefor; R. H. Vickers, Fayetteville, Ark. App. filed Jan. 3, 1913 Includes a spring-pressed pawl or pawls adapted to sit within recesses formed in a circuit-closing plunger.

1,086,300. Rectifying Apparatus; C. A Kraus, Newton Highlands, Mass. App filed Nov. 21, 1910. Eliminates short-circuit arcing in the exhausted container

1,086,311. Electric-Arc Lamp for Searchlights, Projectors and the Like; H. Beck, Meiningen, Germany. App. filed Nov. 22, 1913. Employs a high current density to produce a tongue in the negative flame and blows said tongue away from center of the positive electrode by a jet of gas.

1,086,338. Insulating Lining; C. L. Sherman, Philadelphia, Pa. App. filed June 30, 1913. Elastic compressible socket shell lining with outwardly projecting bead

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The N. E. L. A. and Legislation

The uncertainty about the attitude of the Washington administration concerning holding companies of all kinds has not yet been removed. The last public expression of opinion from President Wilson was his remark: "We are agreed that holding companies should be prohibited." It is understood that the President has modified this sweeping condemnation, but he has not given so effective a publicity to his altered views as to his original statement. The uncertainty is deepened by the delay over the completion of the administration holding-company bill. The delay is generally supposed to be due to the fact that fuller consideration is being given to this important matter. It ought to be reasonable to expect that no serious steps toward the dissolution of holding companies which are economically justifiable will be taken, but unfortunately it is not safe to conclude that destructive action will be withheld. Certainly some holding companies are justifiable, just as there are others which are indefensible. Business men should take pains to point out to the federal government a distinction which it can fairly draw between the two classes. So far as the electrical industry is concerned, the holding company controlling separate utilities has many advantages for both the public and the corporation. Its abuses are preventable. The National Electric Light Association is so clearly the representative of the companies in vital issues that it could well serve the industry by presenting facts and expressing opinions on this subject for the benefit of members of Congress who have asked for the views of business men. In measures affecting the industry the presentation of statements by authorized representatives before committees of Congress is a proper function of the N. E. L. A. The association should do what it can to preserve the economic advantages of the holding company. It can do this with as clear a recognition of the possibilities of abuse of the holding company as of the possibilities of benefit.

Skin Effect in Conductors

It is well known that in the case of a continuous current flowing steadily along a uniform conducting wire the electric energy is carried over the surface of the wire through the surrounding dielectric medium, but some of the energy in transport sinks into the wire and heats it. The remarkable fact is that this dissipation of energy within the substance of the wire is not greater at the surface than at the center, and, so far as can be determined, it is uniform over the entire cross-section, provided that the difference of temperature between the center and surface of the wire is negligible. However, when an alternating current flows through the wire the effect of the alternating magnetic field is to crowd the current into the surface layers of the wire and to keep the current out of the center. If the wire is of large diameter and the frequency high, the current will penetrate appreciably only to a small depth into the wire or will confine itself to the outside skin. The inside of the wire is mere stuffing, from the electrical point of view, under such conditions, and it would be better if the inside were removed altogether. The effect is also substantially the same whether the wire be solid or stranded. We abstract in our Digest a paper by Prof. E. F. Northrup and Mr. J. R. Carson on skin effects, recently published in the *Journal* of the Franklin Institute. The authors discuss the skin effect in conductors from both the experimental and mathematical standpoints. A mathematical analysis of the subject was made many years ago by Lord Kelvin, but the experimental measurements made in this field have been very few. It has been known that, in the case of an ordinary steel wire, the increase of resistance with alternating currents due to skin effect rises with the current strength up to a certain critical value and then declines, but that is almost all. A great deal of new and valuable experimental information is contained in the paper here considered.

Modern Office-Building Problems

The electrical equipment of a large office building is very well typified in the description of the plant of the new Union Central Life Building in Cincinnati on page 417 of this issue. The problems of the situation center around the fact that there must be installed a complete electrical outfit for several city blocks, spaced vertically instead of horizontally, with all the inconveniences thereby implied. The conduits must be run in the walls instead of underground, the feeders must be erected in the same direction, and the electric railway, sufficient to accommodate the casual needs of a population of a town of several thousand people, must go straight up and down instead of running on a level. To be sure one is not forced to wrestle with municipal politics in its administration, but there are frenzied "kicks" from the populace at any interruption of service. Perhaps the most interesting feature of the building, encompassing from basement to capstone some eight acres of floor area, is the fact that it receives energy from a double-decked generating station equipped with a stack about 550 ft. high, which should certainly insure a sufficient draft. The engines for the main plant, installed on the floor above the boiler room, are compound non-condensing units operated with superheat and directly connected to generators having an aggregrate rating of 750 kw—more than enough for many a small city. Use is made of three-wire balancers, as befits the distribution system. The peak load is about 530 kw, of which nearly two-thirds is in motors, a proportion which rather upsets the preconceived notions of the layman about building service. The vertical electrical railway is somewhat less than an eighth of a mile long, but it makes up for the deficiency in length by having nineteen tracks all told and running cars on very short headway. The motor equipment rating averages about 25 hp per car, a fact of which those who remember the early electric railways will take notice. The lighting of the community aggregates about 2400 "16-cp equivalents" on the ancient rating. These comparative items give a good idea of the magnitude of the work which has been carried out, though they do not include the many and interesting refinements which engineering skill has brought to bear upon meeting the special requirements of the case. Truly, a modern office building represents an extraordinary structural feat, and its electrical equipment involves a task of no mean order.

Accumulating a Load-Factor

The description of the load-factor of the Southern California Electric Company in this issue is full of suggestion to the central-station manager. In a system so largely supplied with energy from hydroelectric stations a high load-factor is imperative from the standpoint of fixed costs and of labor as well, and the moral to be drawn from the good results here displayed is an obvious one. The load charts are peculiarly instructive as to the admirable effect of increasing the motor load. As between the two charts shown, differing in date by a year, the evening lighting peak is almost unchanged, while the motor load through the day has increased enormously. The winter months would, of course, show a somewhat less favorable load curve owing to overlaps, and yet the situation is very much better than usual. In the various load curves given the singular feature is their uniformity in point of time. Between individual and individual there are probably great diversity-factors, but between community and community these tend to disappear, and hence great care must be exercised to gather such loads as tend to help matters. It is interesting to observe that the highest load-factor was secured in a rural community with a single small city and a good pumping load devoted to irrigation. In fact, in most of the districts considered irrigation load has proved very advantageous. Looking at the results as a whole, it will be seen that an admirable day load has been built up, but with a large loss at and near noon, while the night load shows the usual deficit, although smaller here than is often noted.

In the case described in this issue the greatest difference lies in the times of maximum loads, owing to diversity of uses. This condition enables the system load-factor to be brought to a very unusual figure, while because of judicious exploitation all the component load-factors are good. The greatest problem with all plants lies in the difficulty of obtaining suitable night loads. From 10 p. m. to 8 a. m. is a period during which only the most desperate efforts seem able to make much headway toward business. It would seem possible that something might be done at such times in the way of pumping water into reservoirs for site supply or for irrigation. It would pay many a plant to make special inducements to transfer loads of this sort mainly into the night hours, for the work requires little or no attention at the receiving end and the generating machinery requires about the same supervision in any event. For economic reasons of the plainest kind a reward awaits the man who devises a method for the profitable utilization of energy through the "wee sma' hours." He will get his energy very cheaply and his name will be blessed of central-station managers. Even lacking this, the situation of the Southern California Edison Company is yet one that reflects vast credit on the assiduity of the managers in business-getting.

Protective Reactors

Reactance in alternating-current circuits is well known to be the cause of a depression of power-factor from the desired 100 per cent limit to values that may sometimes fall below 50 per cent. Alternating-current motors of the induction type, running under light load, operate in such a manner as to offer a relatively high inductive reactance, with a correspondingly low power-factor. From the station manager's standpoint, therefore, reactance in consumption circuits is commonly regarded as an enemy to pressure regulation and to energy delivery.

In recent years, however, the growth of large units and of concentration of production in large electric generating stations has enabled the much-abused reactance to be utilized for the purpose not only of making the power-factor very low in the case of an accidental short-circuit but also of cutting down the maximum short-circuit current. It is evident that great advantage and economy are to be derived from generating 100,000 kw in a single station, instead of in, say, ten generating stations of 10,000 kw each, scattered over the district of distribution. But in the event of a heavy short-circuit occurring close to a station the magnitude of the blow coming on the generators would probably be much greater in the case of the concentrated plant than in that of the scattered plant. The rush of current into a heavy short-circuit might be enormous in the concentrated plant, with correspondingly violent destructive effects.

The effect of distance is capable of being simulated electrically by ohms of separation. Whereas, however, the insertion of resistive ohms between two generating units is not only virtually to separate them to a distance but also to waste energy in their electric communication, reactive ohms between the units give the same virtual separation without the corresponding waste of energy when the units are co-operating. The insertion therefore of, say, a third of an ohm of reactance in each of the three busbars connecting two 6-kv units has the effect of virtually separating them to a considerable distance of ordinary conductor, so that, in the event of a heavy short-circuit coming on one of the units, the other would feel the blow in greatly reduced degree. At the same time, the energy expended wastefully, as heat, in the reactor is much less than that which would accompany the same amount of resistance in the normal co-operative output of the units.

A paper on the subject of protective reactors which we abstract in this week's Digest has recently been presented to the Newcastle Section of the Institution of Electrical Engineers in Great Britain. There is some difference of opinion as to the best location for these reactors with respect to generators, busbars and feeders. The reactors are ordinarily of very simple mechanical construction, being formed of bare copper cable, wrapped helically in two or three open layers around insulating blocks. Nevertheless, they occupy a relatively large space, because they can absorb energy during a short-circuit only protectively, by concentrating magnetic energy cyclically into the neighboring air. It is desirable to keep the number and volume of necessary reactors to reasonably low limits. At first, reactors were inserted merely in the generator mains of a station, between each generator and the busbars, but there is a tendency at the present time to place the reactors in the busbars and in the feeders, leaving the generator connections clear. There can be no doubt that the judicious use of reactance in this manner has already reduced the danger to central-station plants from short-circuits in their immediate neighborhood.

Trust Legislation

To the electrical industry the most important part of the proceedings of the Chamber of Commerce of the United States, which met in Washington last week, was the address by Mr. Guy E. Tripp, abstracted elsewhere in this issue. It is the clearest and most outspoken criticism of the administration policies concerning business that has come publicly from a large interest in the electrical industry. It is not a sweeping or destructive criticism. It recognizes good in the pending legislation. It recommends changes to adapt the legislation more closely to the needs of business. We do not doubt that if time had permitted Mr. Tripp would have elaborated his constructive ideas to greater length. It will be an advantage to the industry if he will do so in the future. Congress has not had so much experience in business as it has had in the regulation of business. Unless it is told, it will not know how laws will affect business. To show that this is so, there may be cited the complete absence of any recognition of the inherent monopolistic character of public utilities in the pending program of legislation. Monopoly is decried, but it is not expressly stated that monopoly of specific trades or industries is the thing that is opposed; nor is it stated, as should be done explicitly or by undeniable inference, that monopoly in a single public utility service in a single community is economically beneficial to the public. There was a time when operators, though knowing that they were economically right in seeking public utility monopoly of this character, feared to express their views publicly. But all that they did not say on this subject has been said effectively since then by the public service commissions appointed by the public to regulate the companies. Now it appears to be necessary to say it again in order that Congress may not legislate unwisely. With this idea in mind, Mr. Tripp draws a distinction between the natural public utility monopoly and the naturally competitive business.

In his discussion of the proposed trade commission Mr. Tripp confines himself to the bill introduced to make effective the purpose of the administration. That is to say, he does not discuss the suggestions for a trade commission with power over industry similar to the power held by the Interstate Commerce Commission over railroads. The trade commission which the administration bill proposes is not much more than an enlargement of the present Bureau of Corporations. That bureau has not been effective as a promoter of commerce. Its activities have been confined to investigations and reports partly of the yellow newspaper style. If the trade commission is not to do more, except in the amount of its activities, than the Bureau of Corporations has done, substantially the same end will be served by letting the Bureau of Corporations remain where it is. The most serious criticism in Mr. Tripp's remarks on the interlocking directorate bill is that the prohibition intended by this law will foster dummy boards of directors. In other words, it will tend in some cases to keep responsible men from positions which they should fill and for the proper occupancy of which they should be held accountable.

With supplemental definitions of the Sherman act which increase the uncertainty for business men and a trade commission without authority to clear the outlook, the present program of the administration does not provide a "help to build up the business of the country on sound and permanent lines." These words, in which President Wilson expressed his early views, should not be lost to sight. The performance should square with the promise. Mr. Tripp regards the anti-holding company bill as "fraught with more danger" than any of the others. The draft of the administration bill on this subject has not been completed. Until it is completed there is only the President's sweeping word against holding companies *in toto* to guide criticism. It appears improbable that so ill-informed an act as a complete prohibition of all holding companies could become a law. But the danger that such legislation may be enacted is imminent until there shall be definite assurance to the contrary. Business men affected cannot safely or wisely assume that the pending legislation will not be inimical to their fair interests. The President's early reassurances to business were sincere. The spirit of them should be kept in the laws.

The News of the Week

Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.

Tennessee Contractors' Convention at Memphis

The third annual convention of the Tennessee Electrical Contractors' Association was held at Memphis, Feb. 16 and 17. President Ernest Freeman and other officers of the National Electrical Contractors' Association were in attendance during the second day's session. Officers of the Tennessee association were elected as follows: President, Mr. W. C. Tupher, Memphis; secretary, Mr. Joseph A. Fowler, Memphis, and state director in the national association, Mr. H. G. Street, Memphis. The convention closed with a Jovian rejuvenation.

N. E. L. A. Exhibit Arrangements

The Bellevue-Stratford Hotel, Philadelphia, has been selected as the meeting place for the National Electric Light Association convention to be held in that city in June, and it will also be the headquarters for the exhibit of Class D members of the association. The top floor of the hotel is to be used as the exhibit space and will be handsomely decorated in keeping with the appointments of the rooms themselves and with the standards set by previous convention exhibitions. Most of the rooms have 30-ft. ceilings and every window commands a view for miles over the city. Information concerning the exhibit plans, application blanks, etc., will shortly be sent out to prospective exhibitors.

Electric Trucks in New York's Snowstorm

Beginning Saturday morning, Feb. 14, a heavy snowstorm blockaded the streets of New York City, and subsequent falls during the next three days increased the drifts on the city's thoroughfares until vehicular traffic could proceed only with the utmost difficulty. Taxicab companies, for example, refused to send cars out of their garages, and many street-car lines were forced to stop running owing to the clogging of the underground slots with snow and ice. Storage-battery cars transferred from other lines were put on emergency service along some of the more important routes and carried hundreds of passengers who otherwise would have been forced to walk.

While the heavy snow impeded all kinds of vehicles, motor-driven trucks got through the drifts in many instances where horse-drawn wagons were utterly helpless. Particularly good records were made by fleets of electric trucks. Of the fourteen parcel-post delivery wagons (described in these columns Jan. 10) leased by the New York post office, nine were in active service the first day of the storm, and this number was increased to thirteen on the second day. All made their accustomed deliveries and returned to the postal substations without trouble. The New York Edison Company had about 125 electric trucks in operation on both days, and in each instance reported trouble with only three or four. Electric trucks in the service of wholesale grocers, brewers, merchants, etc., experienced varying degrees of difficulty, but despite the severe conditions most made their deliveries, although with greatly reduced battery mileage. Many trucks had gone out without fully charged batteries, and most of the "towins" that occurred were traced to this cause. Altogether electric trucks made enviable records in negotiating the heavy drifts of the storm and furnished the public with a striking demonstration of the dependability of the electric vehicle under the most adverse road and weather conditions.

Western Inspectors Favor Refillable Fuses

At the annual meeting of the Western Association of Electrical Inspectors held in Cincinnati on Jan. 27, 28 and 29 there was much discussion on the subject of the advisability of approving refillable fuses. Finally, at the instance of Mr. Victor T. Tousley, chief electrical inspector for the city of Chicago, a motion was carried by which the association recommended that Rule 68 of the National Electrical Code be so revised as to permit approval of refillable cartridge fuses.

In explaining the motion Mr. Tousley said that he did not think it would be proper for the association to go to the extent of recommending any particular wording or any specific change in the present wording of the rule covering this matter. But the motion is intended to express the fact that there is a desire for a refillable fuse.

Stevens Creek Plant Put Into Operation

Operation of the Stevens Creek plant of the Georgia-Carolina Power Company was inaugurated Feb. 16, energy from this station being transmitted to the city of Augusta, Ga., 9 miles distant. The new development is on the Savannah River north of Augusta. The dam, which is of the ogee type and built of cyclopean masonry, is 2000 ft. long and averages 30 ft. in height. Its maximum height is 47 ft. The power house is designed for an ultimate installation of ten 3125-hp I. P. Morris vertical main units and two 450-hp exciters. At present only five main units and the exciters have been installed. The ultimate output of the station will be 31,000 hp. The capacity of the first installation is 15,600 hp. Adjacent to the power house is a lock 30 ft. wide and 150 ft. long, with a lift of 27 ft.

Banquet of Pittsburgh Section, A. I. E. E.

More than 300 persons attended the annual banquet of the Pittsburgh Section of the American Institute of Electrical Engineers, which was held Feb. 14 at the Fort Pitt Hotel, Pittsburgh, Pa. In his address President Mailloux, the guest of honor, characterized the A. I. E. E. as the "alma mater" of many electrical engineers, who, he said, hold it in grateful affection for the instruction acquired through its activities. Mr. Paul M. Lincoln, Westinghouse Electric & Manufacturing Company, spoke on the subject of "Rates."

Conservation in Electric Railway Relations

At a joint meeting of the Washington Section, American Institute of Electrical Engineers, and the Washington Society of Engineers, Feb. 10, Mr. B. J. Arnold, Chicago, gave an illustrated talk on the subject "Some Applications of the Principles of Conservation to the Readjustment of Relations Between Municipalities and Urban Railways." The speaker discussed conditions in Chicago, San Francisco and Kansas City and explained his plan for the creation of an amortization fund which might be used to build extensions, make repairs, etc., thus increasing the gross revenues of the company without correspondingly adding to its capitalization. In the case of a new electric railway, said Mr. Arnold, no sooner are the cars first run than the equipment becomes "second-hand" and its value goes down to 75 per cent of the initial investment. The New York subway, continued the speaker, has increased the value of surrounding real estate to an amount equal to the cost of building the subway itself. Messrs. Clarence King, Ralph W. Pope and Colonel Harding took part in the discussion.

Co-operation Between Architect and Engineer

Under the auspices of the Architectural League a meeting was held at the league rooms on West Fifty-seventh Street on Feb. 17, to discuss plans for creating and fostering a better spirit of co-operation between architect and engineer in the construction of city buildings, particularly as regards the requirements of scientific illumination and the needs of the tenants for various electrical service within the building.

Invitations to participate in the discussion were extended to representatives of the Architectural League, the Society of Mural Painters, the National Sculpture Society, the Society for Electrical Development, the Jovian Order, the Illuminating Engineering Society and the American Museum of Safety. The proceedings were in the nature of a preliminary conversation, and the chairman, Mr. Cass Gilbert, was careful to point out that no definite action arising out of the discussion could be taken at once by the league, but that resolutions passed at the meeting could be placed before the directors for their careful attention.

Dr. William H. Tolman, of the Museum of Safety, made a request for the co-operation of Architectural League members as jurors in passing upon designs of medals awarded by his association for the successful housing of industrial plants and those employed in the industries.

Mr. J. M. Wakeman, representing the Society for Electrical Development, spoke of the need for closer harmony between architect and electrical engineer in making provision for electrical service in modern buildings, not only as regards their lighting requirements but also in relation to all the other uses of electricity.

Mr. L. B. Marks, on behalf of the Illuminating Engineering Society, stated that this society exists only for the purpose of co-operation and declared that it would be pleased to help in carrying these co-operative plans to a point of definite accomplishment. He said that engineers are sometimes ignorant of the technique of architecture, but it is also true that they possessed valuable experience on correct and incorrect methods of illumination which could be of the greatest assistance to the architects.

Mr. J. R. Strong, who spoke for the members of the Jovian Order, referred to the confusion which exists through duplication and multiplication of authority in passing upon the electrical equipment of buildings. The right to say whether such and such a wiring plan or service equipment is adequate and safe or inadequate and unsafe should be vested in a single authority, and anything that can be done in straightening this matter out will undoubtedly redound to the great advantage of the electrical interests involved.

The most interesting feature of the evening's proceedings was a lecture by Mr. M. Luckiesh, of the physical laboratory of the National Quality Division of the General Electric Company, Cleveland. With a somewhat elaborate lighting equipment, over which the lecturer had exact control as to quantity, color and direction, Mr. Luckiesh displayed a number of different sculptural exhibits, colored prints and oil paintings, and illustrated in a very striking manner the wide variation in effect which can be produced upon a single exhibit by possible changes in the light source.

Business Training for the Engineer

At the joint meeting of the Philadelphia sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers held in Philadelphia last week, Mr. Henry Hess gave an original and striking analysis of the causes of complaint of the engineer's alleged lack of business ability.

Mr. Hess stated that the trouble lies in a misconception of what constitutes an engineer. Broadly, an engineer is one who brings about a desired end by the use of the materials at hand or which can be brought to hand. The definition embraces almost every human activity; it is indorsed by the community in general as is evidenced by the current phrase "engineering a deal." It appears, however, that the colleges in particular have construed the term "engineer" in a narrow sense, giving it the meaning "designer" rather than its broad significance. Thus there are courses in civil engineering, in electrical engineering, in mechanical engineering, with occasional reference to some possible connection with the practical conduct of affairs. Almost invariably, however, this is in schools of a rather elementary grade and not in the high-class technical schools. Once get the engineering colleges to realize that their function is to teach more than mere design and there will be secure reliance on the self-sacrificing body of earnest men known as the faculties to teach real engineering as well as they now teach design.

Young men will not be turned out of college fully fledged or spring full-panoplied from their alma mater as did Athena from the head of Zeus. In fact, a further course in the actual business of life is absolutely necessary. No college can give the needful training; in fact, nothing can but a hard rub against the business man who demands a dollar plus of real value for a dollar in pay.

To illustrate his meaning, Mr. Hess cited a case from his own experience. He had associated with him at one time a graduate of a prominent German technical college. When asked to design a simple pneumatic crane, an almost completed pencil design of beautifully precise execution was produced in two days' time, including a set of triple-expansion hoisting cylinders of high efficiency. A question as to the kind of efficiency included in the calculations was met with scorn. A request for a calculation in marks and pfennigs of making fifty lifts per day, based on initial cost and probable relegation to the scrap heap in ten years as compared with a crude, single-cylinder affair having no cut-off, resulted in the resignation of the graduate. He would not be a party to the making of so criminally inefficient a design merely to satisfy a non-professional, brutally commercial instinct. This young man was a "school engineer"; he dealt and had been taught to deal only with part of the materials at hand. No matter how efficiently he might deal with that part, he never could be a successful engineer, although he might achieve excellent success as a designer.

The logical process of the real engineer are these: He first inquires into the ultimate purpose to be served; then how this may be done at the least possible cost, including all factors. In the case of the hoist there are the costs of building it, of finishing it with operating labor, of supplying it with compressed air, of keeping it in repair, and finally of discarding it at the probable end of its useful life. In the last analysis, it is the "dollar" efficiency that marks the engineer, as "mechanical" efficiency marks the designer.

American Society for Fire Prevention

The American Society for Fire Prevention, organized in New York City on Feb. 11, has as its main object the uniform codification of statutes, ordinances and regulations pertaining to building construction. Among the greatest obstacles to fire prevention at the present time are the chaotic condition of building regulations and the conflicting authority of various departments enforcing these requirements.

The new society invites the advice and co-operation of all who are interested in its objects, and desires data and suggestions which may increase the effectiveness of its work. The services and records of the society are offered to all without charge. The organization is supported by voluntary contributions from its members.

Among the other objects of the society, it purposes to compile detailed information on fireproof materials and construction; to appear before legislative, civic and other bodies in advocacy of its objects; to inspect buildings and conduct tests on safety devices; to investigate the causes of conflagrations and recommend preventive measures for similar catastrophes, and to prosecute those responsible for the non-enforcement of safety methods.

At the organization meeting nine vice-presidents, a secretary, treasurer, director of safety and an advisory board of eight members were elected. The president will be chosen later. The offices of the society are at 51 Chambers Street, New York, and Mr. Bernard Glaser is secretary.

Applications of Electricity in Mines

The American Institute of Mining Engineers, which met in New York City, Feb. 16 to 19, devoted its session of Tuesday afternoon to papers and discussions relating to applications of electricity in mines. Mr. H. H. Clark, Chicago, read a paper on "Safeguarding the Use of Electricity in Mines," and Mr. C. M. Means, Pittsburgh, Pa., presented the related subject, "The Safety of Underground Electrical Installations." Mr. H. W. Rogers discussed the equipment of motor-driven excavators, and Mr. Sanford B. Belden, Columbus, Ohio, contributed a paper on "Recent Developments in the Design of Electric Locomotives and Coal-Cutting Machines," which was read by Mr. R. R. Dunlop. Mr. Charles Legrand's paper on "Electric Traction in Mines" was read by title in the author's absence. Mr. S. LeFevre spoke on operating costs of electric mine equipment at Mineville, N. Y. Messrs. W. Kelly and F. H. Armstong described installations in the Penn and Republic mines in Michigan. Mr. W. L. Saunders closed the program with a paper on electric-drill performances. Abstracts of the papers and discussions will be presented later in these columns.

Electrical Supply Jobbers' Meeting

By Telegraph

The Electrical Supply Jobbers' Association met at the Hotel Raleigh, Washington, on Tuesday and Wednesday of this week. Approximately 150 jobbers were in attendance, and half that number of manufacturers looked on from without. Two long sessions were held on Tuesday and three sessions on Wednesday. All were conducted behind closed doors except the session on Wednesday night, at which Representative Oscar W. Underwood, of Birmingham, Ala., and Mr. J. E. Latta, of the Underwriters' Laboratories, spoke. To that session the manufacturers were invited.

The sessions on Tuesday were given over to routine matters such as reports of various standing committees and the appointment of new committees. At the meeting of the board of directors on that day Mr. Franklin Overbagh was re-elected secretary-treasurer, and Mr. T. M. Debevoise counsel, these two being the only officers of the association.

On Tuesday night the Jovian Order held a rejuvenation in the ballroom of the Hotel Raleigh at which forty men joined the ranks of those who pull all together all the time for everything electrical. Among those initiated were Mr. Clarence P. King and Mr. W. F. Ham, president and vice-president respectively of the Washington Railway & Electric Company. Mr. E. S. Marlow, of the Potomac Electric Power Company, was chairman of the rejuvenation committee. The ceremonies were followed by a Dutch supper and cabaret show. About 400 Jovians were in attendance. Speeches were made in turn by Reigning Jupiter W. N. Matthews and Past-Jupiters F. E. Watts, Oscar Turner, W. E. Robertson and T. Bibber.

At the session on Wednesday morning, on the suggestion of Mr. W. E. Robertson, the Electrical Supply Jobbers' Association voted to apply for membership in the Chamber of Commerce of the United States. Mr. Robertson, who attended the meeting of the Chamber of Commerce held in Washington last week, told of the advantages to be gained from membership in that body. He urged the jobbers as an organization to take part in the work of proper representation of business interests and gave in abstract the discussion on the topics of interest to the jobbing trade which took place at that meeting.

Plans for Future Meetings

At the morning session it was also decided to alter the date of the Pacific Coast meeting from 1915 to 1916. The next meeting of the association will be held in May, 1914, at French Lick Springs, Ind., if accommodations can be secured at that time, and if not at the Hotel Chalfonte, Atlantic City. A meeting will also be held at Birmingham, Ala., in October or November, 1914.

At the session on Wednesday afternoon Mr. W. E. Robertson outlined the present status of the Society for Electrical Development, showing how loyally the jobbers' association body had contributed to the co-operative movement and intimating that if the other great bodies, notably the central stations of the country, had supported the society as liberally as had the jobbers it would long ago have been actively engaged in the work for which it was formed.

Mr. H. R. Brand, of New York, addressed the meeting, soliciting its aid in the formation of a society for the development of business standards and control. Such a society, which is in process of formation, has for its object the education of the business man as to the most efficient and advanced methods of doing business. Specialists will work continuously on bookkeeping, filing, billing, shipping, credit systems, etc., compiling data, conducting tests and arranging exhibits for the information and enlightenment of members.

Politics and Business

Owing to the efforts of Mr. Oscar Turner, of Birmingham, Representative Underwood of Alabama, the Democratic leader of the House, was secured as the chief speaker for the session on Wednesday night. Representative Underwood spoke on the topic "Politics and Its Relation to Business." The burden of his address was that the business interests should assert themelves in obtaining proper legislation. He contended that the American people will deal justly if they know the facts, and that it is incumbent on the business interests to see that the people have the facts and have them correctly. Otherwise misinformation will be supplied by the demagogue, and if confiscation and destruction follow the business men of the country have only themselves to blame. Proper publicity and an honest purpose to do what is right were the remedies suggested.

Mr. J. E. Latta, of the Underwriters' Laboratories, made the concluding address of the meeting. His topic was "The Education of the Public in the Use of Standard Electric Wiring Materials." The time when electric service was an experiment, he said, has passed. The property owner now knows that the wiring in his building will be needed as long as will the walls themselves. Why, then, should the installation of flimsy, unstable wiring continue to be so common? Why is it that it is still easy to find a market for sub-standard wiring materials? It has been asserted that the cheap contractor is largely to blame. That he is wholly blameless none would deny. Some maintain that the zeal of the central-station manager for new business likewise contributes to the disorder; but Mr. Latta cited instances where the lighting company, without any local ordinance to demand it, refused to connect service to any building in which the wiring had not been inspected and been found to comply with the specifications of the National Electrical Code. The real cause of the trouble, he stated, is the ignorance of the public as to what constitutes standard electrical work, and the real remedy is to be found in the education of the public in this matter.

The time will probably never come when even the most intelligent layman will be able to distinguish satisfactorily between the better and the less desirable grades of electrical goods. He will probably always have to depend largely upon some other authority than his own judgment. The greater his confidence in a properly constituted authority the better. The thing most needed, therefore, is a more wholesome and general appreciation of the National Electrical Code.

Formulation of Code Rules

Although the code falls short of perfection, Mr. Latta intimated that lack of confidence in it arises from ignorance as to how its rules are made and revised. He said that the committee in charge of revising the code has on it representatives of practically every branch of the electrical industry. Suggested changes may be submitted by anybody and are passed upon by the committee, whose recommendations are reported to an open meeting. It is there that the final adoption or rejection of any proposed amendment occurs, and anyone who so desires may attend, join in the discussion and vote. In the estimation of the speaker, there could be no more satisfactory way of formulating a set of rules, and yet he said the opinion among even well-informed electrical people is that the code represents the findings of some autocratic body with power to impose its wishes upon a helpless public. He suggested that the jobbers through their advertising and sales men should help to make the nature of the code more popularly known, and thus render the road rougher for the pirate dealer in electrical supplies, the dealer whose principal claim to consideration is the fact that he can undersell his competitors, the fellow who is always ready to push the sale of sub-standard materials.

Mr. Latta told of a town where sub-standard wiring and the use of nondescript, hazardous fittings was for years the rule. Finally there came an electrical contractor who told the public, in bold-faced type in the daily newspapers, what standard wiring meant. As a result the contractor now has a large share of the wiring business in that town, and the first thing that his principal competitor does when a prospective customer enters his place of business is to assure him that he sells only approved materials. Ability to take orders for cheap goods, the speaker contended, is not salesmanship.

The Underwriters' Laboratories' Label Service

Outlining the work of the Underwriters' Laboratories along electrical lines, Mr. Latta said he had met salesmen who were very properly making the fact that their goods were on the approved list a strong argument for consideration with any prospective customer. Yet these salesmen thought that when any given product of any particular manufacturer had been admitted to the Laboratories' label service the manufacturer was entitled to apply labels to any unit in this class of products which he might offer for sale. The label service, however, amounts to continuous supervision of the manufacturers' goods at the factory, and, as far as is practicable, this supervision is reinforced by following up the behavior of the labeled appliances or materials in the field. In the case of rubber-covered wire, for example, the Laboratories' inspector at the factory actually tests enough of the factory output to convince him that the coils to which labels are to be applied are standard, and then there is a very complete field follow-up system. From time to time representatives in various parts of the country purchase coils of wire from the stocks of local dealers and send them to the Laboratories for examination and test. Moreover, there has lately been adopted the practice of sending out to every electrical inspector who will use them cardboard tags for mailing samples of wire of doubtful quality to the Laboratories. The inspector who finds wire that seems to him to be sub-standard material uses this tag to forward a 2-ft. sample of it to the Laboratories, and without any charge whatsoever gets a prompt report of the result of the Laboratories' test on the samples submitted.

Mr. Latta also explained the demerit system as it is employed in the label service on rubber-covered wire, which scheme has also been extended to apply to rigid conduits.

The Underwriters' Laboratories, he said, are desirous of having the public know intimately their work. The Laboratories' natural field, so far as the electrical industry is concerned, is the examination of materials to see that they conform to the requirements of the code, but no opportunity is lost to educate inspection departments and the public to require standard materials. He urged unified effort to continue the campaign until even in the hamlet most remote from the vigilance of the electrical inspector there shall be no thought of using wiring materials that are not up to the standards prescribed by the National Electrical Code.

Policy of Washington Administration on Water-Power Development

President Wilson and the Cabinet devoted almost the whole of the session on Feb. 17 to a discussion of water-powers. It is understood that Secretary Lane of the Interior Department and Secretary Garrison of the War Department are to draft new bills under which water-power resources may be developed.

In accordance with his message to Congress of Dec. 2, it is understood that the President is anxious that there shall be a reconciliation of the differences which have existed between the advocates of "states' rights" and "federal control," and that opportunity shall be given to private capital to develop water-power resources for the benefit of the people if such opportunity can be created without at the same time creating monopolies.

The bills of Secretary Lane and Secretary Garrison are to be based upon the following:

(1) Permits shall be granted to private capital to establish water-power plants on navigable streams to run for, say, fifty years.

(2) At the end of the permit period the plant and the right to operate are to revert to the federal government.

It is the intention of the administration to endeavor to get in touch with private capital to ascertain whether these features could be carried out. In other words, the administration desires to know whether it would be profitable to private capital to build and operate water-power plants for, say, fifty years on such terms. Before drafting their bills in final form Secretary Lane and Secretary Garrison will consult with water-power experts and also with chairmen and members of committees of Congress having to do with water-power matters. Secretary Garrison's bill will deal with water-powers on navigable streams and Secretary Lane will take up the subject of water-powers on public lands.

While the President is understood not to be committed to these features of a proposed bill, it is said that he regards such a permit and reverting plan as a possible solution of the difficulties. The suggested features are tentative and much will depend on what private capital has to say. It is understood that the proposed bill will contain a clause giving to the states in which they are located the plants and the rights to operate them at the end of the suggested fifty-year period.

Water-power matters are expected to occupy a large share of attention of public men in Washington during the remainder of this session of Congress. The office of the chairman of the House committee on commerce is besieged by representatives of capital who desire to know where they stand. A representative of a water-power owner of magnitude in the State of Washington had a conference with Chairman Adamson of that committee last week, during which he said that a great English financial firm desires to go into that field and will furnish unlimited means to build plants if a settlement of the question can be had in Washington on some basis other than the revocable permit plan.

Representative Adamson stated that he has been working for a year, with a sub-committee, of which he is chairman, of the commerce committee of the House, on a plan to amend the general dam act, and that he hopes to bring in an amendment to that act soon.

It is understood in Washington that an effort will be made to bring out of the rules committee of the House, to which it was referred, a resolution offered by Mr. Rainey on Jan. 28, which, if passed, will give to the committee on commerce the power to inquire into the act of Congress granting to the Keokuk & Hamilton Water Power Company the right to construct a dam across the Mississippi River at Keokuk, Ia. This franchise was assigned to the Mississippi River Power Company, and the preamble of the resolution charges that the dam which has been constructed across the river is a hindrance to navigation; that steamboats proceeding up the river are compelled to await the pleasure of the company operating the dam and are sometimes compelled to wait for hours; that the power company is permitted to store water in the night-time in the pool, thereby rendering navigation unsafe and often impossible; that the power company is buying electric-light plants in Illinois, Missouri and Iowa, paying therefor in many cases much more than said properties are worth; that the power company is furnishing poor service at excessive compensation; that a bridge has been built across the river in violation of law and that there has been no compensation provided for the valuable privileges granted by the act.

Trust Legislation, Retail Prices and Patents

The principal subject of discussion at the second annual meeting of the Chamber of Commerce of the United States, held in Washington last week, was the pending anti-trust legislation. Other subjects discussed that are of interest to the electrical industry were the maintenance of retail prices and patents. The latter subject was taken up in a report of a committee. An account of part of the proceedings was published in last week's issue. The article published herewith, containing other proceedings of the convention, includes an abstract of an address by Mr. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, who discussed the bills now under consideration by Congress under the program of the administration.

Address of Mr. Tripp

Mr. Tripp said that, whether it is economically sound or not, the public has the belief that practically all business should be roughly divided into two classes, the one comprising the natural monopolies of public necessities—in other words, public utilities—the other comprising the naturally competitive private business undertakings. Personally, Mr. Tripp finds no fault with such a division, but manifestly these two distinct classes require different legislative treatments. That public utilities should be regulated and not given the free hand that naturally competitive business requires is sound doctrine, but only when such regulation carries with it an obligation to protect such utilities against the menaces which confront competitive business.

Almost nothing has remained unthought of in the way of regulation and restriction, and the cheerfulness with which regulatory burdens have been heaped upon public utilities is discouraging when it is remembered that hardly a single voluntary act for protection has been heard of. Public utilities should be protected against competition, inadequate rates, demands for excessive service, unreasonable and unjust damage claims, federal regulations superimposed upon state regulations and, most important of all, against oppressive demands of labor. Under present conditions, the mere threat of a labor strike on a railroad is sufficient almost automatically to produce an increase in wages or cause railway managers to relinquish their right to enforce discipline in the interest of the safety of the public and economy of operation, as instanced by the recent strike on the Delaware & Hudson road. The best evidence that legislators have abandoned their campaign of punishment and have become sincerely desirous of doing the fair thing by public utilities will be shown when someone has the courage to introduce a bill intended to prohibit effectually strikes and lockouts on railroads.

While railroads and other public utilities need special legislation for both regulation and protection, Mr. Tripp added that a naturally competitive business (like that in which he is engaged) stands on an entirely different basis and, if competitive conditions are maintained for it, as he believes they should be, neither regulation nor protection of the character mentioned has any place in its dealings with the government. If one cannot manufacture his goods and sell them as cheaply as his competitor can, he must eventually fail, and, if his employees force him to the issue, he can shut up his shop and both he and his employees will be out of income for a longer or shorter period, but the general public welfare is not vitally affected.

A great deal of the proposed legislation at Washington is directed toward creating or maintaining conditions which, in the mind of the legislators, will tend to insure competition among this class of industries, which are to be distinguished from public utilities. In so far as these measures will be effective in the direction of securing sane competition Mr. Tripp believes they are wise.

Monopoly is not in itself objectionable; in fact, it is often the most effective way of dealing with industrial affairs. In Germany it is fostered and protected by the government to a large extent, with the result that the commercial supremacy of that country in the markets of the world has been established within a comparatively few years of the most rapid business growth perhaps that has ever been seen. But Mr. Tripp believes that our political institutions and the temper of our people are not adapted to monopolistic methods that are in restraint of trade, and that fair competition in business will make a more contented public, a more secure government, and in the end give greater protection to property. Therefore, he is in favor of all fair and reasonable legislation sustaining that theory.

Fair or sane competition is hard to define. Free competition is not sane competition. The biggest business in the country was founded almost entirely upon the principle of free competition, namely, that of making prices what and when you will and taking all the business from your competitor that you can. If this business was a monopoly, it grew to be so without the aid of interlocking directorates or the alleged money trust; it became a monopoly simply by the practices of free competition. Therefore, in considering the various business measures now pending, particular attention should be given to the question, Will they, or will they not, assist in securing sane competition, not free competition? First, Are they based upon the right principles? Second, Is it probable that acts can be framed which will sustain these principles without doing more harm than good?

A trade commission seems to Mr. Tripp to be needed in a well-rounded plan of business legislation. No other agency can so well collect information, conduct investigations and determine facts for the guidance of the legislatures and courts, and that in the last analysis is all the power that the bill gives it. No great harm can come from elaborate powers given the commission in the way of getting papers and documents except expense and bother to the corporations. It would be a physical impossibility for it to exercise its full powers in this direction. Mr. Tripp objects to the provision that the commission may from time to time make public such information in such form and to such extent as it may deem necessary. There is danger of telling competitors too much and giving half truths to the public.

In the opinion of Mr. Tripp, the interlocking directorates bill, as at present drawn, will wholly fail in its object and will foster the very thing that it aims to prevent. It will tend to create dummy boards and enable responsible men to exercise as much control as ever without the restraining influence of personal responsibility. It will tend to create one-man power corporations and thus render more unstable the investments of the public. It is based on a mistaken or exaggerated notion of the Machiavellian activity of the interlocking director. Those terrible charts of control through interlocking directors are worse than worthless. As an instance, enough misinformation has been gleaned from them to bring out the statement that the General Electric Company and the Westinghouse Electric & Manufacturing Company are only alleged competitors. That is untrue, said Mr. Tripp. If the whole interlocking directorate bill should be wiped out except the last section, and that should simply provide that the fact of a common director shall be prima facie evidence instead of conclusive that no competition exists between two corporations, it would probably be ample to cover the situation.

A careful reading of the very short and concise paragraphs of the Sherman law definition bill leaves one with a feeling that the definitions are fully as vague as the Sherman act itself, and, instead of improving, it further complicates a situation which had begun to be clarified.

If the prohibition against discrimination in prices in the trade relations bill is intended to create sane instead of free competition, Mr. Tripp thinks it may prove to be a good provision. As to prohibiting the fixing of prices upon the understanding that the purchaser shall not deal in the goods of a competitor, Mr. Tripp does not view that as revolutionary, although it might cause inconvenience to some to adjust themselves to it. On the whole, he thinks it is fair.

Mr. Tripp said that there should be included in this bill a provision such as that recommended in the report of the committee on interstate commerce, as follows: "There ought to be a way in which men in such a venture could submit their plan to the government and inquiry be made as to the legality of such a transaction; and, if the government was of the opinion that competitive conditions would not be substantially impaired, there should be an approval, and in so far as the lawfulness of the exact thing proposed is concerned there should be a decision, and if favorable to the proposal there should be an end to that particular controversy for all time."

Section 13 of this bill permits any person to sue out an injunction against threatened loss or damage and might subject a large company to a multitude of strike suits. It should certainly be amended.

The anti-holding-company bill, Mr. Tripp declared, is fraught with more danger than any other of the business bills recently proposed. It will be impossible to prohibit all holding companies without financial disaster, and just how the good can be separated from the bad in an act of Congress Mr. Tripp said he cannot imagine. Public utility holding companies, for example, are sound in principle, even though some are not so in practice. Practically all large corporations are holding companies to some extent and in many cases they are compelled to be so by the operation of state laws.

In conclusion, Mr. Tripp said he believes that no good results can be obtained through wholesale condemnation, and that he does not fear the principles outlined but does fear the unknown dangers of untried legislation and should have preferred to see such vital changes tried one at a time. If that cannot be, he hopes the government will finally resolve all doubtfully dangerous provisions on the side of the intimidated and apprehensive business interests.

Large and Small Business

Mr. William C. Redfield, Secretary of Commerce, in his discussion on trust legislation, said that a very small number of the large industrial combinations formed a number of years ago had made a success. The competition of small keenly managed competitors has been effective against large organizations. The internal politics of some of the large industrial combinations have equaled the absurdity of the more public politics of the nation. Mr. Redfield said he doubts if any production engineer to-day would argue that the way to get efficiency of production would be to combine twenty or thirty factories hitherto unrelated. The strength of such a combination is no greater than the strength of its most efficient part. Many plants of combinations have been closed in order to make the efficient plant more efficient. Mr. Redfield also spoke of the point at which production becomes so large as to be no longer economical and declared that unseen objects of cost come into sight the minute production is pressed beyond that point.

Mr. Louis D. Brandeis, of Boston, said that the problem could not be solved unless there was a complete divorcement of the railroads and industry. He declared that a discrimination against the small shipper is going on in the railroad world to-day. It must be remembered that America is working on the problem of democracy and that this problem cannot be solved if the effort is confined to a political democracy. Side by side with that must come the consideration of industrial democracy. Mr. Brandeis asked what better thing the government could do than to extend to the manufacturer the aid and opportunity of knowing about his particular line that it extends to the farmer. Medical science, architecture and almost every branch of engineering make known discoveries and methods that will advance the art. Business men should follow the same policy.

Prof. Henry R. Seager, of Columbia University, said that he was in entire accord with the administration's proposal to create a trade commission but regretted other proposals that in his judgment would prevent that commission from rendering the great service of which it was capable in guiding the policy of the country with reference to industrial combinations. The bill designed to amend the anti-trust act so as to condemn expressly discriminatory price policies and selling contracts and to give private litigants the advantage of evidence collected or convictions obtained in government suits is commendable in purpose. The measure against which Professor Seager particularly protested as unnecessary and harmful is the bill which undertakes not only to make the punishment for violation of the anti-trust act personal, as he agreed it should be, but also to define the terms "every contract combination in the form of trust or otherwise" and "conspiracy in restraint of trade" and the word "monopolize" in conformity with the narrowest and most dogmatic conviction that every departure on the part of business men from unrestrained competition necessarily results in restraint of trade and is therefore to be condemned.

Professor Seager thinks that the distinction between natural monopolies and industrial enterprises such as coal mining and iron and steel manufacturing has been too sharply drawn. It is still an open question economically whether the advantage is not with combination rather than with unregulated competition in some branches of mining and manufacturing. German economists and public men are almost unanimous in approving the combination movement in that country, though admitting that the machinery for regulating the cartels is still inadequate and that a vigorous governmental policy is necessary to prevent producers from taking advantage of consumers. Is it probable that a policy so generally approved in Germany is entirely unsuited to the United States?

Retail Prices

Mr. Joseph E. Davies, Commissioner of Corporations, Department of Commerce, discussed retail prices. The bureau is now engaged in making an exhaustive study of this question from an economic point of view. It is the purpose to make that investigation fair and impartial without preconceived bias, prejudice or judgment. For that reason Mr. Davies expressed no opinion upon the merits of the question at this time. He said, however, that the question is not a simple one. It is most far-reaching in its effects. There are excellent reasons advanced in favor of retail price maintenance and strong arguments urged against it. Its importance is not confined alone to the manufacturers, the wholesalers, the jobbers and the retailers. In the matter of the cost of living it affects very vitally the great body of consumers in the country. In the processes of production from the raw materials to the final consumer it is commonly stated that one of the greatest factors contributing to the high cost of commodities is found in the process of distribution. It is a statement of inexorable fact that no system of distribution that does not ultimately and fundamentally conserve the interests of the great mass of the people will ultimately obtain and that the interests of manufacturer and distributer alike lie in the establishment only of such a system as will conduce to the well-being and advantage of the great body of consumers, for in that alone are there assured lasting profit and advantage to the producer and manufacturer and the retailer.

Dr. Donald Dey, of Dey Brothers & Company, Syracuse, N. Y., in discussing price and maintenance from the retailer's point of view said in part: "We have agreements of hours of labor. May not the merchants without injury to the consumer agree with each other on so reasonable a matter as a fair minimum of price? The legislature will surely find a way to permit an arrangement of sale that will be fair, equitable and just. As a layman it seems incomprehensible to me that a manufacturer and a merchant may not enter into an agreement to buy at a certain price, and to sign a stipulation and agreement as to re-sale. It seems unreasonable to me that merchants must appeal to the government for the privilege of entering into a contract with a manufacturer to buy and sell merchandise according to a mutual arrangement or agreement. I think in a practical way we need have no fear of there not being enough competition between the dry goods merchants of every town or city in this broad land of ours."

Patent Legislation

The report of the committee on patents, trade-marks and copyrights recommended an amendment or correction of the Kahn law to relieve this measure of the provision which has caused concern. It also recommended that Congress enact as soon as possible a law establishing a Court of Patent Appeals, to which cases may be taken by either party to a patent suit from the Circuit Court of Appeals, thus doing away with the existing situation under which the patent may be declared valid and infringed by the Circuit Court of Appeals in one district and held to be invalid in another. The other recommendation of the committee was that an expert commission be created and empowered to investigate the patent laws and the practice under them, to recommend to Congress such legislation as it may conclude to be necessary to perfect the one and correct any abuses discovered in the other, and that no other patent legislation be enacted until this commission has made its report.

Other Matters

A resolution was passed approving the action of the board of directors in taking a referendum of members on the pending anti-trust legislation. Another resolution provided for the appointment of a separate committee by the president of the organization to investigate the subject of price maintenance in respect to articles sold under trade-marks in its economic, public and business aspects and report conclusions and recommendations to the board of directors.

Mr. William B. Wilson, Secretary of Labor, in an address on Feb. 18, expressed opposition to compulsory arbitration of industrial disputes. He said that the decision under such an arbitration may do an injustice to the employer by giving wages which will absorb his entire capital or it might make the employees little better than serfs.

At the banquet held on the evening of Feb. 19 Secretary of Commerce Redfield described the work of his department. He said that the existing conditions had forced upon the department an inquiry as to the fundamental standards of public service corporations. As things are now the companies are much better informed than the public. Few phases of activity will be more useful than this if the department is permitted by Congress to continue the work which it has begun.

Dr. Carl Rathgen, of Hamburg, Germany, who has been making an investigation of the trust situation in this country for the German government, was also a speaker at the banquet.

Hearings on Anti-Trust Legislation

Hearings have been held in Washington during the last week on the proposed anti-trust legislation of the administration before the committees on interstate and foreign commerce and on the judiciary of the House of Representatives.

The commerce committee has closed its hearings on the two bills before that body, the measures to provide an industrial trade commission and to regulate stock exchanges. Chairman Adamson announced that while no more hearings will be held, for the present at least, the committee will be glad to receive and consider statements from anyone who has anything to say.

A sub-committee has been appointed, with Representative Covington as chairman, to draft an entirely new industrial trade commission bill. The other members are Messrs. Sims, Talcott, Rayburn, Stevens and Esch.

While the sub-committee is drafting a new bill, the judiciary committee will continue its hearings on the other forms of the proposed legislation. The committee desires to hear everyone who has anything to say and will receive statements and briefs from any who desire to submit them. They should be addressed to the chairman of the judiciary committee, Mr. Clayton.

It is stated in Washington that the Senate committees do not expect to hold any hearings on these bills. Senators expect that all of the points that should be brought out will be discussed at the House hearings. In case, however, some point develops in the Senate committees which does not seem entirely clear, Senators may ask for statements from those who are known to have special knowledge on the subject.

Public Service Commission News

Wisconsin Commission

The Wisconsin Railroad Commission has granted the petition of the Mount Horeb Electric Company for an increase in rates. The present revenues were found to be inadequate to take care of interest and depreciation charges. The rates authorized are as follows: Primary rate, 14 cents net for the first thirty hours' use per month of the active connected load; secondary rate, 12 cents net for the next sixty hours' use; excess rate, 9 cents net. In Class A, consisting of residences, etc., 60 per cent of the first 500 watts connected and 33.3 per cent of the excess is to be considered as active. In Class B, consisting of stores, offices, banks, etc., 70 per cent of the first 2.5 kw and 55 per cent of the excess is to be active. In Class C, consisting of churches, industrial establishments, hotels, schools, etc., 55 per cent of the connected load is to be considered as active.

The rates for power service are to consist of a service charge of 75 cents per month per hp of connected load and an energy charge of 5 cents per kw-hr. for the first fifty hours' use per month of the connected load, with an excess rate of 3 cents per kw-hr.

The rates ordered are not so high as petitioned for nor so high as the cost of service would require, but, in the opinion of the commission, the interests of the company in the way of increased lighting business could best be conserved by the schedule prescribed.

Indiana Commission

The Public Service Commission of Indiana, in its long-awaited decision in the Indianapolis street-railway strike arbitration proceedings, took steps to avoid a recurrence of a situation under which the commission might be brought forward again as an arbitration board. In its decision the commission established a new board of arbitration, composed of three men to be appointed by the judge of the United States District Court and the chief justices of the State Supreme and Appellate Courts, to handle all differences that may arise within the three-year period during which the awards of the commission in the Indianapolis street-railway trouble are to be binding. The commission also advised that the 1915 Legislature provide an arbitration board.

Several disputes between the employees and the traction companies in various part of the State remain for the commission to solve. These were taken up by the commission during the strike troubles.

The commission has announced a rule which it declares it will follow in the future in regard to a valuation of utility properties. After a petition for approval of issues of stocks or bonds, if there is doubt as to the position of the company, a valuation will be made. The question arose when the Huntington Light & Fuel Company asked the commission for authority to issue $250,000 bonds to retire stock. City officials of Huntington protested that the value of the plant did not warrant this step, and the commission postponed final disposition of the matter pending a valuation.

Criticism of the new system of uniform accounting has been offered in various Indiana cities, principally because city clerks do not understand the meaning of the law. In many places it is declared that the new system of the commission will increase the annual cost to the city many hundreds of dollars. The commission's reply to these criticisms contains a copy of the section of the law which provides for a system of accounting. In nearly every instance that has come to the attention of the commission the privately owned utilities of the State already have a system of accounting that is far in advance of those of the municipal utilities.

Current News Notes

Extensible Platforms for Subway Stations.—No longer will the guard's familiar cry, "Watch your step!" be heard at stations on curves in the New York subway if the extensible platform device now being experimented with proves successful. At points opposite the car doors there will be mounted under the platforms sliding shelf gratings moved by air cylinders controlled by solenoid valves. These gratings will be extended by the platform attendant to cover the gaps, just before the cars come to a stop, and will be automatically withdrawn again after the train has proceeded a few feet on its journey. A trial equipment is now being installed at the Fourteenth Street station.

* * *

Interchange of Dates for I. E. C. Publicity Meeting and Dinner-Dance.—Announcement has been made of the interchange of the dates of the International Electric Congress publicity meeting and the Congress dinner-dance to be held during the midwinter convention of the American Institute of Electrical Engineers at New York next week. According to the revised program, the publicity meeting will be held in the auditorium of the Engineering Societies Building, New York City, Wednesday evening, Feb. 25, when a number of prominent speakers will tell of plans for the Congress and the San Francisco exposition and of the scenic and electrical features of the trip across the continent. On Thursday evening, Feb. 26, the I. E. C. dinner-dance will be held at the Hotel Biltmore.

* * *

Proposed Amalgamation of Electric Club of Chicago and Chicago Jovian League.—At the regular weekly luncheon of the Chicago Jovian League on Feb. 16 resolutions were adopted favoring the merger of the Chicago Jovian League and the Electric Club of Chicago under the title "The Electric Club (with which is affiliated the Chicago Jovian League)." The resolutions were offered by the board of managers of the league and presented by Statesman H. E. Niesz. It is proposed that the league be discontinued, its members to be admitted to the Electric Club without initiation fee. Mr. A. R. Bone, president of the Electric Club, said that the board of managers of the club had considered the proposal and was in favor of it. At the time of writing, however, the Electric Club as a body had not accepted the Jovians' proposition.

* * *

Illuminating Engineers Guests of a Mail-Order House.—On Feb. 11 the Chicago Section of the Illuminating Engineering Society was tendered a dinner by Sears, Roebuck & Company at the company's plant in Chicago. Following the dinner the guests were invited to inspect the lighting of the various office buildings. During the inspection Mr. S. E. Church, electrical engineer for the company, read a brief paper giving the results of tests made on the different types of lighting employed. Among the most interesting of these figures were those showing the effect of accumulated dirt on direct and indirect lighting units. In one office where deep reflectors and frosted-tip tungsten lamps were used to provide direct illumination the tests showed that in two months the light intensity was reduced by 23.2 per cent because of dirt. In an adjacent office where lighting is accomplished by means of indirect units each containing a single tungsten lamp the deterioration was 22.5 per cent for the same time, a surprising result. In summing up the lighting equipment of the company Mr. Church said that there are in operation on the company's premises 20,600 tungsten lamps, 7782 carbon lamps and 3013 Nernst lamps.

SOCIETY MEETINGS

Rejuvenation in Los Angeles.—The Jovians of Los Angeles, Cal., and vicinity gave a rejuvenation at the Union League Club in that city on Feb. 6. There was a dinner, at which Mr. A. E. Morphy was toastmaster. The event was held under the direction of Mr. J. N. Colkitt, statesman, and Mr. J. G. Pomeroy was the Jupiter of the initiation team.

* * *

New York Electrical Society.—The New York Electrical Society will meet at the new 201st Street generating station of the United Electric Light & Power Company, New York City, Feb. 27, for an inspection of the plant. Addresses will be made by Mr. Frank W. Smith, vice-president of the company, and Mr. H. W. Leech, electrical superintendent.

* * *

St. Louis Section, A. I. E. E.—At a meeting of the St. Louis Section, American Institute of Electrical Engineers, Feb. 11, Mr. S. N. Clarkson, power engineer for the Union Electric Light & Power Company, St. Louis, presented a paper on "Some Features of High-Tension Direct-Current Long-Distance Transmission," describing the Thury constant-current system used in Europe.

* * *

Minnesota Convention Next Month.—The next annual convention of the Minnesota Electrical Association will be held at the Hotel Radisson, Minneapolis, on March 18, 19 and 20. The president of the association elected at last year's convention was Mr. Eugene Holcomb, but he has since left the State and the executive committee has recently elected as president Mr. P. T. Glidden, manager of the Consumers' Power Company, of St. Paul, who will fill out the unexpired term of Mr. Holcomb. Mr. Fred A. Otto, of the St. Paul Gas Light Company, is the secretary and treasurer of the association. Every effort is being made to arrange for a good convention.

* * *

Yale A. I. E. E.—Mr. Charles R. Underhill, electrical engineer of the Acme Wire Company, New Haven, Conn., delivered an experimental lecture on "Electromagnets" before the Yale University Branch of the American Institute of Electrical Engineers on the evening of Feb. 11. At the request of Prof. Charles F. Scott, Mr. Underhill repeated the lecture before the senior class on the afternoon of Feb. 12. The lecture covered chiefly the effects of magnetic leakage in plunger electromagnets, and Mr. Underhill showed how the ordinary laws of traction, as usually given in textbooks, must be modified on account of leakage, so that the traction may be accurately predetermined.

* * *

Pittsburgh Section, Association of Iron and Steel Electrical Engineers.—At the Feb. 7 meeting of the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers Mr. E. M. Hewlett, General Electric Company, gave an illustrated lecture on the control apparatus of the Panama Canal locks. Motion pictures were shown of the complete equipment in operation. Conditions peculiar to the Canal Zone were described which made it necessary to employ noncorrosive alloys, mica insulation and non-hygroscopic insulating materials on all of the equipment installed. The speaker pointed out how similar remote-indicating apparatus may be employed on gas and water systems to indicate the position of valves. Motion pictures were also shown of the Butte Copper Mines, Anaconda Smelters and the Butte, Anaconda & Pacific Railway system, which is the first steam railroad to be electrified with 2400-volt direct current.

Union Central Life Building, Cincinnati

Electrical features, generating equipment, distribution systems, interior illumination and exterior ornamental lighting of a new thirty-two-story office structure

FEW office buildings in this country outside of New York City and Chicago are as elaborate in exterior and interior details as the new thirty-two-story Union Central Life Insurance Building recently completed at Cincinnati, Ohio. The illumination effects and the electric generating plant in the sub-basement are in keeping with the handsome structural features. The building measures 150 ft. long by 100 ft. wide up to the nineteenth floor. Above this it takes the form of a tower having a cross-sectional area of 8000 sq. ft. and culminating in a pyramidal cap 537 ft. above the level of Baker Street.

Granite and terra cotta are used exclusively for the outer walls. The exterior of the pyramidal-shaped cap is covered with rough tile into which goldleaf has been baked to give it a glistening appearance in the sun. Surmounting the top of the tower is a wrought-iron grill cage which serves as an outlet for smoke from the furnaces in the boiler room. The corridor on the main floor, the library and the executive offices of the insurance company's officials are very elaborately decorated with groined arches, goldleaf, tan marble and ornamental electric fixtures. The general color combination throughout the building is tan and gold.

The second and third floors of the building will be occupied by the Cincinnati Chamber of Commerce, while the floors from the eleventh to the eighteenth inclusive will be used by the Union Central Life Insurance Company. The remainder of the building will be leased to office tenants.

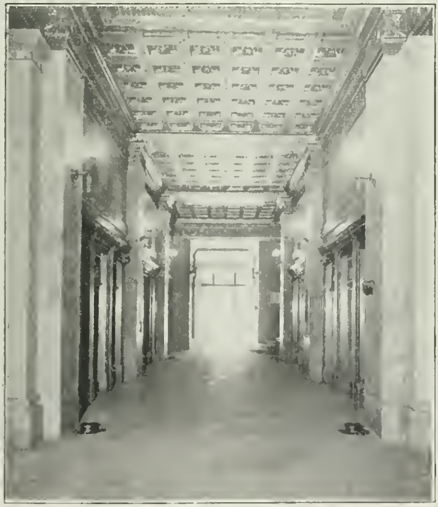


FIG. 1—MAIN CORRIDOR, SHOWING BRACKET FIXTURES

Boiler-Room Equipment

Electric service for the building is supplied from a generating plant in the sub-basement. On a level below this, however, are installed four Heine boilers, each having 10,000 sq. ft. of heating surface, which supply steam for the generating equipment and for heating the building. Two of these boilers are arranged in a battery and the remaining two are separate units. Each is set on wrought-iron supports independent of the brick setting and is equipped with Roney stokers having removable fuel plates. Each grate has an area of 200 sq. ft. and is designed to burn a low grade of bituminous coal without smoke when 30 lb. of fuel is being consumed per square foot of grate surface. Two vertical, double-cylinder, single-action engines, one of which is normally held in reserve, drive the stoker apparatus.

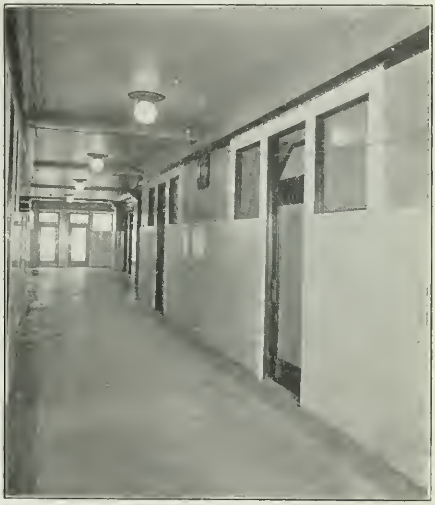


FIG. 2—TYPICAL OFFICE-FLOOR CORRIDOR LIGHTING

Feed water is circulated through a Reilly multicoil heater before being delivered to the boilers. All of the water required for 800 hp in boilers can be heated in this one apparatus within 2 deg. to 5 deg. Fahr. of the steam entering the heater. Four feed-water pumps are installed, two of which are compound-duplex pumps and the remainder simple-duplex. The compound pumps are capable of delivering 80 gal. of water per minute at a piston speed of 30 ft. per minute, and the simple pumps, which are used at night and on Sundays, are capable of delivering 20 gal. of water at a piston speed of 22 ft. per minute.

Smoke from the boilers is led up through a single steel stack which runs up the south wall of the building to the twenty-first floor, where an offset connects it with a stack extending up through the central portion of the tower to the grating at the apex. The stack is supported at alternate floors and is provided with extension joints consisting of slip collars and stuffing boxes below each support. The lower 100 ft. of the stack is made of

0.375-in. riveted steel, while the upper portion is of 0.25-in. stock. For a distance of 30 ft. above the grates the stack is lined with firebrick, and from the twenty-first floor to the top with 2 in. of "vitribestos."

Coal is delivered at the rear of the building on the street level and is dumped through manholes into large concrete storage bins. Three 1-ton coal cars equipped with ball bearings convey the coal from the storage bunkers into the firing room, where it is shoveled by hand into the stoker hoppers. The furnaces are provided with doors so that they may be fired by hand in emergencies. Two flat-topped ash cars, 33 in. wide and 60 in. long, are used to convey the ashes from beneath the grates to storage bins and to a telescoping sidewalk lift.

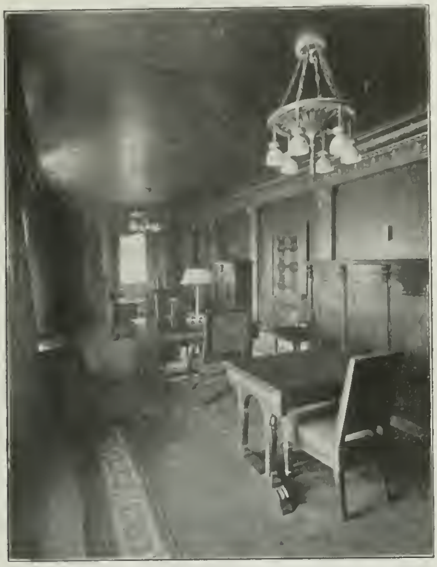


FIG. 3—ORNAMENTAL FIXTURES IN EXECUTIVE OFFICE

Electrical Generating Equipment

Three generators are installed in the engine room. Two of these are 300-kw, 250-volt direct-current machines and are directly connected to tandem-compound engines, manufactured by Hooven, Owen & Rentschler, of Hamilton, Ohio. The other unit, which is rated at 150 kw, is driven by a non-condensing simple horizontal engine of the same make. All of the generators were made by the Triumph Electric Company, of Cincinnati, and operate at 150 r.p.m., supplying energy to individual buses. The generators are over-compounded 5 per cent and are connected so that they will share the load in proportion to their respective ratings.

As the electric lamps in the building are rated at 120 volts and the motors at 240 volts, two 15-kw differentially wound balancer sets are connected permanently across the generator terminals to provide for three-wire distribution. When the generator is started up the balancer set connected to it is therefore brought gradually up to speed with it.

The switchboard consists of ten panels, three of which control the generators, one is the main power panel, two are distributing panels for the lighting circuits, two are for distributing energy to motors, one is for controlling the balancer sets, and the last is held as a spare. Instead of extending the panels to the floor, the intervening space is filled with a glazed tile wall which forms a partial support for the switchboard. As arranged at present, the machine panels are provided with duplicate buses and three-blade double-throw switches which may be used to connect either generator and its balancer set onto either bus. Motors and lamps are ordinarily fed from separate buses, but it is possible to tie the buses together and to operate the plant as a unit.

A metal grill is constructed around the ends and back of the switchboard, allowing sufficient space for inspection of the rear of the board. As all of the feeder cables are carried out at the top of the switchboard, a sheet-metal pull box, supported from the ceiling and extending the entire length of the board, is installed, so that new cables may be pulled in or old ones inspected. The interior of the box is accessible from the back through a hinged door. This method of conducting the cables to the switchboard makes a more sightly installation than if the box were not used, and also affords means of grouping the cables so that they are suitably arranged for connection to their respective panels.

In the generating room is a 14-in. by 10-in. vacuum pump which operates at 200 r.p.m. and is connected by a silent-chain drive to an 11-hp Allis-Chalmers motor which runs at 925 r.p.m. This pump furnishes the suction for the cleaning system used in the building. Constant vacuum is maintained by an electric regulator which automatically starts and stops the pump motor.

Motor-Driven Ventilating Apparatus

The boiler and generating rooms are provided with both induced and exhaust ventilators, as the superheat maintained in the steam would otherwise make the basement rooms extremely hot. Induced draft for the boiler-room ventilation is supplied by a 42-in. fan driven by a 7.5-hp motor, while that for the Chamber of Commerce is furnished by a 66-in. fan driven by a 10-hp motor. A 15-hp motor drives the boiler and generating room exhaust fan, which is 66 in. in diameter.

Air supplied to the Chamber of Commerce rooms is washed and tempered before being delivered. A set of coils having 2100 sq. ft. of heating surface tempers the air, and an air-washer operated on the spray system removes impurities such as dust. Water for spraying the air is supplied by a motor-driven centrifugal pump.

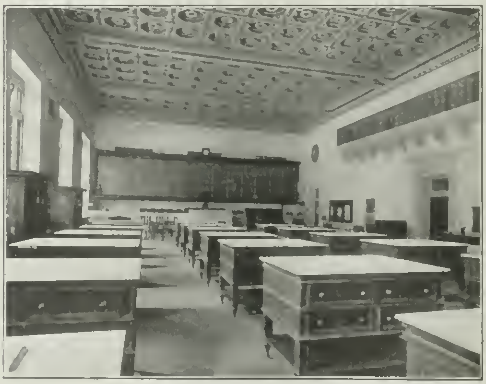


FIG. 4—CHAMBER OF COMMERCE, SHOWING CEILING FIXTURES AND BULLETIN-BOARD LIGHTING

System of Electrical Distribution

There are two feeder riser shafts in the building—one extending to the top of the structure, and the other only to the eighteenth floor as shown in the accompanying diagram. In the latter shaft are four three-wire circuits supplying energy to as many sub-feeders connected with about half of the distributing panels below the nineteenth floor. Two of the sub-feeders supply five floors each, and the other two feed two and three floors respectively.

The high-rise shaft contains five three-wire feeder circuits, most of which deliver energy to sub-feeders supplying five floors each. Two special feeders run to the twenty-seventh and thirty-first floors respectively, to supply energy for exterior ornamental lamps. In the two shafts taken together there are one No. 000, two No. 0000, three 300,000-circ. mil, five 400,000-circ. mil and one 500,000-circ. mil three-wire circuits.

The feeders are supported at every floor by Russel & Stoll cable supports. In the riser shafts at intervals of approximately 35 ft. iron cabinets are installed which serve as additional supports for the conduits and cables passing through them. The riser cables feeding both motor and lamp circuits are insulated with varnished cambric and are protected against mechanical injury by iron conduit. On each floor near the riser shafts are sheet-steel distributing cabinets 0.0125 in. thick, on each side of which are wiring compartments which facilitate making connections with the distributing panels. From the distributing panels to the motor and lamp outlets two-wire circuits are employed. The distributing panels were manufactured by the Frank Adam Electric Company, of St. Louis.

Motors which are used in the building for other than elevator service receive energy from the distributing panels just described. Knife switches are placed on panels near each motor. No circuit-breakers are used on the individual motor circuits as the fuses in the distributing boxes are depended on for protection. Four express-service elevators run to the twenty-eighth floor and eight local cars run up to the seventeenth floor. In addition to these there are two dumb-waiter elevators and five freight elevators. Geared overhead-traction-type elevator motors, having an aggregate rating of 480 hp, are located on the eighteenth and thirty-first floors. Energy for these motors is supplied through special feeders—two 700,000-circ. mil circuits delivering energy for the low-rise elevators and two 400,000-circ. mil circuits for the high-rise cars.

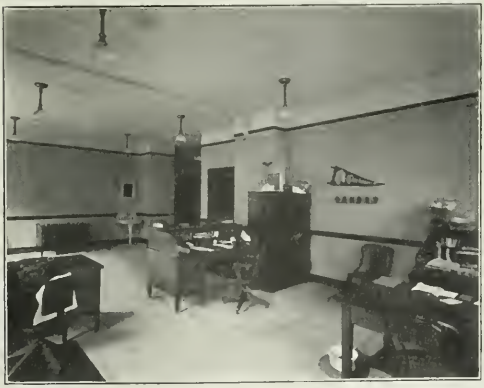


FIG. 5—LIGHTING ARRANGEMENT OF TYPICAL TENANT'S OFFICE

All wires supplying energy for office lighting are run in conduit from the distributing cabinets along the ceiling to their respective rooms and thence down the walls to switches. Each conduit entering an outlet switch or distributing box is provided with a coupling about 1 ft. from the box so that in case it is necessary to move the box it can be done by replacing the short piece of conduit by another of different length. Knife switches are used on all lighting circuits carrying 15 amp or over.

Interior Illumination

Several different types of electric fixtures are employed in this building. The main corridor is lighted by eighteen five-lamp frosted clusters supported on ornamental bracket fixtures about 10 ft. above the floor. Leading from this corridor to the one on the second floor is an attractive marble stairway which is lighted by indirect illumination. The lamps are concealed from view in the stairway molding, so that the light from them can be thrown on the ceiling and diffused.

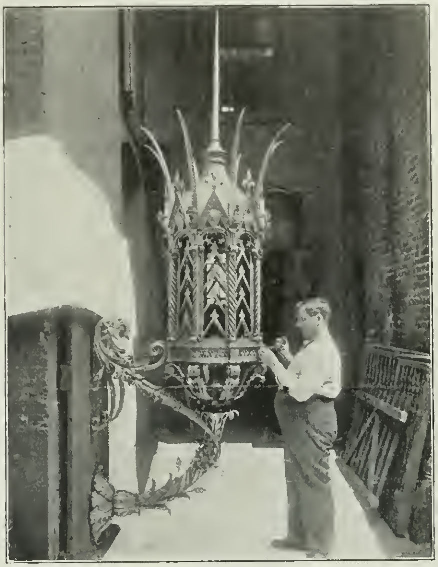


FIG. 6—ONE OF THE FIXTURES USED AT MAIN ENTRANCE IN THE ASSEMBLY ROOM OF MANUFACTURERS

In the Chamber of Commerce on the second floor are 120 frosted ceiling lamps supported by short rigid pendants as shown in an accompanying illustration. In this room is a stock-quotation bulletin board which is illuminated by ten lamps equipped with angle reflectors. Each of these fixtures is supported by a conduit fitting projecting horizontally from the upper edge of the board.

Offices of executives of the insurance company have been equipped with lighting fixtures selected by their occupants. In the executive office also shown herewith are elaborately decorated chain-pendent fixtures, each supporting a shower of six lamps with opal reflectors. Table lamps are also provided in this room.

The arrangement of fixtures in the tenants' offices is the same throughout the building. Rigid pendent fixtures equipped with opal reflectors are employed. In the corridors on the tenant-office floors milk-glass globes supported by ceiling pieces are used. These are arranged in a single row along the center line of ceilings, the lamps in them being controlled from lock switches on each floor.

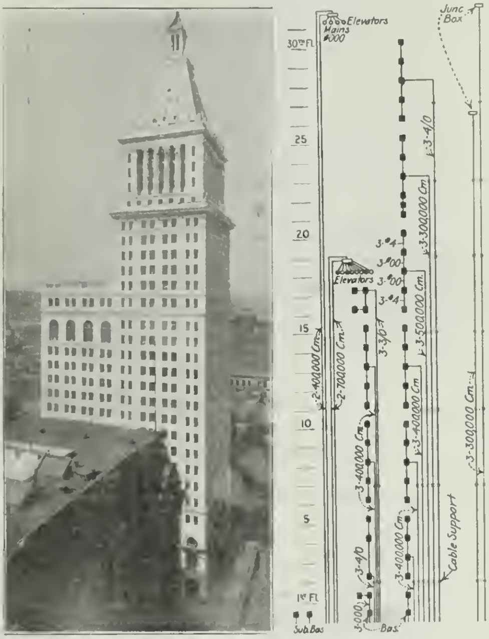
Exterior Lighting

Two large hand-forged, wrought-iron lanterns, illuminating the front of the building, are mounted on each side of the main entrance. These fixtures are indeed massive, measuring about 12 ft. from the top to the base of the support, while the lanterns themselves are about 3 ft. in diameter. They were manufactured by Mr. Samuel Yellin, Philadelphia.

Around the cornice of the building are thirty-six 150-watt lamps inclosed in 22-in. milk-glass bowls protected by wire netting. Four five-lamp pinnacle-type fixtures mark the corners of the tower. On these fixtures are supported vapor-proof globes containing 40-watt lamps. The circuits supplying the exterior lamps are incased in lead sheathing. All of the cable used in the Union Central Life Building is manufactured by the Underground Cable Company.

Telephone and Signal Systems

Telegraph cables are run up each of the riser shafts and are incased in lead sheathing which is strapped directly to the tile walls for support. The individual office circuits are concealed in sheet-metal molding.



FIGS. 7 AND 8—EXTERIOR OF CINCINNATI SKY SCRAPER, AND RISER DIAGRAM

A Gamewell fire-alarm system is installed, being supplemented also by an annunciator in the engine room in the sub-basement. Alarms can be turned in from two places on each floor. A single-stroke bell indicates the box at which a fire alarm has been turned in. Ninety-two private watchmen's clocks are installed, four being located on each floor up to the seventeenth, above which there are only two.

On one wall of the main corridor is a cordless switchboard and intercommunicating telephone system by means of which the elevator starter is able to talk with any one of the elevator operators. Motor-generator sets for operating the up-and-down elevator signals are installed on the eighteenth and thirty-first floors. After the building was completed it was found that the lamp load totaled 120 kw and the motor load 410 kw.

The Thompson-Starrett Company, of New York City, was the general contractor for the building, and the electrical work was done by the Hatfield Electric Company of Indianapolis. Messrs. Cass Gilbert, New York, and Garber & Woodward, Cincinnati, were the associated architects.

Substation Extensions in Chicago

There is much activity in the substation development of the Commonwealth Edison Company. This company now supplies practically all the energy requirements of the surface and elevated railways of Chicago. Some of the rotary converters used in the newer stations are of exceptionally large size. In December there was put into service a 4000-kw rotary in the Homer Street substation of the Chicago Railways Company. The new downtown Sherman Street substation of the Edison Company has a rating of 5500 kw. At Harding Avenue a second 4000-kw rotary for railway service will soon be in service. A duplicate of this machine and a 1000-kw motor-generator set have been put into commission recently at the Ravenswood substation. At Troy Street the fourth 1500-kva, sixty-cycle transformer has been installed.

Three new substations are under construction—Hermitage Avenue, Sedgwick Street and Sixty-second Street. They will replace the present 600-volt direct-current generating stations recently taken over from the elevated railroads and will, when completed, have ratings as follows: Hermitage Avenue, 16,000 kw for railway purposes; Sedgwick Street, 12,000 kw for railway service; Sixty-second Street, 10,000 kw for railway service and 7500 kva for Edison service.

Compact Radio Equipment of U. S. Motor Boat "Tarragon"

The United States motor boat *Tarragon*, of the Bureau of Navigation, Department of Commerce, which enforces the navigation laws, has been equipped with very compact and efficient radio apparatus. The transmitting equipment and motor-generator are mounted as a single unit on a panelboard 32 in. wide by 30 in. high. A storage battery of twenty cells operates the motor-generator and on one charge will energize the apparatus continuously at full load for about eight hours. The battery is charged by a small auxiliary gas engine directly connected to a 35-volt, 35-amp generator. The transmitter is of the quenched-gap type. A break system relay is provided, which enables the operator to be "broken" or to overhear any interference.

At present the normal wave-length of the *Tarragon* outfit is 300 m (985 ft.). In addition to this, transmitting wave-lengths of 200 m (657 ft.) and 450 m (1475 ft.) are also provided for. The change from one wave-length to another is accomplished by throwing over a six-point switch mounted on the panelboard. This single operation tunes both the oscillating and open circuits to resonance, and with a slight variation of coupling maximum radiation is obtained. The wave-length change device and the method of varying the coupling are very ingenious and were devised by Mr. F. A. Kolster, of the United States Bureau of Standards, who designed the equipment. The entire installation is rated at 0.25 kw and at the 300-m adjustment delivers a little over 3 amp in the antenna, which is of the inverted-V type, having a maximum height above the water-line of 27 ft. and a natural period of 60 m (197 ft.). Communication has already been established over a thickly wooded country to a distance of about 35 miles, indicating that at sea by night the equipment will have a transmitting range of about 150 miles.

Resonance in Radiotelegraphy—I

Modified electrical theory of resonance phenomena in high-frequency circuits, with special reference to wireless telegraphy. By J. Hettinger

IN what follows an attempt is made to give a modified electrical theory of the resonance phenomena in high-frequency circuits. The theory now more or less generally adopted has been fully developed in Zenneck's standard book on electromagnetic waves and wireless telegraphy.[1] The difference between this theory and that now put forward does not lie so much in the respective conclusions arrived at, since qualitatively they are in many respects similar, as in the premises on which they are based. In view of this statement it would appear that the proposal of a new theory, when the adopted one accounts sufficiently well for the results experimentally obtained, is superfluous. This, however, is a truism which, as the history of sciences has shown, does not always hold good.

The Present-Day Theory

It seems desirable first to give a brief outline of the essential part of the theory now adopted. For the sake of convenience reference is made more particularly to the case of two inductively coupled oscillatory circuits.

When a high-frequency current flows through a primary circuit inductively coupled with a secondary circuit it produces in the latter an oscillatory current which is to a great extent dependent upon the relation between the frequency of the current in the primary circuit and the natural frequency of the secondary circuit. The current in the secondary circuit attains its maximum amplitude when the two frequencies are equal, or, strictly speaking, nearly equal, to one another. The secondary circuit is then stated to be in resonance with the primary circuit. The oscillation induced in the secondary circuit is supposed to be the resultant of a "forced oscillation," the frequency of which is equal to that of the oscillation in the primary circuit, and of a "free oscillation," the frequency of which is equal to the natural frequency of the secondary circuit, the frequency of the forced oscillation and that of the free oscillation being thus, according to the above definition, substantially equal to one another in the case of resonance.

A graphical illustration of the theory is given in Fig. 1, wherein *a* represents the forced oscillation, which in this case is assumed to be undamped; *b* the free oscillation, which is damped, and *c* the resultant oscillation, which is obtained by reasoning as follows:

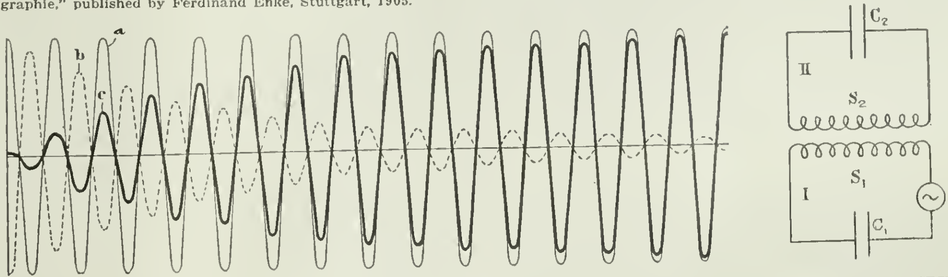
At the moment the oscillations are started, the inducing emf is either nil or at its positive or negative maximum. In the first case the current of the forced oscillation *a* is nil at this moment and the potential thereof is at its positive maximum, the potential of the free oscillation *b* then becoming equal to that of the forced oscillation but of opposite sign; that is to say, the free oscillation can only have the position shown by the dotted lines and the forced oscillation only the position shown in full lines. In the second case, namely, when the inducing emf is at its positive or negative maximum at the moment the oscillations are started, *a* and *b* represent "current" instead of "potential" curves, and so does also the resultant curve *c*, the amplitudes of which in either case are at every moment equal to the difference between the amplitude of the forced oscillation and that of the free oscillation and gradually increase until they attain, in the case illustrated, the amplitude of the forced oscillation.

This constitutes the essence of the present-day electrical theory, a criticism of which would be outside the scope of the present article.

The Writer's Theory

The theory which the writer ventures to propose may best be explained with reference to the case in which two oscillatory circuits are inductively coupled together, such as is illustrated in Fig. 2, wherein I is the primary circuit and II the secondary circuit, and wherein the natural frequency of the secondary circuit is assumed to be equal to the frequency of the current in the primary circuit.

(a) First of all, it is but natural to admit that the oscillatory change of the magnetic lines due to the oscillatory current in coil S_1 of the primary circuit I necessarily induces a corresponding oscillation in coil S_2 of the secondary circuit II. Such induced oscillation is generally termed a "forced oscillation," and its frequency is obviously equal to that of the inducing oscillation. Fig. 3 is a diagram of a forced oscillation, in which *A*, *B*, *C* . . . . *N* represent half oscillations due to corresponding half oscillations of the inducing current.



FIGS. 1 AND 2—GRAPHICAL ILLUSTRATION OF PRESENT-DAY THEORY, AND TWO OSCILLATORY CIRCUITS CONNECTED INDUCTIVELY

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[1] J. Zenneck, "Elektromagnetische Schwngungen und drahtlose Telegraphie," published by Ferdinand Enke, Stuttgart, 1905.

(b) The next natural assumption is that whatever the actual phenomena which determine the forced oscillation may be, these phenomena are repeated after each period T, and thus cause the oscillations AB, CD, EF, etc., to follow one another with the greatest regularity of time.

In other words, the electrical conditions at the moments a_1, b_1, c_1 and d_1 which determine the two half oscillations A and B are (qualitatively, and in the case of an undamped forced oscillation also quantitatively) exactly the same as the conditions at the moments a_2, b_2, c_2 and d_2 which determine the two half oscillations C and D, exactly the same as the conditions at the moments a_3, b_3, c_3 and d_3 which determine the two half oscillations E and F, and so on, whence the regularity in the repetition of the oscillations.

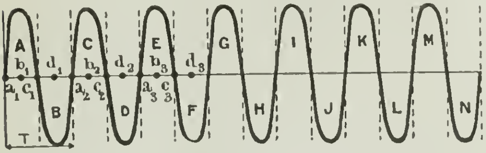
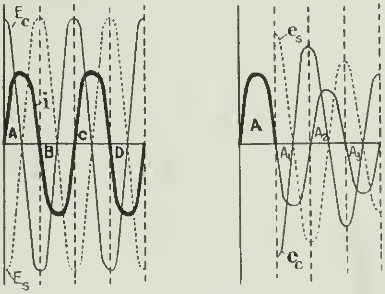


FIG. 3—DIAGRAM OF A FORCED OSCILLATION

(c) It is well known that in an alternating-current circuit containing a capacity and a self-induction the phase relation between the current (i), the emf (E_s) of the self-induction and the condenser potential (E_c), is as illustrated in Fig. 4, E_s being equal to E_c in the case of resonance. If i represents the forced oscillation induced in the circuit II by the oscillatory current in the circuit I (Fig. 2), E_s must necessarily represent the emf curve of the self-induction of the circuit II, and E_c the potential curve of the condenser C_2.

(d) Consider now the half oscillation A independently of the subsequent half oscillations B, C, etc., of the forced oscillation i, all of which are in any case independent of one another, each of them being due solely to certain phenomena forming part of a series of consecutive and identical phenomena initiated by the oscillatory current in the circuit I. This half oscillation A of the forced oscillatory current is accompanied (1) by a loss of energy due to the resistance of the circuit and (2) by a transformation of electric energy into magnetic energy and of magnetic energy into electric energy, which, theoretically, is not accompanied by any loss. This transformation of energy is determined by the oscillations represented by the curves E_s and E_c in Fig. 4 and is a phenomenon well known in alternating-current circuits.



FIGS. 4 AND 5—RELATION BETWEEN i, E_s AND E_c, AND FORMATION OF A FREE OSCILLATION

The question which next arises is as to what would happen at the end of the half oscillation A, namely, at the moment c_1 when the current is nil (Fig. 3), if no subsequent half oscillations B, C, etc., of the forced oscillation were produced. Would the oscillation be continued or would it end there? As a forced oscillation it would naturally be at an end, but in spite of this it would continue in the form of an oscillation, which in the case of resonance would be of the same frequency as the forced oscillation A. This continuation of the half oscillation A is attributable solely to the transformation of energy above referred to, which energy at the end of the half oscillation A is stored in the condenser C_2 in the form of electric energy and from this moment onward continues its transformation into magnetic energy and vice versa until the energy initially stored in the condenser is entirely exhausted, because of the loss due to the resistance of the circuit. An oscillation of this nature is generally termed a "free oscillation." Fig. 5 illustrates the formation of such an oscillation, A being the half oscillation "forced" in the secondary circuit II by the current in the primary circuit I, and A_1, A_2, A_3, the first three half oscillations which are initiated entirely by the electrical conditions prevalent in the secondary circuit at the end of A, and are completely "free" from the influence of the primary circuit. In order to indicate that the forced oscillation A is accompanied by the transformation of energy referred to but is not produced thereby, and that the free oscillation A_1, A_2, etc., is actually due to such transformation, the potential curves determining the transformation from electric into magnetic energy and vice versa in the first case have been marked E_s, E_c (Fig. 4), and in the second case e_s, e_c (Fig. 5).

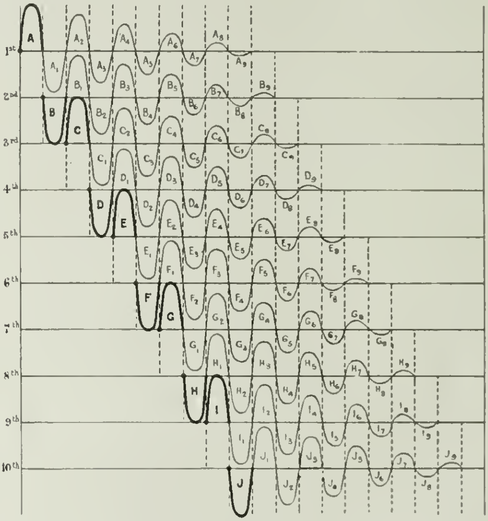


FIG. 6—FORMATION OF THE SERIES OF FREE OSCILLATIONS

(e) If each one of the half oscillations B, C, D, etc., of the forced oscillation induced in the secondary circuit and diagrammatically illustrated in Fig. 3 is considered independently of the other half oscillations, in the same manner as the half oscillation A, one necessarily comes to the conclusion that each one of them is the beginning of a free oscillation of the same frequency as that of the free oscillation which was initiated by the first half oscillation A, and which may be termed the "first free oscillation." (Fig. 6.) In view of the fact that hitherto it has always been assumed that the forced oscillation is accompanied by one free oscillation only, the above conclusion may appear somewhat surprising and peculiar; however, it is quite natural and correct. Indeed, suppose that no first half oscillation *A* were produced—"forced" in the secondary circuit—that at the end of half a period a "forced" half oscillation *B* were started which ended after another half period, and that the same were not followed by any other "forced" oscillation. It is only natural to admit that such forced half oscillation must be accompanied while it is taking place by a transformation of energy similar to that above described with reference to Fig. 4, and be followed by an oscillation due entirely to the electric energy stored in the condenser C_2 at the end of the half period and to the transformation of the same into magnetic energy and vice versa, as described with reference to Fig. 5. This free oscillation initiated by the second forced half oscillation may be termed the "second free oscillation." In the same way there is obtained a "third free oscillation" initiated by the third forced half oscillation *C*, a "fourth free oscillation" initiated by the fourth forced half oscillation *D*, and so on. This series of "free oscillations" is diagrammatically illustrated in Fig. 6, which shows ten "free oscillations" initiated by the first ten half oscillations of a "forced oscillation," each free oscillation starting and ending half a period later than the preceding free oscillation, and all of them having obviously the same frequency and the same damping coefficient, because of the fact that they are all determined by the electrical constants of one and the same circuit, namely, the secondary circuit II.

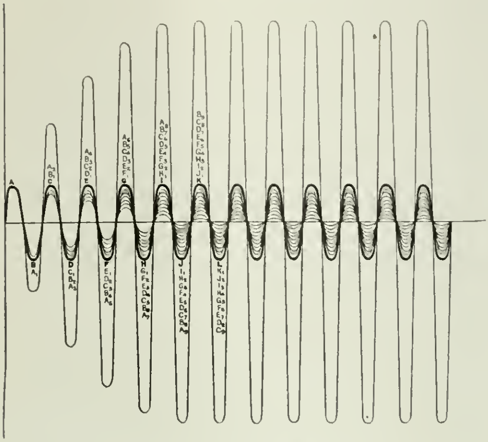

A
A_2 B_1 C
A_4 B_3 C_2 D_1 E
A_6 B_5 C_4 D_3 E_2 F_1 G
A_8 B_7 C_6 D_5 E_4 F_3 G_2 H_1 I
B_9 C_8 D_7 E_6 F_5 G_4 H_3 I_2 J_1 K
B A_1
D C_1 B_2 A_3
F E_1 D_2 C_3 B_4 A_5
H G_1 F_2 E_3 D_4 C_5 B_6 A_7
J I_1 H_2 G_3 F_4 E_5 D_6 C_7 B_8 A_9
L K_1 J_2 I_3 H_4 G_5 F_6 E_7 D_8 C_9

FIG. 7—SUPERPOSITION OF THE FORCED OSCILLATION AND SERIES OF FREE OSCILLATIONS

Consider now the forced oscillation shown in Fig. 3, not merely in regard to its separate half oscillations but also with regard to the whole series of such half oscillations, which constitute a continuous oscillation. It appears again natural and correct to admit that the whole forced oscillation is accompanied by a series of free oscillations which are superposed to one another in the order indicated in Fig. 6. The actual superposition is shown in Fig. 7, in which is indicated also the resultant oscillation obtained by the superposition of the series of oscillations.

A comparison of the diagram illustrated in Fig. 1 with those illustrated in Figs. 6 and 7 clearly shows the difference between the present-day theory and the one just explained. While hitherto the resultant oscillation in a resonance circuit was attributed to the superposition of one free oscillation on a forced oscillation, according to the above interpretation it is attributable to the superposition of a great number of free oscillations, the first half oscillation of each of which is constituted by one of the half oscillations of the forced oscillation, or, considered from another point of view, the resultant oscillation is due to the superposition of a great number of free oscillations on a forced oscillation, each one of the free oscillations being a continuation of one of the half oscillations of the forced oscillation.

Although the theory developed under this heading of the article was originally conceived with the idea of explaining the resonance phenomenon in high-frequency circuits, the writer came finally to the conclusion, the reason for which can easily be appreciated from the above, that it is applicable to alternating-current circuits in general, whether such circuits are of low or high frequency, and whether they fulfil the condition of resonance or not. It is not the intention, however, to extend the present article beyond the scope set out in the title.

In a later issue of the *Electrical World* there will be published a further development of the foregoing theory, giving the general consequences of the resonance phenomenon and an outline of the part that high-frequency currents play in wireless-telegraphy circuits.

Electric-Lighted Advertising on Delivery Automobiles

The Boston (Mass.) coffee house of the J. M. McCracken Company recently equipped the sides of a light gasoline delivery car with reflectors and 6-volt, 2-cp lamps operated from a three-cell storage battery carried on a shelf within the vehicle body. The reflectors were designed by Mr. C. W. Merrill, and, as shown in the accompanying photograph, are placed along the edge of the roof at the top of the side panel. Each measures 3 ft. 6 in. long and 3 in. in diameter. In each reflector are mounted three lamps spaced 17 in. apart and carried on plug sockets 1.5 in. above the bottom of the reflector, which gives ample protection against the weather and good light distribution. The tail-lamp and an inside lamp, both of 2-cp rating, are supplied from the battery, which has a capacity of 80 amp-hr. and is mounted on a tray with locking bars running vertically past the cell exteriors to prevent vibration and possible overturning. The interiors of the reflectors are nickel-plated and each cost about $20. The outlay for operating the lamps is less than 50 cents per week, and the advertising effect produced, even with the small sizes of lamps employed, has attracted much attention throughout the company's territory.

ELECTRICALLY ILLUMINATED ADVERTISING ON DELIVERY AUTOMOBILE

Building a Load-Factor on an Electric System

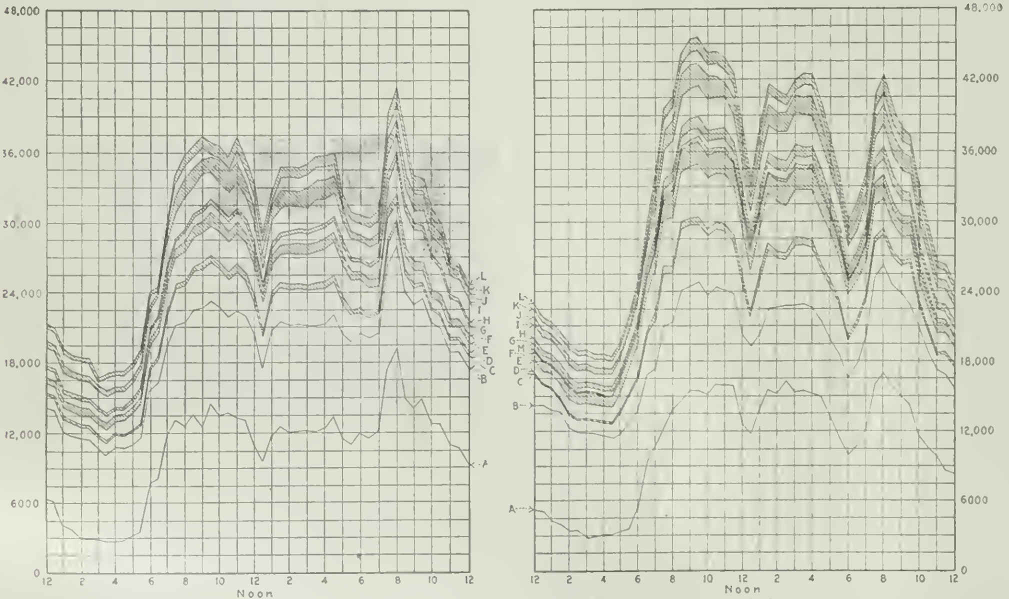
Methods of increasing the business of a central-station company and providing diversified service through extensive and intensive development. By S. M. Kennedy

It is an easy matter to explain the difference between load building and load-factor building, but not always easy to tell how to obtain a better load-factor when building up the business of a central station. In most communities evening peak load will come without much effort, but not so with the day load and the early morning load. In order to build up a really good load-factor there must be a great diversity in the classes of service supplied, and for an electric company to reach a load-factor of 60 per cent or better apparently there must be a diversity in the communities supplied with service, in order to obtain the necessary diversity of load.

The load-factor of the Southern California Edison Company is frequently referred to as being of more than ordinary interest, and the following information and data will help to demonstrate how this company has developed an annual load-factor of 60 per cent and why a monthly load-factor around 70 per cent is not unusual.

The company referred to occupies and serves a territory which includes some thirty cities of various sizes, and in addition the intervening rural districts, which have been fairly well educated as to the advantages of electrical energy for lighting and motor uses. For operating purposes the territory has been divided into thirteen districts, each being conducted like a separate business as far as accounting is concerned, but all interconnected by transmission and private telephone lines and under the supervision of the general offices. Each of these districts has some distinctive feature peculiar to itself regarding the character of its load. Some districts embrace cities along the coast, which do a large summer business entertaining visitors from inland. Some districts are largely interested in industrial enterprises. Several districts look to agriculture and horticulture for their livelihood, and others make a study of entertaining winter tourists from the East, in addition to taking care of local needs. Just in accordance with the variance between each district's business is there a variance in the diversity of the company's load and combined load-factor. The beach towns show a high peak in the early evening during the summer months, on account of the heavy loads for decorative and amusement purposes. During the same months the inland districts have a higher peak in the daytime than at night, and in this way the system load is evened up and the percentage of load-factor pushed further up the scale. The chart herewith exhibited (Fig. 2) shows the company's combined average load for a summer month in 1913—the load of one district being superimposed upon another until the structure of the total curve is complete. An analysis of the characteristics of each district as designated by letters from "A" to "M" will help to explain the diversity of individual district curves, which make up the combined load.

District A.—This district has within its limits a city



FIGS. 1 AND 2—CHARTS SHOWING THE COMBINED LOAD FOR A SUMMER MONTH OF 1912 AND THAT FOR THE CORRESPONDING MONTH OF 1913

of more than 400,000 population, supplied with electric service by three companies. The curve shown includes some railway load, and the actual load-factor for the month referred to on the chart is 54 per cent. The consumption per capita for 1912 in District A was $9.11.

District B has a large industrial load as well as a wholesale load, energy being sold to two cities for municipal distribution. This district also has a good summer load for irrigating purposes. The consumption per capita for 1912 was $12.73. The load-factor for the month in question was 84 per cent, and in this district the load-factor never falls below 70 per cent in any month of the year.

District C shows a load that is peculiarly agricultural. The load-factor for the month shown was 46 per cent, the average daily peak being at 10 o'clock in the morning. The electric consumption per capita in 1912 was $7.66.

District D.—This is a relatively small district containing two cities of approximately 5000 each and also including a considerable orange-growing territory. The load-factor in this district is 41 per cent for the month indicated, the average peak being at 10:30 a. m. The electric consumption per capita for 1912 was $8.34.

District E, comprising three cities and having a large citrus fruit area, shows a load-factor of 52 per cent, the daily peak for the month indicated being at 9:30 a.m. In this district the 1912 electric consumption per capita was $10.96.

District F has indicated a load-factor of 41 per cent, the average peak being at 11 a. m. during the month shown. The district includes two beach cities with a rural territory having a good irrigating and some industrial load. The area covered is large, the population scattered, and the 1912 income per capita was $6.61.

District G has two beach cities and a small rural community. The load-factor for the month was 42 per cent, the average daily peak being at 8 p. m. The electric consumption per capita for 1912 was $8.07.

District H.—A district with a city of about 6000 population and a large rural territory with a good pumping load for irrigating. The curve on the chart shows a load-factor of 60 per cent, the average load at 10 a. m., 4 p. m. and 7 p. m. being about the same. The consumption per capita in 1912 was $7.01.

District I.—This district has a relatively small population, but a large motor load, the energy being used for irrigating, industrial and development purposes. The load-factor as shown is 52 per cent, the average daily peak being at 3 p. m. The annual consumption of electricity per capita was $14.21 in the year 1912.

District J.—This district includes an important beach city, with a large local business. The load-factor indicated by the curve on the chart is 46 per cent, the industrial load causing a sharp maximum peak at 10 a. m., the evening peak being broad and continued, on account of the beach amusement enterprises. Here the consumption per capita for 1912 was $8.91.

District K has an industrial and dredging load, in conjunction with the business of a harbor city. The load-factor shown equals 50 per cent, the average peak being at 10 a. m. The consumption per capita was $10.41 for 1912.

District L.—A district including a large residence city with a good suburban business and little industrial or irrigating load. The daily peak for the month indicated was at 8 p. m. and the load-factor 54 per cent. The electric consumption per capita was $7.28 during the last calendar year.

District M.—Another beach city with some rural business, similar to district G. The indicated load-factor is 45 per cent and the average daily peak at 8 p. m. The electric consumption per capita was $10.61 during 1912.

The combined load as indicated on the chart (Fig. 2) shows the company's average daily load for the month. The maximum load for the same month was 53,170 kw, the maximum peak on that day being at 9:50 a. m. On the same day the load at 4 p. m. was 49,553 kw and at 8 p. m. 49,375 kw.

Fig. 1 shows the combined average load of the company for the month of 1912 corresponding to that Fig. 2 represents in 1913. The comparison indicates the progress made in twelve months in pushing up the curve during the daylight hours. It is worthy of particular note that whereas the average daily peaks in Districts G, L and M are in the early evening, the average daily peaks in Districts C, D, E and H are during the daylight hours, so that the night peaks in some districts are counterbalanced by the day peaks in others, the result being a combined load-factor on the company's system for the month indicated of 69 per cent.

While there is a great diversity of load represented in the various districts supplied by the company, there is also a very considerable diversity of load in each district. Southern California being a comparatively new country and developing rapidly, there is a good demand for electricity for all purposes. This condition is helped along by the comparatively low rates prevailing for electric service, and the low rates are made possible by the high load-factors. The company maintains a vigilant staff of salesmen and commercial engineers. Probably 98 per cent of the houses within striking distance of the company's lines use electric lighting, and electric drive prevails for industrial plants both large and small. In addition, there are more than 100,000 electrical appliances with an average consumption of 4 amp to 5 amp each in more or less regular use among the company's customers. The relatively high load-factor obtained by this company is the result of extensive and intensive development mainly brought about through the personal efforts of its representatives in explaining and demonstrating the undeniable advantages derived from the use of electric service—to every man according to his necessity.

Night Illumination of Shop Exterior

The accompanying illustration shows the striking night illumination of the plant of the California Corrugated Culvert Company at West Berkeley, Cal. The building measures 212 ft. long, and the large sign shown is 8 ft. high. Metal reflectors supported on conduit pipes and braced by guy wires contain 60-watt tungsten lamps, twenty-five of these units being required to illuminate the long north side of the building. On the west side, which is opposite the railway, 100-watt tungsten lamps are used, the wall being illuminated clear to the top of the gable.

NIGHT ILLUMINATION OF FACTORY EXTERIOR

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Triple-Card System for Recording Travels of Meters

The Metropolitan Electric Company, Reading, Pa., employs a comprehensive system of indexing its meters so that a record is always available showing the travels of a meter from the time it is received from the manufacturer until sold to the junk dealer. Riveted to each meter case is a 0.4375-in. wide aluminum strip on which is embossed the serial number of the meter. On file in the company's offices are three sets of meter-record cards. One set contains the names of consumers using meters arranged alphabetically; another set bears their addresses listed by streets, and the third set shows the serial numbers of the meters arranged in rotation. On each of the cards are noted the meter number, dial and test constants and installation record. The latter shows the meter installations in time order, thus indicating the frequency of changes and transferences. The name cards also bear the consumer's connected load, with the type and size of the meter installed. The serial-number record card, in addition to showing the type, size and constants of the meter, indicates the names and addresses of the customers who have used the instrument.

Electricity at the New York Household Show

Among the interesting features of the New York Edison Company's exhibit at the third annual Woman's Industrial Show and Housewives' League Exhibition, held recently at the Grand Central Palace, New York, was an electric doughnut cooking pan. The central-station exhibit also included the model kitchen and dining room situated in the Edison company's booth on the main floor and illustrated herewith. The kitchen was fitted up with an ice-box kitchen cabinet, an electrically heated boiler, several standard electric irons, a washing machine, towel driers and an electric range. The dining room was furnished with such electrical apparatus as chafing dishes, percolators, toasters and a vacuum cleaner.

MODEL ELECTRIC DINING ROOM AND KITCHEN

Doubling Electric Appliance Sales at St. Louis

After checking up the volume of appliance sales for the year 1913, the Union Electric Light & Power Company, St. Louis, Mo., announces that a 97 per cent net increase has been made in this department of the company's business over the showing for the previous twelve months. The year 1914 has been started with vigorous and aggressive campaigns which it is hoped will make this year even more productive of sales than its predecessor.

Effect of Rate Changes at Springfield, Ill.

Evidence of the fact that the general public is quick to take advantage of any opportunity to reduce electric-light bills is to be found in conditions brought about by the establishment of rates at Springfield, Ill., based on connected load and energy consumption. Carbon lamps are renewed free of charge, but since the change in rates customers are seeking a means by which their connected load may be reduced and the carbon lamp is losing its former place of preference. Mr. C. L. Owen, new-business manager for the company, says that the new rate schedule has brought tungsten lamps into use where otherwise it would have been a task to place them.

New Business Requires Double Plant Rating

As a result of the growth enjoyed during the last year by the Texas Public Service Company at Bay City, Tex., the company's present plant equipment is to be practically doubled in rating, 250 hp in boiler capacity being added with an additional 150 kw in generator rating.

Among the items of motor load that have been taken on since Oct. 1, 1912, when the present management assumed charge, are the following:

	Hp
Cotton gin	150.0
Water-works pumping	20.0
Steam laundry	10.0
Planing mill	15.0
Woodyard	7.5
Blacksmith shop	5.0
Two ice-cream factories	7.0
Garage	3.0
Printing office	2.5
Three coffee mills in stores	1.5
Total	221.5

During the same period the number of lighting customers was increased from 305 to 440, a net gain of 135, or 44 per cent. The monthly income from street lighting has been increased from $78 to $103, and a "white way," adding $55 to the company's gross income, has also been installed. Mr. W. C. Duncan is manager.

Sawing Ice by Electricity at Worcester, Mass.

A marked advance over the customary methods of harvesting ice is illustrated in the accompanying photographs, which were taken recently at the Coes Pond headquarters of the Walker Ice Company, of Worcester, Mass. In cutting ice prior to its haulage into the storehouse the usual plan is to form the blocks on the surface of the pond and to push them to the ice-house runway along a channel which is sometimes of such extreme length that the blocks freeze together before reaching the hoisting chain. The cutting is extremely tedious and the labor cost correspondingly high. At the Coes Pond establishment central-station energy supplied by the Worcester Electric Light Company has been utilized, and the sawing of the standard cakes is all accomplished by a motor-driven plant situated within a few rods of the ice-house. By this means the services of twenty two-horse teams and forty men are eliminated.

The plant consists of two sets of 36-in. Disston saws with slightly offset teeth, installed in an artificial channel about 20 ft. wide, each set of saws being belt-driven by a 35-hp, 220-volt, three-phase General Electric induction motor rented from the central station. Tests will shortly be undertaken to determine whether a smaller size of motor can handle the work satisfactorily. The ice is floated in 12-ft. by 18-ft. cakes to the head of the artificial channel, where the channelmen push it under the first row of saws, which cut seven parallel blocks 28 in. wide. These segments, still in reasonably close contact, are then turned around in the channel and are pushed through the second set of saws, which cut the cake into nine 20-in. blocks.

Time Required for Cutting

The entire operation, resulting in the cutting of each cake into sixty-three blocks, consumes barely half a minute, after which the blocks are separated by long-handled ice tools and are rapidly poled to the chain and harvested into the house at the rate of about 120 blocks per minute, a day's run aggregating about 5000 tons. The present hoisting chain is steam-driven, but next year a motor-driven chain is to be used. The services of several men will also be eliminated by the installation of an accelerating toothed cylinder in the channel outside the ice house, the cylinder to be driven by a 7.5-hp motor. A 35-hp motor-driven, 10-in. by 12-in. pump is also to be placed in service to facilitate the removal of chips cut off the ice blocks as they pass into the house, all blocks being automatically chipped to a standard size of 12 in. by 20 in. by 28 in. and weighing about 212 lb. each.

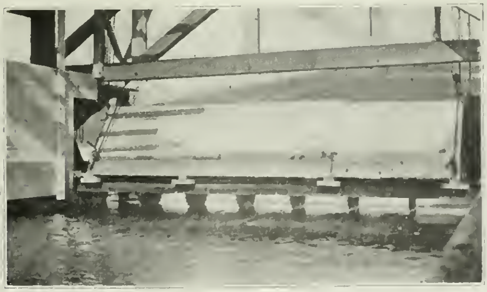


FIG. 1—ARRANGEMENT OF MOTOR-DRIVEN ICE SAW

The saws are driven at a speed of 400 r.p.m. on a shaft equipped with a pulley 2 ft. in diameter and connected with an 8-in. pulley by a 9-in. belt. From the latter pulley a 3-in. shaft is connected directly to the motor through a coupling, the motor speed being 1200 r.p.m. As shown, the motors are equipped with starting compensators and are started directly from the line side of the fuses, the latter being in circuit only when full speed has been attained. By means of tackle the saws can be raised and lowered to meet varying thicknesses of ice and the entire outfit can readily be dismantled and assembled for service in other localities.

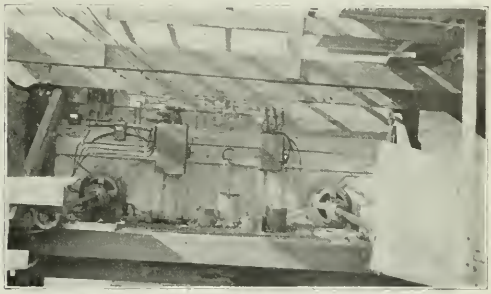


FIG. 2—MOTOR DRIVE FOR ICE SAWS

Power Requirements

Tests made at Coes Pond show that the power required to operate the saws in the water alone is about double that necessary in the middle of the cakes. To drive six saws which cut the ice the first time in the water the power input is 29.8 kw. While cutting the input of energy begins to drop, falling to about 15 kw in the center of the cake and increasing again to 28 kw as the ice leaves the saws. This is probably due to the heavy drag of water carried around with the saws. By this method the ice is cut into exact rectangular blocks and can easily be cleaned and harvested. The power requirements of the six-gang and eight-gang saws are practically the same. Since the plant was started it has been found advisable to insert extra bearings between the motor and the saw shaft to reduce vibration.

The Worcester installation has attracted widespread attention in the New England ice industry and will doubtless be the forerunner of others of its kind.

Electric-Appliance Playlet in Salesmanship Course

A feature of the salesmanship course of the Boston (Mass.) Young Men's Christian Union being given during the winter months at the headquarters of the organization was a recent electrical-appliance sales evening, which was held under the auspices of the Boston Edison Company. On this occasion the association's stage was completely equipped as an electrical appliance store, in charge of Mr. W. G. Stetson, superintendent of the appliance department of the Boston company. An informal playlet was given, in which Mr. Louis D. Gibbs, superintendent of advertising of the company, assumed the part of a "prospect" about to provide his residence "with lots of light," and the hit of the evening was a witty and impromptu dialogue between the two "stars," resulting in the purchase of an electric range, vacuum cleaner and several other appliances on an instalment basis. Washing machines, electric-heating devices and special lighting equipment were shown in full operation, and two woman demonstrators from the company's staff assisted in "convincing" the "prospect" as to the cleanliness, simplicity and economy of electric service. The questions asked were specially adapted to bring out the ease with which the layman's household, from mistress to maid, could avail itself of electric cooking, lighting, heating and motor equipment, and at the close of the short act the two principals gave the audience talks upon salesmanship and advertising. Technical terms were tabooed, and the large audience, which included a number of the company's employees, maintained an appreciative interest from start to finish.

Utilizing the Blank Plant Walls

The accompanying photograph, taken at the generating plant of the Salem (Mass.) Electric Lighting Company, suggests a simple and inexpensive method of utilizing the station exterior for publicity purposes. The plant is situated near the center of the business district, and by the easy expedient of painting the company's name and service on the wall of the turbine room the attention of the passer-by is invariably attracted when he comes within range of the structure.

SIGN OF ELECTRIC LIGHTING COMPANY, SALEM, MASS.

"Elyria, the 100 Per Cent City"

Elyria, Ohio, has adopted as its motto the slogan "Elyria, the 100 per cent city," and the local central-station company, which is owned and operated by H. L. Doherty & Company, New York, under the name "R. E. Burger, agent," will present the city with a large electric sign bearing the above legend. The company also offers to maintain the sign without charge. A location for the display, visible from passing railroad trains, is to be decided on shortly by a committee of the local Chamber of Commerce, and various sign builders will then be asked to submit designs. The slogan adopted was one of 700 suggestions received during a campaign recently conducted by a local newspaper. To the man who proposed the winning motto a prize of $25 was awarded for his idea.

Central-Station Methods at East Liverpool, Ohio

The East Liverpool (Ohio) Traction & Light Company, operating interconnected generating stations at East Liverpool and Steubenville, has undergone a substantial growth within the last three years as the accompanying load diagrams of the station outputs show. Load curves of the Steubenville plant for the three years 1911, 1912 and 1913 remained practically unchanged, as this plant was carrying its maximum rating at all times. In the case of the East Liverpool station (Fig. 2) it will be seen that the 1912 kilowatt-hour output was far ahead of that registered during 1911, while the business for 1913 bade fair to be about double that of 1911.

Plant Additions and Improvements

One 4000-kw turbo-generator unit has been added to the equipment of the East Liverpool station. After cleaning and overhauling the plant boilers it was found that enough steam could be generated with the present installation to carry the load of the additional unit. After cleaning the boiler tubes, lime in quantities was put directly into the renovated units so that a slight scale would be formed on the tubes, protecting them from the acid in the river water. Steel mills and other industrial plants dumping waste material into the streams above are said to be responsible for the acid character of the river at East Liverpool.

With the boiler tubes put into good shape the coal consumption for the plants was reduced during the past year by approximately 1 lb. per kilowatt-hour generated. Now that a new spray system for handling the cooling water has been installed even better results are expected along this line. Further savings have also been effected by the use of a home-made oil filter, a home-made water filter and a siphonic condenser intake.

Commercial Methods

As the result of aggressive and continuous sales effort 315 motor-service customers are now connected to the circuits of the company. In securing this business the solicitors tried to meet each prospective motor user on a common basis by first familiarizing themselves with the customer's business and then trying to talk from his viewpoint. With gas selling at 12 cents per 1000 cu. ft. for power purposes the task has not been easy. Rates paid by these customers are perhaps as low proportionately as any in the country, the average price per kilowatt-hour for all motor service ranging between 1.5 cents and 2 cents.

The total population of the district served by the company is about 100,000, and in this territory several small towns have been furnished with electric service.

One point which has come to notice in campaigning these villages is worthy of attention. It has been found much easier to induce the merchants in these towns to light store windows if the street lighting of the town is not taken up until the majority of the window-lighting business has been secured. With well-lighted streets in the village the average merchant wants to rely upon the general illumination to light his store window. Towns in which the reverse policy was tried are still without adequate lighting in most display windows.

Co-operation with a company manufacturing flat-rate controllers has also been instrumental in securing a good percentage of the small customers in the territory. Prior to Jan. 1, 1912, 700 "Excess" indicators were in service on the lines of the company. Since that time 755 indicators have been installed in the communities, being distributed among the residential and commercial customers as shown in the accompanying table. A commercial customer is designated as one whose business is kept open after 8 p. m. For the indicator service commercial customers pay 1.5 cents net per watt of maximum demand while the charge for residential patrons is 1 cent net.

Use for Discarded Arc Lamps

Casting about for a possible use for the bases and globes of a large number of arc lamps which were being discarded, the idea of tearing out the regulating mechanism and installing 100-watt tungsten lamps was hit upon. Enlisting the services of a local manufacturing company, a telescoping arrangement was made and fitted to the sheet-metal bases of the lamps. An incandescent lamp socket was fixed to this device so that when the lamp was placed in the socket an adjustment of the telescoping tubes centered the bulb in the globe of the former arc lamp.

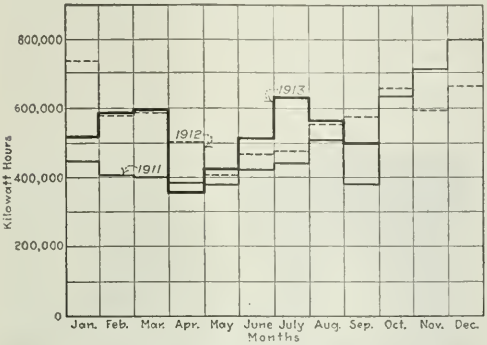


FIG. 1—OUTPUT BY MONTHS OF STEUBENVILLE POWER HOUSE

These units are installed for street lighting and for illuminating fronts of stores and theaters. The electric-service company owns and maintains the lamps, making a monthly flat-rate charge of $1.50 per 100-watt lamp for the lighting.

All of these "tungsten arc" lamps, as they are called, are connected on a special circuit arranged for the electric-sign and display lighting. With an average of four and one-half hours' operation, these lamps net the company about 7 cents per kw-hr. for energy consumed.

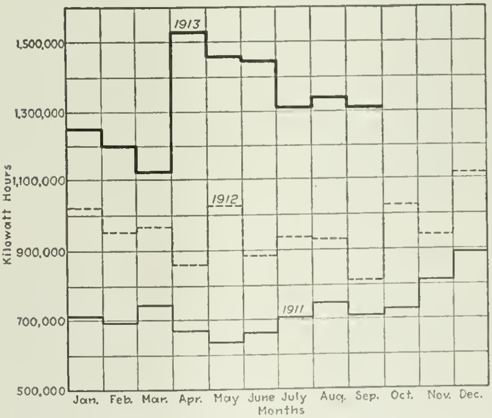


FIG. 2—OUTPUT BY MONTHS OF EAST LIVERPOOL POWER HOUSE

In most instances it has been found good practice to connect all window and display lighting on the special sign circuit. Since this feeder is controlled from the power house or the substations in the respective districts the hours during which it is operated are definitely known. As a result energy for sign lighting is sold at prices ranging from 5 cents to 6 cents per kw-hr., even though it has to be carried through the lighting peak. At the outset of the first electric-sign campaigns conducted by the company inexpensive signs were made and sold to the company's patrons at cost.

STATISTICS OF EQUIPMENT INSTALLED ON SYSTEM

District	Excess Indicators		Electric Signs	Tungsten "Arc" Fixtures
	Residential	Commercial		
Steubenville	196	4	63	91
East Liverpool	259	18	64	172
Beaver County properties	228	50	33	107
Installed before Jan. 1,1912	700	....	....	....
Total	1383	72	160	370

Two Years' Work in a Minnesota Town of 1500

As proof of the results which can be accomplished by two years' work in a small farming community without the assistance of a professional solicitor, the central-station manager in a Minnesota town of 1500 population has sent us the accompanying interesting facts relating to the inauguration and development of service by his company.

The latter secured its franchise in August, 1911, and on Dec. 2 of the same year commenced operation with one 100-hp Corliss engine, one 75-kw, 2300-volt generator and one 16-in. by 60-in. boiler.

The records of Dec. 1, 1913, two years later, showed the following figures: Total customers, 309; motor customers having 1 hp or more, 23; electric irons, 153; washing machines, 47; disk stoves and toasters, 29; water heaters, 6; fans, 28; forge blowers, 7, and motors (1-hp to 15-hp), 39. Thirteen five-lamp ornamental posts were secured for lighting the main street at the same time that forty-eight 100-watt series lamps were installed on other streets of the town, displacing gas lamps. The plant equipment now includes two boilers and an additional 200-kw generator and 250-hp Corliss engine. The company will soon add another boiler.

This street-lighting business was secured in competition with a municipal gas plant in which the citizens took quite a pride. Needless to say, none of the advertising matter used in furthering electric service mentioned gas in any way nor was a word spoken against it. In soliciting new customers, the manager invariably asked them to "try electricity" and then to use their own judgment as to which was best. In this way the friendly sympathy of the citizens was secured for the company. The municipal gas plant now has only one residence-lighting patron and no business place, and at present operates mostly for the domestic-science cooking service in the local high school. As stated before, no solicitor was employed by the electric company, but form letters, newspaper advertisements and manufacturers' advertising literature were employed liberally.

The community contains no manufacturing plants of any kind except one flour mill which has not been secured as a central-station customer. The local population consists mostly of retired farmers and the merchants doing business in town.

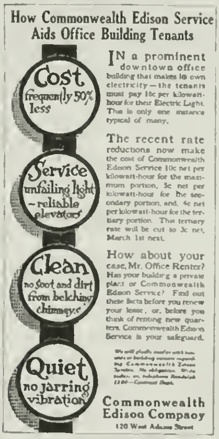
The manager reports that his initial selling efforts were devoted particularly to the small and poorer homes and to those retired farmers who were known to hold their money the "closest." Shortly, however, when it was seen that these people who did not use gas could and did use electricity (even guaranteeing $1 a month minimum) all the other citizens who had aspirations to be up to date fell rapidly into line. Four of the company's customers live entirely on their pensions, but say they would not be without electric light and the use of electric flatirons in summer. At the present price of the 5-amp meter such customers constitute "good business," declares the manager, if a good share of the population can be secured.

The ratio in the case of the town cited is better than one customer to every five inhabitants, which places it in the front rank with the best cities in the country.

It is of interest to note that the manager formerly served elsewhere in Minnesota on the staff of the Consumers' Power Company, and there learned modern methods of going after and getting new business. In a small town these methods can be applied even more intensively than in a larger place, he declares, for as the local executive meets and learns to know his people and their conditions, he is better able to see things from their point of view and can figure on the scale of installations which they actually need or can afford. No drop cords are used in lighting installations. For cheap construction ceiling pull-chain outfits, with shades, are provided. Twenty-four-hour service was given from the beginning, as the management figured that if this could not be afforded it had better not start at all.

Advertising to Office-Building Tenants

Tenants in office buildings often pay too much for electric lighting, or, where the service is included in the rent, more than they realize. The Commonwealth Edison Company of Chicago mentions a case in that city where the tenants in an office building pay 16 cents per kw-hr., when the maximum rate of the electric-service company is 10 cents. The company calls attention to this matter in a recent daily newspaper advertisement, reproduced herewith. The advantages of quality as well as cost of central-station service are pointed out.



How Commonwealth Edison Service Aids Office Building Tenants

IN a prominent downtown office building that makes its own electricity—the tenants must pay 16c per kilowatt-hour for their Electric Light. This is only one instance typical of many.

The recent rate reductions now make the cost of Commonwealth Edison Service 10c net per kilowatt-hour for the maximum portion, 5c net per kilowatt-hour for the secondary portion, and, 4c net per kilowatt-hour for the tertiary portion. This tertiary rate will be cut to 3c net, March 1st next.

How about your case, Mr. Office Renter? Has your building a private plant or Commonwealth Edison Service? Find out these facts before you renew your lease, or, before you think of renting new quarters. Commonwealth Edison Service is your safeguard.

[illegible]

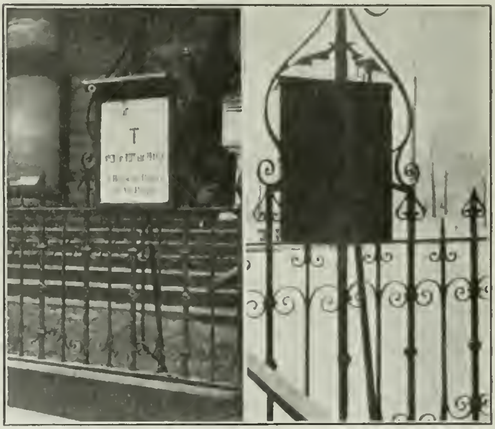
Commonwealth Edison Company
120 West Adams Street

ADVERTISEMENT CALLING ATTENTION TO EXCESSIVE COST OF ELECTRICITY

Illumination and Wiring

Illuminated Bulletin Boards

Effective use of electric illumination during the winter months is made by St. Paul's Cathedral, Boston, the diocesan church of the Episcopal communion and one of the historic edifices of New England. At the main entrance on Tremont Street two 20-in. by 26-in. bulletin boards are installed, one on either side of the central gate, and announcements of services are featured with the aid of incandescent lamps concealed in scroll-shaped reflectors at the tops of the boards. Each bulletin is equipped with two 16-cp lamps of the tubular type, the reflectors being 7 in. wide and 2.5 in. deep and cutting off all glare from the face of the bulletin. The lamps are wired through condulets to iron conduit carried down the back of the bulletin board. A key switch is installed in a small iron box at the fence rail, being covered with a leather guard as a protection against moisture. From the switch box the conduit leads into the cathedral after passing under the lawn. It is stated that the attendance at services after dusk has been much increased by the use of these illuminated bulletins with their cheerful invitation to passers-by.



FIGS. 1 AND 2—FRONT VIEW OF ILLUMINATED BULLETIN BOARD, AND REAR VIEW SHOWING SWITCH BOX

Interesting Fire-Pump Connection in Chicago

Perhaps the most interesting electrical feature of the equipment at the new assembling factory of the Ford Motor Company in Chicago is in the connection of the emergency fire pump. The service enters the building through a 3000-amp, 220-volt switch and then passes through the maximum-demand meter. Here the circuit is divided, one branch being taken to the fire pump and the other to the house-service switch. By this arrangement the house-service switch may be opened while the fire pump is being periodically tested, reducing the maximum energy demand. Since the charge is based on a demand and energy rate the monetary saving to the Ford company is considerable. It is said that this is the first fire-pump installation in Chicago where advantage has been taken of the single maximum-demand meter type of connection.

Distribution Equipment Cost on a Small System

In a recent report to the lighting committee of the town of South Hadley, Mass., by Mr. William Plattner, manager of the North Attleboro (Mass.) electric lighting department, a thorough study was made of the cost of the local distribution system. The value of the equipment in use was based upon the market price of its replacement, as of August, 1913, and transportation charges, freight and express and the labor cost of installation were included. Extracts from the various tables of unit cost submitted are given herewith, in view of their interest to the manager of the small central station.

ENGINEERING DATA FROM SOUTH HADLEY REPORT

(Estimated Cost of Replacing Various Equipment)

Number and Kind	Poles in Place		
	Cost	Length, Feet	Expected Life Years
315 first class	$1180.25	25	15
63 first class	283.50	30	15
132 second class	528.00	25	10
28 second class	126.00	30	10
94 third class	376.00	25	5
18 third class	81.50	30	5
11 fourth class	44.00	25	Need replacement
1 fourth class	4.50	30	

Painting 129 poles	$64.50
Setting 71 poles in concrete	35.50
Setting 4 poles in curb	2.00
Fourteen guys.—80 ft. No. 4 copper wire, 299 ft. No. 6 copper wire, and 444 ft. No. 6 galvanized steel wire, all in place	85.75

ELECTRIC METERS (G. E. TWO-WIRE)

No.	Size, Amp	Unit Cost	Total Cost	Transportation	Labor, Erection	Total	Total per Meter
40	5	$10.00	$400.00	$13.00	$20.00	$433.00	$10.82
267	10	11.20	2990.48	81.25	135.00	3206.73	12.00
17	15	12.80	217.60	5.00	10.00	232.60	13.65
31	25	16.00	496.00	9.50	16.00	521.50	16.80
11	50	21.40	235.40	3.67	8.00	247.07	22.36
2	100	26.70	53.40	1.00	5.00	59.40	29.70

TRANSFORMERS (G. E. AND STANLEY, VOLTAGE 1100-2200; 110-220)

No.	Size, Kw	Unit Cost	Total Cost	Freight Charges	Labor, Erection	Total	Total per Transformer
65	1	$21.80	$1417.00	$23.90	$96.00	$1536.90	$23.60
16	1.5	26.00	416.00	4.00	24.00	444.00	27.80
21	2	30.40	638.00	10.40	30.00	678.40	32.20
9	2.5	34.00	306.00	5.00	18.00	329.00	36.60
10	3	38.00	380.00	5.00	19.00	404.00	40.40
2	4	45.60	91.20	2.90	5.00	99.10	49.55
9	5	53.20	478.80	9.20	18.00	506.00	56.22
2	7.5	70.40	140.80	2.68	10.00	153.48	76.74
3	10	87.20	261.60	3.80	20.00	285.40	95.13
1	20	146.80	146.80	2.74	18.00	167.54	167.54
1	25	172.80	172.80	4.00	18.00	194.80	194.80
1	30	197.20	197.20	5.50	22.00	224.70	224.70

The transformer costs include fuses, cut-outs, hangers and oil

TRANSFORMER HOUSE, SOUTH HADLEY

One house, matched boards, 7 ft. 3 in. by 7 ft. 3 in. by 9 ft. 9 in. high in front, 8 ft. 6 in. high in rear, tar-paper roof, paneled window, wire screen door, painted	$75.00
One G. E. regulator, type I R.S., 8.75 kva, 2300 volts, 25 amp, complete with panel and transformers	468.40
One G. E. constant-current transformer, 10 kw, 5.5 amp, form G, complete	304.50
One G. E. transformer, 1 kw, oil type, 2200 volts to 110-220 volts	16.73
One Campbell time switch, series street lighting, 2500 volts, two-pole, 25 amp, eight-day clock	25.00
Two G. E. 2300-3000-volt horn-gap lightning arresters	9.50
Inside wiring, material, labor, etc.	35.50
Outside wiring, including 300 ft. service for lighting	21.75
Total	$956.38

Electric Truck with Removable Tower

The Union Electric Company, Dubuque, Ia., has in use an electric 1-ton truck which is equipped with a removable trolley-repair tower so that the vehicle may be employed either as a regular delivery truck or as a tower wagon. When not in use the extensible tower is hung on ropes and pulleys in one corner of the garage. To convert the truck into a trolley-repair wagon, it is backed under the suspended tower and the framework is lowered by means of the double windlass at the right. Bolts hold the tower in place on the body of the wagon. The chassis of this General Vehicle truck, which is equipped with an Edison battery, was purchased by the Dubuque company about twelve months ago, tower and body having since been built in the company's own repair shops. Mr. H. G. Gorr, superintendent of light and power, designed the removable tower shown.

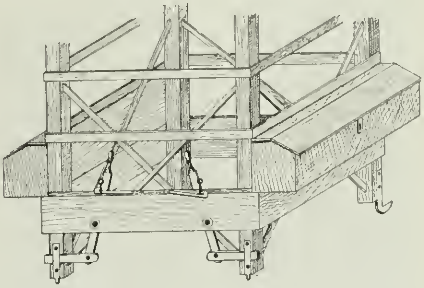


FIG. 1—METHOD OF ATTACHING TOWER OF TRUCK BODY

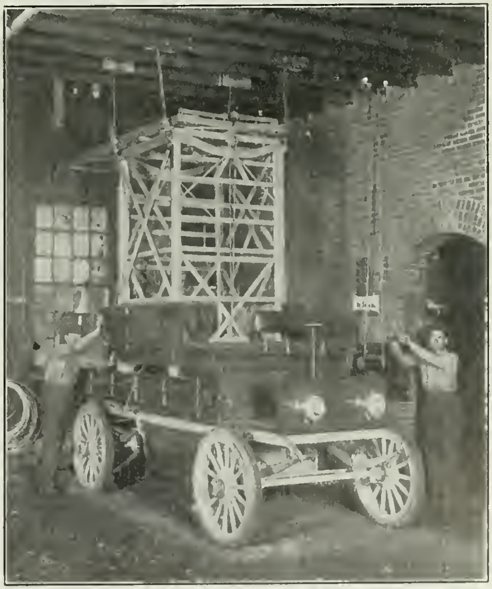
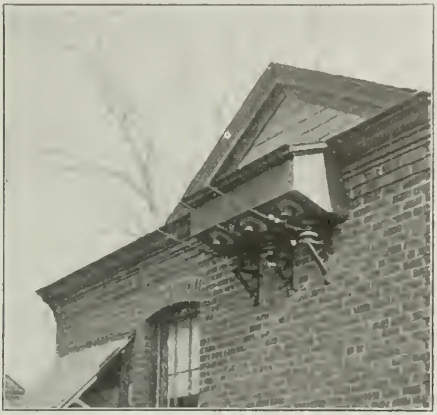


FIG. 2—TRUCK WITH REMOVABLE TROLLEY-REPAIR TOWER

Safeguarding Wires at a Factory Substation

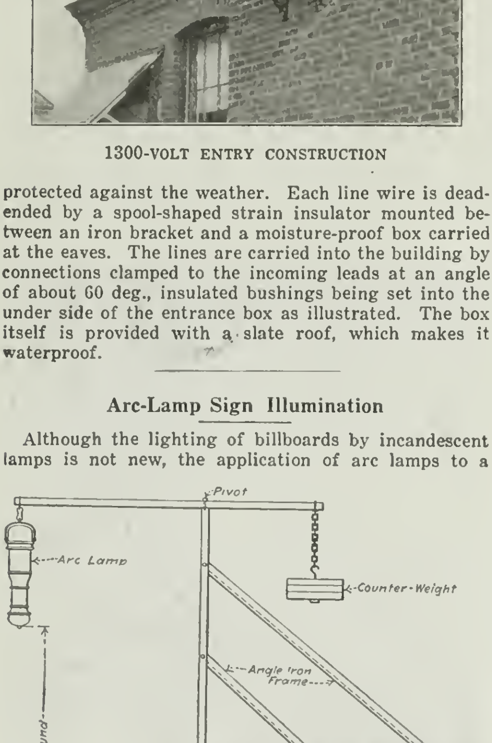
Improved standards of construction are evident in the accompanying photograph of the substation of the Coes Wrench Company, Worcester, Mass., a feature being the manner in which the incoming 1300-volt wires are protected against the weather. Each line wire is dead-ended by a spool-shaped strain insulator mounted between an iron bracket and a moisture-proof box carried at the eaves. The lines are carried into the building by connections clamped to the incoming leads at an angle of about 60 deg., insulated bushings being set into the under side of the entrance box as illustrated. The box itself is provided with a slate roof, which makes it waterproof.



1300-VOLT ENTRY CONSTRUCTION

Arc-Lamp Sign Illumination

Although the lighting of billboards by incandescent lamps is not new, the application of arc lamps to a similar use is less common. The general scheme employed in a city of the Middle West for lighting a department-store sign by flame lamps is shown in the sketch herewith. Facing one of the main railway stations, the advertising space on which the sign is painted comes within the view of a large percentage of the population. The bright light sources suspended from the angle-iron framework on the building illuminate the wall and yet are high enough above the sign not to obstruct vision with their glare. The color contrast with other signs within the eye's range presents an added attraction.



ILLUMINATING SIGN WITH ARC LAMP

The supporting framework is simple but substantial. For trimming, provision has been made for swinging the four arc lamps in the installation back over the roof. Counter weights at the opposite ends of the beams reduce the bending strain on the angle-iron structure.

Street Lighting in Large Cities

At a joint meeting of the New York Section of the Illuminating Engineering Society with the Municipal Art Society at New York, Feb. 11, Mr. Arthur Williams presented "Some Notes on Present-Day Street Lighting," and Mr. C. F. Lacombe, chief engineer department of water supply, gas and electricity, New York City, read a paper on "The High-Intensity Lighting of European Cities Compared with New York," which he illustrated with numerous lantern slides reproduced from pictures taken during a recent trip abroad to study lighting conditions.

Whether electrical energy for street illumination shall be purchased from a central station or generated in the city's own plant is simply an economic question, declared Mr. Williams, depending on which method costs less under local conditions. The service for New York City is obtained from the local companies, while that for Chicago is chiefly generated in municipal plants. New York's public lighting bill for 1912, the latest year for which figures are available, was itemized as follows:

Electric lighting	$2,201,000
Gas	1,038,000
Naphtha	51,000
Total	$3,290,000

This total represents an individual tax of 65 cents per year per capita, or 0.8 mill per day per person.

The accompanying table, also presented by Mr. Williams, compares the number of arc lamps and population in representative American cities:

City	Population	Number Arc Lamps
Albany, N. Y.	105,000	1,000
Baltimore, Md.	500,000	2,900
Boston, Mass.	720,000	3,850
Chicago, Ill.	2,300,000	8,920
Cleveland, Ohio	560,000	4,592
Los Angeles, Cal.	325,000	7,400
New Orleans, La.	340,000	3,400
Philadelphia, Pa.	1,600,000	14,000
Pittsburgh, Pa.	500,000	4,400
New York (Manhattan and Bronx	2,900,000	9,900

The form of "bishop's crook" lamp-post in use in New York City, said the speaker, is the result of long and careful study of a large number of designs, both American and European, final approval having been accorded the accepted design by the late Stanford White.

In his address comparing public lighting conditions in European cities with those in the United States, Mr. Lacombe emphasized the very high intensities employed abroad in thoroughfares of high traffic density, the illumination being so great that objects are seen directly by their own reflected light rather than by silhouette. In London, Paris and Berlin, for example, the principal streets show intensities as high as 7.9 ft.-candles to 2 ft.-candles at locations near the lamps, with minimums of 0.25 ft.-candle to 0.5 ft.-candle at more remote points. Compared with these high values, similar streets and plazas in New York City, like Times Square, Fifth Avenue, etc., have maximum intensities not exceeding 1.2 ft.-candles on the street surface, while the minimums fall as low as 0.08 ft.-candle. In Fifth Avenue directly beneath the double-lamp standards intensities of 1.7 ft.-candles are found, with minimums of 0.05 ft-candles.

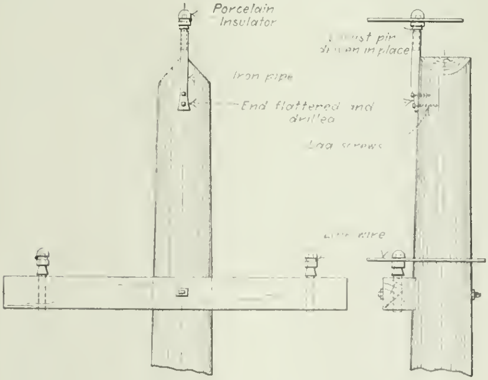
In Europe manufacturers have developed highly efficient types of flaming-arc lamps to operate several in series from multiple circuits, the control of the lamps being effected by pilot wires led from central points. Abroad all such high-candle-power units are placed from 3 ft. to 10 ft. higher than is the practice in America. At these greater elevations the lamps are removed outside the glare angle, and it is possible to employ clear-glass globes, contributing to the efficiency of the lamp units. American business thoroughfares benefit largely from the coincident store-window and sign lighting. In Europe the high-intensity lighting is usually partly diminished after the hours of heavy traffic.

Abroad, said Mr. Lacombe in closing, there is an utter lack of artistic or scientific interior lighting. In this respect, as in the use of tungsten units, he declared, American practice is far in advance of European methods.

Iron-Pipe Top Bracket on 2200-Volt Line

A few years ago certain transmission companies tried the practice of making inexpensive top brackets for three-phase lines by setting large locust pins in holes bored in the tops of the line poles. Owing to the fact that the bored holes acted as catch-basins for rain water to accumulate in, the scheme proved impracticable. A few winters, therefore, saw the elimination of most of this type of home-made bracket, with the substitution of sturdy manufactured cast-iron brackets fixed to the poles by lag screws.

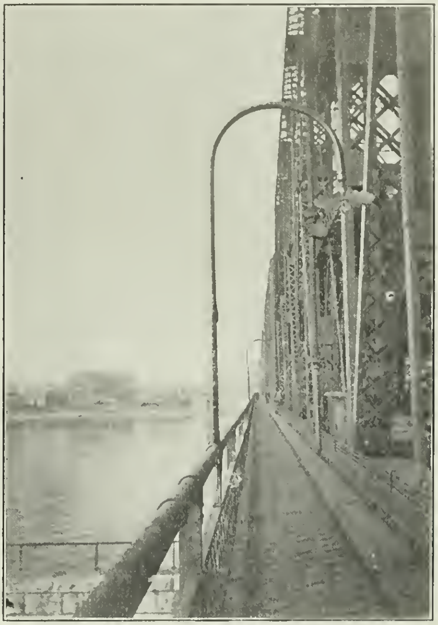
The Menominee & Marinette (Wis.) Light & Traction Company in erecting a short line to serve the homes of its station operators near the hydroelectric plant at Ingalls recently hit upon a plan for combining the lasting qualities of the cast-iron bracket and the inexpensive feature of the home-made pole-top pins. The bracket consists of a 15-in. length of iron pipe flattened at one end and drilled to receive the lag screws which fasten it to the pole. Ordinary locust pins selected to fit the pipe tightly were driven into the top of the pipe before it was put in place.



IRON-PIPE TOP BRACKET

Bridge Wiring and Lighting at Davenport, Ia.

On one of the bridges which span the Mississippi connecting the cities of Davenport, Ia., and Rock Island, Ill., incandescent lighting units of the type shown in the illustration herewith have been installed. The circuits feeding the lamps are drawn through the iron pipe which forms the hand rail, multiple taps being taken off through holes drilled in the top of this pipe and carried through the hollow standards to the lamps. Since a portion of the bridge is swung for vessels passing up and down the river, circuits have been brought in from each end and are controlled from the houses of the watchman situated at the ends of the bridge. Tungsten lamps have not yet been used for this bridge lighting as trains passing over the upper deck of the structure set up vibration which the authorities feared might shorten the life of the lamps. The units are spaced about 30 ft. apart and line the pedestrian walks.



BRIDGE LIGHTING, DAVENPORT, IA.

Recent Telephone Patent

To the Gray Telephone Pay Station Company has been assigned a patent granted recently to Mr. G. A. Long, of Hartford, Conn., the design of which is similar to that of a prepayment gas or electric meter. Provision is made for the deposit in advance of any convenient coin or coins which give credit for service to be rendered later. A proper charge is deducted for each call until the amount of money prepaid has been exhausted. An indicator may be provided to show just how much unexpended money is on hand in the box. A lever is pulled after each coin is deposited which steps the control mechanism through gearing a definite distance from its stop. Each time a call is made a push-button is pressed to give the operator a signal. This operation causes the control device to move a certain distance, thus indicating how much should be deducted.

Letters to the Editors

Cost Figures from Brookings, S. D.

To the Editors of the Electrical World:

Sirs:—In your issue dated Dec. 27, 1913, you publish on page 1321 an article entitled "Cost Figures from Brookings, S. D.," by Mr. E. M. Soreng.

According to this article, the Brookings municipal plant shows a total net revenue in ten years of $50,000.

I herewith submit a statement of the operations of the plant for 1912, the amount of gross revenue, plant cost and cost of coal being those given by Mr. Soreng.

ANALYSIS OF COSTS AT BROOKINGS, S. D.

Plant cost		$41,000.00
Revenue, 1912:		
Commercial electric		$15,600.00
For street lighting, estimated		1,500.00
For heating		5,600.00
Total revenue		$22,700.00
Expense, 1912:		
(Rate of wages estimated per month.)		
One superintendent	$100.00	
Two engineers ($90 each)	180.00	
One fireman	60.00	
One lineman	80.00	
One assistant lineman	40.00	
One auditor	50.00	
Total for year		$6,120.00
Coal		9,000.00
Taxes, 2 per cent.		
Insurance, 2 per cent.		
Interest, 7 per cent.		
Depreciation, 6 per cent.		
17 per cent of $41,000		6,970.00
Employer's liability at $3.75 per $100 of payroll		229.50
Oil, waste, water, cinders		250.00
Gross expense		$22,569.50

No account is taken above of the expense of general repairs and supplies, including transformers, meters, series lamp renewals, station supplies, boiler, engine and machinery repairs.

It would seem to me that a system of accurate bookkeeping would be of assistance to some municipal plants and prevent them from misleading, not only themselves, but the public, which is not always sufficiently versed to get underneath the actual cost of producing and distributing electric energy.

Omaha, Neb. A. V. Kent.

To the Editors of the Electrical World:

Sirs:—In the lighting and heating plant referred to in my article in the *Electrical World* of Dec. 27, 1913, two parties are interested—the public, on the one hand, we will say, and the city corporation, on the other.

The people are interested in getting good service at a just and reasonable rate, and we may assume that if this condition obtains it makes no difference to them whether the service is obtained from a private plant or from a municipal plant. The city as a corporation is interested in making the plant a financial success, for obvious reasons.

In reply to Mr. Kent's comments on my figures, I will say that my article did not pretend to be a detailed statement of the expenses and earnings of the plant, but it was intended to show that the plant is a financial success. Assuming that the public has been fairly treated, we can regard the plant from the point of view of a private investment.

There are certain facts, however, which need to be cleared up.

First, Mr. Kent assumes certain values for wages which are somewhat higher than are the actual costs.

Second, the amount that has been credited to the plant for street lighting is an average for ten years and not the amount to be credited at present. As a matter of fact, the amount that has been levied during the last two years is $3,000, which amount has been agreed on for the last six years.

Third, in his analysis of costs, Mr. Kent further assumes interest at the rate of 7 per cent. This would probably be a fair rate for a private investment, but in the case of this municipal plant the money invested in the shape of bonds bears 5 per cent interest, and this represents a real advantage of the municipal plant over the private plant.

In the case of the above plant, when the bonds are paid off, this interest money amounts to a real earning and is available for any purpose. The item of 6 per cent for depreciation also vanishes when the bonds are paid. Both interest and depreciation are figured as a percentage on the capital investment, and when there is no capital invested they represent a real earning.

Assuming in this case that the street lighting had been paid for in cash, the plant would be in the position of having earned at least $9,000 above its cost in ten years after paying all legitimate expenses against it. The city is, then, in the position of owning a piece of property which has not cost it anything and against which no interest or depreciation can be charged.

On this basis the analysis of costs is as follows:

Plant cost	$41,000
Revenue, 1912:	
Commercial electric	$15,600
Street lighting	3,000
*Heating	6,065
Total	$24,665
Expenses for 1912:	
One superintendent	$1,200
One engineer	960
One engineer	840
One fireman	720
One lineman	720
One assistant lineman	350
Auditor (part time)	600
Coal	9,000
Oil, waste, water	300
Taxes (2 per cent)	820
Insurance (2 per cent)	820
Lamps, meters, etc.	600
Total expense	$16,930
Net earnings	7,735

*The amount of revenue from heating for 1912 was $6,065 instead of $5,600, as estimated in my article of Dec. 27.

This amount represents a real earning, and part or all of it can, if so desired, be used as a sinking fund to replace the plant when the latter is worn out, or it may be used for any other purpose agreed upon.

Milwaukee, Wis. E. M. Soreng.

Fireproof Electrical Devices

To the Editors of the Electrical World:

Sirs:—Interesting proof of the ruggedness of present electrical apparatus was given in this city recently when a tailor's shop burned. An ordinary electric iron found in the ruins of the shop had its handle burned off, the cord destroyed and the nickel finish blackened and discolored. Furthermore it was badly soaked with water. A new cord was fitted, and the current turned on. The iron heated up at once, and after a few minutes' popping, due to the water inside, there was nothing in its performance to indicate that it had ever been in any trouble. The iron was an inexpensive one, sold under the name of the "Red Shield."

A Sangamo meter in the shop was also exposed to considerable heat and smoke, and, although blackened and smelling of fire, it still showed its original accuracy.

A large General Electric tailor's goose, although not exposed to such extreme treatment as the smaller iron, was found in good shape after the fire, with the exception of a burned handle and discolorations.

Bowling Green, Mo. Colin K. Lee.

The Low-Priced Electric Vehicle

To the Editors of the Electrical World:

Sirs:—In your issue of Jan. 17 appeared an account of the plans by which Mr. Henry Ford proposes to produce a low-priced electric vehicle, and also an editorial on the same subject.

It is perhaps only natural that a journal which is so closely identified with the central station's interests should take the view that the mission of the electric automobile is to supply revenue to the producers of electrical energy. We have heard repeatedly from members of the Electric Vehicle Association of America that the chief trouble with the electric vehicle industry is that the price of its products is too high and that before long some manufacturer will come to the front by bringing out a car at a low price and built in enormous quantities—making a fortune for himself and for the central-station man and benefiting humanity generally by filling a long-felt want.

Those manufacturers who have been in the business the longest and have heard this cry the most have perhaps had the best opportunity to consider its real value. Seven or eight years ago, when activity in electric-car building took renewed life, there was a leaning on the part of the public toward buying open machines—stanhopes, runabouts and victorias—in spite of the fact that an electric vehicle company had for years before built many closed cars. Even then, the better of these open models in finish, construction, speed and mileage constituted the paying proposition from the builders' standpoint, since they were the ones the public was buying, although the highest in price.

From this time onward the demand has been continually for larger and finer cars. Within a few years of the time above mentioned the coupé and other closed models crowded out the older types with their lighter weights and lower costs, and it is a significant fact that the manufacturer who attempted to market anything at less than $2,000 either went to the wall or had to come to a higher price.

The tendency is still in the same direction. There is no buying class that wishes a car costing $600 to $1,000. The man with this amount of money to spend wants speed and mileage. Most likely it will be his first car; he will want to get out into the country. The car you mention is figured to give 100 miles per charge, but from any figure of watt-hours per ton-mile attainable by careful design, the use of special tires and the best of mechanical and electrical work, such a car would be compelled to go excruciatingly slow to make the desired trip over average country roads; and quantity production should not make such a car go much faster.

That the cheap electric vehicle is not desired is shown by the fact that second-hand open cars can be bought for $600 and less which have more real value than a new car at the same figure. Electric cars seem to have some of the peculiarities of ladies' hats—their second-hand price is very low when real value is considered—and dealers in electric cars who have "traded-in" a quantity of the "junk" made several years ago would extend a hearty welcome to that part of the dear public willing to buy a car at an "everyman's" price.

The writer's recollection is that, according to the Edison battery people's own statement, they are about breaking even at present prices of their battery. Today the vehicle manufacturer would pay about $360 for the 405 lb. of Edison battery. If the dealer is to obtain his twenty per cent, the vehicle manufacturer would still have $120 to cover material, labor, burden, and possibly profit, and anyone who has had any experience with the manufacture of these machines and who knows anything about the cost of tires, motors, anti-friction bearings and the hundred and one other items will find this close enough figuring to make the problem of such a low-priced car extremely interesting.

The electric-car-buying public is somewhat critical. The present cars are built as they are, not because the manufacturer is trying to force prices higher and higher but because the demand is for more speed, more mileage, more expensive finish—not a car, but a house on wheels—and each succeeding year calls for more rather than less. Each year, also, the tire manufacturer is making his product a little less efficient as to miles per charge in order to get longer life. These requirements all cut in on the $120 at the disposal of the manufacturer of the car.

With a price ratio of ten to one existing between the most expensive and the cheapest of the gas cars, it is only reasonable that a five to one ratio should obtain among electric cars. A reaction seems to be at work now in that the gasoline car appears to be going toward a lower level of price and weight. This tendency may also come in the domain of the "electric," but it has not appeared as yet. When buyers will be content with a relatively low-speed, open car, with inexpensive finish, and when owners will not worry about an occasional squeak or rattle, then the cheap electric vehicle will be much nearer to us than it is at present.

John H. Hertner,

Cleveland, Ohio. *Rauch & Lang Carriage Company.*

Compulsory Registration of Engineers

To the Editors of the Electrical World:

Sirs:—Under the provisions of the law passed by the Austrian government in 1913, compulsory chambers of civil engineers have been created. Every civil engineer must belong to the chamber of his own province and is subject to its disciplinary power.

In Austria the professional qualification of "civil engineer" is protected by law, the title being accorded only to graduates after five years' apprenticeship, followed by examination. Those inscribed on the civil-engineer roll are usually at least twenty-six to twenty-eight years of age, since they must have completed successively the primary school (admission not under six years of age), four years; middle school, seven to eight years; polytechnic, four to five years, and the apprenticeship, five years.

Civil engineers are entitled to use the imperial eagle in their seals, and technical documents signed by them are considered equally valid with those signed by state officials. Civil engineers in Austria are divided into eight classes, having to do with (1) railways, roads and waterways, (2) architecture, (3) mechanical engineering, (4) electrical engineering, (5) shipbuilding, (6) agronomy, (7) forestry, (8) industrial chemistry.

Since 1901 it has been possible for a graduate of a polytechnic school to take an examination and receive the degree of "doctor rerum technicarum," but as the preparation for this degree requires at least a year few applicants obtain it.

The compulsory chambers of civil engineers represent an entirely new feature of legislative support of graduates and will be a useful weapon of protection in the hands of civil engineers.

Trieste, Austria. Dr. Gino Dompieri.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Operating Record of the Keokuk-St. Louis Transmission Lines

Officials of the Electric Company of Missouri, which distributes Keokuk hydroelectric energy in St. Louis and vicinity, are authority for the comment that the most interesting events connected with the operation of the 110,000-volt line between the Keokuk water-power plant and the Page Avenue substation at St. Louis are those which have not happened. With the line already in operation more than six months there has been only one interruption to the 110,000-volt service, and it may be added that this failure was not due to any fault of the apparatus. The mistake which left St. Louis without its "Keokuk service" for a few minutes was the result of a peculiar condition arising in the generating station.

At the time of the accident the two auxiliary water-wheel-driven generators which stand in the center of the station and furnish 440-volt energy for the motor-driven exciters were both in operation with one unit carrying all of the excitation load. Load was to be shifted from one of these machines to the other and an operator was sent to shut the gates on the idle machine. Unwittingly, however, he closed the gate of the alternator which was carrying the load, and the shutting down of this machine removed the field excitation from the main generators, interrupting the delivery of energy to the 110,000-volt lines.

Some of the rigorous treatment which the lines have withstood without interrupting service has shown the remarkable sturdiness of the transmission equipment. One Sunday morning a farmer with a new rifle proved his ability as a marksman by putting a neat hole through a string of insulators, letting one phase of the line down onto the street cross-arm. Although there was a reduction of voltage at the Page Avenue substation, the load was switched to the duplicate transmission line without interrupting service.

At another time an insulator supporting a wall-type disconnect switch broke down, but the load at this time was successfully transferred to the other line without difficulty, the line disturbance being hardly noticeable. During both of these latter accidents the steam plant of the Union Electric Light & Power Company at St. Louis remained in synchronism with the Keokuk plant.

The accompanying illustration shows the completed Page Avenue substation, the equipment of which was described in the *Electrical World* of May 31, 1913. Towers and roof structures for the 110,000-volt service are shown in the background of the picture, while in the foreground may be seen one of the two square towers carrying the 13,000-volt leads over which energy is distributed to the local electric-service companies.

THE ST. LOUIS TERMINAL SUBSTATION OF THE 110,000-VOLT KEOKUK TRANSMISSION LINE

Management of Oil-Fuel Plants

By R. T. Strohm

The management of an oil-burning plant differs very considerably from the management of a coal-burning plant because of the rapidity with which any alteration in the rate of firing affects the generation of steam. With a coal fire the response to an increased rate of firing is slow, because it is necessary for the fresh fuel to become heated to the temperature of ignition before it can burn and give off heat. In the case of an oil fire, however, the combustion keeps pace with the rate of feeding the oil, so that an increased flow of oil is immediately followed by an increased generation of heat.

The fact that an oil-burning plant is so quickly responsive to alterations in the conditions of combustion makes it necessary to observe care in the regulation of the burners and the control of the air supply. It is particularly necessary to guard against the admission of too much air, which will dilute the products of combustion and cause loss of heat. A fireman accustomed to the use of solid fuel may find it difficult to learn to reduce the air supply sufficiently for the economic burning of oil, as oil requires a much smaller excess of air.

Starting an Oil Fire

The method to be used in starting an oil fire under a boiler will depend on whether the boiler is the only one in the plant or whether there are other boilers already under steam. If steam is not available from some auxiliary source, it is necessary to start an ordinary wood fire and get up steam pressure enough to atomize the oil. If the boiler is one that has been converted from coal burning to oil burning, and the grates are still in place, covered with firebrick, the wood fire is built right on the firebrick layer and is kept going until the steam gage on the boiler shows a pressure of at least 20 lb., which will be sufficient to atomize the oil for starting the fire. It is not necessary to remove the burner while this fire is under way, but the fire should be kept at a safe distance from the burner.

When the steam pressure reaches 20 lb. the oil-pressure pump should be started and the steam valve on the burner should be opened. Steam should be allowed to blow through the burner until the issuing jet appears to be dry. Then the oil valve is opened and oil is allowed to flow into the burner. The spray of oil will be directed into the wood fire on the floor of the furnace and will be ignited, after which the burner will continue its operation in the usual way. The wood fire may be allowed to burn out or it may be raked out after the oil fire has been started.

If there are other boilers in use, so that a supply of steam is at hand, the operation of starting an oil fire under a cold boiler is made much simpler and shorter. The first thing to do is to open the damper to its full extent. The steam and oil stop valves are kept closed, but the needle valve or oil-regulating valve is opened slightly. Now steam is admitted to the burner and is allowed to flow until the pipes and the burner are heated and the issuing current seems to be dry, which indicates that there is no condensation collected in the steam-supply system. Next, a bunch of waste saturated with oil should be lighted and placed inside the furnace, on the firebrick, directly in the path of the steam blast. Then the fire door should be closed quickly and the oil valve should be opened. The oil will flow though the partly opened needle valve or oil-regulating valve and the spray will be ignited by the burning waste. After the fire is thus started, the combustion may be regulated by adjusting the flow of oil and steam and by changing the air supply through manipulation of the ash-pit doors and the damper.

Before starting the fire, it is a wise precaution to blow steam through the oil side of the burner to make sure that the oil passages are clear. This is done by opening the by-pass valve and the steam valve. After the fire is started the intensity of the fire should not be increased too rapidly, as there is danger in forcing the fires under a cold boiler.

The condition of the fire is observed through peepholes that are placed in front of the setting or at the sides. When the boiler and its setting have become heated to the usual working temperature the interior of the furnace should appear to be filled with flame, the color of which should verge on a dazzling white. The flame should be steady and not surging or gusty. An experienced fireman can judge the condition of his fire very accurately by observing the color of the flame, but it is advantageous if he can also see the top of the chimney.

The combustion of oil is accompanied by a roaring noise, and the nature of this roaring also serves as a guide to the conditions existing in the furnace. It is noticeable that an excessive supply of cold air greatly increases the noise, and that preheating of the air supply renders the combustion much quieter. It is natural to suppose, therefore, that the reduction of roaring in the furnace is accompanied by an increased efficiency of combustion, since it is obtained by cutting down the excess of air and by increasing its temperature.

The formation of smoke may be traced to an insufficient supply of air, an oversupply of oil or too little steam to atomize the oil thoroughly. A burner that has not been properly cleaned and that is clogged or imperfectly adjusted will produce an unsteady flame and may cause smoke. If there are scintillating particles in the flame and they appear to fall to the floor of the furnace, it may be concluded that the atomization is imperfect. The pressure of the atomizing agent should therefore be increased. If there is water in the oil or in the steam, the burner will spit and act erratically. A similar sputtering may be caused by the presence of gases in the oil, due to an excessive heating of the oil on its way to the burner.

Regulating the Fuel Burners

In the average small plant using liquid fuel the burners are regulated by hand to accommodate the rate of firing to the demand for steam. This can be done readily because the number of burners to be adjusted is not great; but in a very large plant this method of control would be irksome, particularly if the load were subject to wide and frequent changes. With hand regulation of the separate burners the economy depends on the intelligence of the fireman in judging the conditions of combustion and in the quickness with which he adjusts the burners to changes of load.

Automatic regulation is employed in some of the larger plants. The means by which regulation is effected varies, but the end attained is the same, namely, an increase or decrease in the rate of firing to correspond to an increase or decrease of load. An increased demand for steam is evidenced by a decrease of steam pressure in a boiler. One system of automatic control therefore uses a regulating valve on the oil line to the burners. This valve determines the rate of flow of the oil, and its stem is attached to a spring and to a diaphragm that is acted on by the steam pressure. The pressure of the spring and the steam pressure act to oppose each other, and the tension of the spring can be altered to suit conditions. By setting this spring to the proper tension, any decrease of steam pressure following an increased load on the boiler will allow the spring to open the valve slightly and more oil will be admitted to the burners. In this way the rate of combustion can be made to follow the demand for steam very closely. In this system the pressure of the oil as supplied by the pump remains constant.

In another system of automatic regulation the regulating valve takes the form of a pump governor. When an increase of load comes on, the governor admits more steam to the pump, which increases its speed and gives a higher oil pressure. The oil valves at the burners are left open, and the result of the higher pressure is an increased flow of oil. There is a greater amount of heat thus generated and the steam pressure is quickly brought back to normal by the accelerated evaporation. While the steam pressure is increasing the governor is gradually cutting down the speed of the pump. In this way the steam pressure is kept fairly uniform.

Of course, an increased flow of oil demands an increased flow of steam to atomize it properly. In the system of control just described the steam supply is regulated by a valve whose stem is fastened to a diaphragm acted on by the oil pressure. An increased oil pressure immediately causes an increased opening of the steam valve, and thus the correct ratio of steam to oil is maintained.

Draft

The draft required for the burning of oil fuel is very small, ranging from about 1/8 in. to 1/2 in. of water. This is much less than is required for the burning of solid fuels and is accounted for by the fact that in an oil-burning boiler the only resistance to be overcome by the draft is that due to the friction of the gases in passing through the furnace, among or through the tubes and along the breeching and the chimney to the outer air. In a coal-burning boiler the draft must not only overcome these resistances but must also cause the air supply to rise through the bed of fuel on the grates. For this reason the chimney of a coal-burning plant will give too strong a draft when the fuel is changed to oil, and to prevent the inrush of too much air the damper must be closed to a greater extent than when solid fuel is used.

The regulation of the air supply to the furnace may be effected either by means of the damper alone or by means of the damper and the ash-pit doors. When the damper alone is used, the ash-pit doors are left wide open and the rate at which air flows into the furnace is controlled by the amount of opening of the damper. The advantage of this system of control is that at all times there is ample opening for the admission of air and the air enters at a rate sufficient to replace the gases that escape to the chimney. By impeding the escape of hot gases at the damper the hot products of combustion are kept in contact with the boiler surfaces for a longer period and the rate of travel is reduced, thus giving ample time for complete combustion.

It is probable, however, that in the larger number of plants the regulation is accomplished by both the damper and the ash-pit doors. When the load on the boiler decreases the amounts of air and oil are reduced. This results in a corresponding reduction of the weight of gases formed in the furnace, and so the damper should be moved toward its closed position. When the demand for steam increases the opposite adjustment must be made. In any case, the object to be attained is efficient combustion, and this should be done with the least possible amount of air. To judge as to when this point has been reached, the air supply may be cut down until smoke is formed, indicating that there is too little air. Then the supply may be increased gradually until the smoke disappears and only a slight haze is visible at the top of the chimney.

When an oil-burning boiler is to be shut down, the stop valve on the oil line to the burners should be closed first of all, thus cutting off the flow of oil and stopping combustion in the furnace. Next, the steam valve should be closed until only a small jet of steam escapes from the burner. The oil side of the burner should then be blown out, which is done by opening the oil-regulating valve on the burner, the by-pass valve and then the steam valve. This precaution is necessary to prevent clogging of the burner; for if the oil is allowed to remain stagnant in the burner and its connecting pipes, the heat of the setting will carbonize the oil and bake its tarry constituents on the inside of the passages, and there will be trouble and delay when the burner is again put into service. The ash-pit doors and any other openings for the admission of cold air to the furnace should be closed and the damper opened, so that the setting may not cool too rapidly.

As a usual thing, the heat stored in the brick lining of the furnace will re-ignite the oil spray if the flow of oil is interrupted for a few seconds. If the supply of oil is cut off for some time, however, the temperature of the furnace may fall to such a point that the oil cannot be ignited by the heat of the firebrick. In such a case the fireman should shut off all oil and then close the steam valve, putting the burners out of action. Then he should throw a bunch of burning waste into the furnace, close the fire door and restart the burner in the usual way.

The inflammable nature of oil fuel renders accidental fires a possibility. Should oil escape from the pipes and become ignited, the flames should be smothered by scattering sand or earth over the surface of the blazing liquid. The air is thus shut off from the oil and combustion dies out because of the lack of oxygen. It is useless to attempt to put out an oil fire by turning water on it, because the only effect of the water will be to spread the oil without extinguishing the flame.

Home-Made Outfit for Thawing Water Pipes Electrically

A 20-kw, 2300, 110-volt, pole-type transformer, 60 ft. of No. 10 wire, two outdoor-type fuse blocks with 15-amp fuses, 200 ft. of No. 00 stranded insulated wire and a wagon on which the foregoing apparatus can be mounted comprise the necessary equipment for an emergency pipe-thawing outfit. In the past some companies have thought it advisable to use a 55-volt secondary for thawing, but results where both the 55-volt and 110-volt circuits have been tried show that current values with 110-volt secondary circuits do not rise

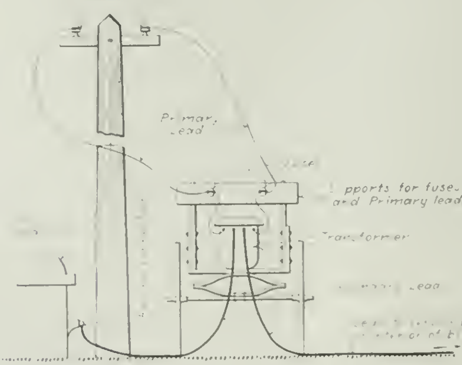


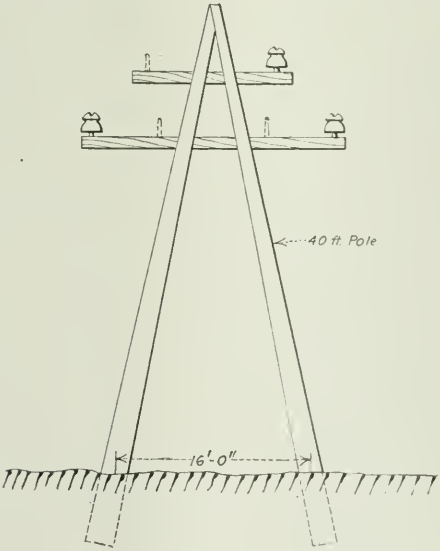
DIAGRAM OF CONNECTIONS FOR THAWING WATER PIPES above 300 amp for ordinary service pipe. By mounting the transformer in the bed of a wagon and erecting a supporting frame of pine boards for the fuse blocks, using the No. 10 wire to connect the primary lines to the fuse blocks, making permanent connections from the fuse blocks to the transformer primary taps, and carrying the 200-ft. stranded cable for secondary connections, such an outfit can be put together by a force of linemen in a short time.

Water pipes generally freeze between the street main and the house-service valve in the basement of the building supplied, and the Illinois Northern Utilities Company, which has done considerable pipe-thawing work in Evanston and Oak Park, Ill., believes it always good policy to disconnect the pipe being thawed from the remainder of the water-works system. Disconnection eliminates the possibility of shunted currents which necessitate a longer period of thawing and create a possible fire risk. For an external connection to the house-service pipe a fire plug in the street may be used.

In cases where temporary thawing outfits have been equipped with electrical measuring instruments and current-limiting devices it has been speedily discovered that the latter were superfluous since the resistance of the ordinary service pipe alone keeps the current values well within the range of rating of a 20-kw transformer. As a rule, the current in the secondary circuit varies from 150 amp to 300 amp for ordinary iron pipe.

Pole Construction for Transmission-Line Turns

Pole construction similar to that shown in the accompanying illustration is being used by the Eastern Michigan Edison Company on curves on some of its transmission lines to withstand transverse stresses. Wooden poles 40 ft. long are fastened together at their tops by a mitered joint, and two cross-arms are attached before the A-structure is raised. Only three insulator-pin positions are used on these frames at present, but six positions can be obtained for double-circuit lines by arranging the pins symmetrically on each side of the center line. The 16-ft. spread of the legs has been found satisfactory on 35-deg. turns where three No. 0 copper conductors are used and the poles are spaced about 175 ft. apart, and this construction can also be used on spans of 500 ft. or 600 ft. Mr. G. E. Lewis, of Ann Arbor, Mich., who is division superintendent of the company, is to be credited with inaugurating the use of this construction as well as the 1000-ft. span towers described in the *Electrical World* Dec. 13, 1913.

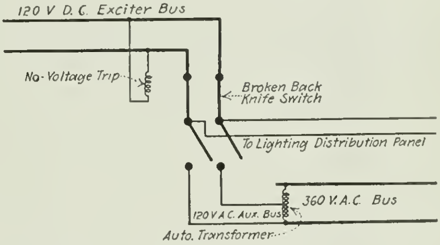


POLE CONSTRUCTION FOR USE ON CURVES

Emergency Lighting Service in Reserve Steam Plant

We have a railway steam generating station, which has recently been converted into a combined rotary-converter substation and reserve plant to operate in conjunction with a large hydroelectric system. The station lighting was laid out to operate on two-wire direct-current energy furnished by a steam-driven exciter, but when the main generating units are shut down and the plant is being operated as a substation it is, of course, uneconomical to run the exciter in order to carry only the station lamp load. To simplify our energy-exchange records, however, we prefer operating the lamps on the exciter circuit as long as the steam generating sets are in use, but would like to adopt a system whereby the lamps could be automatically thrown over onto the hydroelectric supply in case of emergency or when the steam plant is shut down. H. K. S.

You do not mention the voltage used on your electric railway, but, assuming that it is 625 volts direct current, the alternating-current potential impressed across the converter slip-rings would be about 360 volts. In such a case it would be simple to connect an auto-transformer across one phase of the alternating current bus and run 120-volt taps to an auxiliary bus for lighting. A double-blade broken-back knife switch can then be placed on the back of the exciter panel with its upper clips connected to the exciter bus, the lower pair to the auxiliary lighting bus, and the blade terminals to the lighting distribution panel. The switch can be equipped with a spring and a no-voltage trip which will cause the lighting circuit to be thrown over onto the auxiliary bus when the exciter bus is de-energized. This scheme should not be employed if any direct-current arc lamps are used.



EMERGENCY LIGHTING SERVICE CONNECTION FOR RAILWAY CONVERTER STATION

Current for Three-Phase Motor

What is the approximate value of the line current required for a 10-hp 500-volt three-phase motor? A. M.

At full load a 10-hp motor of this type has an efficiency of about 84 per cent and operates at about 89 per cent power-factor. Since 1 hp equals 746 watts, the power taken by the motor under full load conditions will be $10 \times 746 \div 0.84 = 8880$ watts, or 8.88 kw. The current per line wire (I) in a three-phase circuit is expressed by the formula below, where E is the voltage, $\cos \theta$ is the power-factor and P the power in watts. Substituting, $I = P \div (1.73\, E \cos \theta) =$

$$8880 \div 1.73 \times 500 \times 0.89 = 11.51 \text{ amp}$$

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Temperature of Machines in Intermittent Operation.—L. ISAMBERT.—This article explains how with the aid of simple tests of a machine it is possible to calculate approximately the rating of the machine in intermittent operation. Under average conditions the rating in intermittent operation equals the rating in continuous operation multiplied by $\sqrt{1 + 1.6\,n}$, where n is the ratio of the period of rest to the period of work.—*La Lumière, Elec.*, Jan. 31, 1914.

Induced Emfs.—L. BARBILLION.—A mathematical article, being a supplement to his recent article on various forms of magnetic fields and the emfs induced thereby. The present article deals first with the definition of the "coefficients of reduction" of the fluxes and of the "coefficients of reduction" of the emfs. These coefficients are often used in workshops, but their definitions are not free from confusion. The author then compares the value of the induced emfs if the primary fields vary with the time or do not vary, and finally discusses the most general expressions of these emfs when the induction is not represented by sinusoidal functions of time and space.—*La Lumière Elec.*, Jan. 31, 1914.

Alternating-Current Generators.—B. G. LAMME.—In a second article on the engineering evolution of electrical apparatus a historical review is given of the development of the alternating-current generator in the United States with special reference to the work of the Westinghouse company. The subject is discussed under the headings of surface-wound armatures, toothed armatures, compounding alternators, introduction of polyphase alternators, the first Niagara alternators, influence of direct-current design, rotating-field generators, field construction and waterwheel-type generators.—*Elec. Journal*, February, 1914.

Three-Phase Repulsion Motor.—A. HEYLAND.—A brief article describing a three-phase repulsion motor which is claimed to be as simple as the single-phase repulsion motor and to have essentially the same properties as the three-phase series motor without its disadvantages and to be cheaper in construction on account of the simple rotor short-circuit and the avoidance of a transformer.—*Elek. Zeit.*, Jan. 22, 1914.

Generation, Transmission and Distribution

Reactance Coils.—E. P. HOLLIS.—An abstract of a paper read before the (British) Institution of Electrical Engineers. The author reviews the part played by inherent and added inductance in the phenomena that occur in electrical power circuits. He discusses how reactance may be usefully employed to solve certain engineering problems. These problems include the limiting of the excessive current that may momentarily flow in the case of a short-circuit and the increase in the stability of power systems so that they can better withstand internal disorders. It is explained why internal reactance cannot be relied upon solely in the case of a generator and why some of the needed reactance must be external. It is also explained why the benefits conferred upon a generator by reactance and reactance coils do not apply in the same way to a transformer. A few notes on suitable forms of reactance coils are added. —*London Electrician*, Jan. 30, 1914.

Electric Power in Cement Factories.—W. FUCHS.—An illustrated description of the hydroelectric installation of a Portland cement factory in Brasso, Hungary. This factory was formerly operated by steam, but water-power has now been developed, the plant containing two 550-hp turbines each connected to a 550-kva three-phase generator. Energy is generated at 15,000 volts for transmission to the factory. For transmission and distribution to a nearby village the pressure is reduced to 3000 volts. At the cement factory there is one large motor of 800 hp running at 125 r.p.m., as well as smaller ones.—*Elek. u. Masch.* (Vienna), Jan. 25, 1914.

Evolution of Apparatus.—C. F. SCOTT.—In the first article of a serial on the engineering evolution of electrical apparatus the author describes the beginnings of the alternating-current system in the late eighties.—*Elec. Journal*, January, 1914.

Traction

Electrification of Swiss Railways.—J. REYVAL.—The conclusion of his account of the report of the Swiss commission for the investigation of the electrification of the Swiss railways. It decides in favor of the single-phase system with series motors. In the present instalment an account is given of one of the projects which have been worked out. It relates to the electrification of the old Gotthard line.—*La Lumière Elec.*, Jan. 24, 1914.

Installations, Systems and Appliances

Rates for Residences.—H. H. SEABROOK.—An abstract of an address on the "ratable value" rate schedule for residences. The author is convinced that in the present state of the art the ratable value is superior to any other basis of primary charge, with the proviso that where the price of gas is not more than 62 cents per 1000 cu. ft. the secondary rate should not exceed 2 cents per kw-hr. It is adaptable to an almost universal application, because, although all undertakings cannot afford to take such a low percentage of ratable value as 10 per cent per year, they can take 20 or 25 per cent without affecting the principle, and a very large number can then afford to supply the energy used at 1 cent per kw-hr. (assuming gas competition at 62 cents). It is possible to regard the ratable-value system in two ways—first, to calculate the primary charge so that it covers investment costs and standing charges of the complete electric service to a residence, and that the secondary rate of 1 cent represents the running cost, plus profit, of the kilowatt-hours sold; secondly, the primary charge plus a few kilowatt-hours at 1 cent can be regarded as the charge for lighting the residence and the secondary element regarded as the charge for additional business from other uses than lighting. The objection is discussed that two residences of equal size may have very different ratable values brought about by their positions in the same locality, resulting in an apparently unfair difference in the amounts payable as primary charge. This objection is answered by the argument that the man who lives in the more expensive neighborhood will have more money and will therefore be better able to purchase a complete electrical outfit than the other man. For instance, whereas the man in a less expensive residence section may be content with electric light and a cooker and a few heaters, used intermittently, the resident in the expensive section will want the complete service—light, heat and cooking—and will use it to the exclusion of other agents. For the same reason the cost of the units will be a smaller matter to him than to the other man. In arranging taxes of any kind it is a recognized practice that those who can pay shall pay.—*London Electrician*, Jan. 23, 1914.

Electrophysics and Magnetism

Skin Effect.—E. F. Northrup and J. R. Carson.—A detailed discussion of the mathematical theory of the skin effect and alternating-current resistance. The authors give a complete mathematical investigation of the subject together with the results of a series of experiments. There are at least three important cases in engineering practice where the skin effect may play a prominent part: in third-rail transmission, in energy transmission by means of copper-clad iron conductors, and in the short and very heavy copper conductors which carry large alternating currents from the low-tension side of transformers to electric furnaces. The skin effect is almost wholly a phenomenon of the lines of induction on the interior of the conductor. It is, therefore, impossible to diminish it by subdividing the conductor into strands which lie close together or by giving to the return conductor a non-inductive disposition. It may, however, be diminished by disposing the material in the form of a tube or a sheet. The effect can also be greatly diminished by decreasing the permeability. Thus steel rails made of a certain composition are practically non-magnetic. Even though these show a higher ohmic resistance than ordinary steel rails, they might prove to be very much better carriers of alternating current. If it were possible to divide a conductor into many strands and then intermingle the strands of the return conductor with the strands of the outgoing conductor, the skin effect would be greatly diminished. This procedure might be applied in connection with electric furnaces. The skin effect is practically the main cause of the increase of the ratio of alternating-current resistance to the direct-current resistance in ferrous materials. But the hysteresis of the iron must also play a small part in increasing the ratio.—*Journal Franklin Inst.*, February, 1914.

Supposed Chemical Decomposition of Varying Magnetic Fields.—In 1908 I. Rosenthal presented to the Berlin Academy of Science an account of some experiments, according to which complex molecules like starch, when dissolved in water, seemed to be changed into the simpler molecules of fruit sugar (fructose) when acted upon by varying electric fields of certain periodicities. The solutions were placed in beakers surrounded by solenoids, and Rosenthal stated that the induced currents or fields had to be of certain periodicity. Under ordinary conditions the solution would become warm when the currents were turned on, while at a certain characteristic periodicity the substance would not become hot but break down into simpler compounds. Rosenthal has not published any continuation of these remarkable experiments, but two refutations appeared last summer. The first, by R. Cegielskij, was presented to the Deutsche Physikalisch Gesellschaft; the second and more complete paper was contributed by George W. Heimrod, of the New York Rockefeller Institute of Medical Research. The latter made his experiments—or, rather, this second series of them—in the Hanover Technical High School under Bodenstein. He took a Wehnelt interrupter consisting of a quartz tube drawn out to a capillary and through which a platinum wire passed and kept this apparatus working at from 200 to 900 interruptions per second of a current of 10 amp for several days. Ordinary apparatus would not have stood this. In all cases he conducted two parallel experiments, one with the high-frequency treatment and a check experiment without any electric treatment. The results were in all the pairs the same at temperatures ranging up to 90 deg. The starch remained starch, or a slight percentage of sugar was formed when additions of electrolytes were made to the starch; but that percentage of sugar was the same in the electrically treated and in the untreated starch. The additions were sodium chloride, hydrochloric acid, phosphoric acid, acetic acid and diastase—the acid and diastase effect on hydrolysis which leads to sugar formation. Thus Rosenthal's experiments, which appeared very remarkable, though they hardly could have an analogy in the household of nature, remain unconfirmed. Rosenthal, in fact, himself failed in repetitions of his experiments. He experimented with other compounds besides starch and found different characteristic periodicities for different compounds.—*Zeit. f. Elektrochemie*, Oct. 15, 1913; noticed in London *Engineering*, Jan. 16, 1914.

Theory of Relativity.—G. Dimmer.—A concise review of the fundamental principles of the theory of relativity, giving a sketch of Michelson's experiments, Lorentz's transformation equations, Einstein's principles of relativity and Minkowski's scheme of giving a picture of the world in a four-dimensional space with three axes of space, the fourth axis (the "world axis") being that appertaining to time.—*Elek. u. Masch.* (Vienna), Jan. 25, 1914.

Electrochemistry and Batteries

Electrolytic Corrosion of Iron in Soils and Destruction of Pipes by Stray Currents.—Burton McCollum and K. H. Logan.—An account of an investigation describing the arrangement of the experiments and discussing the factors which affect efficiency of corrosion and the factors which affect earth resistance. The conclusions are as follows: The current density has a marked effect on efficiency of corrosion of iron in soils, the efficiency of corrosion being in general greater the lower the current density. In saturated soils the corrosion may vary between 20 per cent and about 140 per cent for the range of current densities between 5 milliamp and 0.05 milliamp per sq. cm. Moisture content in the soil also has a marked effect on efficiency or corrosion, the corrosion efficiency being in general greater with increasing moisture content up to saturation of the soil. Beyond this point increased moisture content has comparatively little effect. Temperature changes within the limits commonly met with in practice have no important effect on corrosion efficiency. The depth of burial of pipes has no direct effect on corrosion efficiency provided other conditions remain constant. In practice, however, the moisture content, current carried by the pipes and various other factors which affect corrosion efficiency will vary with depth, so that indirectly difference due to depth may be noted. The amount of oxygen present has no appreciable effect on the efficiency of corrosion in the case of iron immersed in liquid electrolyte. Corrosion efficiency of iron embedded in earth is always greater in open vessels than in sealed vessels. The amount of oxygen present has a marked effect on the end products of corrosion. If the corrosion is rapid and the supply of oxygen small, there will be a preponderance of magnetic oxide, while if the rate of corrosion is low and the supply of oxygen abundant the ferric oxide will predominate. Owing to the fact that the supply of oxygen around pipes buried in earth is always more or less limited, the character of the oxides formed gives some indication as to the rate of corrosion, and thus indirectly the cause of the corrosion, if local conditions are properly considered. There is no material difference in the efficiency of corrosion shown by the various kinds of iron commonly used in the manufacture of underground pipes. The fact that a given chemical tends strongly to inhibit either self-corrosion or electrolytic corrosion in liquids is no indication that it will materially retard electrolysis of iron embedded in soils. Pitting of iron embedded in soils is affected not only by a non-homogeneous condition of the iron or soil, but also by the chemicals contained in the soil. The efficiency of corrosion was found not to be a function of the voltage except in so far as the current density may be affected. Pressures as low as 0.1 volt and 0.6 volt showed practically the same efficiency of corrosion as those of 5 volts to 10 volts or higher. Corrosion tests on a large number of different kinds of soil from widely different sources with average moisture content and moderate current density indicate that corrosion efficiencies between 50 and 110 per cent may usually be expected under most practical conditions. The resistance of soils varies throughout a very wide range with variations in moisture content, the resistance of the comparatively dry soil being of the order of several hundred times the resistance of the same soil at about saturation. Above saturation increase in moisture content has but little effect on the resistance of the soil. Because of the great variations in resistance of earth with moisture content, voltage surveys should not be made at times when the earth is extremely dry. The resistance of the soil varies greatly with temperature within the ordinary range encountered in practice. In the case of the soil tested the resistance at 18 deg. below zero C. was over 200 times as great as at 18 deg. above zero C. Even at about freezing temperature the resistance will be several times that at summer temperatures. This not only has an important bearing on the magnitude of the electrolysis trouble that may occur at different seasons, but it also indicates that practical voltage surveys should not be made when extremely low temperatures prevail. The experimental results given in this paper have an important bearing on the subject of electrolysis mitigation through the limitation of voltage drop in the negative return. For some years the chief means of preventing trouble from electrolysis in certain foreign countries has been the limitation of the permissible voltage drop between any two points on the return circuit. In some places the limit has been placed on the maximum voltage during peak load, whereas in other cases the average voltage for twenty-four hours has been the determining factor. It will be evident that if the total amount of damage which results is proportional to the average current, then the limitation of the average voltage would be more logical than the limitation of the peak-load voltage, since in the former case the cost of meeting the voltage limitation in any case would be proportionate to the danger involved irrespective of the station load-factor. On the other hand, if the voltage at peak load is the determining factor the cost of complying with the requirements depends not only on the danger involved but on the load-factor of the system, and the poorer the load-factor the greater its cost will be. It appears from the data presented in this paper that the rate of damage does not increase as fast as the voltage increases because of the tendency toward lower corrosion efficiencies at higher current densities. This indicates that with a given average all-day current the actual amount of electrolysis that would occur would be less with a bad load-factor than with a good load-factor, and hence points to the undesirability of penalizing a high peak of short duration. It would appear more logical, therefore, in so far as the damage itself is concerned, to make the average all-day voltage the basis of the limitation rather than the voltage at time of peak load.—*Technologic Papers, United States Bureau of Standards*, Nov. 25, 1913.

Units, Measurements and Instruments

Measuring Idle Volt-Amperes.—H. B. TAYLOR.—The reason why some station operators prefer instruments which indicate the wattless component rather than the power component of an alternating-current circuit is a psychological one. At fairly high power-factors the wattless component of a given load is large as compared with the difference between the per cent power-factor and 100 per cent. For instance, 97 per cent power-factor really means practically the same thing as 25 per cent wattless factor. There are two instruments for indicating the components flowing in the circuit; one is the wattless-factor meter, and the other the power-factor meter. No essential difference exists between the two except the scale marking. The wattless-factor meter indicates zero when the power-factor meter indicates 100 per cent. A wattless-component meter indicates the total wattless component of the volt-amperes in the circuit, regardless of the power-factor, in the same way that the wattmeter indicates the total power component. It differs from a wattmeter only in the way it is connected to the circuit. This type of meter has the advantage of giving a more emphatic indication when the circuit is heavily loaded, coupled with the disadvantage that its indication is liable to escape attention at relatively small loads. Methods of making the connections of this type of meter are described.—*Elec. Journal*, February, 1914.

Analysis of Periodic Waves.—L. W. CHUBB.—An article illustrated by diagrams discussing the Fourier or harmonic series, harmonic analysis and mechanical analyzers. A new mechanical analyzer is described which is adapted to work from a cut-out templet or grooved record of a polar curve printed directly from a polar or circular oscillogram. The accuracy and value of the machine are emphasized. Problems which take days to analyze by former methods can now be worked out with greater accuracy in as many hours.—*Elec. Journal*, February, 1914.

Measurement of High Potentials.—C. E. GUYE AND A. TCHERNIAWSKY.—An illustrated article on an electrometer employing compressed carbonic acid gas at 4 to 10 atmospheres for the measurement of high potentials.—*Archives des Sciences Phys. et Nat.*, 1913; *La Revue Elec.*, Jan. 16, 1914.

Temperature Measurements of Electric Machines.—O. W. A. OETTING.—After a discussion of the effective temperature in electrical machines, the author discusses the methods of temperature measurements by means of thermometers, rise of resistance, resistance exploring coils, and thermocouples.—*Elec. Journal*, February, 1914.

Telegraphy, Telephony and Signals

Non-Uniform Telephone Lines.—DEVAUX CHARBONNEL.—The author has formerly shown how it is possible to determine by experiment without complicated calculations the constants of propagation of wave transmission over homogeneous lines. After determining the characteristic constant it is sufficient to measure the values of the currents at the transmitting and receiving ends, the line being closed through an impedance equal to the line characteristic. The author shows now that the same method is applicable to non-uniform lines and that the method of experimenting is not any more complicated.—*La Lumière Elec.*, Jan. 24, 1914.

Use of Telegraph Lines for Long-Distance Telephony.—BELA GATI.—The first part of a paper in which the author discusses the difficulty of separating telephone currents from telegraph currents at the present day, owing to the higher speeds that are used in telegraphy and the fact that dynamos for generating telegraph currents give rise to high-frequency currents due to commutation. He discusses the improvement of conditions

(1) by means of Pupin coils, (2) by means of earth-shunted conductive coils, and (3) by decreasing the effective resistance and leakage of the lines.—London *Electrician*, Jan. 16, 1914.

Electrolytic Detectors.—PAUL JEGOU.—The conclusion of his illustrated article on the electrolytic detector. The action is considered as a case of depolarization of an electrode. The author has formerly described an electrolytic detector which is capable of detecting the waves with a high degree of sensitiveness without the use of any external source of current. This detector differed from ordinary detectors only by an inactive electrode which consisted of tin amalgam. The author has now found that the use of zinc amalgam gives much better results. The construction is shown in the diagram. *A* is the active electrode point, *B* is concentrated sulphuric acid, *C* is zinc amalgam and *D* is a platinum electrode (the latter two representing the inactive electrode).—*La Lumière Elec.*, Jan. 24, 1914.

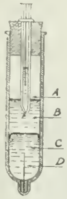


DIAGRAM OF ELECTROLYTIC DETECTOR

Book Reviews

LABORATORY MANUAL: DIRECT AND ALTERNATING CURRENT. Prepared to accompany Timbie's Elements of Electricity. By Clarence E. Clewell. Published by the author at New Haven, Conn. 100 pages, 27 illus. Price, $1.

An elementary textbook of laboratory exercises in an electrical-engineering course. Thirty laboratory experiments are formulated and described, of which twenty involve direct-current supply and ten alternating-current supply, including single-phase and three-phase supply. The style is extremely simple and the treatment diagrammatic. Although designed for college students, the book might also prove serviceable in the laboratory instruction of evening schools and vocational schools for lads of high-school grade.

INSULATION AND DESIGN OF ELECTRICAL WINDINGS. By A. P. M. Fleming and R. Johnson. New York: Longmans, Green & Company. 102 illus. Price, $2.25.

On account of the importance of sufficient and durable insulation on electrical machines, the study of the properties of insulating materials and the best methods of utilizing these materials in the design of electrical machinery deserves more attention than it has received in the past. The use of higher voltages and the increased importance of insulating problems have led of recent years to a more thorough study of dielectrics; but the published results of this scientific research work are scattered and not always readily obtainable. A treatise on insulation and the design of electrical windings is therefore to be welcomed, even if it should do no more than bring together in a single volume the results arrived at by various workers in this field. The subjects dealt with in the book under review include a study of the physical characteristics of dielectrics; an account of the insulating materials of practical utility; the theory of electrostatic stresses leading to the correct design of insulation and the arrangement of windings in rotating machinery and transformers; insulation tests; the drying and handling of electrical windings, and the causes of insulation failures. These subjects are not treated exhaustively, but the numerous references to scientific papers and other sources of information will be found very useful to those who wish to pursue the matter further. Without altering the character or scope of the book, it is possible that some of the subjects dealt with might have been treated more fully with advantage. On referring to the index, the practical designer may not always find what he is seeking. As an instance, the causes of pressure concentration leading to breakdown of insulation between the end turns of inductive windings do not appear to be referred to, but the phenomenon is briefly discussed on page 49 and again on page 162. This is one of the problems which might be expected to receive a more thorough treatment in a book of this nature. In Fig. 4, on page 10, the pressure should be read as kilovolts, not as volts. A commendable feature of the book is the summary of the standard insulation tests as applied in Germany, America and Great Britain.

WIRELESS TELEGRAPHY AND TELEPHONY. By Charles R. Gibson. Philadelphia, Pa.: J. B. Lippincott Company. 156 pages, illus. Price, $1.

This book is intended to teach to persons of no scientific experience the theory, growth and present condition of radio signaling. While the arrangement and development of the subject is interesting, the author has not avoided the inaccuracies which are usually frequent in "popular science" works of this sort. Statements which imply that the period of an oscillating circuit is altered in practice by changing its resistance occur at two points, and some very shaky analogies are given. The book is rather more ambitious than the average primers of applied science in its attempts to present fundamentals. The electronic theory of electrical actions is the subject of a chapter, and some conception of it should be secured from a study of the book by a lay reader. It appears that to explain completely the entire history of ether communication from Faraday and Henry to the British "Imperial Wireless Chain," together with the principles underlying electrical phenomena, is too big a contract for 156 pages. The author has, however, picked out and presented much of the pith of the subject and quotes some interesting paragraphs from the technical and public press. A number of excellent photographs are shown, but it is unfortunate that all are of one general type, when there are available others of equal interest and instructive value. Although the publication is dated 1914, modern American radio practice is not treated at all; and, while the Goldschmidt generator is briefly described, there is not a word on "solid rectifiers" as detectors. Thus it will appear that the book is not especially well balanced, but there is in it, nevertheless, a quantity of material which should be interesting to its readers. If in studying it one will not permit the writer's abrupt style and occasional lack of grammatical care to distract him, and will not insist upon absolute accuracy in the treatment of recently developed instruments and methods, he should gain a fairly good idea of the elements and history of wireless. The numerous inventors are treated quite impartially, and though brevity has apparently forced out discussions of many important steps in the art's development, the history of the early and middle years of radio signaling is really excellent.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Primary Switch-Type Pole Cut-out

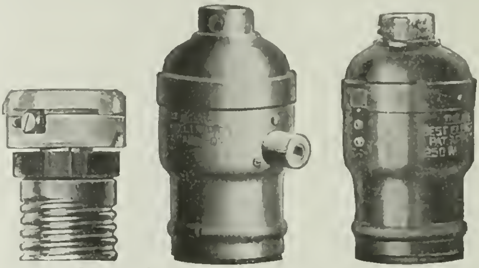
A switch cut-out and fuse designed for the control and protection of overhead lines for currents as high as 150 amp and pressures up to 2600 volts is being manufactured by the Metropolitan Engineering Company, Brooklyn, N. Y. The cut-out is constructed of heavy porcelain finished in brown, and it is made weatherproof for service on cross-arms. Each conductor is held in position in the terminals by two screws which prevent the loosening of connections due to possible pole vibration. The live parts are amply recessed and protected, thus making the liability to shock small. The fuse, as shown in the accompanying illustration, has a tapped base and is held in place on the end of the switch handle by a coarse-thread screw. A square shoulder on the fuse handle prevents the fuse or handle from loosening while in service. The height of the device with the fuse and handle is 14.5 in. and without it 8.5 in.; its width is 6.5 in. and its depth 5 in.

SWITCH CUT-OUT

Lock Sockets

The Best Electric Company, Pittsburgh, Pa., has put on the market a lock socket which is designed to prevent the theft of lamps. Fig. 1 shows the interior of the device. Shoulder plates and a small plunger make it possible to turn the lamp firmly into the socket; but when turning the lamp in the opposite direction, as unscrewing it, the base rotates and holds the lamp so that it cannot be removed. In order to replace a lamp it is necessary to break the bulb. After knocking off the glass at the base, the outer brass shell of the bracket should be removed, and then by holding the rotating part of the lock the old base can be taken out. After replacing the outer shell, the new lamp can be inserted in the usual manner.

Fig. 2 shows a socket fitted with a special key release attachment. Sockets are also provided with key switches. Fig. 3 shows a keyless socket. These sockets are finished in polished brass unless otherwise specified. Porcelain and weatherproof composition sockets are furnished with key switches if desired but not with key release attachments.



FIGS. 1, 2 AND 3—INTERIOR OF LOCK SOCKET, SOCKET WITH KEY RELEASE AND KEYLESS SOCKET

Electric Tractors in Municipal Service

Electric tractors are being employed in a variety of ways to eliminate the mule and the horse. Among these interesting applications is the 5-ton apparatus illustrated herewith, which is used by the city of New York and is shown hauling 7.5 tons of sand. Its wheelbase measures 74 in. and the frame is made of 6-in. channels. The long body was built by the city and designed for moving garbage, refuse, etc.; but the tractor proved so much more efficient than horses that this work was not enough to keep the machine in operation full time, and as a result it has been used to haul sand, cobblestones, etc. The tractor illustrated was built by the General Vehicle Company, Long Island City, N. Y.

ELECTRIC TRACTOR USED BY CITY OF NEW YORK

Mercury-Motor Watt-Hour Meters

The mercury-motor watt-hour meter, like all motor meters, consists of a motor-generator set coupled to a revolution-recording mechanism, the speed of the set being proportional to the power delivered through it. The mercury motor consists essentially of a copper disk floated in mercury between the poles of a magnet and provided with leads to and from the mercury at diametrically opposite points.

The Sangamo Electric Company, Springfield, Ill., has developed a meter of this type, the complete motor element of which, including the damping disk, is built up into one compact unit which is held firmly in accurate position by three screws fastened to lugs cast with the base.

Fig. 1 shows a two-wire, direct-current watt-hour meter with the case removed. The damping disk and the motor disk are carried on the same shaft, which extends from the lower ring bearing up through the mercury chamber to the top bearing. The mercury is kept from spilling by a long tubular sleeve which surrounds the shaft, with a clearance of only 0.006 in. The motor element carries the recording train.

Meters for use on circuits of more than 130 volts are provided with resistors connected in series with the potential magnet windings, and these resistors when used in meters for circuits not exceeding 250 volts are mounted upon and form a part of the motor element. On circuits of more than 250 volts the series resistor is mounted in an external box.

A reversible thermocouple is used for compensation of friction on light loads. The couple with its heating winding is made very small and compact and is arranged so that it can be changed easily from positive to negative and vice versa by reversing the couple and without disturbing any of the meter connections.

The lower end of the shaft is held in its correct position by a ring jewel fastened permanently in the bottom of the mercury chamber, which is a special nonmagnetic high-resistance alloy stamping thoroughly enameled. The upper end of the shaft is provided with a long split sleeve of brass that has the worm cut on its lower extremity. At the upper end it carries an accurately ground and highly polished steel pivot. The sleeve pivot and worm can easily be removed if necessary and replaced by a new one without disturbing any other adjustments of the meter. This sleeve also carries the damping disk, which is effectively insulated from it with large heat-resisting insulating washers and a tube of the same material.

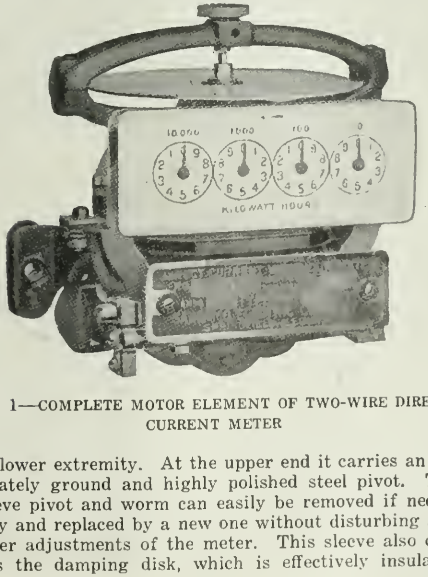


FIG. 1—COMPLETE MOTOR ELEMENT OF TWO-WIRE DIRECT-CURRENT METER

The hub of the damping disk is fitted with two set screws that serve the double purpose of holding the disk firmly in its proper position on the worm sleeve and of clamping the latter (which is split longitudinally) securely to the shaft. The motor field magnet is built up of laminated high-permeability iron and energized by a pair of coils wound with fine enameled copper wire. The windings are arranged for connection across the line in series with the heater winding of the thermocouple. For pressures above 130 volts a resistor is connected in series with the magnet winding.

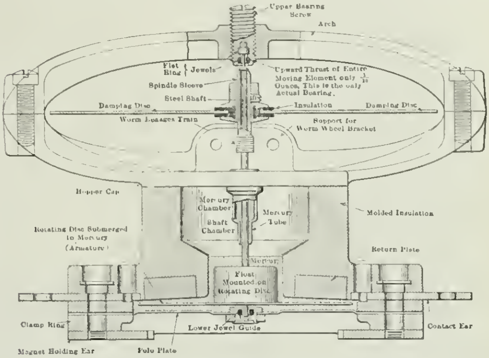


FIG. 2—CROSS-SECTION OF TWO-WIRE, DIRECT-CURRENT METER WITH RECORDING MECHANISM AND FIELD AND DAMPING MAGNETS REMOVED

The magnet structure is clamped to the base of the mercury chamber by two punched ears that engage with slots in the laminated core and are securely bolted into slots milled into the bottom of the bracket ring which supports the mercury chamber. The bottom of the chamber or "pole plate" is stamped from special alloy metal. At its center it carries the lower ring jewel bearing which is permanently fixed in place.

The upper part of the mercury chamber is made of molded insulating material in which is embedded a circular ring of laminated electrical sheet steel wound edgewise under heavy pressure, this ring or return plate completing the magnetic circuit of the shunt magnet. The lower side of the molded chamber is accurately drilled and doweled to correspond with the pole plate and clamp-ring bracket on which the chamber rests. The mercury chamber is clamped securely to the bracket by six screws.

The permanent magnets which furnish the damping field are each supported on four brass posts riveted into the iron base of the meter. They are held in position by brass clamps that permit accurate initial adjustment of the magnets both with reference to each other and to the motor element. The main speed of the meter is adjusted by a magnetic shunt consisting of a soft-iron disk mounted on a fine-pitch screw. The shunting effect may be gradually and smoothly varied over a wide range by turning the disk up or down in a threaded boss that is cast into the base.

The dial train is so designed that the main part which gives successive decimal reductions for the several circles is exactly the same for meters of all capacities. The train is installed on a pressed-brass bracket and held by two small levers. By drawing the levers up to a vertical position they are disengaged from the supporting bracket and the train can be easily removed by sliding it forward.

In the three-wire direct-current meter two mercury motors are coupled together, and they drive a generator or damping disk, the revolutions of which are recorded in the usual way.

Current-Limiting Reactance Coil

A current-limiting reactance coil of new design has been put on the market recently by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. The coil, as shown in the illustration, is of the air-core type, no magnetic material being used. The windings consist of a number of fine-stranded bare copper cables arranged in multiple. The use of multiple cables gives a greater surface with a given cross-section, resulting in low operating temperatures. The fine stranding reduces eddy-current losses to a minimum.

By placing the windings radially in disk-shaped layers the electrical stress between the layers is kept very low. By the same method of winding the length of each of the parallel cables is made the same, thus giving equal resistances. As each cable is in the same field, the equal inductances accomplish complete elimination of circulating currents.

A feature of the coil is the absence of heavy supports either inside or outside of the conductors. The conductors and the cleats separating the conductors are placed in such a way that the copper is put in tension and acts against the stresses radially outward while the cleats are put in compression against the stress in a line with the axis of the coil.

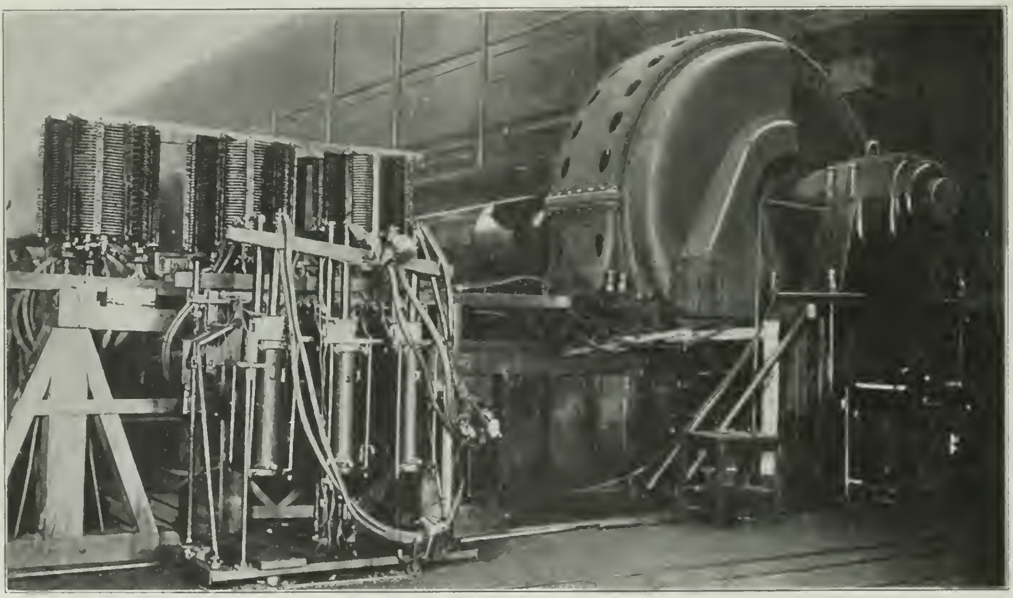
These coil supports or cleats are made of a special molded material and are non-inflammable. The supports have a high insulating quality and can withstand high temperatures.

The cables at one end are connected together and are brought to a terminal at the top of the coil, and at the other end to a terminal at the bottom of the coil. Duplicate terminals are provided at the top and bottom of the coil, so that, if desired, connection can be made from either the top or bottom through the center of the open coil. The absence of internal or external supports reduces the weight of the apparatus to a minimum and simplifies greatly the work of installation. The open construction allows a free circulation of air. The complete coil is mounted on insulators which are provided with special top castings of non-magnetic material.

As a test, a 16,700-kva, 8800-volt generator of recent design, running at full speed and without resistance or any other protection in the circuit, was short-circuited. Oscillogram records showed that a current of 21,000 amp, or twelve and one-half times greater than the normal, flowed through the generator. With generators designed some years ago such a test would have wrecked the machine, but in this instance no damage whatsoever was done. The only visible effect was a static flash between the field and the armature.

The test was performed to prove the fact that generators are now being built which require no protection from outside short-circuits, the apparatus itself being designed to be self-protecting. Unless the generator is properly constructed, a complete short-circuit tends to tear out the armature coils, which, when coming into contact with the revolving field, will cause considerable wreckage. The static flashes, furthermore, which always occur under such circumstances will destroy inferior insulation. With generators of the type tested, however, both results are guarded against by firmly securing the armature coils and bracing their ends, on one hand, and by the use of mica insulation, on the other. In consequence, even so severe an ordeal as this test was undergone without harm, although it was repeated a number of times.

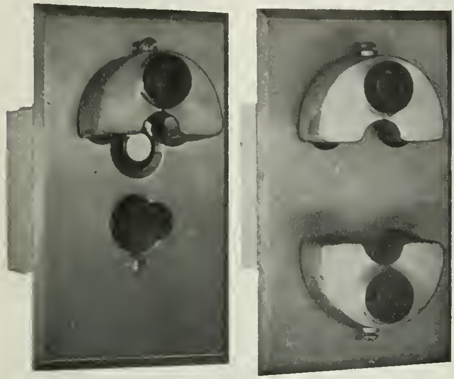
Several other tests were made in order to prove the reliability of circuit-breakers and reactance coils for protecting the feeder circuits. The generator was repeatedly short-circuited through these devices, which stood up well under the enormous stresses to which they were subjected.



AIR-COOLED TYPE REACTANCE COIL

Combined Switch and Receptacle Outlet

The combined switch and receptacle shown in Fig. 1 is equipped with a detachable mechanism and an outside attachment plug. The outer box is made with contact pieces on the inside, on the ends of which binding screws are provided. The box is put in the wall and the wires are permanently connected to the binding screws. The mechanism is made entirely separate from the outer box; it has spring contact pieces, however, which engage with the contact pieces of the outer box when the mechanism is slipped inside. The device when wired for double-pole operation may be used as a switch and receptacle outlet simultaneously. If the plug mechanism is inserted with the receptacle contacts on the live side, the tap-off circuit is independent of the switch; if on the dead side, the switch will control both through and tap-off circuits. The plate is made solid. Fig. 2 shows a receptacle having two outside attachment plugs and no push-button switch.



FIGS. 1 AND 2—COMBINED SWITCH AND RECEPTACLE, AND RECEPTACLE WITH TWO OUTSIDE PLUGS

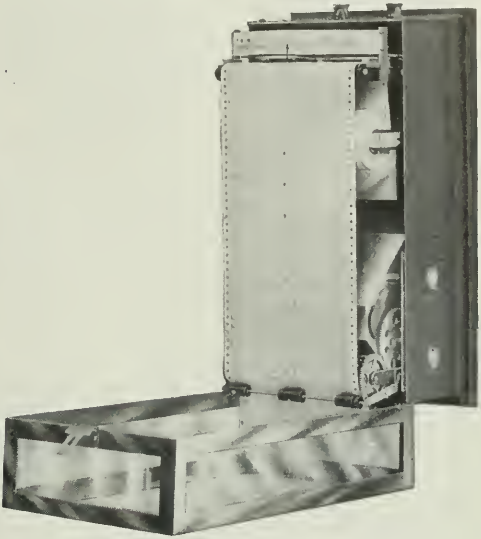
These receptacles are the product of the Metropolitan Electric Manufacturing Company, Long Island City, N. Y.

Continuous-Chart Recording Instrument

The Brown Instrument Company and the Keystone Electrical Instrument Company, of Philadelphia, Pa., are placing on the market a continuous recording instrument for use as an electrical pyrometer for recording temperatures and also as a recording voltmeter or ammeter. Efforts have been made in the design of this instrument to produce a device simple in construction and of the most compact form possible. The case of the instrument is 15 in. high and 8 in. wide and projects from the switchboard or wall 7 in. The space occupied has been made small by placing the clock mechanism behind the record chart instead of at one side, the record chart being the only part shown on the face of the instrument.

A two-month roll of record paper is used, which can be supplied with ink ribbon to make a dotted ink record, or the record can be made on coated paper. It is necessary to wind the clock once a week. In Fig. 1 is shown the complete instrument with a ten-hour record on the chart. One scale is placed above the record so that the indications are clearly visible at all times, and the paper has the scale printed on it for direct reading. In Fig. 2 the instrument is shown with the door open, and the interior construction can be clearly seen. This case need be opened once every two months only to renew the roll of paper.

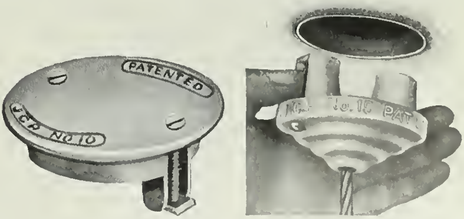
Such a continuous recording instrument, it is pointed out, will prove advantageous for use as an electric pyrometer in conjunction with thermocouples, or as a resistance thermometer for measuring low temperatures, and also for recording voltages or currents. As the d'Arsonval type of direct-current instrument of the frictionless type is used to prevent lag in the readings, a very sensitive and accurate instrument is secured.



CONTINUOUS RECORDING INSTRUMENT

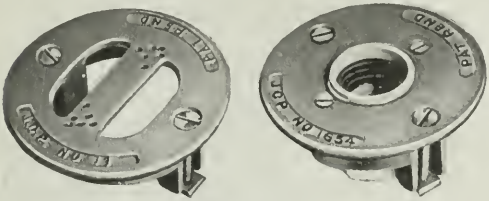
Outlet-Box Fittings

Fittings that can be readily attached to ordinary outlet-box covers, when plastered in the ceiling, without breaking the plaster have been designed and put on the market by Mr. James C. Phelps, Springfield, Mass. Each of the devices is attached to the cover by two stove bolts, the nuts of which work in channels extending into the box. The lower ends of the channels are inclined backward toward the center of the fitting and allow the nuts to be held in with the thumb and finger while inserting the fitting into the box, as shown in Fig. 2. When the screws are tightened up the nuts ride out on the inclined places in the channels and engage the inner edges of the box cover, thus fastening the device securely to the box.



FIGS. 1 AND 2—IRON COVER, AND METHOD OF INSERTING ROSETTE FITTING

Fig. 1 illustrates an iron cover for closing an outlet box not in use. Fig. 2 shows a rosette made of white-glazed porcelain for attaching a pendent cord to an open outlet-box cover plastered into the ceiling. In Fig. 3 is shown a galvanized-iron cover which is drilled for taking surface switches, wall sockets, etc. The cover shown in Fig. 4 is fitted with a flush receptacle and is made of galvanized iron.

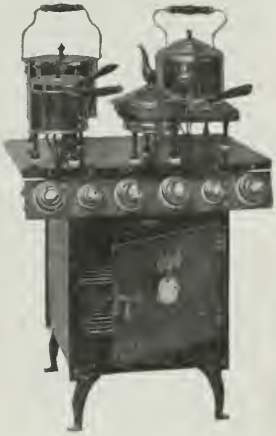


FIGS. 3 AND 4—COVER FOR SWITCHES AND SOCKETS, AND COVER WITH FLUSH RECEPTACLE

Electric Range

The Simplex Electric Heating Company, Cambridge, Mass., is manufacturing a number of different types of ranges in sizes suitable for families of from two to ten persons. The range shown in the illustration has a top 21.5 in. wide and 27.5 in. long, and when full heat is turned on the total power consumption is 4515 watts. Raised above the top surface about 3 in. (to allow for cleaning) are three disk stoves, two of them 6 in. in diameter and one 8 in. in diameter, for large and small cooking utensils, and also a broiler with a removable griddle top.

The disk stoves, the broiler and the oven are each heated separately, and the temperature is controlled in three degrees (high, medium and low) by switches clearly marked and easy of access on the front of the range. The broiler has a corrugated top, slanting slightly toward a grooved end, which receives the juices from the meat. There are no odors or gases from combustion absorbed in the meat, as in broiling with a flame. A separate smooth top fits on the broiler for making griddlecakes, toast, etc. The oven has double walls interlined with asbestos which confine the heat. It is heated from both top and bottom, and the desired temperature is distributed evenly throughout.

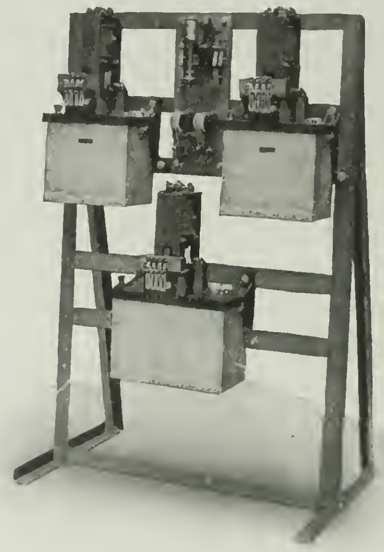


ELECTRIC RANGE

The utensils provided with each range have a "lock-on" device for perfect heating contact. They are made of heavy nickel-plated copper and include a blazer, a double boiler (porcelain food vessel), a vegetable boiler and a teakettle.

Automatic Starting Apparatus for High-Voltage Motors

Motors operating at high voltages are frequently desirable in large industrial plants, and for driving centrifugal pumps and similar machines 1100-volt and 2200-volt squirrel-cage motors are being used to a considerable extent. To make the starting of these motors easy and eliminate the danger of hand control the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has put on the market a new line of high-tension self-starters. These controllers, one of which is shown in the accompanying illustration, are of the multiple-solenoid type, and each consists of an angle-iron, floor-type, self-supporting frame, which carries the high-tension oil-immersed solenoid switches and the necessary relays for controlling the motor and auto-transformer circuits.



AUTOMATIC STARTER FOR HIGH-VOLTAGE MOTORS

The oil-immersed primary and starting switches are operated by single-phase solenoids. All contacts are entirely immersed in oil so that no live parts carrying high voltages are exposed. Low-voltage energy is used for the operation of the solenoid coils. The ratings of the standard types of these self-starters range from 20 hp to 300 hp, and the devices are made for both twenty-five-cycle and sixty-cycle, three-phase circuits. They can be automatically controlled when operating on an open-tank system by means of a float switch, and on a closed or compression-tank system by means of a gage or diaphragm pressure regulator. For remote control from one or more points control stations can be employed so that the operator need only push a button to start or stop the motor.

Jobber, Dealer and Contractor

Looking Forward to a Good Year

Mr. W. W. Low, of Chicago, president of the Electric Appliance Company, is a shrewd observer of the trend of electrical business, and a man whose wide acquaintance and long and practical experience give weight to his opinion on the outlook in the electrical supply business. In the course of a recent conversation with a representative of the *Electrical World*, Mr. Low said that he thought that the year 1914 would be a good one for the electrical jobbing business. However, at the present time the purchasers of electrical supplies are buying only from hand to mouth. The volume of orders now being handled by the electrical jobbers is very large, but it is a noticeable fact that the average amount involved in each order is unusually small. Thus, while the jobbers, judging by Mr. Low's experience, are very busy—being rushed with business, in fact—the cost of doing the business is proportionately very high. However, Mr. Low is confident that normal conditions will be restored later in the year and that it may be expected that the size of individual orders placed by contractors, central stations and others will be increased as returning confidence supplants the somewhat unsettled conditions of the winter.

St. Louis Company Guarantees Work of Electrical Contractors

With the inauguration of its latest wiring contract for already-built houses, the Union Electric Light & Power Company of St. Louis, Mo., is guaranteeing the work of the electrical contractors who wire buildings for it. In the contract covering this work the price of the first item carries the entire overhead cost. Should the prospective customer contend that he does not wish all of the outlets in the first item, he is informed that the cost will be $17.95 whether all of the outlets are installed or not. The result is that all of the outlets are installed and the use of appliances is thus stimulated. The price schedule for wiring houses follows:

PRICE SCHEDULE FOR WIRING ALREADY-BUILT HOUSES*

One outlet in each of any two rooms on one floor, and in addition thereto one baseboard or wall outlet equipped with receptacle for electrical appliance attachment, ready for service connection	$17.95
One additional outlet on next floor	7.00
Each additional outlet on same floor with other outlets	2.00
Each switch outlet with flush wall switch (single pole)	3.00
Each two-circuit switch outlet with electrolier switch	4.50
Each switch outlet with flush wall switch (combination three-way)	4.00
Each additional baseboard or wall outlet with receptacle for electrical appliance attachment	3.75
One outlet in basement with switch on first floor (including flush switch)	5.00
One outlet in basement of second-floor apartment with switch on second floor (including flush switch)	10.00
Each additional basement outlet on same switch	1.00
Each drop cord with socket	1.00
Each pendent switch	1.00
Additional charge for wiring where there are double floors—per ceiling or floor outlet	2.00

*Does not cover outlets in brick walls or lamps.

Formerly the company in co-operating with the contractors in the city gave each a job in turn. Now the policy is to give each contractor in turn $100 worth of business regardless of whether it is made up of one or several jobs. In this way the company hopes to distribute the work more equitably among the various contractors. In case a contractor receiving work from the new-business department of the company has no credit or responsibility, the central station requires him to furnish a bond in order that it shall not suffer loss should his work on its contracts fail to give satisfaction. Mr. F. D. Beardslee, sales manager of the Union Electric Light & Power Company, states that the contractors are all well pleased with the schedule as well as with the other terms of the agreement.

Iowa Contractors Organize

The Iowa Electrical Contractors' Association was formed at a meeting held in Waterloo on Feb. 2. Mr. W. C. McCarten was elected president and Mr. M. T Humphrey, of Waterloo, secretary. Twenty-six contractors became charter members. The next meeting will be held in Cedar Rapids on April 21.

Co-operation Between Contractors, Dealers and Central Station in Dayton

The Dayton (Ohio) Power & Light Company so thoroughly believes in co-operation between the electrical contractors, district representatives of manufacturers of electrical apparatus and the central station that it has arranged to hold dinners and meetings at least once every three months throughout the year, when all can get together, talk over the business that has been secured and plan for the future. The first of these dinners was held at the Phillips House in Dayton last month, and about thirty attended as guests of the Dayton Power & Light Company. Mr. Thomas F. Kelly, sales manager of the Dayton Power & Light Company, acted as chairman of the meeting which followed and told of the very successful year that the company had enjoyed in spite of the flood. He reported that the company had made an increase of 36 per cent in customers during 1913, which was an increase of 73 per cent over the 1912 increase. Predictions of a still greater increase for 1914 were made because of the arrangement that has just been completed with the electrical contractors whereby old homes can be equipped for electricity and payment made in monthly instalments. Many complimentary remarks were made by those present concerning the efforts put forth by the lighting company during the past year to further the interests of those engaged in the electrical industry in Dayton and vicinity.

Qualifications of the Electrical Contractor

Speaking for the electrical contractor at the dinner given by the Edison Electric Illuminating Company of Brooklyn on Feb. 7, Mr. Louis Kalischer, president of the Electrical Contractors' Association of Long Island, said that of the central station, the manufacturer, the supply house, the consulting engineer and the contractor, the latter is the only one brought into direct contact with each of the others as well as with the most important individual of all, the customer. Moreover, the contractor must possess a number of accomplishments. He is expected to know all forms of the lighting company's contracts and the service available in all parts of the city. He must be familiar with every device and appliance on the market (one large New York company manufactures over 57,000 devices alone) and must know where to get the material best suited for the work at the right price. He must also be familiar with all of the Underwriters' or the city department's requirements, and sometimes must divine the interpretations of the rules by individual inspectors. A good knowledge of building construction must be his. He must be able to size up workmen and at times know what the customer will need for future expansion.

In addition to the above, the electrical contractor must be equipped with a complete set of measuring instruments, in order to be able to make accurate tests on engines, generators, motors, etc., locate troubles and give advice. If he is awarded the contract, he must back his judgment with his own money as to the cost of labor and material to do the work, follow at times an ambiguous specification, and if possible complete the job to the entire satisfaction of all parties concerned. The electrical contractor is thus the shock absorber of the electrical business. From the time he spends his first money estimating on the job until he puts the final payment in the bank he has been hard at it.

Competition Between Dealer, Contractor and Central Station

By C. L. Eidlitz

Early methods of electrical merchandising were limited in effectiveness because the stock then handled consisted of only standard supplies and fittings which could not be made features of new-business campaigns. Now, when every opportunity is afforded to make the electric-supply store and show windows attractive with displays of household devices, ornamental fixtures, etc., the dealers are handicapped by the central-station companies selling supplies at prices which permit of no competition. It was logical for the electric-service companies to sell supplies at wholesale and even give them away when electricity was first being introduced and a struggle was being made to supplant gas. But now, in fairness to the contractors and dealers whose legitimate business it is to sell supplies, it seems that central-station companies should limit their field of business to supplying energy only.

When the electrical business was first being built up central-station companies maintained large business-promoting staffs and paid attractive commissions in addition to salaries to members of the staff for every energy contract secured. Houses were even wired for nothing to induce people to use electric service. A considerable portion of the burden of securing new business was taken off the central stations when electrical contractors sprang into existence, as the latter were necessarily compelled to connect the buildings which they wired onto the electric-service company's distributing system. For this service the contractor received no recompense from the central-station company, even though it was enabled to reduce its business promotion expenses thereby.

The Contractor Shut Out from Legitimate Business

Instead of the contractor being allowed to furnish all of the apparatus and supplies which might be required in buildings wired by him, as time passed on the central stations and wholesale supply dealers quoted such low prices on supplies that the contractor became unable to make a profit on what is his legitimate business. If this condition did not exist, a contractor might have a lifelong customer in the person whose building was wired and build up an electrical supply business which would bring him a nice profit without inflicting a hardship on anyone.

Since the price of tungsten lamps is decreasing and their life increasing, lamp renewals are no longer a factor in securing or holding central-station business, so that electric-service companies might as well stop the practice and allow dealers and contractors to profit by the sale of lamps. By doing this the electric-service companies would be able to eliminate the lamp-renewal department, cutting down overhead charges, labor expense, etc., and devoting such savings to a reduction in rates.

If there were a profit in selling electrical devices and supplies (and there isn't in cities where they are sold at wholesale or below cost), contractors and dealers would have an incentive to do campaigning, and electrical apparatus would be given as widespread distribution by them as central stations are now giving it. There should be co-operation between the central stations and dealers, the former introducing new apparatus and informing the public where their nearest supply dealer is stationed, and the latter supplying the goods.

A Trade Divided Against Itself

Electrical merchandising can be extended to include the selling of a contractor's services. As the Underwriters' stamp must be on all wire and conduit installed in buildings, there is little difference in the quality of material which a good and an inferior contractor can furnish. The superiority of one contractor over another consists in the method of installing the apparatus. Every contractor should be compelled to qualify himself before inspection is allowed on his work. The work done by contractors could be relied on more than it is at present if "pawnbroking" of electrical contracts by the petty contractors could be prevented.

Cases have arisen where competent contractors have been deliberately underbid by some inferior contractor who knew that the work could not be accomplished according to specifications at the sum quoted by him. Being the lowest bidder, however, he generally secures the contract and then assigns it to a supply house, with the agreement that the latter shall pay him in instalments for supervising the work. Not always being acquainted with the job or the fact that the contractor has underestimated the cost of doing the work, the supply house and the party letting the contract are made the "goats" of the deal. The low-bidding contractor starts the work in apparent good faith and after receiving several payments which are in excess of the value of the work done he finally declares that more than the sum contracted for must be paid before the work can be finished. If the contractor fails to receive the additional amount, he usually disappears, leaving the supply house to face the task of completing the job at a loss.

Contractors would also have a better basis on which to make estimates on work if a more strenuous attempt were made to prevent the sale of stolen goods to contractors. If all contractors were to buy direct from the supply houses and ignore the ridiculously low offers made by some transient salesmen on electrical supplies, the "fences" could soon be put out of existence. As things exist now, some contractors are able to make extremely low bids on electrical work as they make a practice of buying from these "fences." Supply houses could also avoid considerable losses if a detective was sent to watch goods when they are delivered if there is doubt as to the identity of the party receiving them. Often when a mysterious order is received by telephone the supply house will refuse to deliver the goods. Many of the "fences" would be discouraged and frightened out of continuing their illegitimate practice, however, if the goods were delivered and a detective hired to follow the goods and learn how they are disposed of. These illegitimate methods of conducting a business are responsible for a great share of the unsuccessful attempts to conduct business on a legitimate basis.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Mercury Mine in Nevada to Be Electrically Operated.—The Westinghouse Electric & Manufacturing Company reports the receipt of an order from the Nevada Cinnabar Company, Ione, Nev., for electrical equipment consisting of a 50-kva generator and motors for operating pumps, crusher, elevator and fans. This is the first electrically driven mercury mine in Nevada.

President Herr of the Westinghouse Company Optimistic.—Reports from Pittsburgh credit E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, with the expression, in a recent interview, of some very optimistic sentiments anent the present industrial condition of the country. He thinks that the business depression which started last fall is fast vanishing and that everything indicates a slow but steady and permanent improvement. This seems to be a very general opinion among the leading men in the electrical as well as other industries.

Electric Drive in a Kentucky Tannery.—After using steam power exclusively for over half a century in some cases, the leather-working concerns of Louisville, Ky., are giving careful attention to the question of electric drive at the present time. William Schuff & Company, tanners, have just completed the erection of a four-story reinforced-concrete building to be used for their cutting operations. The company employs steam power in its tannery proper, but, instead of providing for similar operation in the new plant, arrangements have been made to drive the cutting machines with electricity, General Electric motors being installed. Central-station energy is supplied by the Louisville Gas & Electric Company, which is taking up actively the extension of its service among the industries within its territory.

American Engineers Secured for Large Canadian Development.—Announcement has just been made by Sir William Mackenzie of plans for the development of a large hydroelectric power site on property of the Winnipeg (Manitoba) Electric Railway near that city. Plans for an immediate installation to deliver 40,000 hp are to be drawn up, and the ultimate capacity of the site is estimated at over 100,000 hp. The energy will be used for traction, lighting and industrial drive. In 1904 the Winnipeg Electric Railway was incorporated as a consolidation of the Winnipeg Electric Street Railway and the Winnipeg General Power Company, and it now controls the Winnipeg, Selkirk & Lake Winnipeg Railway and the Suburban Rapid Transit Company. Its present generating capacity is 50,000 hp, of which 30,000 hp is generated at the hydroelectric plant at Pinawa Channel, Winnipeg River. The authorized capital stock of the company is $10,000,000, of which $9,000,000 is outstanding. The exploration, surveys, designs, plans and estimates for the new plant will be made by the J. G. White Engineering Corporation, of 43 Exchange Place, New York City.

South American Customs Concerning Foreign Business Representatives.—In view of the rapidly increased interest being shown by American business enterprises in the possibilities for foreign trade with the countries in South America, it may be of some benefit to outline the results of a recent government investigation into the customs and policies of these countries, with regard to the activities of foreign business representatives within their several boundaries. In most of these countries there is a tax levied on all business enterprises, and in order to put the importer on the same competitive basis his commercial representative is also taxed. Ordinarily the tax may be annulled if the agent associates himself with some local firm, through which goods will be booked and delivered. Usually samples are admitted free of duty for a temporary period, but the practice varies. In some places a deposit equal to the duty charge must be made on entry and is refunded on re-exportation, and in other places a bond executed with satisfactory securities is sufficient. Samples of no intrinsic value are admitted duty free in practically every country. In many cases it is advisable that the traveling representative hold power of attorney from his firm. The first thing that a commercial agent should do, in nearly every case, is to get in touch with the American consul as soon as possible after his arrival in any South American country.

Present Rate of Business of the General Electric Company.—Sales of the General Electric Company for the first few weeks of the present year have been at the rate of about $80,000,000 per annum, or approximately 75 per cent of the average rate for 1913. This represents a larger decline from the figures for the corresponding period of last year. At the present time the mainstay of the company is its business in small apparatus and supplies. The present working force is more likely to be decreased than increased, and a high official stated that the first six months of 1914 will show less than normal activity. The final report for the past year has not yet appeared, but the closest estimates, checked by the opinions of the executives of the company, place last year's business at $105,000,000 sales billed out and $111,000,000 orders booked. It is expected that the 1913 earnings on the $101,369,600 outstanding stock will amount to about 16 per cent, the same percentage earned during 1912 on a capitalization of $77,764,700. For a long period the company's sales have been growing at a rate which has made necessary steady additions to its plant capacity. Expenditures for this purpose during the last two years have been between $8,000,000 and $10,000,000, and it is considered unlikely that this program of expansion of production facilities can be materially curtailed without seriously affecting the ability of the company to handle the business anticipated for 1915. The copper consumption of the General Electric Company during 1913 was in the neighborhood of 75,000,000 lb., representing an increase of about 10,000,000 lb. over the figures for 1912.

An Efficient Method for Supervising Production.—In a large industrial plant recently visited by an *Electrical World* representative several features of particular merit were observed in connection with the system used for pushing production. This company manufactures large power station apparatus, of a kind which calls for special designs on a big percentage of its output, and the stock parts are only the small pieces which can be standard in a wide variety of product. The production order system used is similar to that in use by the better class of factory generally, and is made to include everything down to the smallest stock parts. The point of special merit in this plant, however—and one which is believed to be distinctive—is that as soon as the order for a piece of apparatus has passed the business or order department it goes to the shipping department, on which is placed the full responsibility for its proper progress through the shops and its completion on the contract shipping date. The shipping department is the one which naturally bears the burden of criticism in case of delay, and this placing of responsibility with it for the whole production operation is the best possible arrangement. The fruits of the system are proved best by a trip through the shops. There is a regular path along which the product travels from raw material to finished apparatus. Except in cases of very special work, the material enters regularly at a given point, passes in regular order from tool to tool and leaves each shop at a regular point. Inspection of the product in its several stages is made very easy under this system. The product travels along the shortest possible path and receives the minimum of handling possible, and it is possible to tell exactly where a given job stands at all times. The above system also lends itself most easily to intensive cost keeping, and that part of the operation of the plant in question has been worked out to a very fine point. The kernel of this whole system is the placing of responsibility for the entire production operation in one place, and in the right place, with the department which performs the final act of shipping the product to the purchaser.

An American Engineer's Views on European Conditions in the Electrical Industry.—In an interview with an *Electrical World* representative, Theodore Stave, of 30 Church Street, New York City, who recently returned from an eight months' trip to England and the Continent, spent in an investigation of the latest electrical developments abroad, stated that he had observed as great industrial activity in Europe as in the United States, and that both foreign and domestic practices in electrical matters seem to be progressing toward common standards. The "safety first" movement, he thinks, is the biggest one in both continents at the present time. He stated that there is a field abroad for some classes of American electrical goods, particularly those where the competition is on design or quality rather than on price, as in the latter consideration the article of home manufacture has a decided advantage. In the opinion of Mr. Stave, the interest shown abroad—especially in Germany—in the question of improved illumination, both interior and exterior, is as great as or possibly greater than that shown in this country. He said that the nitrogen-filled tungsten lamp has been eagerly taken up there, and that these lamps are rapidly coming into common use in the streets of Berlin. Their use in interior illumination work of the indirect or semi-indirect class seems to be advocated there also to some extent. Touching on some of the projects of electrical interest abroad at this time, Mr. Stave stated that plans are on foot for the electrification of the elevated and surface railroad lines in Berlin, a move which will call for the expenditure of about 60,000,000 marks and will be participated in by both the city and state. Another big move which is pending is the building of a generating station of unusual size in the coal district near Berlin, from which that city will draw a large part of its electrical energy supply. The negotiations for this project are now going on. According to Mr. Stave, some of the finest hydroelectric development work in the world has been done in the district around Milan, Italy. Generating stations of large capacity have been constructed there and are supplying a big part of the power for the silk mills in the district and for electric traction purposes. He said that high-tension alternating-current railway operation has reached an advanced stage of development in Italy, Switzerland and Germany, and he spoke of the recently completed Loetschberg line as one of the finest pieces of electrical engineering in existence. While abroad Mr. Stave was on the look-out for new ideas and devices that would prove adaptable in this country, and he is now preparing to introduce some special electrical apparatus new to the American trade.

Industrial Opportunities in the Pacific Northwest.—The following extract from a recent statement by W. E. Herring, industrial agent of the Puget Sound Traction, Light & Power Company, contains much of interest to the electrical industry. He said in part: "That the opening of the Panama Canal will mean a great influx of Europeans to the entire Pacific Coast, and particularly to the Pacific Northwest, is now conceded by every person who has given the matter any thought. This will result in more completely fulfilling one of the conditions which is essential to industrial preeminence and will be one large factor in promoting the industrial growth of this region. Accompanying the influx of labor will be the usual large increase in the population, drawn, for the most part, from other portions of the United States. Such a condition naturally means a much larger market for all products, and coupled with the existing demand must necessarily mean that many of the articles manufactured in the East and Middle West and shipped here by rail will be more economically manufactured on the ground. With an enormous supply of the raw materials needed in many of the industries, with a market extending over the entire Pacific Coast States—having a population at present of more than 4,500,000—and with the Orient and Hawaii as an additional market, there can be no question that the number of manufacturing concerns will rapidly increase. The four essentials for industrial success are a market for the product, the raw materials needed in its manufacture, labor and transportation, and, to a smaller extent, cheap power may be added. In addition to possessing the other requisites, the Pacific Northwest has the advantage over other parts of the country in having cheap power. This is occasioned by the fact that the streams on the west side of the Cascade Mountains have a rapid fall in their short length; the precipitation is heavy, and a natural storage reservoir is afforded in the enormous snow fields and glaciers. This means that the streams can be harnessed and electrical energy delivered at low cost. The developments so far made on the various streams are but a small portion of the potential energy in them. Much has been said of the enormous power resources of the Pacific Northwest, but little thught has been given to the use that could be made of the power when developed. Heretofore the market was the secondary consideration, for the simple reason that there was a continual demand for additional power. Since the present markets, however, have been saturated, it is necessary that the additional uses for power be found before any new developments will be made. There is at present in the Puget Sound region available for immediate delivery by the Puget Sound Traction, Light & Power Company approximately 40,000 hp out of its total of 140,000 hp. Before this amount of power is absorbed additional steps will be taken to increase the capacities of some of the present operating plants or to construct new plants to meet the demand. The Puget Sound region of the Pacific Northwest is at present supplied with electrical energy for both light and power purposes by the above-mentioned company from four hydraulic plants and six steam plants, with a total one-hour actual operating capacity in the water-power plants of 98,000 hp and a total capacity in the steam plants of 41,233 hp, making a total of 139,233 hp. The territory served by these plants extends from Tacoma on the south to the British Columbia line on the north. The rate for residence lighting in the city of Seattle is 6 cents per kw-hr. for the first 60 kw-hr. and 4 cents for all over that amount, with a monthly minimum of 50 cents. The rates for motor service are as low as can be had anywhere in the United States, with the possible exception of the Niagara Falls district. The rate given depends upon the amount of power used, the manner in which it is used and the particular location of the plant in question. These rates vary from a little less than $20 per hp a year, to large users of continuous power, upward. The Puget Sound Traction, Light & Power Company has established an industrial department for the sole purpose of getting in touch with Eastern manufacturers, calling their attention to the possibilities existing here, furnishing any and all kinds of information in regard to markets, transportation, labor, raw materials, power and any other essentials needed in their particular line, with the idea of eventually attracting these manufacturers to this part of the country."

NEW YORK METAL MARKET PRICES

	Feb. 9		Feb 17	
Copper	Bid	Asked	Bid	Asked
Standard spot*	....	14.75	14.12½	14.50
	Selling Prices		Selling Prices	
	£ s. d.		£ s d	
London, standard, spot*	65 0 0		65 2 6	
Prime Lake	14.87½	to 15.12½	14.87½	to 15.12½
Electrolytic	14.65	to 14.75	14.60	to 14.70
Casting	14.45	to 14.55	14.40	to 14.50
Copper wire base.	15.87½	to 16.00	15.75	to 16.00
Lead	4.15		4.00	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.25		7.25	
Spelter, spot	5.45	to 5.47½	5.40	to 5.45
Tin, spot	40.12½	to 40.50	39.65	to 39.85
Aluminum:				
Prompt delivery	18.75	to 19.00	18.75	to 19.00
Future	18.50	to 18.75	18.50	to 18.75

*OLD METALS

Heavy copper and wire	13.75	13.75
Brass, heavy	8.87½	8.87½
Brass, light	7.87½	7.87½
Lead, heavy	4.05	4.05
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to Feb. 17. 21,434

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*From daily transactions on the New York Metal Exchange

Corporate and Financial

Initial Dividend Declared on Central States Electric Common Stock.—The directors of the Central States Electric Corporation recently declared an initial quarterly dividend of 1 per cent on the $5,451,900 common stock of the company, putting it on a 4 per cent per annum basis. This company controls the Cleveland Electric Illuminating Company through ownership of about 75 per cent of the common stock of the latter.

Suit to Prevent Unified Operation of Surface Street-Railway Lines in Chicago.—Attorneys representing Clarence H. Venner, of New York, have brought suit in the United States District Court in Chicago against the city of Chicago, the Chicago City Railway Company, the Chicago Railways Company and others, seeking to prevent the carrying out of the ordinance providing for the unified operation of the surface traction lines of Chicago. It is asserted in the bill filed for Mr. Venner that he is the holder of $40,000 worth of stock in the Chicago City Railway Company and that his rights as a stockholder will be placed in danger if the unified-operation plan is carried out.

Oragnization Change in the Electric Properties Corporation.—Announcement has been made of the resignation of A. L. Kramer from the vice-presidency of the Equitable Trust Company, in order to accept the presidency of the Electric Properties Corporation of New York, succeeding J. F. Wallace, who has resigned that position in order to devote more time to the affairs of Westinghouse, Church, Kerr & Company, of which he is president. The entire stock of the latter concern is owned by the Electric Properties Corporation, which was organized in 1906 for the purpose of managing and financing public utility properties, and bears much the same relation to the Westinghouse interests that the Electric Bond & Share and the Electrical Securities companies bear to the General Electric interests. Among the directors of the Electric Properties Company are A. W. Krech, G. E. Tripp, George Westinghouse, J. F. Wallace, F. Q. Brown, P. D. Cravath, and H. R. Hayes.

Atlantic Gas & Electric Company Prospering.—The report presented by President A. D. Lord to the security holders of the Atlantic Gas & Electric Company on Feb. 14, covering the last quarter of the year ended Dec. 31, 1913, contains information of general interest. During this period a 2000-kw General Electric turbo-generator was installed at the plant of the Binghamton (N. Y.) Light, Heat & Power Company, doubling the rating of that station and increasing its operating efficiency. Within the present year another unit of equal size is expected to be installed in this plant. The Dock Street station at Easton, Pa., is being completely overhauled and two 5000-kw generating units are being installed, together with the necessary auxiliary equipment. At Boonton, N. J., the present plant is being overhauled and a new station is in process of construction. The gross earnings of the company for the fiscal year 1913 were $1,126,254, and, with the completion of the above construction program, it is expected that even greater attention can be given to the expanding of the company's service, producing a corresponding increase in gross and net earnings.

Pennsylvania Utility Declares First Dividend on Common.—An initial quarterly dividend of 1 per cent has been declared on the outstanding common stock of the Pennsylvania Water & Power Company, payable Apr. 1. According to the report of J. E. Aldred, president of the company, covering the fiscal year ended Dec. 31, the gross income for that period was $826,815 and the net earnings amounted to $709,767. For the same period a surplus of $302,663 was realized. In the Nov. 1, 1913, issue of the *Electrical World* note was made of the installation by this company, at its Holtwood (Pa.) plant, of a 16,000-hp generating unit, and the same item gave an idea of the recent growth of the concern. It is now understood that another generating unit of the same size as the above mentioned is to be installed shortly. At the Baltimore (Md.) substation a seventh transformer of 10,000-kw rating will also be installed in the near future. A duplicate transmission line is to be built to handle the large and growing Baltimore load and it is estimated that the saving in resistance losses will be sufficiently large to finance the new construction, costing in the neighborhood of $400,000.

Insull Emphasizes Value of Selling Efficiency.—Speaking recently on the question of the factors affecting the values of public securities, Samuel Insull, president of the Commonwealth Edison Company of Chicago, and one of the leading operating men of the day, expressed the opinion that the factor of primary importance in the growth of an operating electrical property is the efficiency of its selling force. This, he said, has more real bearing on the prosperity of the enterprise than the replacement value of either the generating or the distribution system. As between first-class construction work on a station and first-class sales engineering in pushing its business, he said that the latter is by far the more desirable and the harder to obtain. This statement, by a man of such signal attainments in the field in question, should carry great weight, and at a time when the public utility security seems to be in particular favor with the investing public it comes with special emphasis as an aid to the wise selection of the strongest securities.

Employees Benefit Under Columbus Merger.—Following the completion of the public utility merger in Columbus, Ohio, the announcement has been made of an increase in the wage scale of the Columbus Railway, Power & Light Company, a change which affects 700 employees and will increase the pay roll $32,000 per year. The company also placed in effect a pension and death benefit plan by which members will pay an entrance fee of $1 and dues of 50 cents a month, the company to add to this 50 per cent of amounts paid by the men each month and also to pay all expenses of operation of the pension system. Sick benefits of $1 a day will be paid and $150 funeral expenses. Without assistance from the beneficial association the company also agrees to pay a death benefit of $500 to actual dependents of an employee who has been with the company more than two years and has been receiving less than $200 a month salary. After service of twenty-five years an employee may retire at the age of sixty-five years and receive a pension of $30 a month.

Financing of Telephone Expansion.—The annual report of President B. E. Sunny of the Chicago Telephone Company for the year 1913 shows that the total number of telephones connected to the company's exchanges at the close of the year was 430,812. Six years ago the number of telephones connected was less than half of the present number. The increase in the number of telephones in Chicago continues to be largely for the low-priced service. In 1913 the number of telephone stations increased 48,275. About $6,000,000 of new capital will be required in 1914 to care for new subscribers. The rapid growth not only means the addition of new plant but also involves the replacement of existing plant, in some instances long before it has had a normal life. Mr. Sunny makes some interesting observations on this point, substantially as follows: "While the replacement has been in the past largely with reference to outside plant, the removal of poles and wires and the substitution of aerial or underground cables, and the substitution of larger cables for smaller ones, we are in a condition now where several exchanges in the city, including the land, buildings, switchboards and other equipment, must be abandoned. The salvage value of these exchanges will be small, but new and larger exchanges must be provided. Not only are exchanges outgrown, but the wire center shifts. Exchanges located ten years ago, or even more recently, at what were then the wire centers of the districts to be served, are now found to be from half a mile to a mile or more from the present or prospective centers, owing to new telephones installed. Because of the heavy expense for conduits and cables, the necessity of having exchanges centrally situated will he readily appreciated. The exchanges of recent years have been constructed with reference to a continuing large growth. Larger parcels of ground have been bought and buildings and switchboards provided in such manner that additions can be made readily and effectively." The 430,000 telephones of the company are used on an average seven times a day for outgoing calls. The gross earnings for 1913 were $16,274,602, compared with $14.538,399 in 1912. Other figures from the earnings statement for 1913 are as follows: Operation expenses, $6,620,413; current maintenance, $2,581,391; depreciation, $2,608,530; taxes, $858,300. Deducting the sum of these items leaves $3,605,968 as the net earnings for the year. From this was paid bond interest and 8 per cent dividends on $27,000,000 of capital stock.

Business Notes

Horace M. McCord & Company, with headquarters at 433 Lumber Exchange, Minneapolis, Minn., have taken over the business of manufacturing electrical specialties formerly conducted by H. M. McCord.

The Falkenbach Manufacturing Company, manufacturer of wood-fiber composition lighting fixtures, has moved its headquarters from 103 Park Avenue to 159 East Fifty-fourth Street, New York City.

Fairbanks, Morse & Company have recently made organization changes by which A. C. Browne, who has been in charge of the electrical department of the New York office during the past year, has been transferred to a similar position in the Baltimore branch office.

Meikleham & Dinsmore, bankers, 25 Broad Street, New York, have just opened a Pittsburgh office, under the direction of F. S. Carmack, with whom are associated A. S. Everest, H. L. McVicker, W. R. Crawford and David Stewart. N. P. Hall was recently appointed representative of the firm in western New York, with offices at 72 Pearl Street, Buffalo, N. Y.

The Oshkosh Manufacturing Company, of Oshkosh, Wis., has appointed the Union Electric Company, of Pittsburgh, Pa., as its Pittsburgh agent and has arranged for that company to carry a large and representative stock of its construction tools and specialties, ready for prompt shipments. Arrangements have been made so that the Eastern jobbers can use this stock to advantage.

Horace F. Bowser, lighting specialist, of 489 Fifth Avenue, New York City, has announced the addition of a "residence lighting" department to supplement the commercial lighting business established by him in the latter part of October, 1913. Mr. Bowser aims to act directly between the manufacturer and the purchaser on all apparatus and fixtures necessary for lighting installations and, by combining art with engineering, to secure the best results possible in lighting effects and fixtures.

New Industrial Companies

The Autophone Company of New England, of Boston, Mass., has been incorporated with a capital stock of $600,000 by E. B. Lyman and C. H. Knapp, of Brookline, Mass.

The Mercer Gas & Electric Fixture Company, of Trenton, N. J., has been chartered with a capital stock of $25,000 to manufacture gas and electric fixtures. The incorporators are R. H. Rue, H. O. Bruner and C. L. Snedeker, of Trenton.

The Ellington Electric Company, of Quincy, Ill., has been granted a capital stock of $1500 to manufacture and deal in electrical apparatus, appliances, etc. The incorporators are Lawrence M. Persons, W. Collins Morris and J. R. Williams.

The Salom Electric Storage Battery Corporation has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $830,000 and proposes to manufacture batteries, electrical appliances, etc. The incorporators are H. E. Latter, W. J. Maloney and O. J. Richard, of Wilmington.

The Lighthouse Electric Company, of Toledo, Ohio, has been incorporated with a capital stock of $10,000 to handle electrical supplies. The company proposes to operate a chain of ten stores in Ohio, including one at 243 Michigan Street, Toledo; one each in Dayton, Columbus and Lima, and two each in Cleveland and Cincinnati. The incorporators are Samuel L. Allen, Frank H. Farnsworth, George M. Frink, Stephen M. Hegel and George F. Beatty.

The American Electric Car Company, of Saginaw, Mich., has been organized with a capital stock of $1,250,000. The company is a consolidation of the Argo Electric Company, of Saginaw, the Broc Electric Company, of Cleveland, Ohio, and the Borland-Grannis Company, of Chicago, Ill. The headquarters and plants of the company will be in Saginaw. C. W. Brand, president of the Broc Electric Company, is president, and Theodore Huss, of Saginaw, is secretary and treasurer.

Trade Publications

Insulators.—Drawn-steel-pipe insulators are described and illustrated in a leaflet published by the Wirt Company, Philadelphia, Pa.

Generating Sets.—The generating sets made by Engberg's Electric & Mechanical Works, St. Joseph, Mich., are illustrated on blotters being distributed by the company.

Switches.—Bulletin 800 of the Pacific Electric Manufacturing Company, San Francisco, Cal., briefly describes and shows diagrammatically the company's weatherproof oil switch.

Motors and Motor Appliances.—Bulletin No. 15-A of the Menominee Electric Manufacturing Company, Menominee, Mich., contains the net prices to the trade on its power motors and motor appliances.

Electric Stoves.—A folder recently issued by the Hotpoint Electric Heating Company, Ontario, Cal., refers to its electric range "El Bako" and its disk stove "El Stovo," briefly setting forth their advantages.

Resistance Boxes.—Bulletin No. 476 of the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa., refers to its unit-type Wheatstone bridges and resistance boxes, which are described and illustrated.

Second-Hand Machinery.—The Glow Electric Company, 219 Walnut Street, Cincinnati, Ohio, has issued its Pocket Bargain Sheet No. 11, which contains a long list of "Glow rebuilt" electrical machinery for sale, indexed for easy reference.

Post Grinder.—The Stow Manufacturing Company, Binghamton, N. Y., has issued an illustrated leaflet relating to its tool-post grinder for 110 or 220 volts, sixty cycles, alternating or direct current, and another leaflet referring to its electric bench grinder.

Governors.—"Lombardata I"—a card 5⅝ in. by 7¼ in.—shows an effective illustration of the Mississippi Power Company's plant at Keokuk, one of the "famous plants Lombard-governed." This card is the first of a series being prepared by the Lombard Governor Company, Ashland, Mass.

Terminals.—A catalog recently issued by the Meliorite Manufacturing Company, 290 Taaffe Place, Brooklyn, N. Y., refers to its terminals. These are said to protect the insulation, reduce the ill effects of strains and make perfect contact with the wire at two points without the use of solder.

Lamp Holder.—In an eight-page leaflet issued by the Adjustable Light Holder Manufacturing Company, 416 Penn Avenue, Pittsburgh, Pa., an illustrated description is given of its adjustable lamp holder. With the use of this device a lamp can be easily adjusted to any height or angle from the ceiling to the floor.

Lamps.—The Wallace Novelty Company, 299 Madison Avenue, New York, has issued a folder illustrating and briefly referring to the flexibility of the Wallace electric lamp. This lamp can be hung or stood in any place desired, making it adaptable for all lighting needs in the office and home or when traveling.

Headlamp Device.—An electrically controlled device that enables the driver of an automobile to see the roadway perfectly at night, with the glare from the headlamp eliminated, is the subject of a leaflet issued by the Ward Leonard Electric Company. "Nodaz" installed on a headlamp enables the lamp to be operated at full candle-power in any city street.

Aluminum.—The British Aluminum Company, Ltd., 109 Queen Victoria Street, London, E. C., England, devotes Leaflet No. 130a to an illustration of and brief reference concerning aluminum in the automobile chassis; No. 221a to aluminum netting and gauze; No. 129a to aluminum mandrels for rubber manufacturers, and No. 145 to aluminum insulation for magnet coils.

Ventilating Sets.—The Sturtevant "ready-to-run" ventilating set is the subject of an attractive and readable booklet of twenty-eight pages which tells the story of this apparatus in a concise manner and one readily understood by the layman. Well-selected illustrations embellish the text. These ventilating outfits are made by the B. F. Sturtevant Company, Hyde Park, Mass.

Personal Mention

Mr. Frank J. Duffy, manager of the Southern Railway & Light Company, Natchez, Miss., has been elected chairman of the depositors' committee of the First Natchez Bank.

Mr. B. F. Tucker, formerly superintendent of District T at Taylorville, Ill., for the Central Illinois Public Service Company, has been placed in charge of Districts T and W.

Mr. W. H. Booth, president of the Hot Point Electric Heating Company, Ontario, Cal., sailed for South America on Feb. 7, with his family and a party of friends, for a two months' trip.

Mr. W. M. Stowell, formerly superintendent of District W for the Central Illinois Public Service Company, has been transferred to the company's engineering department at Mattoon, Ill.

Mr. J. B. Crawford, formerly superintendent of District M for the Central Illinois Public Service Company, with headquarters at Mattoon, Ill., has been placed in charge of Districts M and D.

Mr. B. E. Sunny, president of the Chicago Telephone Company and of other Bell telephone companies, has been elected a member of the Chicago City & Connecting Railways collateral trust.

Mr. C. F. Ziegler, president of the Reynolds Electric Flasher Manufacturing Company, Chicago, is making an extended trip through the South and will include Cuba and Panama in his itinerary.

Mr. A. Ludlow Kramer has been elected president of the Electric Properties Company, New York, succeeding Mr. John F. Wallace, resigned. Mr. Kramer was formerly president of the Equitable Trust Company.

Mr. P. T. Glidden, manager of the Consumers' Power Company, of St. Paul, Minn., has been elected president of the Minnesota Electrical Association to succeed Mr. Eugene Holcomb, resigned, owing to removal from the State.

Mr. Mike S. Hart, of Chicago, commercial agent of the Middle West Utilities Company, has been appointed secretary of the rate research committee of the National Electric Light Association, succeeding Mr. William J. Norton.

Mr. William J. Norton has resigned as secretary of the rate research committee of the National Electric Light Association. Mr. Norton still remains a member of the committee and editor of *Rate Research*, the committee's weekly paper.

Mr. Hugo Reisinger, New York City, has accepted the invitation of the Earl of Kintore to become honorary commissioner and chairman of the American fine arts committee for the Anglo-American Exposition to be held in London this summer.

Mr. Edward Schwartz, until recently vice-president for William E. Slaughter & Company, Chicago, and designer of the Schwartz line of electric-heating specialties, has severed his connection with that firm. Mr. Schwartz, who is a native of Austria and who was in earlier life an expert tool maker, has been connected with the Western Electric Company and the Pelouze Manufacturing Company.

Mr. H. S. Whiting has been employed by the Isthmian Canal Commission as illuminating engineer. He will have charge of the designs for all interior and exterior artificial lighting for the permanent buildings of the commission in the Canal Zone, as well as public lighting arrangements at the permanent town sites. Mr. Whiting is a member of the Illuminating Engineering Society and was formerly connected with the Holophane Company.

Mr. George D. Baxter, who was superintendent of the Haverhill (Mass.) Electric Company for thirteen years and is now manager of the Exeter (N. H.) plant of the Tenney Service Association, was the guest of honor at a banquet of the Haverhill Electric Club held in that city on Feb. 3. During the course of the dinner Mr. Baxter was presented with a gold open-face watch engraved with his initials on the outside and inscribed "George D. Baxter, from Employees of the Haverhill Electric Company, 1914," on the inside of the case.

Mr. Harry C. Slemin, sales and advertising manager for the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., has resigned to become advertising manager for the Yawman & Erbe Manufacturing Company, of Rochester, N. Y. Mr. Slemin started in the telephone business in Chicago for the Western Electric Company in 1896. In 1904 he joined the new Stromberg-Carlson organization, which was moved to Rochester, N. Y., where he took charge of the apparatus engineering department. Following the engineering work he was given charge of the lead-covered cable business and foreign sales work and in 1910 was made sales and advertising manager.

Obituary

William Henry Boardman, for many years editor of the *Railroad Gazette*, now the *Railway Age Gazette*, died in Ridgfield, Conn., on Feb. 16. He was born Aug. 3, 1846, in Dixon, Ill. He received the degrees of A.B. and C.E. from the University of Michigan in 1868 and 1869. With the exception of one year, his whole active life was spent in the service of the journal mentioned, which by reason of his guidance reached and maintained the highest of editorial standards in engineering publications.

FRANCIS H. SODEN

Francis H. Soden, one of the pioneer electrical men of Chicago and an employee of Edison in the early days of electric-lighting invention at Menlo Park, died at his home in Chicago on Feb. 14. Mr. Soden was born in Newark, N. J., fifty-five years ago and in his young manhood, following his work with Mr. Edison, he was one of those engaged in the electrical work on the old Pearl Street station in New York City. About 1881 young Soden was sent West for the Edison electric lighting interests. He installed the first electric-lighting plant in Minnesota, at Stillwater, and was also electrical constructor for the famous Appleton (Wis.) plant, the first electric central station in the world. Soon after this he went to Chicago, where he lived for the rest of his life. He was associated with the late George H. Bliss, and also with the Western Edison Electric Light Company, and for about five years was engaged in the installation of isolated electric-lighting plants in Chicago. Mr. Soden installed the first electric-lighting equipment in a Chicago theater at the old Academy of Music. About 1887 he accepted a position with the Chicago office of the Thomson-Houston Electric Company, where he was engineer of the lighting department. In 1891 Mr. Soden was one of five electrical men recommended by the Chicago Electric Club of that day for appointment as electrical adviser to Mr. D. H. Burnham, chief of construction for the World's Columbian Exposition. For a time Mr. Soden was engaged in business for himself as an engineer and contractor. He possessed much inventive ability and perfected a number of switching and other electrical devices. He is credited with inventing the flexible electric heating pad for his own use while ill with pleurisy. He also developed apparatus for electrically melting ice in frozen water and gas pipes. He was handicapped for long periods by sickness, but with it all he maintained an indomitable spirit and a constant cheerfulness that endeared him to his friends. For a time he was associated with John R. Markle in street-railway enterprises. Of late he had been employed by the Middle West Utilities Company in charge of the electrical exhibition car "Electra," described in the *Electrical World* of July 26, 1913. He returned from a trip last December, and while the car was laid up for the winter he joined the forces of the Electric Shop of Chicago during the holiday rush. Although Mr. Soden had been in failing health for the last six weeks, his death was quite sudden. Heart failure caused by kidney trouble was given as the cause. Mr. Soden is survived by a wife, three daughters and a brother, John K. Soden, of the city electrical department of Portland, Ore.

Construction

New England

WILTON, N. H.—The Public Service Commission has granted Robert Ware permission to furnish electricity from his plant at West Wilton to any point within a half mile of the band stand.

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, D. C., until March 14, for furnishing and installing elevator machinery, including alterations and repairs to freight elevator in Building 34, Navy Yard, Boston, Mass., to cost about $1,300. Specifications may be obtained on application to the bureau or to the commandant of the navy yard named. H. R. Stanford is chief of bureau.

BROCKTON, MASS.—The city of Brockton has presented a petition to the State Legislature asking permission to establish a municipal electric-light plant.

HOLYOKE, MASS.—Extensive improvements and extensions are contemplated by the Holyoke Street Ry. Co., which will involve an expenditure of about $100,000 and increase the output of the plant to 5000 hp. The plans provide for the installation of additional boiler and engine equipment, mechanical stokers throughout the plant and automatic scoops and coal carriers to bins that feed the mechanical stokers; also the erection of a concrete coal pocket and a tall smokestack to take the place of the present draft system.

NEWPORT, R. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 14 for an alternating-current electric distribution system and transformers, cables, motors and two feeder panels at the naval training station, Newport, R. I., at a cost of about $8,100. Plans and specifications can be obtained upon application to the bureau or to the commandant of the naval station named. H. R. Stanford is chief of bureau.

HARTFORD, CONN.—Plans have been prepared by the New York, New Haven & Hartford R. R. Co. for the building of a new transformer station to be erected on Spruce Street, to take the place of the old station on Laurel Street, in connection with the installation of new signals on the Shore Line division. As soon as the entire system of signals is completed energy for operating the system will be obtained from the main station at Cos Cob, and the service of the Hartford El. Lt. Co. will be discontinued at the local station, except for emergencies. The local station will be 12 ft. by 16 ft., one story, distributing three voltages, for the operation of signals, relays and track mechanism. Edward Gagel, of New Haven, is chief engineer.

Middle Atlantic

ENDICOTT, N. Y.—A large auxiliary power plant will be installed by Endicott, Johnson & Co., of Endicott, it is reported, in connection with their new tanning plant, to cost about $100,000. Orders have been placed for a 2500-kw turbo-generator, four 500-hp boilers, condenser, etc. Fred Firestone, of Rochester, electrical engineer, has charge of the work.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until Feb. 24 for installing electric equipment in new Public School 115 on 176th and 177th streets. Blank forms, plans and specifications may be obtained at estimating room, ninth floor, Hall of Board of Education, Park Avenue and Fifty-ninth Street, New York.

NEW YORK, N. Y.—Bids will be received at the office of the depot quartermaster, Army Building, New York, N. Y., until Feb. 25, for furnishing supplies under schedule No. 506 as follows: For 25 annunciators, 370 standard square outlet boxes, 9 main line switchboxes, 21 panelboard boxes, 21 standard distributing boards, 9 service distributing boards, 1450 conduit bushings, 16,000 ft. galvanized-iron conduit, 300 standard outlet box covers, 144 brass brush covers, 1102 galvanized condulets, 800 galvanized-iron elbows, 110 fuses, 21 electroliers, 375 sockets, 107 electroliers, 128 bracket fixtures, 110 lamp guards, 260 insulating joints, 1524 Fulman lock units, 21 Thompson meters, 42 Hubbell receptacles, 375 shades, 120 shades, 30 shades, 300 fixture studs, 130 switches, 15-lb. ceiling compound, 1625 pipe straps, 60 lb friction tape and 32,000 ft. wire. For further information address Lt.-Col. M. Gray Zalinski, depot quartermaster.

NORWOOD, N. Y.—The Norwood El. Lt. & Pwr. Co. expects to purchase within the next six months one 350-kw, two-phase, 60-cycle generator and switchboard equipment for same. Cortes F. Vance is superintendent.

LOCK HAVEN, PA.—Bids will be received by J. Charles Schwamm, chairman of building committee, Lock Haven School District, Lock Haven, until March 10, for the erection of a school building, for which separate bids will be received as follows: For erection of building; heating and ventilating, plumbing, electric wiring, according to plans and specifications prepared by M. E. Joralemon, of Buffalo, N. Y., copies of which may be obtained upon deposit of $25, to be refunded upon return of same.

SHAMOKIN, PA.—The Borough Council has authorized the electric-light committee to secure estimates of the cost of the installation of a municipal electric-light plant. The present contract for street-lighting does not expire until 1917.

SUNBURY, PA.—The Northumberland County Gas & El. Co., of Sunbury, is contemplating extending its transmission line to McEwensville to furnish electrical service there. The company also proposes to erect a line to Pottsgrove, if sufficient patronage can be secured to justify the expense.

SPRING LAKE, N. J.—Bids will be received by the Mayor and Council of the borough of Spring Lake until Feb. 23 for furnishing 100 60-watt tungsten lamps and 25 100-watt tungsten lamps and necessary wiring for 25 lamp-posts; 10,000 ft. wood, fiber or tile conduit, with opening of from 2 in. to 3 in. Bidders are to submit samples and prices per foot. Also for 25 cast-iron ornamental lamp-posts for five-lamp clusters, with globes and sockets complete, not to cost more than $35 each. Bidders are to furnish their own plans and specifications for lamp-posts. Edward White is borough superintendent.

CHARLESTON, W. VA.—The Lackawanna Coal & Lumber Co., which owns a land acreage, is planning to begin extensive coal operations and contemplates building a model town in Boone County. The town will be known as Griffith, and 300 houses will be erected at once, equipped with running water, electricity and gas. The main office of the company is located in the Connell Building, Scranton, Pa.

RAVENSWOOD, W. VA.—An election will be held Feb. 21 to vote on the proposal to issue bonds for the installation of a water-works system and for improvements to the municipal electric-light plant. C. O. Nilsson is superintendent of the municipal light plant.

BUCHANAN, VA.—The Town Council has granted A. E. McCurdy a 30-year franchise to construct and operate an electric system in Buchanan. Mr. McCurdy expects to build a hydroelectric plant.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 26 for supplying to the various public buildings under the control of the Treasury Department portable vacuum cleaners during the fiscal year ending June 30, 1915. For further details see proposal columns. O. Wenderoth is supervising architect.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until March 2, as follows: (1) For 125 miles of galvanized-iron, 81-mil wire as per drawing 106; (2) 100,000 ft. 45-mil twisted Monnet copper-clad outside distributing wire, as per specification 557; (3) 25,000 ft. 36-mil house wire, as per specification 340-3.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal office, War Department, Washington, D. C., until Feb. 28 under proposal No. 690 as follows: (1) for 50 jars (6 in. by 8 in.) for gravity battery; (2) 12,500 12-in. oak insulator brackets; (3) 17,500 double-groove, glass pony insulators; (4) 16 pole seats; (5) 100 10-amp type 2 fuses; (6) 150 15-amp type 3 fuses; (7) six Edison porcelain sockets; (8) 25 caps for hand receivers of CAT desk sets; (9) 10 3-bar generators for CAT telephones; (10) three 16-strip terminal boxes.

WASHINGTON, D. C.—Bids will be received at the office of general purchasing officer, Isthmian Canal Commission, Washington, D. C., until March 2, for furnishing electrical attachments and fixtures, electric wire, soldering sticks, wire clamps, pliers, galvanized wire, etc. Blank and general information relating to this circular (No. 829) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y., 614 Whitney Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

WASHINGTON, D. C.—Bids will be received at the office of the general supply committee, Union Building, Washington, D. C., until March 19 for furnishing the executive departments and independent governmental establishments during the fiscal year 1915 with stationery and drafting supplies, hardware, metals, cordage and leather goods; leather and saddlery; drugs, medicines and chemicals; laboratory apparatus, hospital appliances and surgical instruments; electrical, engineering and plumbing supplies, etc., incandescent electric lamps, incandescent gas lamp supplies, motor trucks, typewriting and computing machines. Blank forms of specifications and instructions will be sent to all manufacturers and dealers on present list and will be furnished to others upon application to the general supply committee. Byron R. Newton is acting Secretary of Treasury.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 10, for furnishing supplies at the various navy yards and naval stations as follows: Washington, D. C., Schedule 6428—four baskets for motor-driven centrifugals; Schedule 6420—miscellaneous cable for use on cranes. Brooklyn, N. Y., Schedule 6416—2500 lb. chloride calcium, in 50-lb. cans; Schedule 6413—40 seamless steel cylinders, 200 cu. ft. capacity; Schedule 6429—miscellaneous material for switchboard panels; Schedule 6419—750 ft. lead-covered, single-conductor cable; Schedule 6423—95,000 ft. double, flexible conductor for portables, 80,000 ft. double, flexible silk conductor. Philadelphia, Pa., Schedule 6426—miscellaneous lead-sheathed, paper-insulated cable, 450 ft. lead-sheathed, rubber-insulated cable. Boston, Mass., Schedule 6399—one electrically driven triple plunger pump. Bids will also be received until March 17, under Schedule 6430, for ten 1-hp electrically operated potato peelers, to be delivered at the Brooklyn Navy Yard. Applications for proposals should designate the schedule desired by number. T. J. Cowie is paymaster-general, U. S. N.

North Central

BATTLE CREEK, MICH.—The city commission has authorized E. W. Arnold, architect, to prepare plans and specifications for an electric elevator, also for a hydraulic elevator for the new city hall for the purpose of asking for bids for same.

BRIGHTON, MICH.—The State Railroad Commission has granted the Brighton Lt. & Pwr. Co. permission to issue $16,000 in capital stock.

HIGHLAND PARK, MICH.—The village of Highland Park is contemplating the installation of a new water-works system. Electrically operated pumps will be used in the pumping station, which will soon be purchased. H. von Schon, Wayne County Bank Building, Detroit, is chief engineer.

IRON RIVER, MICH.—The Peninsular Pwr. Co., it is reported, is contemplating remodeling and enlarging its power house in Iron River, to cost about $100,000, during 1914. The work will include the erection of a new power house, installation of two new units, increasing the output of the auxiliary plant from 1000 hp to 3000 hp. The company is also adding two new units to its plant at Twin Falls. L. T. Sterling is assistant secretary.

SAGINAW, MICH.—The Germania Society has appointed a committee to make investigations as to the feasibility of installing an electric-lighting plant in its building.

WYANDOTTE, MICH.—The city commission is contemplating calling an election to submit the proposal to issue $40,000 in bonds to enlarge the municipal electric-light plant. The present plans provide for the erection of an addition to the power house at the foot of Vine Street, to be used as a boiler room, the installation of new boilers and a 500-kw or 600-kw generator, if the bond issue carries. Charles Garner is commissioner of municipal service.

AKRON, OHIO.—Plans are under way for increasing the output of the power plant of the Quaker Oats Co. It is proposed to build a new building near the present plant on Canal Street, to install two new boilers and erect a large smoke stack. J. H. Andrews is superintendent of the company.

CANTON, OHIO.—O. C. Barber, of Barberton, has announced that he proposes to establish an electric light and power plant in Canton.

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Congress Should Make Haste Slowly

The great diversity of opinion already expressed before Congress on pending anti-trust measures is illuminating in the knowledge which it gives the country of widely varying business practices. It is an effective cry to Congress to make haste slowly. What is done in haste will be repented in sorrow if the legislation unduly hampers the great business structure of the country. The weapon which is sharpened for monopoly may in fact prove to be a weapon against the small manufacturer. For instance, on the question of maintenance of re-sale prices, the sentiment expressed before the committee as well as by members of the committee is not unanimous. There is a faction that would definitely prohibit the maintenance of resale prices because, forsooth, that is one of the practices of monopolies. A witness points out that, if this is done, the large manufacturer can accomplish the end sought to be prohibited by opening a chain of stores, a practice which the small manufacturer has not the means to follow. The testimony thus far heard by committees of Congress is not by any means representative of all of the main classes of industry. It is not representative of all sections of the country. It is representative of the widely diversified business activities of the nation, and is emphatic in revealing the fact that few industries are without concern over the outcome of the legislative program. Many industries have not presented testimony. Many companies have offered no suggestions. If all were represented, the testimony would reveal still stronger reasons why deliberation, analysis, investigation for facts should precede actual law-making.

The Engineer as a Speaker.

The very interesting plea of the city manager of Dayton, Ohio, outlined elsewhere in this issue, concerning the public-speaking ability of engineers, should make an especially strong appeal to those responsible for the proper education of our future electrical engineers. In none of the various engineering and technical fields is the necessity for clear and exact exposition by word of mouth more important than in our own. The public is painfully ignorant of even elementary electrical matters—a compelling reason for the formation and activities of the Society for Electrical Development. Moreover, the work of no engineer has so great or so important a bearing upon the business and home life of a community as that of the electrical engineer. In no technical field are there so many points of intimate contact between the people and those few especially educated in their craft as in our own. Therefore, it would seem clearly desirable that the electrical engineer of the immediate future be sent out into the world with not only the necessary equipment of technical knowledge but with at least an elementary training in the persuasive art of public speaking, a fact that progressive colleges are now beginning to appreciate.

Electric Steering for Automobiles

As purchasers of gasoline automobiles are now demanding on their cars devices which will all but eliminate muscular exertion, it has been proposed that electrical apparatus be provided for steering. Some drivers find steering tedious, especially on long trips, over rough roads, because of the continuous vibration transmitted to their wrists through the steering column. This objection could be removed to a large extent by employing electrically controlled steering apparatus. And in justifying this further electrification of gasoline cars it may be pointed out that steering requires considerably more muscular effort than the operation of shifting gears for which electricity is already used on many cars. Objections have been raised that electric steering will complicate the cars too much, besides requiring considerably higher battery ratings. Both the practicability and the reliability of electric steering have been demonstrated by the successful use of this principle on ships. With a good storage-battery equipment on an automobile the possibility of interruption to its energy supply would be remote; and, as the power demand of a motor-driven steering device is intermittent and would probably not exceed 30 watts, the battery rating would not have to be much increased. In addition to eliminating the tediousness of long tours, electric steering would make possible one-hand control at all times, and the bulky steering wheel and column, which now hinder entrance to the driver's seat, could then be replaced by some small, compact steering handle.

Successful Electric Mining Plant

One of the striking papers read at the recent convention of the American Institute of Mining Engineers was that detailing the applications of electricity in the iron mines at Mineville, N. Y., one of the first instances of such application and apparently one of the most successful. This particular group of mines yields magnetite to the extent of about 700,000 tons per year, and of this about four-fifths is treated by magnetic separation to give a product of exceptional purity. After ten years' experience it has been found that a cost of 25 cents per ton of ore shipped will cover all the electric energy required to deliver the ore on the cars, including mining machinery underground, hoisting from a 900-ft. shaft, crushing and magnetic separation, together with the lighting and miscellaneous services of the mines. This is indeed a good record for economy. Before the electric plant was in full use steam was employed to lift the ore out of the mine. Under the old régime the cost of hoisting was 7 cents per ton, while with electricity it has dropped to 2 cents. An even more important feature of the equipment is the magnetic ore separators which are in use on a large scale. The equipment is neither complicated nor costly to operate, and the net result is to obtain a concentrate of very excellent quality at comparatively low cost. The regular product of the magnetic concentration is guaranteed to carry 70 per cent of metallic iron, the theoretical amount in absolutely pure magnetic iron ore being 72.4 per cent. Now and then carload lots of a concentrate will run up to 71.2 per cent. These figures show better than any amount of argument the advantages of magnetic separation in producing a pure product, and the quality can be held almost absolutely uniform without regard to the iron content of the crude ore, which in this case ranges from 25 to 55 per cent. Altogether, this electrical mining equipment, while not on a colossal scale, is a particularly fine example of the economies to be secured in mining and treating ores with the aid of a complete electrical equipment.

The Development of a Railway Plant

As a generating station the Louisville plant described in the current issue is not widely different from many a well-designed plant of medium size. However, it is not a little instructive to glance at the causes which brought the necessity for a completely new equipment. The station furnishes energy for about 260 miles of track, of which about two-thirds is in the city and the rest interurban. The growth of the city and the extension of interurban traffic have made some rather startling changes in the local conditions. In ten years from 1902 to the present the average daily output has risen to more than three times its value at the beginning of the decade. The maximum peak has increased nearly fivefold. These figures bespeak large gain in traffic and also a far greater mileage of track and of car services. Even more striking, as showing the change in conditions of equipment, is the output per car-mile, which during the period in question has risen from 1.5 kw-hr. to nearly 4 kw-hr. This means heavier and faster cars, in the use of which the interurban work has undoubtedly been a considerable factor. It is easy to understand, therefore, how the original plant was outgrown. The last touch was added, however, when the city of Louisville turned the bulk of the water supply from which circulating water was obtained in the old plant into its rapidly increasing sewer system. Then a move had to be planned.

The new plant described in this issue is situated on the bank of the Ohio River, where the water supply is reliable, and at the same time where a site could be obtained above the maximum high-water stage of that somewhat erratic stream. The plant as now constructed contains two 6000-kw horizontal turbines with room for six more when necessary. The boiler and condenser equipment is thoroughly up to date like the rest of the plant. The value of the turbine equipment and the importance of every step toward economy are well shown by the fuel consumption, which the load conditions have caused to be nearly 3 lb. of coal of 12,000 heat units per lb. for each kilowatt-hour. One can easily imagine when a first-rate modern plant is under load conditions which give this consumption of fuel what the situation would be with an equipment such as would have been considered thoroughly first class ten or fifteen years ago. Even the shrewdest engineering skill cannot keep down the coal consumption beyond a certain point in the face of natural difficulties of load which are beyond control.

Theories of High-Frequency Resonance

In the present issue Mr. J. Hettinger brings forward some interesting speculation regarding the behavior of coupled circuits used in radio-telegraphy. Each of the several methods which have thus far been offered for treating the highly complicated interactions in such systems appears to involve at least a few partially compromising assumptions and omissions, and in this regard Mr. Hettinger's ideas do not depart from those already advanced. On analysis it is often found that several different modes of expression result in the same ultimate set of conclusions. It might be said, for instance, that Mr. Hettinger has merely reversed some algebraic signs and considers the resultant current in his secondary as the sum of a series of free oscillations of the same phase instead of the difference of a single decaying free oscillation and a forced alternating current of the final amplitude. However this may be, the present graphical investigation of the action of a given few types of paired circuits should help a number of readers toward a better insight into the building up of large alternating currents in resonant networks driven by forced oscillations. It would appear almost immaterial whether the assumed forced oscillation is of the final resonant amplitude, as assumed by Zenneck, or of the initial half-wave amplitude according to Mr. Hettinger's suggestion, since in applying either theory to practical cases such constants would be introduced as might be needed to secure agreement with actual conditions. The expression derived for maximum amplitude at resonance is in terms of the amplitude of the original forced oscillation for the same circuit conditions, and hence is mainly useful in showing the usual relation between decrement and time required to reach full resonance.

In Mr. Hettinger's treatment of receiving apparatus the setting of a sharp line in minimum amplitude to give detectable effect is noteworthy. This line, of course, corresponds to the current normally considered to mark the "limit of audibility," but consideration of its effect on the efficiency of a receiver should serve to bring to mind rather forcibly the looseness with which this limit is often treated. The matter of the integrative abilities of various detectors used in commercial radio-telegraphy is still in dispute, and many experts will disagree with Mr. Hettinger's classification of electrolytic and crystal rectifiers as of the type which depends for effect merely upon the amplitude and not on the persistence of oscillation. When the conclusions of the present article are interpreted from the standpoint of the large dependence of the response of rectifier detectors—in connection with the associated condenser and telephone circuits—upon the persistence of oscillations, sustained waves would appear to lead damped trains in their ability to produce indications. The outline of the cumulative action of the Poulsen-Pedersen "tikker" receiver seems directly in agreement with experimental facts, as is, unfortunately, the criticism to the effect that on account of its characteristic "hissy" response this instrument does not permit the use of a musical tone for reduction of interference. That this lack of pure signal tone need not be held against sustained wave transmission in general, however, has been shown by the recent practical applications of Fessenden's "heterodyne" receiver, which gives cumulative and integrative action along with true musical response of any frequency. The discussion of the relative values of sustained and damped waves is capable of indefinite extensions and, even when transmission phenomena are eliminated, can scarcely be treated in a single paper. It is believed, nevertheless, that Mr. Hettinger's article will offer much material for thought and that, while it does not contain completely acceptable solutions of all the problems discussed, it will be of much interest and value to the radio engineer.

Characteristics of Crystal Rectification

In radio-telegraphy one of the most generally used forms of receiving instrument is the telephone, in connection with a so-called crystal rectifier. The rectifier is a small lump of special substance, pressed tightly between a metallic point and a metallic plate. The special substance is commonly crystalline, such as a lump of silicon; but amorphous or non-crystalline substances exist which will serve the purpose, so that it seems the substance does not have to be crystalline. When an alternating current is made to pass through the device the resistance which the device appears to offer to one direction of current is very distinctly greater than to the other, so that the current which goes through is no longer a simple alternating current, but more nearly a throbbing unidirectional current; that is, a rectified current, such as will produce a one-way movement of a telephone diaphragm.

The wonderful simplicity, convenience and permanence of the crystal rectifier have made the device very popular as a receiver in radio-telegraphy. The widespread use of this rectifier brings the fact prominently into notice that the nature of the action is still very imperfectly understood. Some have tried to explain the action thermo-electrically, but with little success. All that is admitted without dispute is that the action is not microphonic or dependent on a loose electrical contact. It is best developed under a good tight contact from a blunt point on the crystal. Moreover, the surface of the crystal is ordinarily non-uniform. Spots of good action are found separated by areas of bad action, or even of reversed action, as the point is caused to meander over the surface. The best way to describe the action at present, so as to keep within the facts and on the leeward side of controversy, is to call it unilateral conduction, which is a glorified name for rectification and leaves the causes comfortably in the dark.

In a recent paper in the *Physical Review*, referred to in our Digest, Mr. Alan E. Flowers discusses certain experimental characteristics of crystal rectification, using crystals of galena. The rectification ratio, taken from the ratio of direct-current and alternating-current measuring instruments in the circuit of the crystal, was observed at various current strengths and also over a wide range of frequency. It appears from the results that, for a given current strength, the rectification ratio was surprisingly nearly constant at frequencies from 60 cycles to 180,000 cycles per second, being slightly greater at the high frequencies. This is a fortunate circumstance, so far as concerns the use of the device as a radio detector. On the other hand, the rectification tends to disappear with very feeble alternating-current supply, especially with large contact areas. It seems to be important to develop a fairly high current density under the contact, in order to secure good rectification. It is, perhaps, for this reason that some rectifying crystals are used, in practice, with the stimulus of a low direct emf applied to them, in order to enhance their sensitiveness to very feeble oscillating-current wave trains.

Although the theory of action is not discussed in the paper, yet the experimental results reported have a bearing on such theory. If, as appears, the rectifying action is as good at hundreds of thousands of cycles per second as at tens or hundreds, all thermal actions which can propagate themselves differentially through the mass from the contact point appear to be ruled out, because they are necessarily sluggish. The suggestion offers itself that the action is attributable to movements of electrons at or near the contact, which are hampered in one direction more than in the other. After all, we have no right to expect that electricity must move with equal facility along a conductor in either direction. It is very wonderful that no appreciable difference of this kind can be detected in wires or lumps of metal. We have become so spoiled by the remarkable indifference of metals, and pure metallic contacts, to direction of current that when we meet with dissymmetrical behavior in a metal-point-crystal-metal-plate combination we are greatly surprised.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Society for Electrical Development an Accomplished Fact

Its minimum fund of $200,000 having been subscribed, the Society for Electrical Development, Inc., will take up its task of educating the public to "do it electrically" on March 1. The membership on Thursday morning was 1300, apportioned as follows: Central stations, 279; manufacturers, 173; contractors, 568; jobbers, 262, and miscellaneous, 18. Inasmuch as none of the pledges became binding until the $200,000 was subscribed, the society is now engaged in sending out bills to subscribers, and the returns already coming in indicate a very healthy interest in the work for which the society was formed. At the next meeting of the executive committee appropriations will be made for carrying on definite branches of activity. It is certain that the program for a national advertising campaign to educate the reading public in the use of electricity will be one of the first to receive consideration. No letup will be made in the effort to increase the membership. That campaign will be carried on simultaneously with the co-operative and educational work for which the organization was brought into being, because there is no limit to membership or to the funds which may be raised. By this means it is hoped not only to widen the influence of the society but to place at its disposal greater funds to make its work more extensive and immediately responsive. The general aims and plans of the Society for Electrical Development have been outlined in these columns before. Its headquarters are located at 29 West Thirty-ninth Street, New York City.

Patent Reforms Urged

Free and frank discussion of administrative reforms in the Patent Office and in the court procedure dealing with patent cases marked the addresses delivered at the annual banquet of the Patent Law Association of Washington at Rauscher's on Feb. 21. Commissioner of Patents Thomas Ewing, representing the administration; Chief Justice Seth Shepard of the District Court of Appeals, representing the judiciary; Senator Poindexter, of Washington, and Representative Morrison, of Indiana, representing the legislative branch, and several members of the bar voiced the unanimous opinion that by co-operation alone could the evils that now exist in the patent system of the United States be eliminated. But, while criticising the administration of the patent system, the speakers declared that the system was the finest patent system in the world, that its administration was being conducted more satisfactory than ever before, and that the commercial supremacy of the United States rested, not on the customs houses, but upon the Patent Office.

Mr. Ewing said that the severest criticism of the patent system grew out of some seventy-five cases which have been pending for the last fifteen years and were still in the course of litigation. "Let's get rid of these cases, and prevent such delays in the future," urged Mr. Ewing, "and we will have done much to remove the criticism of the patent system."

Representative Martin A. Morrison, of Indiana, ranking member of the House committee on patents in the absence of the chairman, Representative Oldfield, pledged his earnest support to the Patent Office. He admitted that members of Congress were too prone to pass upon matters relating to the Patent Office without knowing anything about the system or its needs.

Chief Justice Shepard of the Court of Appeals urged the members of the association to aid personally in reducing the delay with which in many instances patent cases now drag on before the courts. The remedy for these delays, he said, in the last analysis, rested in the hands of the attorneys trying the cases themselves. He said that the same could be said of the delays in litigation of all kinds to-day. The efficiency of the judiciary in handling quickly the cases before them depended largely, he said, upon the attorneys' assistance.

Hearings on Anti-Trust Legislation

Hearings have continued during the past week before the House judiciary committee at Washington on the proposed anti-trust legislation of the administration, and time has been reserved for additional persons to appear up to the end of next week. Mr. Frederick P. Fish, former president of the American Telephone & Telegraph Company, will be heard March 6. Mr. Horace Stern, of Philadelphia, will appear March 4 to speak on "The Prohibition of Foreign Trusts from Operating in the United States." No date has been set for the discontinuance of the hearings before this committee.

Representative Covington and his sub-committee of the House committee on commerce are still at work drawing an entirely new Interstate Trade Commission bill. On the Senate side of the Capitol it is announced that the committee on interstate commerce, of which Senator Newlands is chairman, is framing an Interstate Trade Commission bill of its own. Senator Cummins and Senator Clapp, however, two of the Republican Senators on this committee, are not taking part in its deliberations, expressing the view that the Democrats will frame the bill irrespective of Republican members' ideas, although the other Republicans on the committee have not assumed this attitude.

Chamber of Commerce Committee on Trust Legislation

As a result of the meeting of the Chamber of Commerce of the United States in Washington two weeks ago a committee has been appointed to consider all proposed anti-trust legislation and to make preparations for taking a referendum through the commercial organizations of the United States. This committee held its first meeting in Washington on Feb. 24. The chairman is Mr. R. G. Rhett, Charleston, S. C. Other members of the committee include President Charles R. Van Hise, University of Wisconsin; Mr. Guy E. Tripp, chairman board of directors Westinghouse Electric & Manufacturing Company, and Mr. W. L. Saunders, president Engersoll-Rand Company.

Municipal Plant a Possibility in New Orleans

Commissioner Lafaye of the Department of Public Property of the city of New Orleans is asking information from the heads of American cities of more than 150,000 population in relation to rates charged for electrical energy. It is said that this is the first move in an effort to reduce electric-service and gas rates in New Orleans. Possibly the movement will lead to the eventual establishment of municipal gas and electric-service plants, but the first endeavor will be to induce the New Orleans Railway & Light Company to reduce its rates. For street lighting, at any rate, the present rates would seem not to be excessive. These rates are $69 a year for all-night arc lamps on overhead circuits and $85 on underground circuits. The street-lighting contract will expire in September, 1915.

Cost of Chicago Street-Lighting Energy

In a report dated Jan. 15, 1914, addressed to the finance committee of the City Council of Chicago, Mr. Ray Palmer, commissioner of gas and electricity (the title now borne by the city electrician), repeats that 0.59 cent per kw-hr., plus $1 per lamp per year, is a fair and reasonable price for the generation, transmission and distribution of electrical energy by the Sanitary District for street-lighting purposes in the city of Chicago. Mr. Palmer says that the city's electric-lighting situation is in a serious condition at the present time and that the source of energy for lighting Chicago from the Sanitary District is unreliable, owing to various conditions not under the control of the Sanitary District, including the restricted flow of the water from Lake Michigan for the Chicago Drainage Canal.

The present rate paid to the Sanitary District for electricity for street lighting in the city of Chicago is 0.5 cent per kw-hr., and it is perhaps unlikely that the finance committee will decide to increase this rate, although the majority of the trustees of the Sanitary District have said that any extension of service is contingent upon an increase in rate.

Promotions in the Commonwealth Edison Organization

At the annual meeting of the stockholders of the Commonwealth Edison Company held in Chicago on Feb. 24 the following directors were re-elected: Messrs. Henry A. Blair, Benjamin Carpenter, Samuel Insull, Robert T. Lincoln, John J. Mitchell, James A. Patten, John G. Shedd, Byron L. Smith and A. A. Sprague. Immediately following the stockholders' meeting, the board of directors met and elected the following executive committee: Messrs. Samuel Insull, chairman; John J. Mitchell, Byron L. Smith, A. A. Sprague and James A. Patten.

Owing to the desire of Mr. Robert T. Lincoln not again to be elected as vice-president, and to the great growth of the company's business, it was deemed an opportune time by the board to make changes in the executive organization of the company, which was done by changing the by-laws and creating a staff of working vice-presidents. The following officers were elected: Mr. Samuel Insull, president; Mr. Louis A. Ferguson, vice-president in charge of the contract, operating and construction departments; Mr. John F. Gilchrist, vice-president in charge of the purchasing, stores, transportation and statistical departments; Mr. William A. Fox, vice-president in charge of finances, securities and claims, with supervision over the secretary and treasurer and his departments; Mr. John H. Gulick, vice-president in charge of accounting, with supervision over the auditor and the auditing department; Mr. Edward J. Doyle, secretary and treasurer; Mr. George E. Burns, assistant treasurer; Mr. Robert L. Elliott, assistant secretary; Mr. William S. Kline, assistant secretary; Mr. Henry E. Addenbrooke, auditor; Mr. R. H. Williams, assistant auditor; Mr. Harry A. Weigle, assistant auditor.

Formation of Jovian Relief Fund Urged

Some of the Jovians of Texas, and more particularly Mr. A. J. Binz, of Houston, are advocating the formation of a Jovian relief fund, from which worthy members of the order in financial need may be relieved. Such a fund for local use has been established by Houston Jovians and has done good work. Mr. Binz urges every Jovian to give study to the subject and says that he is going to push the matter throughout the United States.

Missouri Convention to Be Held on Mississippi River Steamer

The Missouri Electric, Gas, Street Railway and Water Works Association will hold its annual convention, May 21 to 23, aboard the steamer *Quincy*, making a round trip from St. Louis, Mo., to Keokuk, Ia. The boat will leave St. Louis at 10 a. m. on Thursday, May 21, arriving at Keokuk the following day at noon. After an inspection of the hydroelectric development of the Mississippi River Power Company the party will board the boat for the return trip to St. Louis, arriving at the latter city at 5 p. m. Saturday. Mr. F. D. Beardslee, secretary of the association, announces that the round-trip fare, including meals, will be $15, with half-fare rates for children. Reservations can be made through the secretary at 315 North Twelfth Street, St. Louis, Mo. Sessions of the convention will be held on the boat during both trips.

Meter Hearing at Boston

The committee on public lighting of the Massachusetts Legislature gave a hearing on Feb. 13 upon bills requiring electric, gas and water companies to furnish customers with duplicate meter readings and reducing the yearly charge for the use of electric meters from $9 to $5. Advocates of the former contended that customers are entitled to be informed as to their meter readings at the time of the meter reader's visit, in the interests of speedy adjustment of errors. Mr. Everett W. Burdett, Boston, counsel for the Massachusetts Electric Lighting Association, pointed out that the Boston Edison Company provides duplicate readings on request, but that only 200 out of 60,000 patrons ask for these. The central stations of Massachusetts encourage the reading and checking of meters by customers, and the cost of supplying the duplicate when it is not asked for seems a needless expense. Mr. Burdett opposed the reduction of the electric-meter charge from $9 to $5 on the ground that the consumer using only $5 worth of energy in a year is unprofitable to the central station. The cost of meter maintenance is from $7 to $8 per annum, including a loss of $2.34 in the potential coil. Mr. W. D. King, of the Peabody (Mass.) municipal lighting plant, opposed the bill, stating that the loss in the meter averages about $4.20 a year at 12 cents per kw-hr.

Progress of the Jovian Commercial Division

To carry out some of the plans outlined in a general way at the recent Jovian Congress in New York, active work has been started by the Commercial Division of the Jovian Order. In discussing the progress of this work with a representative of the *Electrical World*, Mr. Ell C. Bennett, St. Louis, secretary of the order, said that plans for bringing about co-operation of the architects and electrical men in the principal cities of the country had been carefully considered. It is hoped by such co-operation to secure proper specifications for all electrical installations in buildings, to insure the use of none but first-class material properly placed and to provide for adequate rigid inspection. When these conditions can be brought about the irresponsible contractor putting in electrical apparatus of insufficient rating and poor quality will be eliminated and the reliable dealer submitting a fair bid based on cost of first-class material and construction will be protected.

Thus far the best suggestions of plans for such co-operation indicate that each community should be handled locally by a commitee composed of five men, namely, a representative of the central station, a contractor, a jobber, a manufacturer and an electrical engineer. According to the suggested plans, the services of this committee are to be at the disposal of local architects. In towns where there is a local architects' association the committee will endeavor to meet with that body and enlist its aid in bringing about the desired co-operation. Where no such organization exists action with the leading architects is planned.

In cities where a local inspection bureau is maintained either by the municipality or by insurance interests an effort will be made to secure the services of an inspector on the Jovian committee. Thus, with the architects, the electrical interests and the inspectors working in harmony, it is hoped to achieve a general reduction in life and fire hazards. Better material and better construction will be the watchwords of the committee.

Mr. Bennett also reports that the work of the employment bureau is progressing with satisfying results and that a suggestion sent to Jovian headquarters from the Pacific Coast proposing the establishment of schools of salesmanship is receiving careful attention.

Cable and Telegraph Statistics

Preliminary figures of the forthcoming quinquennial reports on the ocean cable systems, land telegraph systems and wireless telegraph systems of the United States have been given out by the Bureau of the Census. The statistics relate to the years ended Dec. 31, 1912 and 1907, and cover commercial operating companies only. Systems operated by the federal government for military or commercial purposes either in Alaska or the insular possessions, and telegraphs owned and operated exclusively by railways, are not included; neither do the figures include the incidental telegraph business done by telephone companies over their own wires.

Ocean Cable Systems

Included in the number of ocean cable systems is one system operated by a land telegraph company. The financial details of this and the number of employees, not having been segregated in the single report submitted, are made a part of the report for land telegraph systems. The miles of cable and number of cable messages, however, are embraced in the cable system's report. The mileage of ocean cables is that owned or leased by the operating companies and is the entire length of such cables wherever located. The financial statistics, therefore, concern to some extent operations in foreign countries. The statistics of the two foreign companies having cables landing in this country and doing business here are not included in either census. These companies are the Deutsch Atlantische Telegraphengesellschaft and the Compagnie Française des Cables Télégraphiques. Although the number of operating companies remained the same during the semi-

WIRELESS TELEGRAPH SYSTEMS

	1912	1907	Per Cent of Increase, 1907-1912
Number of companies or systems	4	5	—20.0
Number of messages	285,091	154,617	84.4
Number of tower stations	74	117	—36.8
Income, total	$669,158	$106,791	526.6
Net income	4,738	....	......
Expenses, total	664,420	160,329	314.4
General operation and maintenance	588,712	117,480	401.1
Interest and taxes	7,826	5,562	40.7
All other expenses	67,882	37,287	82.1
Net deficit	....	53,538	......
Balance sheet:			
Assets, total	10,377,197	32,958,897	—68.5
Construction and equipment, including real estate, etc	1,205,770	317,614	279.6
Cash and current assets, including supplies	9,171,427	32,196,456	—71.5
Profit and loss deficit	....	444,827	......
Liabilities, total	10,377,197	32,958,897	—68.5
Capital stock	9,602,570	32,676,242	—70.6
Floating debt and mortgages	18,483	37,145	50.2
Accounts payable	583,160	245,510	137.5
Profit and loss surplus	172,984	....	......
Capitalization:			
Capital stock outstanding, par value	9,602,570	32,676,242	—70.6
Employees and salaries and wages:			
Average number	958	176	444.3
Salaries and wages	$393,606	$81,771	381.4

OCEAN CABLE SYSTEMS

	1912	1907	Per Cent of Increase, 1907-1912
Number of companies or systems	7	7	......
Nautical miles of ocean cable	67,676	46,301	46.2
Number of messages	5,841,280	5,869,317	—0.5
Income, total	$8,469,374	$7,671,700	10.4
Telegraph traffic	8,065,798	7,338,280	9.9
All other sources	403,576	333,420	21.0
Net income	2,952,847	4,079,074	—26.7
Expenses, total	5,516,527	3,642,626	51.4
General operation and maintenance, including salaries, wages and legal expenses	4,008,218	2,204,939	81.8
Interest and taxes	1,214,554	1,190,308	2.0
All other expenses	293,755	247,379	18.7
Balance sheet:			
Assets, total	107,583,155	95,624,892	12.5
Construction and equipment, including real estate, etc	78,136,115	77,438,339	0.9
Stocks and bonds of other companies, treasury stock and "other permanent investments"	16,811,087	12,971,564	29.6
Cash and current assets, including supplies	12,635,953	5,214,989	142.3
Liabilities, total	107,583,155	95,624,892	12.5
Capital stock	55,489,400	52,800,000	5.1
Funded debt and reserves	43,549,451	36,561,391	19.1
Accounts payable	1,459,797	314,955	363.5
Dividends due and sundries	587,229	2,452,351	139.5
Profit and loss surplus	6,497,278	3,496,195	85.8
Capitalization:			
Capital stock outstanding, par value	55,489,400	52,800,000	5.1
Dividends on stock	3,010,200	2,533,041	20.0
Employees and salaries and wages:			
Average number	1,656	1,207	37.2
Salaries and wages	$1,167,014	$915,083	27.5

decade, the increase in nautical miles of cable was 21,375, or 46.2 per cent. The increase in profit and loss surplus was $3,001,083, or 85.8 per cent. Reserves were increased very largely, but the total cannot be shown separately as it is practically that of one system. Capital stock outstanding was $2,689,400, or 5.1 per cent, greater in 1912 than in 1907. The number of wage earners increased 37.2 per cent, and salaries 27.5 per cent. The net income shows a decrease of $1,076,227, or 26.7 per cent, caused by increase in cost of operation and maintenance amounting to $1,803,279.

TELEGRAPH SYSTEMS

	1912	1907	Per Cent of Increase, 1907-1912
Number of companies or systems	22	20	10.0
Miles of pole line	247,528	239,646	3.3
Miles of single wire owned and leased	1,814,196	1,577,961	15.0
Number of messages	103,536,418	97,924,759	5.7
Number of telegraph offices	30,781	29,056	5.9
Income, total	$56,293,469	$43,912,168	28.2
Telegraph traffic	52,337,211	37,916,907	38.0
All other sources	3,956,258	5,995,261	—34.0
Net income for the year	3,431,044	5,675,181	—39.5
Expenses, total	52,862,425	38,236,987	38.2
General operation and maintenance	39,067,011	31,852,359	22.6
Interest and taxes	2,740,827	2,246,382	22.0
All other expenses	11,054,587	4,138,246	167.1
Balance sheet:			
Assets, total	191,516,700	166,530,835	15.0
Construction and equipment, including real estate, etc	143,910,631	132,607,620	8.5
Stocks and bonds, including other permanent investments and treasury stock	17,122,592	23,514,882	—27.2
Cash and current assets, including supplies and sundries	29,672,528	10,060,505	179.8
Profit and loss deficit	810,949	347,828	133.1
Liabilities, total	191,516,700	166,530,835	15.0
Capital stock	104,274,435	102,289,575	1.9
Funded debt	34,741,000	37,204,000	—6.6
Reserves	5,254,329	1,876,858	180.0
Accounts payable	12,175,438	7,894,978	54.2
Dividends, taxes and interest due and accrued	1,460,733	....	......
Sundries	23,447,146	87,852	......
Profit and loss surplus	10,163,619	17,177,572	—40.8
Net surplus	9,352,670	16,829,744	—44.4
Capitalization:			
Capital stock outstanding, par value	104,274,435	102,289,575	1.9
Dividends on stock	3,139,861	4,944,042	—36.5
Funded debt	34,741,000	37,204,000	—6.6
Employees and salaries and wages:			
Average number	35,639	26,827	32.8
Salaries and wages	$23,797,980	$16,893,166	40.9

Wireless Telegraph Systems

The figures presented for wireless-telegraph systems show that, while there was a net deficit in operations in 1907, a net income was the result of the business in 1912. The gross income (only the total of which can be given, as to do otherwise would disclose individual financial operations) increased $562,367, or 527 per cent, over 1907. A great part of this income came from the rental of wireless apparatus for ship equipment. The great decrease in assets—$22,581,700, or 68.5 per cent—is due to the disappearance of one large company in a merger of interests. The decrease was largely in the value placed on patent rights, good will and contracts in 1907, and on treasury stock.

Land Telegraph Systems

Of the land telegraph systems all except one (a Canadian company) are operated by companies incorporated in the United States. During the semi-decade covered by the figures shown the number of companies increased by two. The miles of single wire increased by 236,235, and the number of offices was increased 1725. While the gross income increased $12,381,301, the expenses of all kinds increased by a greater amount, $14,625,438. The net income by this showing was therefore reduced $2,244,137. The increase in construction and equipment account appears as $11,303,011, but the amount reported for stocks and bonds and other permanent investments' decreased $6,392,290. There was an increase of $19,612,023 in cash and current assets. Capital stock outstanding increased $1,984,860, and the funded debt decreased $2,463,000. There was a notable increase of $3,377,471 in reserves.

Water-Power from Green River for Kentucky Coal Mines

The du Ponts of Wilmington, Del., who are largely interested in coal-mining operations in western Kentucky, are reported to be back of a plan for the construction of a large power plant on Green River, near Central City, Ky., which will be used to furnish energy for the operation of more than thirty coal mines in that section. Gen. T. C. du Pont was recently in Central City looking over the situation, following which detailed plans for the work were announced. A company capitalized at $300,000, to be known as the Central City, Drakesboro & Greenville Railway Company, will be incorporated first, for the purpose of building a traction line connecting the towns named. This line will be supplied with energy from the proposed power plant on Green River.

The plan is of special interest on account of the fact that a merger of the leading coal-mining interests in western Kentucky is now being planned, indicating that it will be a comparatively easy matter to secure the business of the coal operators. Central power plants for the important coal sections of eastern Kentucky are also in prospect.

"Home-Rule" Question in Chicago

At the April 7 election voters in Chicago will express themselves on the public-policy question "Should the Legislature amend the public utilities act so as to give Chicago home rule over its public utilities?" The question was discussed at the City Club on Feb. 21. Mr. S. S. Gregory, a prominent lawyer, said that there is no more reason why there should be a separate commission for Chicago than there is why there should be a separate Supreme Court. If efficiency is wanted, there must be centralization of power. Mr. Edward W. Bemis, public utility expert, presented the arguments for home rule. He contended that the local rates of monopolies, like local taxation, should be fixed locally as far as possible. The important questions of public policy involved in utility regulation should be decided by the people, and not by a commission. Mr. F. S. Munro, a member of the Legislature, said that local officers, like mayor and aldermen, would never have the strength to raise a rate, no matter how equitable such an increase might be. Mr. James G. Skinner, assistant corporation counsel, who drafted the home-rule article of the original bill, declared that the City Council of Chicago is a more efficient working body than the Illinois Legislature of 1913.

Engineers in Public

Mr. Henry Matson Waite, city manager of Dayton, Ohio, in the course of an interesting talk on "The City as a Business Proposition" at the fiftieth anniversary convention of the Theta Xi Fraternity, New York City, on Feb. 21, urged the necessity for training the young engineer, as a part of his regular college course, in the art of being able to rise to his feet and explain in simple language arguments, conclusions and opinions resulting from his professional work in such logical, orderly and convincing manner as to compel attention and secure prompt action from his hearers. The present trend of all engineering work makes it vitally important that the engineer have at least a modicum of skill in public speaking. This is equally true whether the audience be a board of directors or a meeting of citizens. In the past, Mr. Waite contended, the very nature of the engineer's professional work caused him to shun publicity and compelled him to confine his ability within a written report which, after it left his hands, he had no means of defending, amplifying or even correcting. Just now, however, a new era of engineering is opening up, in which even the keenest specialist must take a broader view of his field than ever before and, in many instances, is obliged to elucidate his points for the benefit of non-technical people. In other words, the engineer of to-day finds it a valuable asset to have a round view of engineering as a whole and the ability to explain professional matters in simple, non-technical language.

State and Federal Franchise for Water-Power Proposed

Following a session of President Wilson's Cabinet with him last week, at which was threshed out the proposed water-power policy of the administration, Secretary of War Garrison has sent to Representative Adamson, chairman of the House committee on commerce, a long letter outlining his views as to what legislation should be passed by the present Congress in relation to water-power.

Secretary Garrison also sent to Representative Adamson a copy of a bill proposed by the War Department, with the approval of the President, but it is understood in Washington that this bill does not contain the proposition advanced in Secretary Garrison's letter that power plants shall be turned over to the State in which they are situated after private owners have enjoyed them for the suggested privilege period of fifty years.

Representative Adamson declines to make public a copy of Secretary Garrison's proposed bill until his sub-committee has had an opportunity to pass on it. He is of the opinion that there is not wide divergence of opinion between the members of his sub-committee on water-power and the Secretary of War. Friends of Mr. Adamson, however, who are acquainted with the water-power resources of his State as well as those of the states from which the other members of the sub-committee come are of the opinion that there is not the least chance that the committee on commerce will insert in any bill it brings in a paragraph permitting or requiring water-power plants to go into the possession of the states after their owners and builders have enjoyed them for the proposed period of fifty years.

The sub-committee, which has been working on water-power legislation for a year, it is expected, will soon have hearings on the various bills proposed, when all interested persons will probably have an opportunity to state their views. The final legislation, Representative Adamson states, will be as an amendment to the general dam act, and it will surely be passed at this Congress.

In writing to Representative Adamson, Secretary Garrison proposes that only public utility corporations shall be permitted to dam a navigable stream and create water-power for hydroelectric uses, and must obtain the right first from the State and then from Congress. Such companies in doing so must be subject to all the laws and regulations of the State for the control of public utilities corporations, while the State in which water-power development is sought must, before the consent of Congress can be obtained, provide these laws.

The bill contains sections to safeguard the public by duplicating the right of control, so that the federal government may be appealed to by citizens who believe they are not justly dealt with by the public utilities corporation using a water-power.

The taxation features of the proposed control of water-power are left to the State, and the suggestion is made that after a certain period of years the water-power revert to the State. In this event it is proposed that the State enter into the position occupied by the corporation, and that the federal right of supervision remain as to the State.

"It seemed to me that the proper point of view from which to approach a situation which had reached what appeared to be a permanent standstill," Mr. Garrison said in his letter, "was to consider not only the law but also the equities and interests of all concerned, so as to decide upon a policy consonant with law and with the equities and interests aforesaid.

"Legally speaking, I do not think there can be any dispute that, with respect to the question of power, the position of the federal government is paramount.

"Therefore, the proper solution seems to me to be to adopt a policy which recognizes the equitable sphere of each of those in interest. I conceive the equitable sphere of the federal government to be to see to it that this great public utility, wherever availed of, shall be availed of in a way that will benefit the greatest number under the most favorable terms possible; and in doing so, to recognize the justice (not as a matter of law) of the State entity or sovereignty receiving a revenue from the operation of this public utility within its confines and regulating it for the benefit of its people."

Elements of a Street-Lighting Contract

Mr. Sylvester B. Way, vice-president Milwaukee Electric Railway & Light Company, read a paper recently before the Milwaukee Electric League on "Elements of a Street-Lighting Contract." Starting with the premise that the best type of franchise is one providing for indeterminate duration but giving to the municipality or the State the right to recapture or own the utility at any time it so desires, Mr. Way said that it is evident that the ideal form of street-lighting contract would be one having no definite term. Such a contract, however, should provide for the supply of street-lighting service at cost and for an indefinite period or until such time as the municipality desires to terminate the contract. The condition of termination, where service has been rendered at cost, would necessarily be that the municipality would be required to take over at its then present value the special investment made by the utility for the purpose of carrying out the contract, or otherwise compensate the utility for the remaining value rendered useless to the utility by the termination of the contract. This ideal condition, however, cannot be realized in Wisconsin as the statutes of that State limit the term for which a municipality can execute a street-lighting contract to a period not longer than ten years. Mr. Way quoted from the report made by the Railroad Commission of Wisconsin to the street-lighting committee of the City Council of Milwaukee, which was described in the issues of the *Electrical World* for Sept. 20 and 27, 1913.

Under the Wisconsin law and commission the matter of arriving at equitable charges for public utility service has been simplified. No contract can be entered into between a municipality and a utility that will not be subject to review by the commission at any time. The value of the property devoted to the particular service is appraised and the usual allowances for interest, depreciation and taxes are determined, and from this analysis and a determination of the reasonable and necessary operating expenses the cost of the service is computed. The item of depreciation constitutes a relatively large proportion of the total cost of service, and if the term of the contract is less than the natural or useful life of the special equipment required for street-lighting purposes the difference between the rate of depreciation corresponding to the natural life of such equipment and the actual life, as determined by the term of the contract, must be allowed as special depreciation or amortization.

If the price to be included in any street-lighting contract is to be based upon cost analysis, all uncertain elements entering into the determination of the cost must be eliminated. With a definite specification as to the number and type of lamps to be used and their location and the term of the contract made definite or indeterminate, the cost of the service can be predicted with a high degree of accuracy.

Mr. Way described in detail the principal elements entering into a contract which would be so constructed as to eliminate all uncertainties to the greatest possible extent and would permit, therefore, a rate to be calculated upon the cost of service basis and at the same time would permit the municipality the widest latitude in keeping its system modern, in changing the location or character of service supplied to lamps, and eliminate the tendency to avoid the installation of needed additional lamps during the last years of the contract.

Electric-Vehicle Tires

At the meeting of the Electric Vehicle Association of America held at New York, Feb. 4, Mr. F. E. Whitney, of the Commercial Truck Company, Philadelphia, Pa., presented in revised form his paper on "The Tire Question as Applied to Electric Vehicles," which had been previously read before the Chicago convention of the association last fall.

The recent rapid rise in popularity of the electric vehicle, said the speaker, has been due to the fitness of this type of car for city work and to marked improvements in such essential features as ball and roller bearings, batteries with largely increased capacity and reduced weight, reduced maintenance costs, reduced cost of electricity and increase in number of charging stations, better and more efficient motors and types of gearing, and, last but not least, greatly increased tire life and, in addition, increased effective quality of the rubber.

A well-designed truck with good tires will show an energy consumption of, say, 35 watt-hr. per 1000-lb.-mile, and of this total from 20 watt-hr. to 25 watt-hr. are absorbed in the tires alone, leaving the remaining 15 watt-hr. to 20 watt-hr. distributed between bearings, gearing, motor loss, windage, etc. A change in tires on this same truck might easily increase the energy consumption to 50 watt-hr. per 1000-lb.-mile, or in comparison in miles on one charge of the battery the truck in the first case would cover, say, 50 miles on one charge of the battery, as against 35 miles in the second case.

The several methods of testing tires which have been found most satisfactory by the author are as follows:

1. The bounce test, which consists in dropping a piece of hard material on the tire from a definite height and measuring the height it will rebound. The proportion of the rebound to the total height represents the efficiency of the tire. Although this is only a comparative test, the results secured are reasonably accurate.
2. The coasting test, in which the vehicle is allowed to coast down a known grade, the distance it will run being determined. The more efficient tire will coast farther.
3. The running test, which is made by running the vehicle over a measured course. With proper instruments and stop-watch, the energy consumed is measured in terms of watt-hours per ton or 1000-lb.-mile.
4. The towing test, with traction dynamometer. This test consists in towing the vehicle over a definite course in both directions and observing the drawbar pull required.
5. The dynamometer test, in which the tire is rolled against a steel-tired wheel.

New York State Electrical Companies on Conservation

A meeting of representatives of electrical companies of New York State was held at the Hotel Ten Eyck, Albany, N. Y., on Feb. 21, to discuss pending water-power legislation. The meeting was called by the Empire State Gas and Electric Association. Mr. J. T. Hutchings, Rochester, president of the association, presided. Mr. Charles H. B. Chapin was secretary. Fifty companies were represented, and practically every one present spoke on the subject. A resolution was adopted expressing the unanimous support by the meeting of the action of the executive committee of the Empire State association on water-power matters. Mr. Chapin read the tentative text of bulletins which the association is to issue to companies in New York State.

Resolutions were adopted for presentation to Governor Glynn calling attention to the platform of the association, which is substantially the same as the declaration of principles adopted by the National Conservation Congress which met in Washington recently. The preamble to the resolutions declares that conservation of natural resources, especially of water resources, is essential to the continued prosperity and pre-eminence of the State and that true conservation of water resources means proper and economic use, with a view not only to present needs but also to future needs. The resolution therefore expresses the opinion of the company representatives, as practical men of long experience in the generation of electrical energy from coal and from water-power and in the transmission, distribution and sale of such energy, and as citizens and taxpayers, that the declaration of principles mentioned, if adopted as the basis of a plan, will accomplish the purposes desired in the most satisfactory manner possible and with the greatest benefit to the State as a whole.

The Empire State association, through Mr. Chapin as secretary, has issued a circular letter to electric light and power companies in the State giving a brief outline of the so-called Velte-Smith hydroelectric bills now pending in the Legislature. A joint hearing on these bills will be held in the Assembly Chamber at Albany at 2 p. m. on March 3. This letter is in part as follows:

"These bills, if enacted into law, would, under the guise of conservation of natural resources, commit the State to a policy of duplicating present investment and entering into direct competition with private capital. This general policy, we firmly believe, would be disastrous to the pre-eminence of the State and the welfare of the people, and in its special application to the electric light and power business would mean a decrease in efficiency of operation, a falling off in the quality of service to consumers, less assurance of a reasonable return upon capital invested, and consequently more difficulty in securing the new capital necessary for extensions and improvements.

"In addition to this, the expense of the project to the State and municipalities would be enormous and the success very doubtful. It would open up another and tremendously large field for the kind of extravagance and mismanagement with which we are becoming familiar through the investigations now being made. It would constitute another means for dealing out political patronage.

"The matter is not local to any community or to any section of the State, as some have seemed to assume. It is State-wide in character and in effect. We are convinced that the project will be defeated once and for all time if full publicity can be given to the facts, as we are sure the people of New York State will not countenance such a proposition for one minute if they are shown its true import. The only thing we are asking you or any one else to do is to tell the truth about it just as often as you can and to as many people as you can get to listen to it.

"Talk to your representatives in the Legislature, to the editors of your local papers, to the people you meet at home and in business, and point out to them the cost of carrying out the project—probably from $200,000,000 to $500,000,000 of public money. Show them the opportunities that this will afford for extravagance, graft and scandal.

"See your local bankers and tell them of the $200,000,000 of State bonds and an equal amount of municipal bonds and ask them what effect this will have on the State's credit and on the value of the State and municipal bonds they are holding as a reserve. You well know the risks of the light and power business due to changes in methods or improvements in the art. Point these out to the bankers, because in adopting this proposed policy the State will be going into the business and will have to assume these risks.

"Get in touch with your directors and stockholders and explain the situation to them. We know that if they understand the matter they will be glad to assist you in giving publicity to the facts. Tell your employees about it and ask them to give the facts to their friends and acquaintances."

Hearing at Washington on Niagara Power

The committee on foreign affairs of the House of Representatives heard testimony from Governor Glynn and other members of a New York delegation in Washington on Feb. 9 concerning the Niagara Falls power bills now before the committee. The committee is expecting to receive a brief from Chairman Van Kennen of the New York Conservation Commission. It has been agreed that the brief shall formally outline the whole position of New York State in the matter. In the delegation which appeared before the committee were, in addition to Governor Glynn, the Attorney General of New York, Mr. Thomas Carmody; Senator H. P. Velte, of the New York State Legislature; Mr. Van Kennen, of the New York Conservation Commission; Mr. Malone, of the New York Power Commission, and Mr. Charles A. Towne, former United States Senator and former member of the House of Representatives, now special counsel for New York State in Niagara Falls power bills matters.

The delegation announced definite opposition to the Cline bill, although an adjournment had been taken at the last hearing of the committee to enable the representatives of New York to suggest amendments to that bill. Instead, it was announced that the New York State government is now solidly lined behind the Levy bill.

Senator Velte, the first speaker at the hearing, said that the delegation was opposed to the Cline bill for the reason that it does not seem to be able to determine whether or not the bill usurps the right which the State of New York claims it has in Niagara Falls. A question had been asked as to the position of the State of New York on the question of diversion of the waters, as to the position the State would take in converting them into power. Senator Velte said he had introduced a bill in the New York Legislature which definitely sets forth the position of the State, and if it becomes a law it will give all the rights of water-power to the people of the State.

Attorney General Carmody said that the federal government has the right to control the diversion of water from Niagara River for one purpose only, and that is in the interest of navigation. New York State concedes the right of the federal government to preserve Niagara River, so far as its commerce is concerned, but when that right has been exercised the function of the federal government ceases.

Continuing, Mr. Carmody said that the property in the river, in the water as well as in the bed of the river, belongs to the State of New York. He said he would like to find out from the committee whether the proposition is challenged that the federal government has no right to control the diversion of water from Niagara River, except in the interest of navigation, or if that question is involved for the purpose of preserving the stream as a boundary stream for national defense.

Mr. Carmody was then told that he had about stated the ground upon which the committee has passed upon the bill.

Mr. Carmody replied that he started with the assumption that the treaty adopted and ratified between this country and Great Britain that permits the diversion of 20,000 cu. ft. of water per second is based upon the navigability and the integrity of the stream for military defense. That question was fully investigated before the treaty was ratified, and it seems to have been conceded that 20,000 cu. ft. of water per second could be diverted from the Niagara River without interfering with the navigability of the stream.

Whether that be so or not, if Congress finds that the navigability of the stream is interfered with by reason of that or any other diversion, Congress may prevent the diversion for the purpose of preserving the stream and Mr. Carmody said he wished to have it distinctly understood that he does not dispute the right of Congress to say how much may be diverted. But when the committee determines the amount of water which may be diverted the property rights of the State of New York are invoked and asserted, and the State has the right to determine the rules and regulations under which that diversion may be enjoyed.

The interest of navigation does not require that Congress should say who shall enjoy the privilege to be enjoyed or the circumstances under which that privilege shall be enjoyed. What will the courts say when trouble arises hereafter, possibly between the State of New York and those to whom the federal government has given permits?

Mr. Carmody then said that what Congress should do is to provide, under the supervision of the Secretary of War, for permits to the State of New York or to such parties as the State may designate as the parties to enjoy what diversion may be permitted, subject to the navigability of the stream or to its preservation for military defense.

When Governor Glynn testified Representative Cline asked him how long it had been since the State of New York gave away 1,000,000 hp at Long Sioux.

Governor Glynn said that the Republicans did that, not the Democrats, and that it would be repealed.

Representative Cline then asked about the bill before the Assembly to limit the provisions in the charters to companies having power rights on the Niagara River.

Governor Glynn said that the bill is pending and will undoubtedly be passed by a Democratic Senate. There are also five other bills which he thinks will match, so far as the securing of true conservation is concerned, any bills ever introduced in Congress by anybody.

Governor Glynn added that he would have the State itself develop every drop of water in the State and sell the power to the people at the cost of production. He would do what Canada is doing.

Governor Glynn added that he wished to dispel the apparent delusion to the effect that the representatives of New York State were there to make war on the power companies at Niagara. Confiscation is not in anyone's thought. He has no desire to do the power companies a wrong but does want to have New York State have control of its water.

Mr. Towne also made an extended argument.

Applications of Electricity in Mines

The American Institute of Mining Engineers, which held its one hundred and seventieth annual meeting in New York City, Feb. 16 to 19 inclusive, devoted the afternoon session of Feb. 17 almost entirely to talks and discussions relating to the application of electricity in mines.

Safeguarding Mine Installations

Mr. H. H. Clark, of Chicago, in his paper on "Safeguarding the Use of Electricity in Mines," said that it is more important to guard against the installation of poorly insulated wires in mines than elsewhere because the dim light usually available there increases the hazard of contact with live wires. The possibility of conductors becoming grounded is also augmented by mine conditions, increasing the danger of shocks or accidental explosions. Explosives, gas or coal dust may be accidentally ignited if exposed electrical conductors are employed or if circuits become grounded. Some very mysterious accidents have been caused by hauling explosives in metallic packages and by sparks from trolley wires coming in contact with exposed explosives. The speaker advised against employing the earth as one conductor of a detonating circuit, as sufficient potential difference may exist between neighboring earth strata to ignite a charge prematurely. Investigation by the United States Bureau of Mines shows that large sizes of carbon lamps and tungsten lamps of 25 watts rating or above are almost certain to ignite inflammable gases when the bulbs are broken. Several general suggestions were made on equipment to be used in mines, and the method of installing it to prevent accidents, but Mr. Clark declared that a code of rules is needed in mines which will be as effective as are the Fire Underwriters' requirements on the surface. Among electrical devices which have made for safer mine operation are the telephone, electrical shot-firing devices, storage-battery locomotives and portable electric mine lamps. The day will come, said the author, when electricity, instead of being considered a menace in mines, will be regarded as a means of safeguarding life and property.

A similar paper on "The Safety of Underground Electrical Installations," by Mr. C. M. Means, Pittsburgh, Pa., was abstracted by Mr. William Kelly, chairman of the electrical section. He called attention to statistics showing that electricity is responsible for only a small percentage of the mine accidents. The paper bore out Mr. Clark's statements that the proper use of electricity in mines will decrease the hazard rather than increase it. As the competent men who are trained in electrical work on the surface do not usually care to confine themselves underground, it is necessary to recruit men for electrical work from among the mine workers. These men should therefore have an opportunity to perfect themselves as electricians through some educational bureau maintained by the mining company. The need of competent mine inspectors and of wiring rules applicable to mines was also emphasized. The author of the paper recommended the concerted action of all interested in the extensive use of electrical apparatus in compiling a suitable set of rules.

A discussion followed the delivery of these two papers in which Messrs. G. S. Rice, New York; E. G. Spilsbury, New York, and B. F. Tillson, Franklin Furnace, N. J., took part.

Mr. Rice declared that English statistics show that 90 per cent of mine accidents, other than the falling of roofs, result from explosions caused by open lamps. He believes the use of electricity increases hazards, but mines cannot be operated economically without this form of energy. Faulty insulation was cited as another cause of accidents in mines. Tests made by the United States Bureau of Mines show that the inflammability of coal dust is generally proportional to the pound-Fahrenheit units contained per pound of coal.

In answer to Mr. Spilsbury's question regarding the weight of portable electric mine lamps and the improvements that have been made in them, Mr. Clark said that 35-lb. brass-inclosed storage-battery lamps are now on the market, the battery of which can be hung on the miner's belt and the lamp attached to his cap.

Mr. Tillson briefly described a light primary-battery lamp which is being used satisfactorily in some mines. The plate electrodes are replaced only once each shift.

Application of Electricity in Mines

Instead of reading his paper on "The Application of Electric Motors to Shovels," Mr. H. W. Rogers gave an illustrated talk on the equipment of motor-driven excavators, and explained some of the characteristic curves of motors most suited to operate them. He recommended the use of series direct-current motors in all cases, because the control is simpler, the size of the motor is minimized, and its characteristics meet the requirements of excavating operations better than those of an alternating-current motor. When only alternating-current energy is available, motor-generators should be employed to furnish the direct current. Two small motors should be used instead of one large machine for hoisting the scoop, as the power required for accelerating is less than that for the thrust. Electric shovels eliminate the employment of three men, teaming for one-half day, use of water, and considerable waste which accompanies the operation of a steam shovel. Comparative estimates were made to show the cost of operating a 120-ton shovel with steam and electricity. Excavating an average of 2500 cu. yd. per day of ten hours, the total cost per day of one shift operating with steam is $48.14, with direct current $42.75 and with alternating current $51.38. With three shifts per day figures favor direct-current drive still more.

Mr. Spilsbury and Mr. F. H. Armstrong, of Vulcan, Mich., took part in the discussion which followed.

Mr. Spilsbury asked whether equipping motors with flywheels would not enable them to carry the peak loads of excavating, to which Mr. Rogers replied that space is not available and that such a system is too expensive, as the power must be divided among more units.

Mr. Armstrong briefly described a new combined electric-hydraulic shovel which will soon be put in operation at the Penn and Republic iron mines in Michigan. Water for operating this shovel is delivered to a pressure tank at 250 lb. pressure by a motor-driven centrifugal pump. The water is used to operate plunger pistons connected to the hoisting, thrust and swinging apparatus.

Recent Developments in Electric Mine Machinery

A paper on "Recent Developments in the Design of Electric Locomotives and Coal-Cutting Machines," by Mr. Sanford B. Belden, Columbus, Ohio, was read in brief by Mr. R. R. Dunlop. A rating of 10 hp per ton hauled was recommended for mine locomotives operating at 6 miles per hour in ordinary cases. In specifying the temperature rise allowable on mine locomotives the author said he believed that the temperature of the commutator should be included, as the latter is usually cramped for space on narrow-gage roads. The use of ball bearings on locomotives will prevent armatures rubbing on the pole pieces, which usually happens if ordinary bushed bearings become worn. Interpoles on mine locomotives are not considered necessary by the author, as the wheels will slip if the motors are overloaded, hence commutation at normal loads is all that need be provided for. Locomotives should be designed so that motor casings may be removed without disturbing pinions or gear cases, and journal boxes should be arranged for rapid removal of wheels and axes. New types of "gathering" locomotives, coal-cutting, long and short wall, and top-cutting, breast-cutting, turret-mining and mechanical-loading machines were described. A motor-driven combined cutting and loading machine spoken of by Mr. Dunlop will be described in a later issue of the *Electrical World*.

ELECTRICALLY OPERATED COMBINATION MINING AND LOADING MACHINE

Owing to the lack of time and the absence of Mr. Charles Legrand, his paper on "Electric Traction in Mines," relating to the electrical equipment of copper mines in Douglas, Ariz., was not read. It called attention to the necessity of protecting trolley wires from dripping acidified water. In one case No. 00 wire was cut in two in three weeks by a small drip. Bad track bonding was cited as a cause of commutator trouble, as it may produce a sudden rush of current after a wheel passes over a rail joint, which will result in a ring of fire around the commutator. Figures were given on the cost of operating trolley and storage-battery locomotives. At one mine a 3-ton storage-battery locomotive, driven by 150 Edison cells mounted on a trailer, required 1.6 kw-hr. per useful ton-mile, under the worst conditions as regards tracks and curves. At the same mine trolley locomotives equipped with ball bearings required 875 watt-hr. at the switchboard per useful ton-mile. During 1912 408,000 ton-miles of work were performed by electric locomotives at a total cost, including maintenance and power, of 15.07 cents per useful ton-mile.

Electrical Equipment of Mines

An interesting paper on the electrical equipment and operating cost of some iron mines at Mineville, N. Y., was read by Mr. Solomon Le Fevre. Electricity is used here for practically every operation, including mining, hoisting, crushing, separating, etc. Motor-driven hoists, showing a total saving of 5 cents per ton over the steam-operated units, are employed.

The "Use of Electricity at the Penn and Republic Iron Mines, Michigan," was described at length in a paper so entitled by Messrs. William Kelly and F. H. Armstrong, of Vulcan, Mich. The pumping equipment, hoisting apparatus, tram system and signaling devices and the hydroelectric plant supplying the energy were described. Results of tests on the equipment, together with methods of operating and descriptions of safety devices, were also included in the paper.

In the discussion of this paper Messrs. K. A. Pauly, Armstrong, Tillson and J. E. Johnson, Ashland, Wis., took part.

In answer to Mr. Pauly's question regarding the range of motor slip which can be obtained with the water rheostat used at the Penn and Republic mines, Mr. Armstrong said that from 6 per cent to 20 per cent could be secured, although only 7 to 8 per cent is normally required.

Mr. Johnson expressed doubt as to the higher efficiency of electric hoists as compared with the air type. Mr. Pauly asserted that the efficiency of air hoists in certain Montana mines does not exceed 29 per cent, while the manufacturers claim that the units develop 50 per cent. He added that more trouble arises in the air end of a motor-driven compressor than in the electrical apparatus, to which statement Mr. Johnson and others took exception.

Electric Drilling

The extensive use of electric air drills on one particular job was brought out in a paper entitled "Drilling Performances at the Kensico Dam, Catskill Aqueduct System, New York," by Mr. W. L. Saunders, New York City. On this eight-million-dollar job of constructing a 29,000,000,000-gal. reservoir it was found that $75,000 could be saved by employing electric air drills rather than other types.

Portable motor-driven pulsators were used to operate the drills which bored holes in flawless gneiss to a maximum depth of 22 ft. and a diameter of 1.75 in. Including the time required for all drilling operations at the quarry supplying stone for this dam, a hole 31 ft. deep could be drilled in 448 minutes, the average spacing of holes being from 17.5 ft. to 16 ft. The total drilling cost per linear foot was 21.48 cents, including energy and labor. At the dam pit one of the drills accomplished an average of 26.4 linear ft. in 236 minutes 10 seconds.

The drilling apparatus, weighing 800 lb., consisted of two units—an air drill and a motor-driven pulsator connected by two lengths of rubber hose which served as a closed circuit for the air, which is used over and over. The pulsator is geared to a small alternating-current motor mounted rigidly on a truck and receiving energy through a flexible cable.

Midwinter Convention, A. I. E. E.

The second annual midwinter meeting of the American Institute of Electrical Engineers at New York, Feb. 25 to 27, was opened with an introductory address by President C. O. Mailloux, who referred to the international beneficial effects resulting from last year's discussion on ratings of electrical machinery. The new administration hopes to produce equally desirable results this year, he said, through the new arrangement of committees and the reclassification of their duties. Mr. Mailloux especially commended Mr. D. B. Rushmore for the energy and effort put into the activities of the electric power committee, of which he is chairman. The entire convention was held under the auspices of this committee, each of the six technical sessions being devoted to subjects of one of the electric power committee's sub-committees.

Mr. Rushmore spoke next on the development of the electrical industry and declared that the American Institute of Electrical Engineers will soon have to serve as a conference for electrical specialists rather than for general engineers, so that developments in the methods of conducting the Institute's conventions similar to those now being instituted must be made continually. The value of this institution has increased as "the time has come," said the speaker, "when the engineer who knows and does can shake off the inefficient engineer who dominates and borders on his work." Mr. Rushmore attributed the effectiveness of the American Institute of Electrical Engineers to the vim of the younger generation represented and to the freedom and initiative allowed the individual members in discussions through the application of the president's broad policy. The readjustment of the duties of the committees and their subdivision into sub-committees is proving effective, which indicates that further subdivisions may induce others to join the Institute who have not been attracted before. The speaker expressed belief that the scope of the electric power committee's duties do and should lie almost entirely in the public utility field. In concluding his remarks, Mr. Rushmore showed some interesting curves, indicating the rate of increase in the production of electrical apparatus, the extensive use of electrical energy, and the increased production of oil, coal, copper, aluminum and electrical apparatus. He predicted that motors will in the future probably be used to a greater extent for mine hoisting than ever before, since the results of electrically operated mines show motor drive to be more simple and efficient in operation, as well as lower in operating cost, than other motive powers. A new era is approaching in the development of electrical apparatus which will result in the elimination of manual operations almost entirely, and the dependence of the public on the generation of electrical energy will be enormous.

Mr. P. H. Thomas, New York, chairman, next submitted the report of the engineering data sub-committee, and was followed by Dr. Harold Pender, Boston, Mass., who read the report of the handbook sub-committee on "The Feasibility of an A. I. E. E. Handbook."

Engineering Data and Handbook

The report of the sub-committee on engineering data outlined the sub-committee's plans for its future work in the collection of engineering information. In this function the work of the sub-committee has been an outgrowth of the former activities of the high-tension transmission committee, but with extended scope. The engineering data which the sub-committee proposes to compile will be of two classes: (1) information of an exact character, the correctness of which is universally conceded, and (2) information as to forms of construction or elements of design which have been used by various individuals in solving frequently recurring problems, the conditions of which are well understood by engineers in general. Such information will usually be useful to an engineer who has a similar problem to solve. In this class is information on water-turbine performance, steam-condenser operation, transmission-line construction, overhead-trolley design, use of measuring instruments, etc.

Other possible subjects are the use of current-limiting reactance coils, the use of synchronous power-factor regulating apparatus, methods of locating grounds in cables, methods of erecting towers in transmission lines, high-tension insulation, electric drive in steel mills, etc.

The handbook sub-committee was created to consider the feasibility of the Institute's compiling a handbook to be issued to its members, and also to present the idea for discussion, in order thereby to determine the feeling of the members at large regarding such a project. There have been a few instances of other technical societies issuing to their members such manuals. The majority of the members of the sub-committee feel, however, that the project of the A. I. E. E. compiling and issuing a handbook of technical data is neither especially desirable nor is it practicable. The suggestion has also been made that if the data regarding electrical engineering facts and methods contained in the *Transactions* could be condensed into small space, the book would be exceedingly valuable. The members of the committee undertook to try this condensation for selected topics, but found the work involved to be enormous. To carry out the work of salaried officers would cost so much that it has not appeared to the members of the committee that the project was feasible. Another suggestion has been that the Institute compile volumes of papers on certain subjects, such as transmission lines, traction, telephony and telegraphy, and the properties of material, as was done several years ago with marked success.

Discussion

Mr. H. F. Thomson, Boston, Mass., secretary of the handbook sub-committee, reported that out of more than twenty engineering societies communicated with only one has itself issued a handbook for the use of its engineering members. Mr. Thomson quoted Mr. T. C. Martin, executive secretary of the National Electric Light Association, as replying that for the Institute to publish a handbook would be simply duplication of work done already and effectively.

The American Society of Mechanical Engineers once considered issuing such a handbook, but deemed its publication not feasible. Mr. C. W. Rice, New York, secretary of the A. S. M. E., reported that he knew of no group of engineers in his own society willing to get up such a publication, and, out of its membership of 5000, had heard of only two persons expressing a desire for such a compilation as that described. He thought it hardly worth while to duplicate existing handbooks.

Mr. H. M. Hobart, Schenectady, N. Y., said that a large number of printed engineering data are out of date, while the most useful material, relatively small in amount, is that which is timely. He suggested that for reference use curves might be reprinted from Institute papers and somewhat elaborated titles given to them which would make their meaning and value available to the reader without other text matter. Out of a given year's Institute papers, also, some 100 pages of selected matter might be compiled for publication, although on account of the great publishing difficulties involved Mr. Hobart advised in general that the Institute encourage activity in the publication of data on the part of others rather than itself undertake the work.

Mr. D. B. Rushmore, Schenectady, N. Y., who presided at the session, said that the Institute is already engaged in certain publishing work and urged that the principle of co-operative, centralized effort be practically applied to the compilation of handbook material.

Mr. P. M. Lincoln, Pittsburgh, Pa., characterized the idea of an Institute handbook as an excellent one, but he questioned its possibility.

Prof. C. A. Adams, Boston, Mass., declared that the handbooks now available are of small usefulness, taken separately, and all together, he added, they do not contain such good material as should be found in a single non-competitive handbook properly compiled under authoritative direction. However, said Professor Adams, the amount of work necessary to issue such a book would indeed be stupendous, and it would be unjust to demand the time of engineers without remuneration.

Mr. S. Haar, New York, advised that the Institute act as an intermediary in securing the publication of a handbook in a way similar to that by which the Nautical Almanac is published under governmental direction.

Mr. E. J. Henkle, New York, said that no commercial organization can secure such balanced data as those which an engineering organization like the Institute can compile. He commended the Hütte handbook, so familiar to engineers abroad. This, he said, is now in its twenty-first edition and presents the greatest uniformity of contents.

Mr. W. J. Hammer, New York, suggested that each of the sub-committees prepare sheets of data to be sent out to Institute members, in this way making a gradual approach toward the handbook problem.

Mr. C. W. Rice, New York, said that it is perfectly ethical for an engineering organization to publish a handbook if it desires to. The Verein Deutsche Ingenieur remunerates its authors and also subsidizes investigations, but it is not likely, said Mr. Rice, that any American society will be able to pay its authors.

In closing the discussion, President Mailloux expressed his belief that the Institute should not compete with publishing houses in the publication of a handbook, but should rather complement their efforts. It is the published material of the Institute which has made it great, he declared, and the broadest possible publicity should be given to its proceedings. In this direction, for example, the Italian Society of Electrical Engineers prints short abstracts of its principal papers in French, so that the information therein contained may be made available to the entire engineering world.

Five papers were presented at the power-station session of Wednesday afternoon.

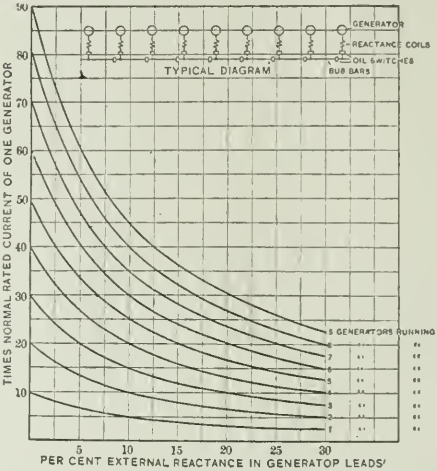
Protective Reactances in Large Power Stations

In a paper by Messrs. James Lyman, Allen M. Rossman and Leslie L. Perry, it was stated that the present tendency in power generation is toward larger central stations and larger units, resulting in the concentration of large amounts of power on single sets of busbars and consequently requiring protection against excessive flows of current into accidental faults. Reactance coils can be used in various ways to limit instantaneous current flows. Reactance coils in the generator leads, while limiting the flow of current from the different generators, are not, however, efficient for limiting the current flow into a fault. The accompanying illustration shows the relation between per cent reactance in the generator leads and the short-circuit current on the busbars for different assumed values of reactances, with one to nine generators connected to the buses. Thus it is seen that the first few per cent of reactance added are much more effective in reducing the short-circuit current than are subsequent additions. With nine 25,000-kva units in operation, each requires 20 per cent reactance in its leads, a total of 45,000 kva, to limit the current flow to thirty times the rated current of one generator.

Bus reactances are less bulky and less expensive than generator reactances, are more efficient in controlling the current flow, and have the advantage of localizing the effect of a fault to one or more sections of the busbars. They have, however, the disadvantage that, under normal conditions of operation, the current flow across them may cause an undesirable drop in voltage.

The ideal system of bus reactances would afford maximum protection to service and equipment in emergencies, while under normal operating conditions it would give minimum voltage difference between various points in the busbars. The straight bus, the ring bus and the ring and transfer bus approach this ideal condition in the order named.

Reactance coils in each feeder circuit are extremely effective in limiting the flow of current into a short-circuit on the feeder and in isolating the effects of this short-circuit from the other parts of the system.



RELATION BETWEEN EXTERNAL REACTANCE AND SHORT-CIRCUIT CURRENT FLOW

Discussion

Mr. Philip Torchio, New York, called attention to the fact that generators usually have considerably less than 10 per cent inherent reactance (usually about 5 per cent for twenty-five-cycle machines), so that reactors of more than, say, 12 per cent are often required to limit short-circuit currents. He stated further that the effectiveness of reactors is destroyed by placing them between bus sections feeding multiple circuits. The speaker expressed belief that bus-tie reactors should have the same current-carrying rating as the tie switches.

Mr. W. S. Moody, Pittsfield, Mass., emphasized the need of constructing reactors as ruggedly as possible since they may be required to withstand enormous mechanical strains when short-circuits occur. Reactors should be so located and used to the extent that they will not interfere seriously with voltage regulation.

Mr. H. G. Stott, New York, pointed out that generators are now being designed with sufficient internal reactance to protect themselves, so that reactors need be employed only to protect cables and switching apparatus. He described an actual condition where a three-conductor No. 000 cable was at times subjected to surges of 60,000 amp, producing repulsive forces between the conductors of 1 ton per running foot and showing the need of protective reactors. Besides being subjected to mechanical strains the cables suffered from these surges by high temperature rises. During as short a period as twelve cycles the temperature was noted to rise 1200 deg. C. A so-called "bridge scheme" of connecting reactors was described, in which each generator fed its respective bus and feeders through 5 per cent reactors, 2 per cent reactors being connected between each generator and a transfer bus to maintain synchronous operation of the machines. With this protection it was found that the short-circuit current in the previous case was reduced from 60,000 amp to 20,000 amp. The ideal operating method, Mr. Stott believes, is to insert reactors in the feeder circuits, but too much space is required to make this practicable.

Mr. P. M. Lincoln, Pittsburgh, Pa., declared that transient conditions are often forgotten when designing reactors. The initial short-circuit current is about double the permanent value, as the current oscillations are symmetrical about a logarithmic curve which finally becomes tangent to the base line.

Professor Vladimir Karapetoff, Ithaca, N. Y., suggested using reactance in generator-exciting circuits to minimize short-circuit currents, adding that he had conducted some rough experiments showing it to be effective. Exciter reactances may contain iron cores and need not be large, as the current carried is limited.

Mr. H. R. Woodrow, New York, showed that transient short-circuit currents are less than double the permanent current values as the oscillations when plotted do not originate at the top of the logarithmic curve but at the intersection of the co-ordinate axis. He declared further that reactors are not practicable in the exciting circuit, for by limiting the increase in field current dangerous voltages will occur in the field coils which may puncture the insulation. By employing reactors in the feeder circuits instead of in the generator leads, Mr. Woodrow explained that lower-rated units may be used.

Mr. W. M. Davis stated that where several generators are employed reactors may be connected between bus sections as described in the paper abstracted by Mr. Rossman, but where only a few units are installed it is preferable to use combination generator and feeder reactors similar to those described by Mr. Stott.

In closing this discussion, Mr. Rossman stated that most modern sixty-cycle generators have an internal reactance of about 10 per cent so that the conclusions arrived at in his paper are correct. He disagreed with Mr. Woodrow concerning the economy of using feeder reactors, as a large number would be required, he said, even though their rating may be lower than that for a generator reactor.

Four papers were next read or abstracted on outdoor substations, and were discussed as a group.

Outdoor Versus Indoor Substations

The recent development of the outdoor substation in opposition to the indoor type has resulted, as pointed out by Mr. Alexander Macomber, purely from economic conditions, particularly the desire to serve from transmission systems the small consumer who could not otherwise be reached on account of the high first costs of installation. The classes of apparatus involved which have required development to meet new conditions may in general be grouped under (1) protective equipment, (2) transformers, and (3) control equipment. The production of low-temperature electrolyte for the aluminum-cell lightning arrester now makes it feasible to place the entire equipment out of doors even under the most severe climatic conditions. For outdoor self-cooled transformers special grades of oil are recommended, and in the case of water-cooled transformers precautions must be taken to prevent the freezing of the circulating system. For the above reasons it is suggested that outdoor substations might offer a field for air-blast transformers. For small isolated loads the outdoor equipment required may be of the simplest character, but to supply demands of larger rating the problem becomes more elaborate. An important detail of outdoor installation is that of providing proper facilities for repairs, and large stations should always provide some shelter where repairs can be properly made.

Summing up, the advantages of an outdoor installation are its lower first cost, ease of extension, reduction of fire hazard, and simplicity of layout. With these are to be compared its disadvantages, which include the difficulty of making repairs, operating risks, danger to public, and appearance. For the small isolated substation up to a few hundred kva the cost will be 25 per cent to 50 per cent less than the corresponding indoor station. In large installations the saving will therefore be much smaller. Up to the present time there are installed or under construction approximately 300,000 kva in high-tension outdoor type transformers. Successful operation of installations during several years has shown that operating difficulties are unusual, and the query may well become, instead of "When shall we use the outdoor substation?" rather "When shall it not be used?"

Indoor and Outdoor Substations in Pennsylvania

The paper by Mr. H. L. Fullerton covered in a general way indoor and outdoor substations for pressures up to 20,000 volts, including a discussion of such topics as choice of location, type of building and the arrangement of electrical apparatus. The author divided his subject into two sections: (1) customers' substations fed from the regular distribution system and those fed from the transmission system; (2) company's substations or those installed at a center of load to deliver service to customers in that district. In selecting a location for transformers there should be considered: (1) the position of the customer's load; (2) location of company's street mains; (3) accessibility for delivering material; (4) accessibility for the operating company's employees, and (5) possibilities of ventilation and sewer connections. Among the advantages of outdoor substations which the author enumerated were reduced cost of installation, increased accessibility for employees, lessened difficulty in making connections to lines, absence of transformer vaults, and better ventilation. Indoor installations, on the other hand, offer the advantages of (1) having the apparatus more accessible for inspection or repairs, (2) involving less danger of unauthorized persons interfering with apparatus, (3) giving customers control of the installation on the primary side if desired, and (4) protection of apparatus from the weather.

In making a selection of a site for a company substation there should be considered the location of the present load, future development of the district, distance from existing substations, outlet from the substation for the various feeders, and street frontage. Types of substations were also discussed, particular attention being devoted to one building formed of concrete slabs. Attention was also called to different arrangements of electrical equipment which may be employed for installations of various sizes. Schemes for installing high-tension switchboard apparatus were discussed, emphasis being laid on the open-wire and concrete-cell methods of construction.

Outdoor Substations in New England

The paper by Mr. Fred L. Hunt described the new substations at Chicopee and Agawam, Mass., put into operation by the Amherst Power Company during last summer. Both are operated from the company's double-circuit, sixty-cycle, three-phase, 66,000-volt transmission line from Turners Falls to Springfield. These stations are of the semi-outdoor type in which all of the 66,000-volt equipment, including the stepdown transformers, is placed outdoors, while the 13,200-volt buses and switching equipment, the 2300-volt distributing switchboard and the railway apparatus are mounted inside. The 66,000-volt apparatus, being the most bulky part of the equipment, is placed outside with the idea of making the greatest saving in building space. On the other hand, the complicated switching necessary with the numerous lower-voltage outgoing circuits would have made an outdoor installation for these very difficult and expensive to handle. A building similar to the one actually erected but of dimensions necessary to accommodate indoors all the apparatus, including the 66,000-volt equipment, would have cost on the above basis nearly two and one-half times as much as did the present building. During cold weather the spare transformer provided is connected to the bus on the low-tension side, keeping the temperature of the oil above its freezing point—minus 15 deg. C. When it becomes necessary to disassemble a transformer it is rolled on a transfer truck, which is run into a compartment at one end of the station where there is a hoist to lift and remove the core. The recent winter-weather test of these substations has so far shown very satisfactory results. Some difficulty was first experienced in keeping the joints of the cooling radiators on the transformers oil-tight, owing to the wide range of temperatures to which they were subjected. The design of the radiators has now been changed, and they have thus far stood the test of rapid temperature changes without developing leaks.

Outdoor Substations in the Middle West

Conditions in the Middle West, and particularly in the agricultural districts, often require the construction of small, inexpensive outdoor substations along transmission lines to make the distribution of energy commercially practicable at loads of 300 kw or less. The paper by Mr. Leslie L. Perry described and illustrated a substation which can be built economically to accommodate three 50-kw, 33,000/2300-volt transformers and the distributing equipment. The station described consists of a corrugated-iron or steel transformer compartment 6 ft. square, on top of which are supported electrolytic lightning arresters and a steel angle-iron frame carrying the horn-gaps and choke-coils. Steel framework was recommended as it can be erected at a lower expense than wood and is both durable and non-inflammable. The low-tension equipment, consisting of oil switches, instruments, voltage regulators, etc., should be placed inside the transformer compartment. To allow isolation of the substation equipment from the transmission line when repairs or inspections are being made the author recommended mounting disconnecting switches on a pole near the substation with levers and gear connection which can be operated by any intelligent man. Operation of similar stations has been successful, but improvements in lighting and overload protective apparatus is looked forward to.

Discussion

Prof. D. C. Jackson, Boston, Mass., opened the discussion on the substation papers by calling attention to the opinions held by the authors in common and emphasizing the importance of extending electric service to everyone.

Mr. A. H. Kruesi, Schenectady, N. Y., said that reliability of service should not be sacrificed for economy since the maximum saving occasioned by the use of outdoor substations instead of the indoor type is only about 10 per cent. If outdoor stations are employed they should be limited to small installations which are not absolutely required to furnish uninterrupted service. Mr. Kruesi abstracted a written discussion contributed by his assistant, Mr. Smith, who said that many engineers have been forced into believing that large savings can be effected by constructing outdoor stations. Real economy may result when these stations do not require attendants or where 60,000-volt or higher-voltage equipment is employed. Because of exposure to the weather about 50 per cent more spacing is required between conductors in outdoor installations. Weather conditions also increase the danger of fire from short-circuits, which may destroy the steel framework supporting the apparatus. Messrs. D. B. Rushmore and R. E. Argersinger, of Schenectady, N. Y., also contributed to the discussion.

Mr. H. B. Gear, Chicago, Ill., expressed belief that in choosing the type of installation to use the building cost should be balanced against increased cost of outdoor equipment, but added that the latter may be desirable for other than economic reasons, when no space is available for an inclosure.

Mr. Moody stated that there is probably more than 600,000 kw in equipment installed or being installed in outdoor stations rated at 200 kw or higher. Outdoor stations rated as high as 7500 kw or 50,000 kw have been constructed. Weather conditions make it necessary to design apparatus with water-tight joints, special ventilation and insulation.

Mr. Rossman declared that some small outdoor substations can be built for less than the price of a 33,000-volt oil switch.

Mr. J. C. Smith, Montreal, Que., declared that outdoor stations have not been employed to a large extent in Canada because self-cooled transformers have to be used. The water-cooled type tend to freeze in the severe winter weather unless heated, and this is undesirable.

Mr. P. W. Sothman, New York, proposed adopting the motto "Continuous service if possible within commercial reason," when considering outdoor stations. He prophesied, however, that combination indoor-outdoor stations will probably be employed to a greater extent in cities.

Mr. J. E. Kearns, Schenectady, N. Y., declared that if attempts are made to eliminate unnecessary equipment in indoor stations as is done in the outdoor type the cost of construction will show in favor of the former. He suggested using air-blast transformers for the outdoor type.

Mr. H. E. Bussey, Atlanta, Ga., discredited the economy claimed for outdoor construction and suggested that cost data on these installations be submitted by constructing engineers.

Mr. Farley Osgood, Newark, N. J., declared that outdoor stations are not adapted to use in congested districts or for purposes where much switching is required.

After a remark by Mr. K. C. Randall, Pittsburgh, Pa., to the effect that manufacturers will probably be willing to furnish outdoor equipment for 150,000 volts, Mr. Jackson closed the discussion. He said that where reliability is uppermost in importance indoor stations should be employed, but in sparsely settled districts energy can be delivered economically to those who need it only by employing outdoor substations.

An account of the other sessions on Wednesday night, Thursday and Friday will appear in a subsequent issue.

Public Service Commission News

California Commission

The Mount Whitney Power & Electric Company has filed an application with the Railroad Commission of California, asking for authority to issue $500,000 first mortgage 6 per cent bonds to be sold at not less than 95. The funds are to be used in hydroelectric development work on the Kaweah River.

The Union Hollywood Water Company has filed a complaint with the Railroad Commission of California against the Pacific Electric Railway, complaining against the damage alleged to be sustained by the underground pipes of the water company which run parallel to the right-of-way of the railway.

Indiana Commission

Mr. Thomas M. Honan, Attorney-General of Indiana, in answer to questions from the Public Service Commission, has decided that no Indiana utility, under the new act, may be authorized by the commission to sell bonds at less than 75 per cent of par. Where bonds were authorized prior to Feb. 1, 1913, and not issued, and the company now desires to sell them, the commission may authorize the sale of such bonds at not less than 65 per cent, the Attorney-General held. No utility has the right to ask authorization of bonds to be used as collateral for less than 75 per cent of their face value, according to the decision.

Mr. Charles A. Edwards, a business man of Huntington, has been appointed by Governor Ralston, to succeed Mr. F. E. Payne, of Indianapolis, as a member of the Public Service Commission of Indiana. Mr. Payne resigned on account of ill-health. Lawyers are still in the majority on the Indiana commission, Commissioners Duncan (chairman), Clark and McClure being former judges.

Wisconsin Commission

In a decision issued recently the Wisconsin Supreme Court has sustained the Railroad Commission by upholding the indeterminate permit law. The decision grew out of the case of the Wisconsin Traction, Light, Heat & Power Company against the city of Menasha. The city, which has been furnishing its own street lighting service for some time, has begun recently to do a regular commercial lighting business in competition with the plaintiff and without the necessary authority as conveyed by the certificate of convenience and necessity. The decision of the court, which was contrary to that of the lower court, held that a municipality, as well as a private corporation, must secure a certificate from the Railroad Commission to the effect that public convenience requires the service it proposes to render.

After having refused repeatedly to obey the commission's orders requiring compliance with the standards of service, the Dodgeville Electric Light & Power Company has been ordered to overhaul its entire system promptly and thoroughly so as to render service in full compliance with the standards. The order provides that the company must engage some competent engineer and notify the commission of the fact; that the complete plans and specifications covering the new equipment and changes shall be filed with the commission within thirty days after the engineer is engaged, and that the work shall be completed within six months.

Ohio Commission

The City Council of Cincinnati has adopted a resolution asking the Ohio Public Service Commission to make a physical valuation of the property of the Union Gas & Electric Company to the end that a better idea of a fair and equitable rate for service may be had.

New Jersey Commission

The Board of Public Utility Commissioners of New Jersey has rendered a decision on the application of the Ocean City Electric Light Company for approval of the transfer upon its books of 1193 of the 1200 shares of capital stock of that company to the Atlantic City Electric Company. Originally application was made to the board for permission to transfer the shares to the American Gas & Electric Company, a holding company incorporated in another state. The board refused this application. The application was then amended to provide for transfer of the shares to the Atlantic City Electric Company.

The price proposed to be paid by the Atlantic City company for the Ocean City stock is $305,000. An appraisal of the property of the Ocean City company by the engineering staff of the board indicates that the cost to reproduce new the physical property of the company, including materials and supplies, would be $249,328. This includes no allowance for organization or promotion expenses or the cost of procuring franchises. From this sum there is deducted for accrued depreciation $51,365, leaving as the present value of the structures $197,963. To this there is added as working capital $12,500, making a total of $210,463. There is then added an allowance for all allowable elements of intangible value tentatively reckoned at 25 per cent of the cost of the physical property, or $62,500, making a total of $272,963. This would mean that the purchase price would exceed by $33,000 the value of the property as determined. In this situation the board declines to grant its approval. If it did so it would not be justified later in withholding approval of an application by the Atlantic City company to capitalize the proposed purchase price of $305,000, nor would it be justified later, in proceedings about rates, in refusing to allow $305,000 as the fair value of the property. The companies will be offered an opportunity to question the appraisal and to introduce testimony to establish that the apparent excess of the purchase price over value does not in fact exist.

New York Commissions

Mr. Seymour Van Santvoord, Troy, N. Y., has been nominated by Governor Glynn to be a member of the New York Public Service Commission, Second District, to succeed Mr. Frank W. Stevens, whose term expired a year ago. The nomination was referred to the finance committee of the Senate. Mr. Van Santvoord is a lawyer. He has been prominent as a banker and was one of the organizers of the Trust Companies Association of New York State.

Pennsylvania Commission

The Public Service Commission of Pennsylvania has passed an order regulating the crossing of facilities of one public service company with those of another public service company. Before constructing any structures or other facilities across the structures or other facilities of any other public service company, whether underground or above ground or at the same or different levels, in the absence of an agreement between the companies affected, a company shall serve ten days' written notice upon the company whose structures it is so desired to cross. This notice shall specify the nature and character of the contemplated crossing and the exact location thereof. A copy, with proof of service, shall be filed with the commission. The commission may fix a time and place for a hearing to determine whether or not the crossing shall be approved. The regulation shall apply to all crossings between the structures or facilities of public service companies other than crossings between railroads and street railways.

Current News Notes

Mr. Taft's Address on Signs of the Times.—The Electrical Manufacturers' Club has published in pamphlet form the address on "The Signs of the Times" given by Ex-president W. H. Taft before the club at its meeting at Hot Springs, Va., on Nov. 6, 1913. A report of this meeting was published in the *Electrical World* on Nov. 15, 1913.

* * *

Engineering Societies Exhibit at Ohio Northern University.—The annual exhibition of the engineering societies of Ohio Northern University, Ada, Ohio, was held on Feb. 20. All the engineering departments were represented. Among the electrical exhibits were various direct-current and alternating-current machines, high-voltage insulators, lighting fixtures, heating appliances, etc. Experiments with high-frequency currents of about 100,000 volts were given.

* * *

Telephone Growth in Chicago.—A committee of the Chicago Telephone Company which has made an exhaustive study of population probabilities predicts that the population of Chicago and its immediate environs in 1930 will be 4,000,000. At that time it is predicted that the number of telephones in Chicago will be about 1,000,000. The present number is about 375,000. The Chicago Telephone Company now employs about 13,200 persons, of whom 5700 are men and boys and 7500 are women and girls.

* * *

Electricity to the Gas Stove's Aid.—During the recent cold snap a householder in an Eastern city found his kitchen gas supply frozen and chances for breakfast poor as the gas stove was depended upon for cooking. Recollecting, however, his trusty electric iron, the hungry householder attached an extra lamp cord and proceeded to "iron" vigorously the gas pipe in the cellar. After a few minutes of this treatment, the gas came gurgling cheerily through the pipe and it was not long before coffee and eggs were steaming on the table.

* * *

SOCIETY MEETINGS

Michigan University Branch, A. I. E. E.—Mr. H. H. Conant spoke on the topic "Commercial Applications of Storage Batteries" before the University of Michigan Branch of the American Institute of Electrical Engineers at its meeting Feb. 12.

* * *

Banquet of Grand Rapids Jovians.—Members of the Jovian Order living in Grand Rapids, Mich., and vicinity held a banquet and initiation at the Hotel Pantlind in that city Feb. 13. Mr. H. A. Robseverry, local statesman, was in charge of the ceremonies, during which twelve novices were admitted into the order.

* * *

Fire Prevention by Means of Code Building.—At the bi-weekly luncheon of the New York Section of the Jovian Order, Feb. 25, Mr. Abram W. Herbst, director of safety American Society for Fire Prevention, and chairman of the committee of buildings of the 1912-13 Board of Aldermen, New York, spoke of the need of proper legislation to eliminate the conflicting authority of the different city departments in regard to the installation of various kinds of electrical apparatus. The speaker stated that the electrical code as now existing in New York City has never been approved by the Board of Aldermen, but that a new code is being drafted, which, it is hoped, will soon obtain the sanction of this body.

Motor Truck Club of America.—At a meeting of the Motor Truck Club of America held Feb. 18 at the Automobile Club of America, New York City, Dr. L. L. Hewes, chief of the Bureau of Economics, Washington, D. C., presented a paper by Mr. Logan Waller Page, director of the Bureau of Public Roads, reviewing the work done by the government in gathering data on highway traffic and wear, establishing standards of construction, etc.

* * *

Boston Electric Vehicle Campaign Dinner.—The third anniversary of the inauguration of the electric-vehicle campaign by the Edison Electric Illuminating Company of Boston is to be observed by a dinner at the American House in that city on Tuesday evening, March 3, at 6:30 o'clock. Men prominent in the automobile business, including manufacturers and agents, as well as publishers and representatives of automobile publications and also members of the Electric Motor Car Club, have been invited to attend.

* * *

Electric-Vehicle Men to Enjoy a Social Evening.—Something of a departure in the program of the Chicago Section of the Electric Vehicle Association is a "social evening," which is planned for the night of March 3. A dinner for members and guests will be given at the Schiller Café and Bowling Alleys, 318 East Thirty-first Street. After the dinner there will be a bowling contest on the ten alleys available. Billiard and pool tables will also be available for those who prefer this form of recreation. Tickets can be obtained from the committee in charge of the affair, consisting of Messrs. E. J. Kilborn, General Motors Truck Company; C. B. Frayer, Edison Storage Battery Company, and F. A. Putt, General Electric Company.

* * *

"Tech" Alumni Reunion in Chicago.—A reunion of the alumni of the Massachusetts Institute of Technology was held in Chicago on Feb. 20 and 21. It was given under the auspices of the Technology Clubs Associated and the Northwestern Association of Alumni. Headquarters were maintained at the Blackstone Hotel, where a banquet was given. An informal dinner and smoker was held at the University Club. There were excursions to the generating stations of the Commonwealth Edison Company, Underwriters' Laboratories, Hawthorne works of Western Electric Company and other points. President Maclaurin spoke on the "New Technology" at the smoker of Feb. 20. President Lowell of Harvard University was one of the speakers.

* * *

Engineers' Dinner in Boston.—The fifth annual dinner to be given jointly by the Boston Section of the American Institute of Electrical Engineers, the Boston Society of Civil Engineers and the Boston Section of the American Society of Mechanical Engineers will be held at the City Club of that city on March 4, at 6 p. m. This dinner is primarily intended to promote the social and professional interests of all engineers of Boston and vicinity and affords an opportunity to consider their broader civic relationship. The guests of honor of the evening will be Mr. Guy E. Tripp, of the Westinghouse Electric & Manufacturing Company, New York, who will speak on "The National Government and Business"; Dr. A. E. Kennelly, professor of electrical engineering, Harvard University, whose subject will be "Results for the Electrical Engineering Fraternity Accomplished by the I. E. C.," and Dr. M. W. Franklin, of the Sprague Electric Works of Bloomfield, N. J., who will speak on "Ozone Applied to Ventilation." Mr. N. J. Neale is chairman of the committee of arrangements for the dinner.

Turbo-Alternator Plant for Louisville Railways

Modern steam station of the Louisville Traction Company planned for an ultimate rating of 48,000 kw—Provisions for coal storage—Intakes for supplying circulating water from the Ohio River

On the south bank of the Ohio River at a point above the Louisville dam and rapids the Louisville Traction Company, owner of the Louisville Railway and the Louisville & Interurban Railroad Company, has just placed in service its modern turbo-generator plant which supplies energy to operate the street-car and interurban lines of Louisville and vicinity. The Louisville Railway system embraces about 165 miles of city tracks, and the Louisville Interurban Railroad Company operates 96 miles of traction lines radiating from Louisville as a center, out through Jefferson, Oldham and Shelby Counties.

The new plant transmits 13,200-volt, twenty-five-cycle, three-phase energy to two city substations and to the company's old generating station on Campbell Street, Louisville, from which point in turn are fed six substations on the seven interurban lines radiating from the city. The recently completed waterside plant of the traction company begins operation with an equipment of 12,000 kw, although it has been designed for an ultimate rating of 48,000 kw when the present plans are completely carried out.

Prior to the construction of the new station the Louisville city and interurban traction system was supplied with electrical energy from the above-mentioned Campbell Street plant, which is situated on Beargrass Creek. This station contained one 3500-kw and one 3000-kw steam turbine and two 1650-kw reciprocating vertical engine-type units, all generating 13,200-volt, twenty-five-cycle, three-phase alternating current. In addition the old plant was equipped with several 550-volt direct-current generators, making a total of 14,600 kw, besides a 3000-amp-hr. storage battery which was used as a reserve during peak-load periods.

Beargrass Creek, on which the old plant was situated and from which circulating water was obtained, formerly received the discharge from a number of sewers. This did not materially impair the value of the water for use in the condensers, but within the past five years the city of Louisville constructed several sewers parallel to the creek, resulting in a reduction of the flow of water in the creek itself to an almost negligible quantity. The situation thus arising made it necessary for the railway company to seek either a new supply of condensing water or a new site for a power station. To put off the day when it would be necessary to build a new plant the company first sank artesian wells and installed a spray cooling system to furnish condensing

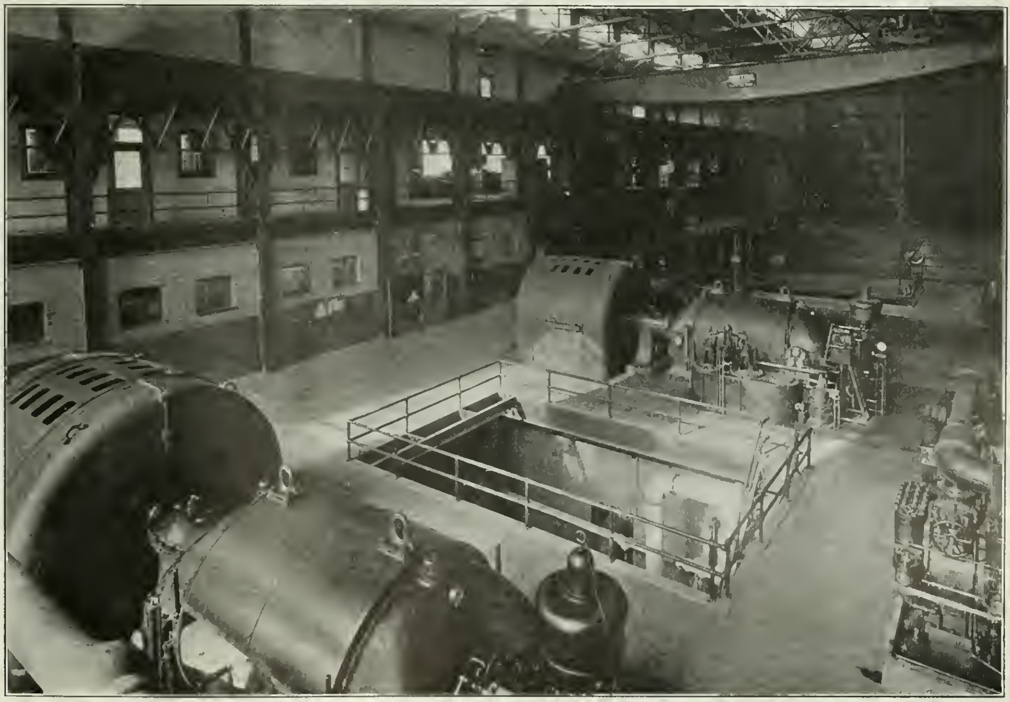


FIG. 1—TURBINE ROOM, LOOKING WEST, LOUISVILLE TRACTION COMPANY STATION

water. Such methods, with the limited quantity of water available and the amount of pumping necessary, proved, however, costly and materially reduced the efficiency of the plant. To eliminate these difficulties and at the same time to take advantage of modern generating efficiencies, it was decided to build a new station at a more advantageous location where plenty of water would be available.

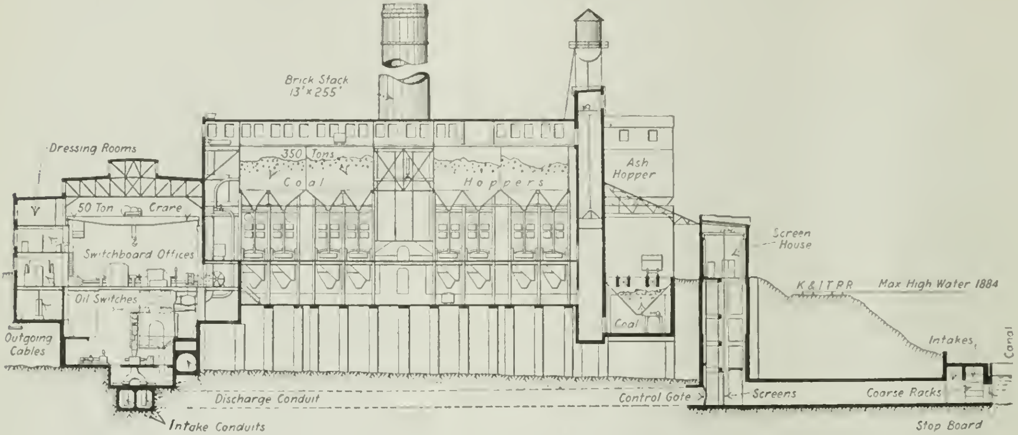


FIG. 2—CROSS-SECTION HIGH STREET POWER HOUSE, LOOKING WEST

In the meantime the average daily output of the existing plant had increased from 35,000 kw-hr. in 1900 to practically 150,000 kw-hr. by the close of 1912. At the same time the maximum demand rose from 3000 kw in 1900 to 15,000 kw in 1912. This rapid growth in the output was due to several causes, including the increased car mileage, track mileage, car sizes and car equipment. During 1902 the generating station output was 1.5 kw-hr. per car mile; in 1905 this had increased to 2.5 kw-hr. and in 1912 to approximately 3.9 kw-hr. per car-mile.

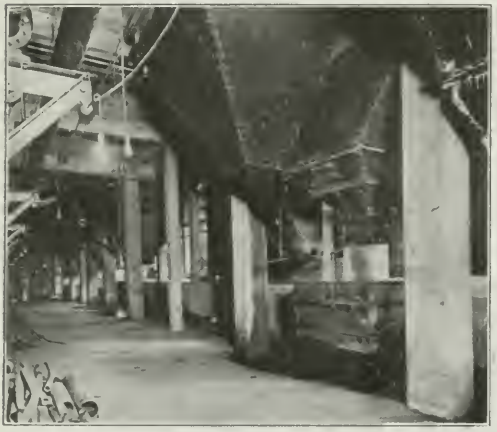


FIG. 3—STEEL ASH BINS FOR LOADING CARS

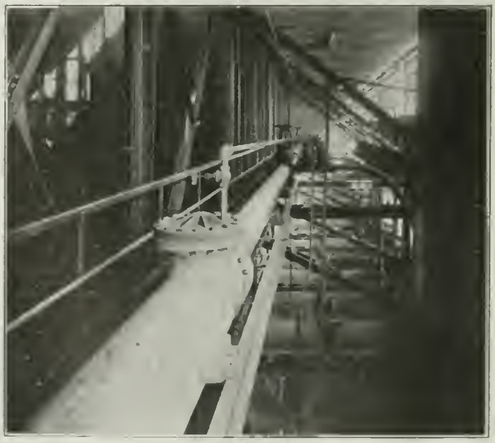


FIG. 4—STEAM MAIN OVER BOILERS

Factors entering into the selection of the new generating site may therefore be summarized as (1) ample condensing water supply, (2) ready access to steam-road transportation, and (3) cheap real estate so as to permit open storage of coal to tide over high-water periods, coal strikes and transportation accidents. To obtain these necessary requirements a site for the new plant was selected on the Ohio River. At a point in the river opposite Louisville the federal government has built a removable dam to limit the low-water stage in the Louisville harbor. Rapids in the river opposite the city have also made necessary locks for transporting boats around the falls during low river stages. Accordingly property for the plant was purchased above the locks at a point where a definite minimum stage of the river could be obtained.

Features of Station Layout

The new plant site fronts 1358 ft. on the Kentucky & Indiana Terminal Railroad Company's right-of-way, which adjoins the Louisville & Portland canal. The transportation facilities offered at this location are especially desirable, because this railroad forms a part of a double-track belt line around about half the city and connects with all the steam roads entering Louisville. In addition, the general level of the plant property is approximately 5 ft. above the maximum high-water stage of the river. The site is underlaid with bed-rock at a depth of about 36 ft.

Switches at each end of the plant property connect to a long side track paralleling the steam road's right-of-way. A lead from one end of this side track in turn branches into five tracks, two of which lead over the coal hopper beside the boiler house, one into the boiler house and one into the generating room under the crane. The space remaining between these four tracks furnishes sufficient area to store two or three months' coal supply in the open. This space has been graded so that all surface water drains off readily. Approximately thirty cars of coal will be required every twenty-four hours for the completed station, and the yard layout of 4000 ft. of track provides for two days' supply of coal on cars at all times, with extra space for one day's empties.

Fuel purchased for storage purposes will be either "mine run" or a combination of nut and slack coal, and will be piled in the yard to a height of approximately 15 ft. By providing a well-drained storage area and limiting the height of the piles it is believed that spontaneous fires will be reduced to a minimum.

The first section of the generating station includes a boiler room, 100 ft. by 180 ft. in plan, built with its long axis at right angles to the turbine room, which is 80 ft. by 175 ft. This boiler room houses the initial equipment of eight 507-hp boilers with spare space for a duplicate battery under the same roof. The turbine room was also designed large enough not only to house the initial installation of two 6000-kw steam turbines but to provide space also for the foundations of two additional units. The buildings are constructed of plain and reinforced concrete, brick and steel, and are thoroughly fireproof structures. They rest either on concrete caissons taken down to rock or on concrete mats resting on Ransome concrete piling driven to bed-rock or to refusal. Ample provision is made for natural illumination and ventilation in the turbine and boiler rooms by large window-glass areas with Fenestra steel sash. In addition, a double monitor skylight surmounts the firing aisle of the boiler room and the long axis of the turbine room.

Boiler-Room Equipment

For serving the initial installation of eight 507-hp Babcock & Wilcox boilers a 13-ft. by 255-ft. dark-red radial-brick stack was erected by the H. R. Heinicke Company on a concrete foundation resting on bed-rock. This stack provides 1 sq. ft. of area for each 36.25 hp. The present boiler equipment generates steam at 200 lb. pressure per sq. in. and 125 deg. Fahr. superheat. Each unit is equipped with a Babcock & Wilcox chain-grate stoker having a grate 9 ft. 6 in. wide by 12 ft. 3 in. long. This size of grate was particularly designed to produce economical results with the Kentucky pea and slack coal used.

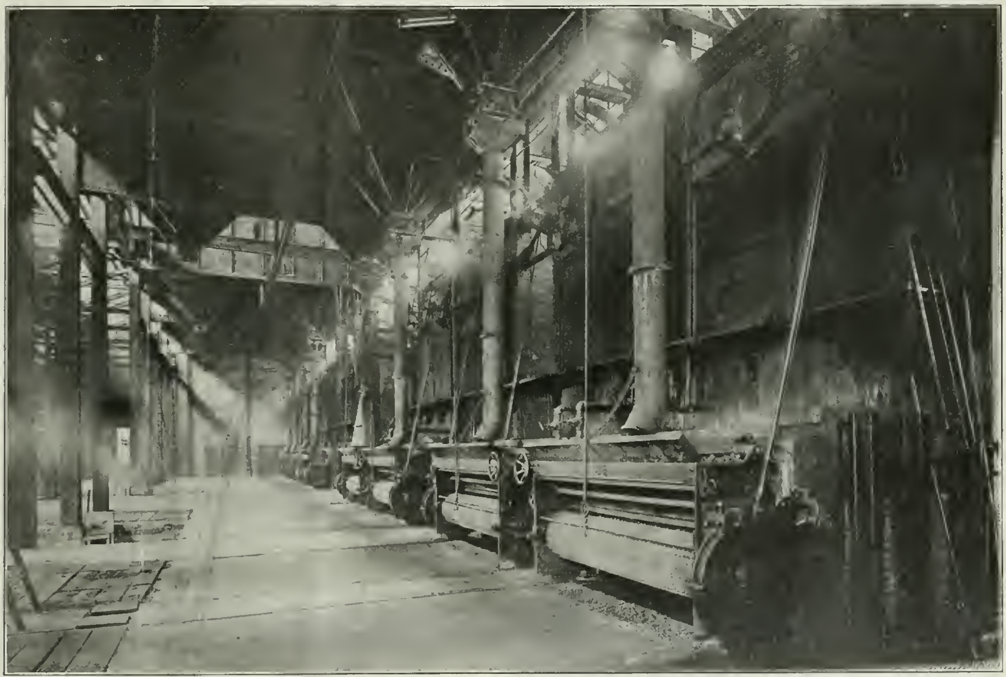


FIG. 5—BOILER ROOM, SHOWING EIGHT UNITS, COAL BUNKERS AND STEEL IN PLACE FOR SECOND ROW OF BOILERS

The stack rises to an elevation 253 ft. above the grate level, and with six of the boilers in service the draft at the base of the stack has averaged 1.2 in. of water. Tests made over the front of the grates, the main breechings and the boiler dampers being open, showed pressure of 0.45 in. of water, while the draft at the last boiler pass measured 1 in. of water. A preliminary test of station efficiency during the second month's operation, before the steam piping was completely covered, and while some steam was being used for drying out and testing purposes, gave a coal consumption of 2.975 lb. per kw-hr. with 12.5 per cent ash. The coal used was Western Kentucky pea and slack, containing approximately 12,000 lb.-Fahr. heat units per lb. when dry.

From these receiving track hoppers, 2-ton hand push cars convey the coal to the structural-steel bunkers over the boiler room by way of duplicate electric elevators. An industrial railway leads from the elevator shaft over the battery of bunkers so that these cars may be pushed by hand and dumped at any point desired. The two platform elevators measure 10 ft. by 10 ft. in size and are of 6000-lb. capacity. They were designed to operate at 100 ft. per minute, one being driven by a 550-volt, 30-hp direct-current motor and the other by a 440-volt, 30-hp, three-phase alternating-current motor.

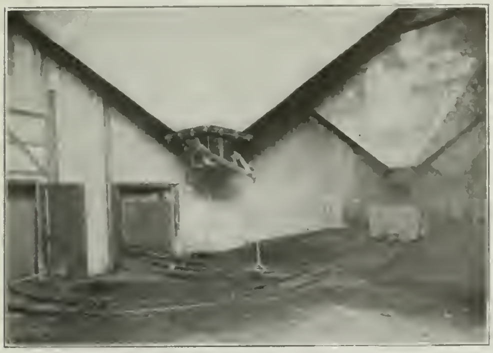


FIG. 6—CONCRETE COAL HOPPERS UNDER COAL-UNLOADING TRACKS

Each battery of two boilers is equipped with a coal bin holding 225 tons, which represents four and one-half days' fuel supply for ordinary operation. This large coal-bin capacity was deemed necessary as a precaution against shortage during extreme high-water periods when the tracks of the steam railroad might be inundated.

The ashes drop from the chain grates into two steel ash hoppers lined with firebrick and are dumped into push cars on an industrial railway. Siftings from the grates are dumped into the cars and returned to the coal bunkers. The small cars loaded with ashes are elevated to a steel ash hopper lined with firebrick, which is installed over the coal-unloading hoppers. By this arrangement after the coal has been unloaded into the track hoppers the cars may again be loaded with ashes from the hoppers overhead.

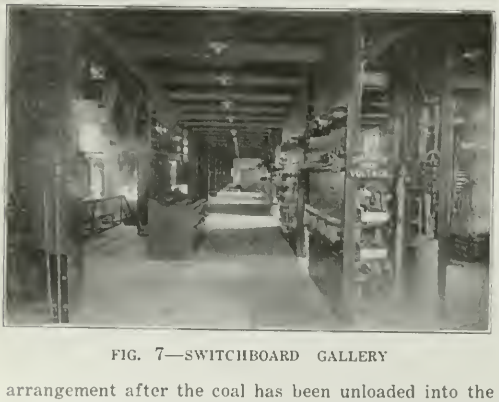


FIG. 7—SWITCHBOARD GALLERY

Piping Layout of the Station

Under normal conditions boiler-feed water will be taken from two 5000-hp Cochrane feed-water heaters placed on the boiler-room floor. This firing floor is 12 ft. above the turbine floor, and the latter projects 15 ft. underneath the boiler room. In this 15-ft. space are installed the station auxiliaries, such as the dry vacuum pumps, the air compressor and the boiler-feed pumps. This allows the boiler-feed pumps to be placed directly beneath the feed-water heater and gives a head for the boiler-feed pumps of 12 ft. plus 3 ft., the height of the heater above the floor. The two boiler-feed pumps are Jeansville 4-in., four-stage, centrifugal sets driven by General Electric steam turbines.

A 35,000-gal. general-utility steel water-supply tank, manufactured by the Henry Vogt Machine Company, Louisville, is installed on top of the elevator shafts over one end of the boiler room. The tank overflow level is 119 ft. above the turbine-room floor, and the tank is supplied with water from one of two steam reciprocating house pumps which take their water from one of the two main 7-ft. by 8-ft. water intakes. A float valve in the tank closes the inlet when the water rises to within 6 in. of the overflow level, thereby producing pressure on the service pump discharge which automatically stops the pump.

An elevation gage installed over the engineer's desk in the turbine room is graduated in feet to indicate the height of the water in the tank. The tank provides uniform head, against which the service pumps operate. Water from the tank is also used for the make-up supply to the feed-water heaters, for water-cooled glands in the main turbines, centrifugal pumps and exciters, and for wetting down ashes and coal, as well as for general washing purposes about the plant.

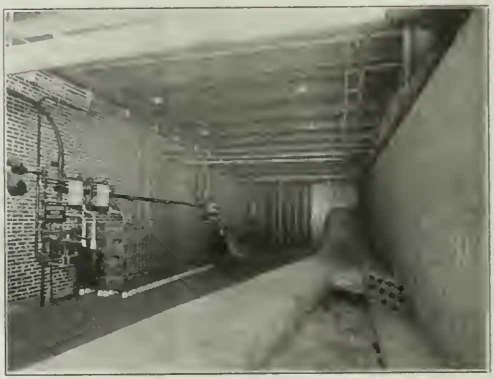


FIG. 8—CABLE ROOM, SHOWING ALTERNATING-CURRENT AND DIRECT-CURRENT CABLE SYSTEMS

The steam-pipe layout includes one steam header installed over the front of the boilers and at right angles to the turbine room. This header varies in size from 12 in. to 16 in. and is connected to a cross-header in the boiler room running parallel to the turbine room. Out of this cross-header steam is taken to the turbines by way of 12-in. long-radius bends. Two 10-in. long radius bends take the steam to an auxiliary header in the basement of the turbine room, which in turn feeds all station auxiliaries. When the second row of boilers is installed a ring system of steam piping is contemplated which will encircle the boiler room so that any battery or any steam bend may be cut out of service for repairs without disturbing the other steam units.

All headers and valves are of cast steel. The headers were furnished by the Crane company. The valves, which were supplied by the Chapman company, have solid monel-metal seats and stems. All bends are of extra-heavy steel with Crane-lap joints and steel flanges. The connection to each boiler is equipped with a Lunkenheimer automatic cut-off valve.

Circulating water for the plant is taken from the canal through eight 4-ft. 8-in. by 8-ft. openings, the bottoms of which are approximately 50 ft. below the generator-room floor, or 12 ft. below normal water level in the canal. The top of these intake openings is approximately 4 ft. below normal water level, which, it is hoped, will eliminate a certain amount of floating trash from clogging the intake screens. Just inside the intake openings in the canal walls there are four cast-iron racks set at 20 deg. to the vertical and composed of 4-in. by 1½-in. bars with 2-in. openings between them for screening off logs and large trash. Manholes are provided over each of these racks in the intake structure so that any trash collected may be hauled out with a long-handled fork.

A duplicate set of screens is installed in a screen house on the railway company's property, approximately 90 ft. from the intake. At the screen house, which measures 18 ft. 6 in. by 30 ft. 4 in. in plan, the intakes flare to provide supports for stop planks and a double row of movable vertical screens. The latter have been installed with four double screens in each of the four channels. In each channel the screen nearest the intake is of ⅞-in.-mesh No. 8 copper wire and the second screen is ½-in.-mesh No. 10 copper wire. Each screen is set in a substantial angle-iron frame 7 ft. ¼ in. wide by 14 ft. 9 in. high, and these frames have slight angle projections which slide in cast-iron vertical slots set in the concrete. A Whiting electric crane installed on runways facilitates raising and lowering the screens and stop boards.

The size of the openings for both intake and discharge were figured for a flow of 160,000 gal. per minute, or 20,000 gal. per minute for each of the eight units in the initial station installation. At this rate of flow the openings produce a discharge speed of only 1.19 ft. per second, such a reduction having been necessary in order not to interfere with small boats passing in the canal.

Two 30-in. cast-iron pipes are laid over the outside walls of each intake conduit. These pipes are continuous from taps in the discharge-water conduit to the inlet at the canal end of the intake and were provided to protect the intakes from clogging with needle ice. Valves installed in these cast-iron connections may be opened and hot water discharged into the canal at the mouth of the intakes. As the hot water is taken from the discharge conduit the only expense involved is that of maintaining the pipe line from the turbine room to the intake structure at the canal.

Turbine-Room Arrangement and Equipment

The turbine room and its basement for the auxiliaries measure 174 ft. long by 61 ft. 6.5 in. wide, with four galleries on one side, 21 ft. 10.5 in. in width. The turbine room is served by a 50-ton Whiting crane. Each turbine foundation consists of two parallel walls resting on bed-rock and extending to within 18 in. of the main turbine-floor level. These walls are so placed and spaced that the surface condensers may be dropped in place under each turbine by the overhead crane. The turbine proper rests on an I-beam grillage, supported in turn on the two concrete foundation walls. Special attention was given to the design and installation of these turbine concrete foundations in view of the fact that their bases are below water level in the river.

The circulating pumps are installed 45 ft. below maximum high water and only 1 ft. above the low-water stage of the Ohio River. This has made it necessary to seal all pipes into the concrete conduit to prevent flooding during high water, when all the waterways inside the building are under very great pressure.

Each of the 6000-kw horizontal Westinghouse turbo-generators is equipped with a 20,000-sq. ft. Worthington surface condenser. The dry vacuum pumps were manufactured by the Laidlaw-Dunn-Gordon Company. Circulating water is supplied to each condenser by a Worthington 26-in. tri-rotor centrifugal pump, driven by a General Electric steam turbine. Each has an emergency 30-in. pipe connection to the circulating pump of the other turbine. The units are arranged in pairs with condensing auxiliaries in a pit between the two foundations. Thus the first two units will be spaced 45 ft. apart and the second and third units will be 30 ft. apart. In this way one operator can care for the auxiliaries of two units. This arrangement also permits sets to be cross-connected more readily and economically. The dry vacuum pumps, the main circulating pumps and the hot-well pumps are connected and arranged so that either generating unit may be used with either of the auxiliaries. A 4-in., two-stage Worthington hot-well pump driven by a 27-hp Terry steam turbine completes the steam-turbine equipment.

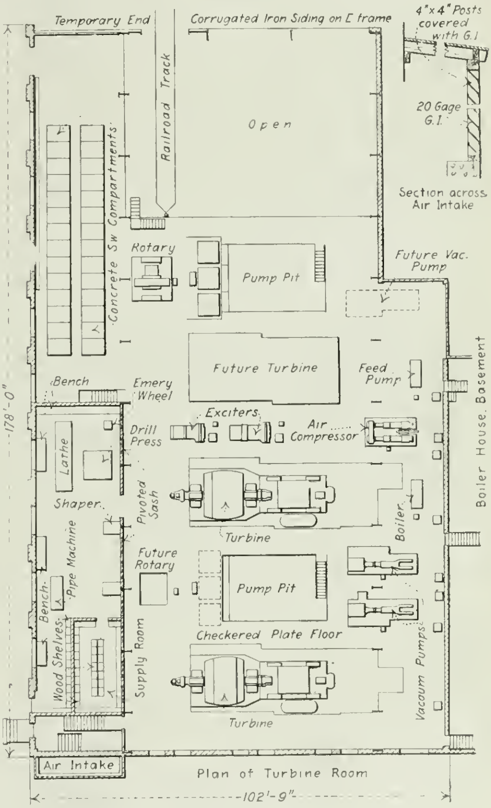


FIG. 9—PLAN OF TURBINE ROOM

The turbo-generators deliver 13,000-volt, twenty-five-cycle, three-phase energy, which is transmitted out over the feeder lines at this same bus pressure. Tirrill regulators control the voltage of the main alternators, the excitation energy for which is supplied by a 30-kw motor-driven direct-current set and by one 100-kw and one 150-kw steam-turbine-driven exciter set.

The first 2000-kw rotary converter has been installed on one of the foundations provided for it beside the auxiliary pit and feeds the trolley sections in the vicinity of the new generating station. This substation equipment is tied in with the two city substations by way of a 600-volt direct-current trunk line. This installation required three 750-kw single-phase oil-cooled, step-down transformers rated at 13,200/440 volts.

Oil for turbine lubrication passes through oil filters installed in the basement. From these duplicate Marsh pumps pump the filtered oil to a tank over the coal bunkers in the boiler room. From this elevation oil may be supplied to all parts of the turbine without pumping even should a breakdown occur in the oil-pressure system supplied by the pumps. Oil for the auxiliaries, such as the dry-vacuum pumps, boiler-feed pumps, etc., is provided by individual tank systems.

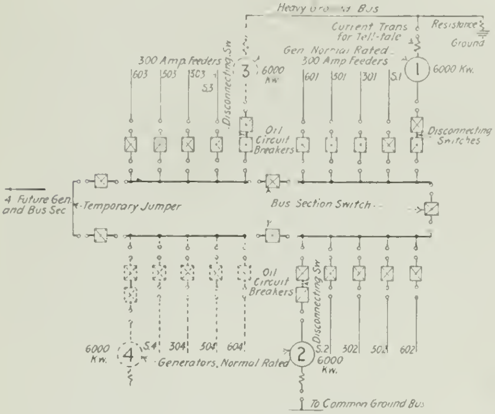


FIG. 10—BUS AND FEEDER ARRANGEMENT HIGH STREET POWER STATION

A four-level gallery adjoins one side of the turbine room. On the lowest gallery, which is below the turbine-room floor, the conduit carrying the underground transmission cables is brought in from the street. From the conduit the cables radiate through the necessary cable-end bells, supported from a central concrete wall which also carries the transformer compartments. This compartment extends the full length of the turbine room and is completely separated from the basement under the turbine-room floor by a 13-in. brick curtain wall. All openings between this gallery and the turbine room are fitted with doors so that the space may be entirely closed and used as an air chamber to supply air to the turbines. An air intake is provided outside of the station at one end of this lower gallery, and air is taken into this chamber by way of louvered openings. After the air passes through the intake into this lower gallery it is screened through ¼-in. mesh copper screens covered with cheesecloth and set at 30 deg. to the direction of the air current.

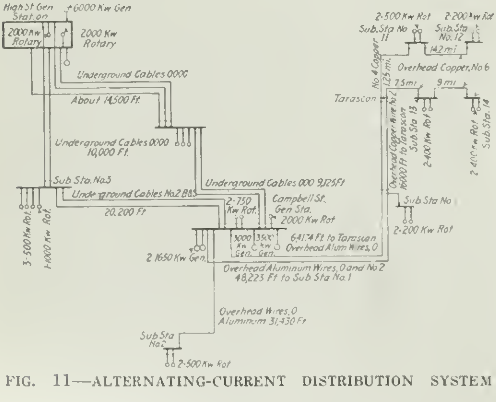


FIG. 11—ALTERNATING-CURRENT DISTRIBUTION SYSTEM

A machine shop is situated on the main-floor gallery along with the tool and storerooms and with the oil switches controlling the high-tension generator and feeder circuits. These 13,200-volt switches are installed in the concrete switch and bus structure, which is built in two parallel sections. At the present time these two sections are divided at their mid-point, so that there are four sections of the high-tension bus. The bus and feeder arrangement is such that each section of the bus connects one generator and four feeder switches. Each generator has two oil switches in series while each feeder is provided with a single oil switch. Disconnecting switches are provided in each phase and on both sides of each oil switch so any one may be cut out of service for repairs or cleaning.

The complete high-tension bus structure was built for four generating units and sixteen feeders. The structure itself has been erected for the complete station, but the total number of feeder oil switches is not to be installed at this time. All generator switches are non-automatic and the feeder oil switches and junction bus section switches are automatic and provided with inverse time-limit relays.

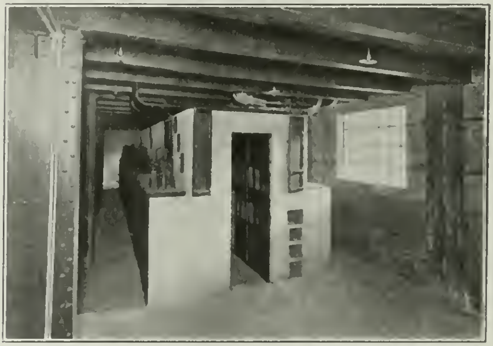


FIG. 12—CONCRETE BUS STRUCTURE

Offices, drafting rooms and laboratory, switchboards and the main desk control board are installed on the first gallery above the turbine-room floor. The panels for the control desk and exciters, as well as outgoing alternating-current and direct-current feeders and the turbine-desk control board, have been placed at one end of this gallery; that is to say, they will be at the center of the turbine-room building when it has been enlarged to conform to proposed future extensions. A balcony extends into the turbine room beyond the gallery line, just in front of the control board, so that the operator, by stepping out onto it, may have a clear view of the turbine-room floor below.

The electrical and mechanical features of this new generating station were designed by the motive-power department of the Louisville Railway Company under the direction of Mr. F. H. Miller, superintendent of motive power. D. X. Murphy & Brother, of Louisville, were the architects, and the Henry Bickel Company, of Louisville, contracted for all excavation, underground waterways and concrete foundations. The electrical and mechanical equipment was purchased installed.

Resonance in Radiotelegraphy—II

General consequences of resonance phenomena and their effects on circuits in which high-frequency currents occur. By J. Hettinger

In the Feb. 21 issue of the *Electrical World* there was given an account of the present-day theory and the writer's theory of the resistance phenomena in high-frequency circuits. The concluding outline of the latter is given below.

General Consequences

The Increase of Amplitude.

The diagram illustrated in Fig. 7 shows clearly the following characteristics of the resonance phenomenon:

(a) The half B of the forced oscillation reinforces the half A_1 of the first free oscillation; the half C of the forced oscillation reinforces the half B_1 of the second free oscillation and the half A_2 of the first free oscillation; the half D of the forced oscillation reinforces the half C_1 of the third free oscillation, the half B_2 of the second free oscillation and the half A_3 of the first free oscillation, etc., the tenth half oscillation J of the forced oscillation reinforcing the half oscillations I_1, H_2, G_3, F_4, E_5, D_6, C_7, B_8 and A_9 of the ninth, eighth, seventh, sixth, fifth, fourth, third, second and first free oscillations respectively. The eleventh half oscillation K and all the subsequent half oscillations of the forced oscillation reinforce in the case illustrated—of an undamped forced oscillation—the same number of free oscillations as the tenth half oscillation J. This result is attributable to the gradual disappearance of the various damped free oscillations and the gradual appearance of fresh free oscillations. The number of superposed free oscillations in the example illustrated is nine. This number agrees with the number of half oscillations which each free oscillation performs until it completely dies away, a fact which can easily be followed from the diagram without further explanation. Moreover, the various amplitudes of the nine free oscillations reinforced by the half oscillation J are equal to the various amplitudes of the nine free oscillations reinforced by the half oscillations K, L, etc., respectively, so that the corresponding resultant amplitudes are equal to one another. The following conclusions are therefore derived:

(1) In the case of resonance the amplitudes of the resultant oscillation continuously increase until the first free oscillation has completely died away.

(2) In the case of an undamped forced oscillation the amplitudes of the resultant oscillation remain constant after the first free oscillation has ceased to oscillate.

(3) The amplitudes of the resultant oscillation are at all times greater than the amplitude of the forced oscillation.

(b) The maximum amplitude attained in the case of resonance can be found as follows: In the case illustrated the amplitudes of all the half oscillations of the forced oscillation are equal to one another, and therefore the free oscillations must be identical with one another, with regard to both the various amplitudes and the number of half oscillations performed by each free oscillation. We thus get:

$$
\begin{aligned}
&A = B = C = D = E = F = G = H = I = J = K = L \\
&A_1 = B_1 = C_1 = D_1 = E_1 = F_1 = G_1 = H_1 = I_1 = J_1 = K_1 = L_1 \\
&A_2 = B_2 = C_2 = D_2 = E_2 = F_2 = G_2 = H_2 = I_2 = J_2 = K_2 = L_2 \\
&A_3 = B_3 = C_3 = D_3 = E_3 = F_3 = G_3 = H_3 = I_3 = J_3 = K_3 = L_3 \\
&A_4 = B_4 = C_4 = D_4 = E_4 = F_4 = G_4 = H_4 = I_4 = J_4 = K_4 = L_4 \\
&A_5 = B_5 = C_6 = D_6 = E_6 = F_6 = G_6 = H_6 = I_6 = J_6 = K_5 = L_6 \\
&A_6 = B_6 = C_6 = D_6 = E_6 = F_6 = G_6 = H_6 = I_6 = J_6 = K_6 = L_6 \\
&A_7 = B_7 = C_7 = D_7 = E_7 = F_7 = G_7 = H_7 = I_7 = J_7 = K_7 = L_7 \\
&A_8 = B_8 = C_6 = D_8 = E_8 = F_8 = G_8 = H_8 = I_8 = J_8 = K_8 = L_8 \\
&A_9 = B_9 = C_9 = D_9 = E_9 = F_9 = G_9 = H_9 = I_9 = J_9 = K_9 = L_9
\end{aligned}
$$

and consequently:

$$
\begin{aligned}
&J + I_1 + H_2 + G_3 + F_4 + E_5 + D_6 + C_7 + B_8 + A_9 = \\
&K + J_1 + I_2 + H_3 + G_4 + F_5 + E_6 + D_7 + C_8 + B_9 = \\
&A + A_1 + A_2 + A_3 + A_4 + A_5 + A_6 + A_7 + A_8 + A_9
\end{aligned}
\qquad (1)
$$

That is to say:

The maximum amplitude of the resultant oscillation in the case of resonance and when the forced oscillation is undamped can be obtained by adding together the amplitude of the forced oscillation and the amplitudes of all the half oscillations of a complete free oscillation, irrespective of their signs.

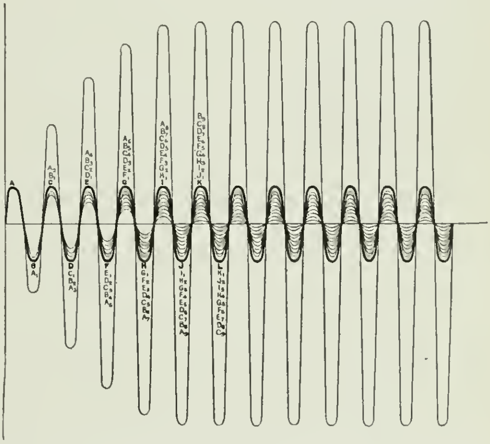

A
A_2 B_1 C
A_4 B_3 C_2 D_1 E
A_6 B_5 C_4 D_3 E_2 F_1 G
A_8 B_7 C_6 D_5 E_4 F_3 G_2 H_1 I
B_9 C_8 D_7 E_6 F_5 G_4 H_3 I_2 J_1 K
B A_1
D C_1 B_2 A_3
F E_1 D_2 C_3 B_4 A_5
H G_1 F_2 E_3 D_4 C_5 B_6 A_7
J I_1 H_2 G_3 F_4 E_5 D_6 C_7 B_8 A_9
L K_1 J_2 I_3 H_4 G_5 F_6 E_7 D_8 C_9

FIG. 7—SUPERPOSITION OF THE FORCED OSCILLATION AND SERIES OF FREE OSCILLATIONS

(c) For the sake of convenience the damped free oscillations in Fig. 7 and in other subsequent illustrations are shown as decreasing according to a straight line. This, of course, is not correct, it being well known that the amplitudes of damped oscillations decrease according to an exponential curve, but, as can easily be appreciated, the results hereinbefore described are in no way affected by the simplified assumption made. However, the problem of the maximum amplitude will now be considered with a view to obtaining a formula for determining its exact value and for this purpose the true conditions must be taken into account.

The apexes of the amplitudes of a damped oscillation lie on an exponential curve of the form

$$A_x = Ae^{-\delta t} \qquad (2)$$

wherein A is the amplitude at the moment $t = 0$; A_x the amplitude at any moment t; e the basis of the natural logarithm, and δ the damping factor of the oscillation.

If time be counted from the moment when the half oscillation A attains its maximum amplitude, and the half period be made $= T$, the following amplitudes are obtained for the half oscillations $A_1, A_2, A_3 \ldots A_9$, in addition to the amplitude A for the forced half oscillation:

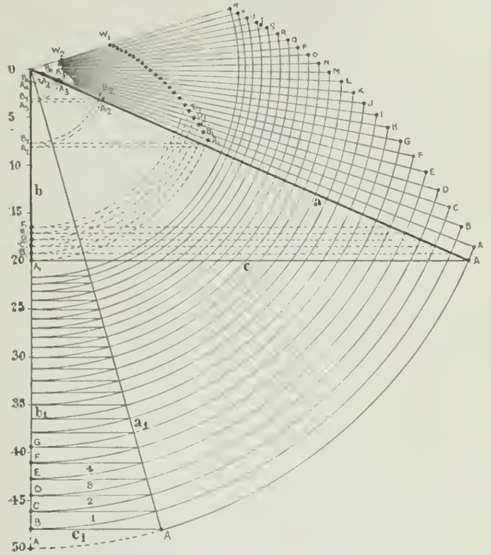


FIG. 8—GRAPHICAL CONSTRUCTION OF THE RESULTANT OSCILLATION IN THE TRANSMITTING AERIAL

$$\left.\begin{array}{lll} A_1 = Ae^{-\delta T}; & A_2 = Ae^{-\delta^2 T}; & A_3 = Ae^{-\delta^3 T}; \\ A_4 = Ae^{-\delta^4 T}; & A_5 = Ae^{-\delta^5 T}; & A_6 = Ae^{-\delta^6 T}; \\ A_7 = Ae^{-\delta^7 T}; & A_8 = Ae^{-\delta^8 T}; & A_9 = Ae^{-\delta^9 T}. \end{array}\right\} \quad (3)$$

If the maximum amplitude obtained in the case of resonance be denoted by R_{max}, there is obtained by substituting the system of equations (3) in equation (1):

$$R_{max} = A + Ae^{-\delta T} + Ae^{-\delta^2 T} + Ae^{-\delta^3 T} + Ae^{-\delta^4 T} + Ae^{-\delta^5 T} + Ae^{-\delta^6 T} + Ae^{-\delta^7 T} + Ae^{-\delta^8 T} + Ae^{-\delta^9 T} \quad (4)$$

The right-hand member of equation (4) represents the sum of the members of a geometrical progression, the first of which is A—the amplitude of the forced oscillation—while the common ratio of the progression is equal to $e^{-\delta T}$ or $\frac{1}{e^{\delta T}}$

Thus:

$$R_{max} = \frac{A\left(1 - \frac{1}{e^{\delta^n T}}\right)}{1 - \frac{1}{e^{\delta T}}} \quad (5)$$

which could be further simplified.

A much simpler formula can, however, be obtained by taking into consideration the fact that the number of the members of the geometrical progression is, mathematically speaking, not limited, but infinite, the time co-ordinate being the asymptote of the exponential curve and by bearing in mind that the ratio of progression is smaller than 1.

There can be written:

$$\lim_{n = \infty} \left(\frac{1}{e^{\delta T}}\right)^n = 0 \quad (6)$$

and

$$R_{max} = A + Ae^{-\delta T} + Ae^{-\delta^2 T} + Ae^{-\delta^3 T} + \ldots = \frac{A}{1 - e^{-\delta T}} \quad (7)$$

or

$$R_{max} = \frac{A}{1 - \frac{1}{e^{\delta T}}} \quad (8)$$

$\frac{1}{e^{\delta T}}$ being the ratio between the amplitude of one-half oscillation and the amplitude of the preceding half oscillation of a free oscillation, the conclusion can be expressed as follows:

The maximum amplitude of the resultant oscillation in the case of resonance and when the forced oscillation is undamped is equal to the amplitude of the forced oscillation divided by the difference between unity and the ratio between the amplitude of one-half oscillation and the amplitude of the preceding half oscillation of a free oscillation, irrespective of their signs.

If, for instance, the amplitude A of the forced oscillation is 10 amp and the ratio $\frac{1}{e^{\delta T}}$ above referred to equal to $\frac{7}{8}$, there is obtained:

$$R_{max} = \frac{10}{1 - \frac{7}{8}} = 80$$

That is to say, the amplitude obtained because of the resonance effect is eight times as large as the amplitude of the forced oscillation.

(d) The maximum amplitude R_{max} obtained in the case of resonance may also be determined graphically as illustrated in Fig. 12. Construct a triangle of which the two sides a and b are equal to amplitudes A and A_1, respectively; draw an arc c with the radius A_1, and from the point 1 where it intersects the side a draw a line d parallel to the side e of the triangle; from the point 2 where this parallel intersects the side A_1 draw an arc with the radius 02 until it intersects the side a at the point 3; then continue the construction in the same manner as before until arriving near the point o of the triangle, when it is hardly possible, and as a matter of fact hardly necessary, to construct further points. It can easily be geometrically demonstrated that the distances 00_1, 01, 03, 05, 07, 09, etc., are equal to the amplitudes A, A_1, A_2, A_3, A_4, etc., of the free oscillation. The sum of these distances will therefore give the value of the maximum amplitude.

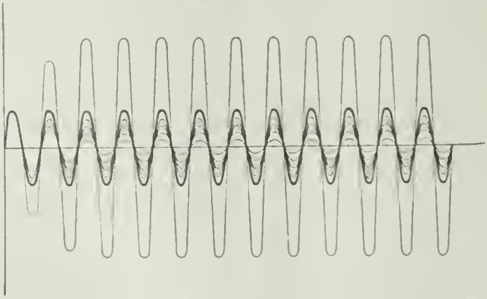


FIG. 9—SECOND EXAMPLE OF SUPERPOSED FORCED AND FREE OSCILLATIONS

Influence of the damping upon the resultant oscillation.

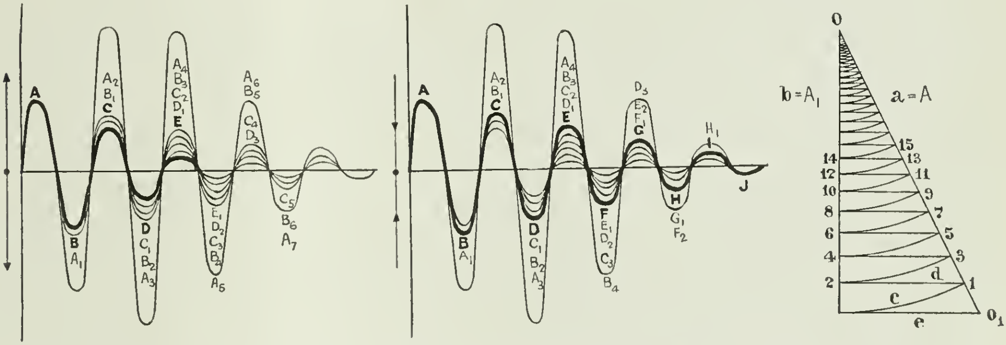
(a) If the diagram illustrated in Fig. 7 be compared with that illustrated in Fig. 9, in which the amplitude of the forced oscillation is shown as being equal to that of the forced oscillation shown in Fig. 7, but the free oscillations more damped than those in said figure, it will be noticed that:

The maximum attained in the case of a more damped free oscillation is reached more quickly but is smaller than that attained in the case of a less damped free oscillation.

(b) Comparing together the diagrams illustrated in Figs. 10 and 11 in which the forced oscillation is shown to be damped—in Fig. 10 more damped than the free oscillation and in Fig. 11 less damped than the free oscillation—the damping of the forced oscillation in Fig. 10 being equal to that of the free oscillation in Fig. 11 and vice versa, it will be noticed that:

(1) The increase of the resultant oscillation up to its maximum amplitude is determined by the oscillation with the higher damping, and its decrease from the maximum amplitude to nil is determined by the oscillation with the smaller damping.

(2) The resultant oscillation obtained by the superposition of damped free oscillations on a forced oscillation which is more damped than the free oscillations is identical with that obtained by the superposition of damped free oscillations on a forced oscillation which is less damped than the free oscillations, provided the damping coefficients of the forced and free oscillations in the one case are identical with the damping coefficients of the free and forced oscillations respectively in the other case.



FIGS. 10, 11 AND 12—THIRD AND FOURTH EXAMPLES OF SUPERPOSED FORCED AND FREE OSCILLATIONS AND GRAPHICAL CONSTRUCTION OF R_{max}

The curves of the resultant oscillations obtained in Figs, 7, 9, 10 and 11 are given in Fig. 13, which shows at a glance the conclusions referred to under a and b.

(c) *Special case.* It can easily be seen that when the damping coefficients of the primary and secondary circuits, and therefore also the damping coefficients of the forced and free oscillations, are equal to one another there is obtained:

$$A_1 = B;\ A_2 = B_1 = C;\ A_3 = B_2 = C_1 = D;\ A_4 = B_3 = C_2 = D_1 = E \text{ and so on;}$$

That is to say, the amplitude of the forced oscillation is at any moment equal to the amplitude of the free, or of each of the free, oscillations superposed on the particular half of the forced oscillation, and therefore the following conclusion can be drawn:

The resultant oscillation in the case of the superposition of damped free oscillations on a damped forced oscillation when their damping coefficients are equal to one another is obtained by multiplying the various amplitudes of the forced oscillation by 1, 2, 3, 4, 5, etc., according to the position of each half of the forced oscillation in the series of periods during which the forced oscillation takes place. In other words, it may be said that the various amplitudes of the resultant oscillation are equal to A, $2B$, $3C$, $4D$, $5E$, etc., respectively.

Wireless Telegraphy

Resonance in wireless-telegraphy circuits.

Wireless-telegraphy circuits in which high-frequency currents come into play may be classified in three groups, namely, the transmitting circuits, the transmitting-receiving circuits and the receiving circuits. These circuits will here be considered in their order of operation.

Transmitting circuits. The typical connection of transmitting circuits is shown in Fig. 14, in which the closed transmitting circuit C_1 acts inductively upon the open transmitting aerial circuit C_2. These two circuits are said to be in resonance with one another when the free frequency of the circuit C_2 is equal to the frequency of the oscillatory currents through the circuit C_1. Assuming that the condition of resonance is fulfilled, construct the resultant oscillation obtained in the circuit C_2 by the superposition of the free oscillations in the circuit on the forced oscillation induced therein by the oscillatory current in circuit C_1, for the case when the oscillations in circuit C_1 are undamped, and for the case when they are damped, and the ratio between the amplitude of one-half oscillation and that of the preceding half-oscillation is, say, $\frac{24}{25}$, the ratio between the amplitude of one half and that of the preceding half of the free oscillation being in both cases, say, $\frac{10}{25}$.

(1) *Circuit C_1 carrying undamped oscillations.* Assume that the amplitude A of the forced oscillation induced in circuit C_2 is equal to 50 units, and that consequently A_1 is equal to $50 \times \frac{10}{25} = 20$. Construct a triangle a, b, c, as shown in Fig. 8, in which b is at right angles to c and equal to $A_1 = 20$, and a equal to $A = 50$, and then find the subsequent amplitudes A_2, A_3, A_4, etc., of the first free oscillation by the graphical construction explained with reference to Fig. 12. The subsequent amplitudes B, C, D of the forced oscillation being all equal to A (that is, 50 units), and $A_1 = B_1 = C_1$, etc., . . . $A_2 = B_2 = C_2$, etc., . . . this case is identical with that illustrated in Fig. 7, and the maximum amplitude R_{max} is equal to $A + A_1 + A_2 + A_3 + A_4 = 83$. The calculation of R_{max} according to equation (8) gives 83.33 so that the value obtained graphically is sufficiently correct. It is known that R_{max} is at-

tained with A_4—that is, the last half of the free oscillation initiated by the first half A of the forced oscillation—and that this half A_4 of the free oscillation is superposed on the half E of the forced oscillation. It is also known that from the moment R_{max} is attained their maximum is maintained as long as a forced oscillation is induced in the circuit. Therefore it is possible to plot the curve of the resultant oscillation including the amplitudes between the beginning of this oscillation and its maximum, these amplitudes being equal to A; $B + A_1$; $C + B_1 + A_2$; $D + C_1 + B_2 + A_3$ and $R_{max} = E + D_1 + C_2 + B_3 + A_4$.

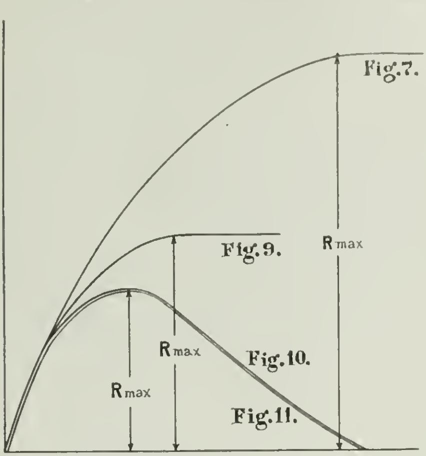


FIG. 13—CURVES OF THE RESULTANT OSCILLATIONS OBTAINED IN FIGS. 7, 9, 10 AND 11

In Fig. 17, in which the amplitudes are plotted on reduced scale, the straight line I represents the constant amplitude of the forced oscillation and II the resultant oscillation obtained as hereinbefore stated. The increase in amplitude obtained in the example illustrated is 66 per cent of the amplitude of the forced oscillation.

(2) *Circuit C_1 carrying damped oscillations.* It has been assumed that the ratio between the amplitude of one half and the amplitude of the preceding half of the forced oscillation is $\frac{24}{25}$ and that the ratio between two consecutive amplitudes of the free oscillation is $\frac{10}{25}$. Assume further that the first amplitude A of the forced oscillation is equal to the amplitude of the forced oscillation considered under 1; that is, equal to 50 units.

First construct in addition to the triangle a, b, c, a triangle a_1, b_1, c_1, shown in Fig. 8, and make a_1 equal to a and A (that is, 50), and b_1 equal to $50 \times \frac{24}{25}$ (that is, 48), and draw c_1 parallel to c. Allow the point of intersection of the sides a and b of the one triangle to coincide with the point of intersection of the sides a_1 and b_1 of the other triangle.

Next determine the amplitudes B, C, D, E, etc., of the forced oscillation, by means of the triangle a_1, b_1, c_1, and graphical construction illustrated in Fig. 12, and the amplitudes A_1, A_2, A_3, etc., of the free oscillation initiated by A by means of the triangle a, b, c.

Then plot on the side a of the triangle a, b, c, the amplitude B of the second half of the forced oscillation by continuing the arc 1 until it intersects the side, and determine the amplitudes B_1, B_2, etc., of the free oscillation initiated by B, in the same manner as those of the free oscillation initiated by A were determined. Continue in the same manner the determination of the amplitudes of the free oscillations initiated by all the other parts C, D, E, etc., of the forced oscillation. In order to avoid confusion between the many points determined on the side a, draw above the latter a series of converging lines, continue the various arcs 1, 2, 3, etc., beyond the side, until each of them intersects a particular line, and mark the points of intersection with A, B, C, etc., as shown. When the amplitudes of the free oscillations initiated by A, B, C, etc., are being determined by means of the triangle a, b, c, continue the arcs drawn for the determination of A_1, A_2, A_3, etc., until they cut the line corresponding to A, the arcs drawn for the determination of B_1, B_2, B_3, etc., until they cut the line corresponding to B, and so on. In this way the amplitudes belonging to a free oscillation and the amplitude of the forced oscillation which initiated the free oscillation are all on one line on which only these amplitudes are indicated.

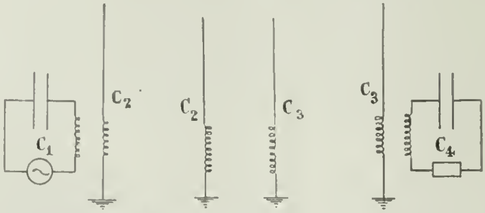
Finally, arrange the various amplitudes determined by the construction shown in Fig. 8 in their proper order of succession and superposition as follows:

A, B, C, D, E, F, G, H,
A_1, B_1, C_1, D_1, E_1, F_1, G_1, H_1,
A_2, B_2, C_2, D_2, E_2, F_2, G_2, H_2,
A_3, B_3, C_3, D_3, E_3, F_3, G_3, H_3,
A_4, B_4, C_4, D_4, E_4, F_4, G_4, H_4,

and add together all the amplitudes belonging to one and the same column. The values A, $B + A_1$, $C + B_1 + A_2$, etc., thus obtained represent the amplitudes of the resultant oscillation.

In Fig. 17 1 is the curve of the forced oscillation, and 2 the curve of the resultant oscillation obtained in the manner above described. A comparison of curve 2 with curve II obtained in connection with the undamped forced oscillation shows that R_{max}, which in this case has been found to be equal to $D + C_1 + B_2 + A_2 = 74.3$, is attained sooner than in the case of undamped oscillations (compare R_t with R_1), and that it is not subsequently maintained and is not so high as in that case. In the example above illustrated, the increase in amplitude obtained is 48.6 per cent of the amplitude of the forced oscillation, which, compared with the increase of 66 per cent in the case of undamped oscillations, gives a difference of 17.4 per cent in favor of the undamped oscillations provided the amplitude of the forced undamped oscillation is equal to the first amplitude of the forced damped oscillation, as has been assumed.

Transmitting-receiving circuits. Whatever may be the true explanation of the actual electrical phenomena which take place between the transmitting aerial circuit C_2 and the receiving aerial circuit C (Fig. 15), one can safely assume that a forced oscillation of the same frequency as the frequency of the resultant oscillation obtained in the transmitting aerial circuit C_2 is induced in the receiving aerial circuit C_3. The two circuits are said to be in resonance with one another if the natural frequency of the circuit C_3 is equal to the frequency

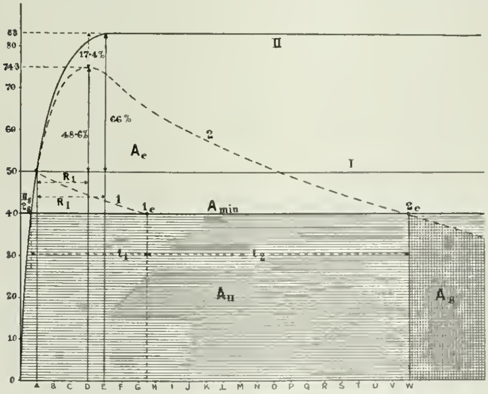


FIGS. 14, 15 AND 16—DIAGRAMS OF TRANSMITTING, TRANSMITTING-RECEIVING AND RECEIVING CIRCUITS of the resultant oscillation in C_2. Assume that this condition is fulfilled and determine according to the method above described the resultant oscillation obtained in circuit C_3 by the superposition of the free oscillations thereof on the forced oscillation induced therein.

Before determining such oscillation it seems well to make a few remarks with reference to the resultant oscillations II and 2 obtained in the circuit C_2, and as shown in Fig. 17 and with reference to the forced oscillations they respectively induce in the circuit C_3.

In the first instance, it is obvious that because of the great amount of energy dissipated in the surrounding space, only a comparatively very small amount reaches a distant receiving circuit and that therefore the electrical units to be considered in such a circuit are of a quite different order as compared with the electrical units coming into question in the transmitting circuit. Nevertheless, one can assume that the amplitude of the forced oscillation induced in the receiving circuit is at any moment proportional to the corresponding amplitude of the resultant oscillation in the transmitting circuit.

It is also obvious, since some energy is lost between the transmitting and receiving circuits, partly through the air and partly through the ground, and since this loss increases with the increase in the distance between the two circuits, that to each distance between two points where such circuits may be established there must correspond a minimum of amplitude of the resultant oscillation, for the induction of any appreciable energy in the receiving circuit, any amplitude below the minimum producing no effect whatever upon the circuit. Assume that in the example being considered 40 is the minimum amplitude below which no effect can be detected in the circuit C_3. If the line A_{min} in Fig. 17 be drawn to correspond to the minimum of 40, the effective part of the resultant oscillation will be seen at a glance. Thus the resultant oscillation II of the undamped oscillations starts to be effective at the moment II_s and thereafter remains continuously effective, while the resultant oscillation 2 of the damped oscillations starts to be effective at the moment 2_s which coincides with II_s and ceases to be effective at the moment 2_e. Moreover, with regard to the resultant oscillation of the damped oscillations, the part of the oscillation beyond the moment 2_e, since it is not effective it constitutes an unnecessary loss. In the diagram the necessarily uneffective part has been indicated by A_{II}, the effective part by A_e, and the superfluous part by A_s.



Scale 1 : 2

FIG. 17—FIRST COMPARATIVE DIAGRAM OF RESULTANT OSCILLATION CURVES

Finally if the resultant oscillation 2 be compared with the forced oscillation 1 from which it has resulted by the superposition of the free oscillations when the condition of resonance is fulfilled, it is seen that the resonance phenomenon in the case of damped oscillations not only effects an increase of amplitude in the transmitting circuit, but also a prolongation (t_2) of the time during which the resultant oscillation produces an effect in the receiving circuit. Indeed, in the example illustrated such time has been more than trebled (compare t_1 with t_2).

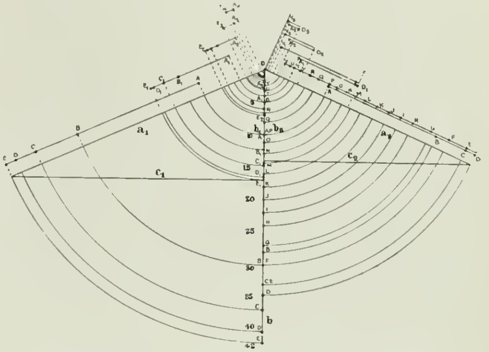


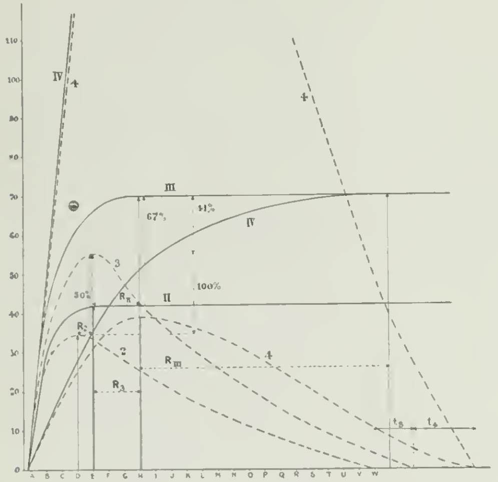
FIG. 18—GRAPHICAL CONSTRUCTION OF THE RESULTANT OSCILLATIONS IN THE RECEIVING AERIAL

Referring now to the determination of the resultant oscillations in the receiving circuit C_3 when the forced oscillations are undamped and damped respectively, use will be made for this purpose of only those parts of the curves II and 2 which are above A_{min}, assuming naturally that the units of the amplitudes are of a much lower order than the units at the transmitting end.

Plot on a vertical line b (Fig. 18) the amplitudes of the effective parts of the curves II and 2, and mark the amplitudes A, B, C, etc., belonging to the curve II at the left-hand side and the amplitudes A, B, C, etc., belonging to the curve 2 at the right-hand side of the line. Assuming that the ratio between an amplitude and the preceding amplitude of a free oscillation of the circuit C_3 is equal to that corresponding to the free oscillation of the circuit C_2—that is, equal to $\frac{10}{25}$—construct on the left-hand side of b a triangle a_1, b_1, c_1, in which a_1 is equal to the maximum amplitude of the curve II and $b_1 = a_1 \frac{10}{25}$, and on its right-hand side a triangle a_2, b_2, c_2, in which a_2 is equal to the maximum amplitude of the curve 2 and $b_2 = a_2 \frac{10}{25}$, the sides c and c_1 in both triangles being at right angles to b, which coincides with b_1 and b_2. The determination of the amplitudes of the various free oscillations initiated by the half oscillations of the forced oscillation II is then carried out by means of the triangle a_1, b_1, c_1, and those of the free oscillations initiated by the half oscillations of the forced oscillation 2 by means of the triangle a_2, b_2, c_2 in the manner already explained. Because of the great number of points plotted in the proximity of the point 0, it has been found more convenient to use for the points belonging to different groups, instead of converging lines, parallel lines, and as an alternative to the construction shown in Fig. 8 the various points have been grouped in Fig. 18 differently from in Fig. 8, in a manner that will be found self-explanatory.

The amplitudes of the resultant oscillations for the two cases are found in the manner already referred to in connection with the transmitting circuits; that is by arranging the various amplitudes indicated and determined in Fig. 18 in their proper order of succession and superposition and adding together the superposed amplitudes corresponding to each half-period.

In Fig. 19, II and III represent the forced and resultant oscillations respectively for the case of undamped oscillations, and 2 and 3 the forced and resultant oscillations for the case of damped oscillations. These curves show that the moment when the maximum amplitude is attained in the case of resonance between C_2 and C_3 is in each case retarded with respect to the maximum attained by the resonance between the circuits C_1 and C_2, and in the case of undamped oscillations more retarded than in the case of damped oscillations (compare R_{II} with R_2). They also show that in the case of undamped oscillations the duration of the effective period has again been increased by t_3. Finally they show that the increase in amplitude in the case of undamped oscillations is 67 per cent of the maximum amplitude of II and in the case of damped oscillations 59 per cent of the maximum amplitude of 2. The maximum of III being compared with the maximum of 2 it is found that the increase is 100 per cent, so that there is a difference of 41 per cent in favor of the undamped oscillations, inclusive of the difference already found in their favor in the transmitting circuits.



Scale, 1 : 5 for Curves IV and 4

FIG. 19—SECOND COMPARATIVE DIAGRAM OF RESULTANT OSCILLATION CURVES

Receiving circuits. The typical connection of receiving circuits is shown in Fig. 16, in which the open receiving aerial circuit C_3 acts inductively upon the closed receiving circuit C_4. These two circuits are in resonance with one another when the free frequency of the circuit C_4 is equal to the frequency of the resultant oscillation obtained in the circuit C. Assuming that this condition is fulfilled and constructing in the manner above described with reference to the transmitting-receiving circuits, the resultant oscillation obtained in C_4 by the superposition of the free oscillations of the latter circuit on the forced oscillation induced therein by the resultant oscillation in C_3 (by the resultant oscillation III corresponding to the undamped oscillations and by the resultant oscillation 3 corresponding to the damped oscillations), and assuming further the ratio of the amplitudes of the free oscillations in C_4 to be $\frac{20}{25}$ and for the sake of simplicity neglecting the question of coupling, there are obtained the curves IV and 4 shown in Fig. 19 on the reduced scale of 1:5 as compared with the other curves in the same illustration.

It will again be seen that in each case the maximum amplitude has been retarded in the circuit C_4, with respect to the maximum amplitude in the circuit C_3, and more retarded in the case of undamped oscillations than in the case of damped oscillations (compare R_{III} with R), and that at the same time the period during which the resultant oscillation of the damped oscillations is effective has been prolonged by t_4. (This period is a little longer than indicated in the diagram, the length of which has been slightly reduced.) A comparison of curves IV and 4 with curves III and 3, respectively, shows that the amplitude has been increased in the case of undamped oscillations by 400 per cent and in the case of damped oscillations by 255 per cent, while the comparison of curves IV and 4 with curve 2 shows an increase of 900 per cent in the case of undamped oscillations and an increase of 457 per cent in the case of damped oscillations. The following is therefore derived:

Assuming the forced oscillations induced in the transmitting aerial to be equal in the two cases, and the condition of resonance to be fulfilled in all the circuits, the increase of amplitude obtained in the last receiving circuit is in the case of undamped oscillations approximately double that obtained in the case of damped oscillations which have the degree of damping above referred to by way of example.

Damped or continuous oscillations.

The question as to whether undamped or continuous oscillations are to be preferred to damped oscillations for wireless telegraphy purposes is of special importance at the present moment. To deal with this question in all its aspects would be outside the scope of this article. However, reference will be made to a few points directly related to or following from the above investigation which have a bearing on the question just raised.

(1) *Detectors, amplitude and persistency of oscillations.*

All the quantitative detectors employed in wireless telegraphy—the word detector being here used in a very broad sense to include not only detectors properly so called but also any equivalent device which enables the high-frequency oscillations in the receiving circuits to effect a change in an indicator—are entirely dependent upon the current or potential amplitude of the high-frequency oscillations, or upon both. Of these detectors, so far as the writer knows, only the thermal detectors, such as the bolometer, depend on both the amplitude and the persistency of oscillations. Under these circumstances it is obvious that the effect produced by undamped oscillations upon a detector of the character last mentioned must be much greater than the effect produced thereon by damped oscillations. However, no thermal detector is known at present having the same great sensitiveness as the magnetic, electrolytic or crystal detector, for which reason thermal detectors are not used in practical wireless telegraphy, and thus, whatever may be gained from the persistency of the undamped oscillations, as apart from their amplitude, is not at present practically gained, and the amplitude remains the only deciding factor.

(2) *Amplitude of forced oscillation.*

It was shown above that the increase in amplitude obtained in the various circuits fulfilling the condition of resonance is dependent, apart from other factors, upon the amplitude of the forced oscillation originally induced in the transmitting aerial circuit by the closed transmitting circuit coupled therewith. The point which next arises is, therefore, the comparison between the amplitudes of the forced oscillations induced by undamped and damped oscillations respectively as produced by practical apparatus.

(3) *Duration of oscillations.*

It is clear that as soon as the oscillation in the last oscillatory receiving circuit has attained its maximum amplitude—thermal detectors dependent also upon the persistency of oscillations having been excluded for the reason above mentioned—there is no further need to maintain the maximum, since the oscillation has already produced the greatest change in the detector. In the case of damped oscillations, the oscillations begin to die off as soon as the maximum has been attained, as they should, while in the case of undamped oscillations they persist after the maximum has been attained, and this is superfluous. Figs. 20 and 21 illustrate these two cases.* While the duration of a complete resultant oscillation in the case of damped oscillations lasts only for a period of time T_1, the resultant oscillation in the case of undamped oscillations lasts for a period T_2 plus a period T_3, which last period if not interrupted is, so to say, infinite. This period T_3 has a corresponding period in the closed transmitting circuit, and the energy produced in the latter constitutes an unnecessary loss.

(4) *Undamped oscillations and the ticker.*

The use of undamped oscillations in wireless telegraphy has been greatly assisted by the introduction of the ticker in the receiving circuits. The reason thereof will be easily perceived if it is borne in mind that in the case of undamped oscillations as soon as the maximum amplitude has been attained it is followed by a "steady" state which is maintained for the very long period of time T_3, during which no further changes can take place in the detector of such a nature as to cause further changes in the indicator controlled thereby, say in a telephone. The introduction of the ticker in the receiving circuits which intermittently connects a condenser circuit to an oscillatory circuit and to a telephone circuit respectively, so that it is first charged by the one and then discharged through the other, permits, however, the energy present in the oscillatory circuits during the period T_3 to be utilized in an effective manner in the indicating device. Figs. 22 and 23 illustrate by way of example the diagrams of the condenser charge and discharge by means of a ticker operating with two different number of interruptions respectively. In each illustration T_2 corresponds to the time necessary for reaching the maximum amplitude, T_3 the time of "steady" state and T_4 the time during which the condenser is discharged through the telephone, while $T_5 = T_2 + T_3 + T_4$ determines the frequency of the interrupter, which in the example illustrated in Fig. 23 is greater than that illustrated in Fig. 22. The greater this frequency can be made the more will the period of "steady" state T_3 be reduced, and the more will the persistency of the oscillations be utilized in the telephone.

(5) *The problem of interference and musical transmission.*

Various methods of solving the problem of interference have been proposed, but howsoever reliable or promising such methods may be, practical complications necessarily arise as soon as more than two or three stations are in interference. The production of groups of oscillations having a definite note has lately come to the front, and there is now a general tendency to believe that the utilization of such oscillations will lead to a more satisfactory solution of the problem of interference than it has been possible to obtain hitherto. From a theoretical point of view musical notes give a greater scope than resonance effects for solving this problem. The writer is inclined to believe that good practical results may be attained in this direction to a greater extent than can be attained by utilizing resonance effects only.

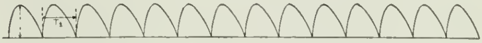


FIG. 20—RECEIVED RESULTANT DAMPED OSCILLATIONS

It can easily be inferred from the above investigation of the resonance phenomenon, and more especially from the resultant curves indicated in Fig. 19 and the diagram illustrated in Fig. 20, that the utilization of groups of oscillations, the groups having a frequency ranging up to about 30,000 cycles per second, and the high-frequency oscillations ranging between the ordinary limits, can give a true musical note, the frequency of which is determined by the frequency of the groups and the modulations by the resultant curve of the high-frequency oscillations, which resultant is in its turn obtained by the utilization of resonance phenomenon.

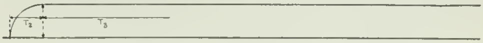


FIG. 21—RECEIVED RESULTANT UNDAMPED OSCILLATIONS

Any important use of resonance phenomenon in the direction just indicated ought to be determined by the transmitting circuits rather than by the receiving circuits, so that the modulations of the note heard at the receiving end should correspond to the character of the particular transmitter, not to that of the receiver.

The diagrams illustrated in Figs. 21 to 23, which refer to undamped oscillations, show on the other hand that one can obtain a musical note with such oscillations only by interrupting their persistency, and as this interruption takes place at the receiving end, the note follows the character of the receiver and not that of the transmitter.

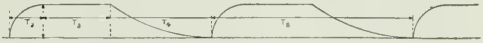


FIG. 22—DIAGRAM SHOWING THE EFFECT OF THE TICKER

The above comparisons between damped and undamped oscillations lead to the following conclusions.

The increase in amplitude due to the utilization of the resonance phenomenon is theoretically greater in the case of undamped oscillations than in the case of damped oscillations, but this increase is neutralized in practice by the greater amplitude which is primarily produced in the apparatus for undamped oscillations.

The persistency of the undamped oscillations, as apart from their amplitude, cannot at present be practically utilized to give greatly enhanced effects at the receiving end, and such persistency is accompanied by a greater or smaller loss, according to the frequency of the ticker.

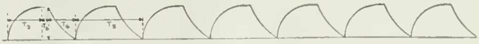


FIG. 23—DIAGRAM SHOWING THE EFFECT OF THE TICKER OPERATING AT A HIGHER FREQUENCY

The production in the case of damped oscillations of a musical note at the transmitting end by the utilization of groups of oscillations determining the frequency of the note and by the utilization of the resonance phenomenon determining the modulations thereof constitutes at the same time a solution of the problem of interference.

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*Fig. 20 is not strictly accurate, since in the usual apparatus employing damped oscillations there is a time of rest between the end of each resultant oscillation and the beginning of the subsequent resultant oscillation.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial
Methods, and Current Practice Among Successful Utilities

Prize Contest for Central-Station Advertisements

To stimulate the interest of the public in its service, the Stockbridge (Mass.) Lighting Company has offered a series of cash prizes for the best suggestions received for the text matter and make-up of its local advertisements. Any one may compete, and the awards are: first prize, $5; second prize, $3; third prize, $2. It is expected that school-children and others will enter the contest and will be thereby encouraged to ask for information regarding electric service. The company's announcements of the offer refer contestants to its offices for all details, and it is believed that in this way a large number of prospective users will be put in touch with the new-business department.

Motor Drive in the Pearl-Button Industry

In the factory of the Hawkeye Pearl Button Company at Keokuk, Ia., sixty-five speed lathes are in daily operation cutting circular disks from musselshells. These "blanks," as the disks are called, vary in diameter from about 0.375 in. to 1 in. and with the factory operating nine hours a day the sixty-five lathe operators turn out 9 tons of blanks a week.

SPEED LATHE IN PEARL-BUTTON FACTORY

Sorting of the shells so that the larger disks may be turned from the heavier shells is accomplished by a set of revolving non-parallel rolls which allow the smaller shells to drop between the rolls at one end but carry the others to wider openings. This classifier and the sixty-five small lathes are driven by one 20-hp, 440-volt, twenty-five-cycle, three-phase induction motor receiving energy from the mains of the Keokuk Electric Company. The average energy consumption for this motor is 1200 kw-hr. a month, and on this basis it will be seen that a ton of blanks can be turned out with an energy consumption of 75 kw-hr., including all losses in the line shafting.

In conjunction with the button plant a shell crusher operated by a 25-hp motor grinds 25 tons of shells a day. Not all of these shells come from the Hawkeye factory, some of them being shipped in from other places. This grinder is not operated in the summer, as there is little demand for crushed shells when the weather permits barnyard fowls to be kept out of doors.

Electric-Sign Activity at Springfield, Ill.

Within the last year eighty new electric signs have been connected to the mains of the Springfield (Ill.) Light, Heat & Power Company through the joint efforts of the new-business department and salesmen of sign manufacturers. Tungsten lamps were used in all displays. The average of these signs carried 120 5-watt lamps. To the co-operative scheme, by which the local solicitors first created interest among prospective customers, later turning them over to an experienced sign salesman to close the contract, is attributed much of the credit for the record of "more than one sign sale a week."

Electric Cooking as an Off-Peak Load

At the January meeting of "The Point Fives," an organization of English central-station managers who are seeking to bring about wide use of electricity through establishing a uniform low rate of "point five" penny (0.5 d., equivalent to 1 cent) per kw-hr., one speaker during the discussion alluded to the danger of superimposing the electric cooking load upon the lighting peak. To this objection Mr. A. Hugh Seabrook replied that the foregoing comment aptly expressed the usual fear of those who have had little or no experience with cooking loads. He mentioned the case of Herstmonceux, where a 60-kw plant dealt with a lighting load on which during the past twelve months there had been superimposed a cooking load connection of about 75 kw. In spite of this increased connected load the 60-kw plant was able to handle the total peak without difficulty.

Electric Tire Pumps in Garages

An additional argument for central-station service is suggested by the large number of gasoline engines displaced on account of their noisy operation by electric motors in towns where all-day electric operation has recently become available. At Mount Sterling, Ky., the Kentucky Utilities Company has put twenty-four-hour service into effect and has succeeded in equipping most of the local energy-consuming industries with motors. Commenting on this fact, the Mount Sterling *Advocate* remarks: "Stone & Flora have at their garage a motor to take the place of the gasoline engine formerly used to pump up their air tank. This motor will do away with the noisy exhaust." Among the industries which the central station is now serving are the Star Planing Mill Company, the McCormick Lumber Company and the Farmers' Tobacco Warehouse Company.

The Cost of Home Garaging for Electric Pleasure Vehicles

Quoting from the results of tests made some time ago in a public garage in St. Louis, Mr. C. E. Michel, of the Union Electric Light & Power Company, gave the average upkeep for an electric-pleasure vehicle in a garage as $14.98 a month (exclusive of the cost of electrical energy). The test was conducted under Mr. Michel's supervision on twenty pleasure vehicles irrespective of make or equipment. Some were equipped with solid and others with pneumatic tires, while all had lead batteries. In the term "upkeep" are included all repairs, painting, tire and battery renewals and other "little extras" which Mr. Michel says the garage man adds; but, as above noted, the cost of charging was not included.

In connection with these figures Mr. Michel says that it is his firm belief that this upkeep cost may be reduced one-third if the car is kept at home. In this statement he adds that he assumes the owner of the car knows little or nothing about an electric vehicle and will not give it especially good treatment. In view of the facts shown in the above tests Mr. Michel thinks that the figure of $23.50 recently given by the Electric Vehicle Association of America as an average monthly cost for upkeep and energy is conservative.

Factory-Lighting Campaign in Chicago

As the result of a determined effort made by the Commonwealth Edison Company, Chicago, to secure a larger factory-lighting load more than 2000 units have been installed recently in installations ranging from 5 to 150. The fixture which the company is using for this campaign (Fig. 1) is equipped with a shallow enameled-steel reflector with an adjustable collar. Since the tungsten lamps contained in it are renewed by the company, a lock socket is supplied with the unit, the conduit serving as the fixture stem and socket support. The lamps are furnished in 100-watt, 150-watt or 250-watt sizes as is desired by the customer.

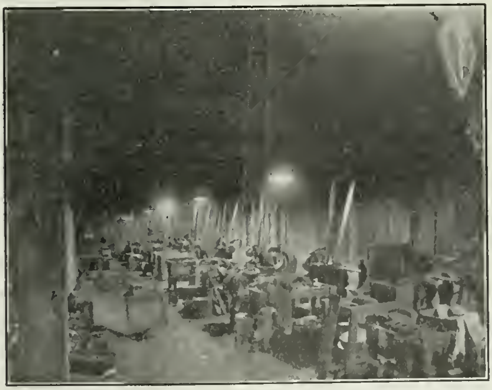


FIG. 1—LIGHTING FOR BUFFERS AND GRINDERS

According to the form of contract under which these small factory-lighting customers are solicited, the charges are divided into three parts—a rental charge, a maintenance charge and a charge for electrical energy. The patron pays a rental charge of 25 cents a month a lamp and a maintenance charge of 25 cents a month, except during the months of June, July and August, in addition to the company's regular rates for energy. During the summer months the maintenance charge is discontinued, as there is a tendency on the part of manufacturers to argue against the charge at times when the lamps are not used. However, the lamps are given their regular cleaning every ten days in the summer as well as at other times, it being thought best to prevent the accumulation of dirt. No special force of men has been necessary for this work of maintenance as yet, the street-lamp men taking care of all units in operation.

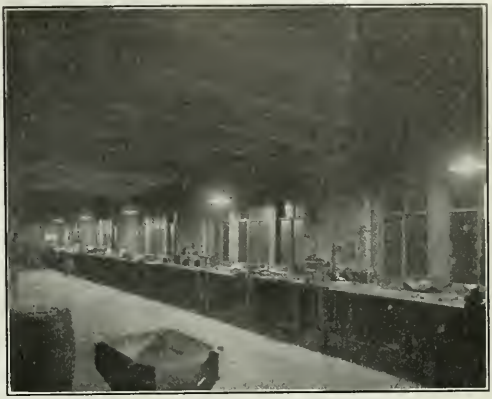


FIG. 2—A WELL-LIGHTED WORK BENCH

At the end of the initial two-year period the installation reverts to the customer, and from then on he may, if he so desires, maintain his own fixtures or may continue to pay the maintenance charge, for which the company will renew the lamps and clean the fixtures as under the previous arrangement.

Chicago is at present divided in three districts, each of which is in the hands of a special factory-lighting solicitor employed by the electric-service company. Contracts turned in by these men are submitted to the company's illuminating engineers, and an effort is made to supply the factory owner with the correct amount of light properly distributed. Within the next year the company confidently expects to install approximately 10,000 of these fixtures, and at present the outlook for such a record is promising.

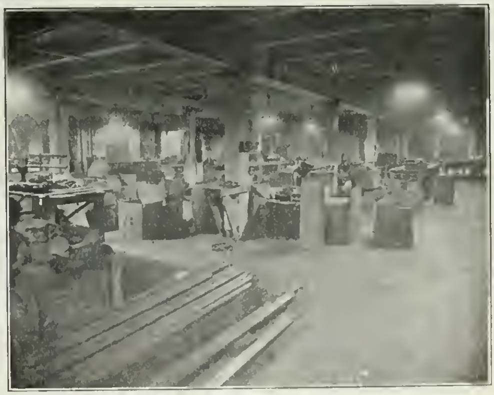
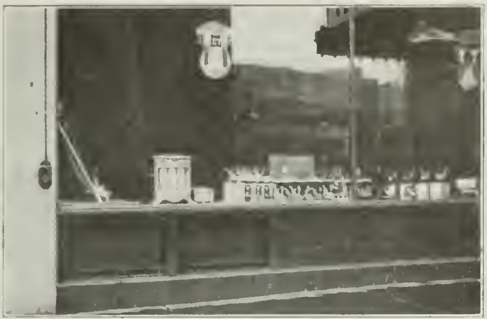


FIG. 3—GENERAL VIEW OF LOFT LIGHTING

Getting Motion Into a Flatiron Display

The value of moving objects to attract attention to window displays has long been recognized, and a novel application of this principle was embodied in a window recently arranged by the Union Electric Light & Power Company, St. Louis, Mo. An ironing board with a 0.5-in. slot lengthwise through its center was placed in the window and beneath it was hidden a 0.25-hp motor and a system of disks, sewing-machine belts and connecting rods to change the motor's rotary motion to reciprocating movement. By extending the lever connection through the slot in the board an electric iron was made to move along the surface much as if it were driven by an unseen human hand. Various styles of irons arranged in the foreground of the display showed those who stopped to watch the number of types of irons the electric-service company was offering to its patrons.



MOVING IRON DISPLAY, ST. LOUIS, MO.

Wall Cabinets for Unwired Houses in New Orleans

The New Orleans Railway & Light Company is meeting with encouraging success in installing electric wall cabinets in unwired houses, and expects during the next few months to take on in this way several thousand additional customers who cannot afford the first cost of a regular wiring installation. As described in the *Electrical World* of Dec. 13, 1913, the cabinet consists of a meter board, fuse block and run of molding, with outlets for a lamp, electric iron, fan or other appliance. To install, it is only necessary to run the service wires through the outside wall and hang the cabinet in place.

A special offer is now being made by the New Orleans company, which for $9 will install a wall cabinet, a 32-cp tungsten lamp and a $3.50 electric iron with 6 ft. of flexible cord. If desired, the customer may pay on the instalment plan—$3 down and $1 monthly. In this way, with an outlay of only $9, and that on easy terms, electric service is made available in houses where the occupant is not willing to defray the cost of a permanent wiring installation.

Electric Service for Vehicle-Battery Charging

A recent announcement made by the Commonwealth Edison Company of Chicago, through Mr. George H. Jones, power engineer, mentions several modifications which the company is effecting in its rates and methods of furnishing electric service for charging the storage batteries of electric vehicles. For example, the maximum price for energy used in public garages for charging storage batteries has been reduced from 5 cents to 4 cents per kw-hr. This is with the stipulation that no charging be done between the hours of 4 p. m. and 8:30 p. m. during the months of November, December, January and February. Even in those months, however, charging can be done between 4 p. m. and 8:30 p. m. on Sundays without the usual "peak" demand charges being made.

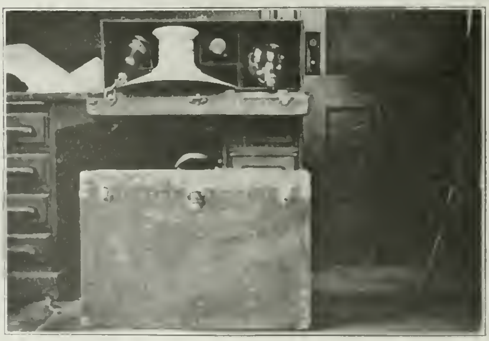
Energy used during the "off-peak" period will be billed monthly instead of on the yearly basis. This will make a considerable reduction for large garages where the maximum demand may vary considerably from month to month. The Commonwealth Edison Company is arranging to install in several of its substations in the outlying districts of Chicago facilities for giving a booster charge of 200 amp. This announcement is of importance to those interested in the use of large trucks. The company solicits suggestions from owners and operators of electric vehicles as well as from the proprietors of public garages in relation to any method which it can adopt to further the electric-vehicle business.

A Slogan Sign for a Town of 2500

The Fulton (Ky.) Electric Light & Power Company has arranged with the local business men's association to pay half the cost of installing and maintaining a large electric sign which is to be used to advertise the advantages from a business standpoint, of the community. The sign will be placed opposite the Illinois Central Railroad station. The Fulton central-station company is improving its plant in a number of ways. New steam lines are being put in, the floors are being concreted, and other changes for the better are being made.

Showing the Customer the Difference

Introduction of the sample-case idea into the sale of electric fixtures for indoor and outdoor illumination is one of the latest selling schemes originated by the new-business department of the Union Electric Light & Power Company at St. Louis, Mo. The case itself, as shown in the accompanying illustration, has its interior divided into four compartments of sufficient size to contain respectively a hanging base and chain, a white-enameled steel shade, a 250-watt lamp and a 500-watt lamp. Use of the case has two advantages—first, to the salesman there is given something concrete to talk from, and, second, he has with him the apparatus to demonstrate to the customer the difference between the 500-watt lamp and the 250-watt lamp.



SALESMAN'S "WHITE WAY" SAMPLE-CASE

Illumination and Wiring

New Lighting System for Pennsylvania Avenue, Washington, D. C.

On Jan. 30 148 new street lamps were put into service on Pennsylvania Avenue, Washington, D. C., between the Capitol and the Treasury. The installation of the present lighting system is the first step in the movement toward making Washington one of the best lighted cities in the world. The new lamps, one of which is shown in the accompanying illustration, are spaced 100 ft. between centers along the curb, being so staggered that they are placed at intervals of 50 ft. along the street. By this arrangement the lamps form the four corners of an equilateral rhombus, the width of the street being approximately the same as the spacing of the lamps along the curb. The lamp standards, which were especially designed for Washington and are similar to those in use around the Union Station, are made of iron with an oxidized copper finish. Each carries a 6.6-amp, 520-watt General Electric luminous-arc lamp giving 1500 cp at the angle of maximum intensity. The alabaster diffusing glass globe, manufactured by the Tiebot-Gleason Company, Brooklyn, N. Y., is made up of twelve segments and has a transmission coefficient of 66.6 per cent, which makes the combination arc and globe give approximately 1000 cp. The lamps formerly used gave 700 cp and were not incased in diffusing globes.

The cost of the lamp standard was $26.90 and that of the diffusing globe $40.50. It was owing to this high initial cost that the globe was made in twelve segments so that when one is broken it can be replaced at a relatively small expense. The lamp standards and the globes are the property of the District of Columbia, and the arc lamps were furnished by the Potomac Electric Power Company as part of its equipment. The lamps are operated by Brush arc machines, which have been rewound for 6.6 amp. The system will be operated 3942 hours per year, only half of the lamps being in use after 1 a.m.

NEW LIGHTING UNIT ON PENNSYLVANIA AVENUE, WASHINGTON, D. C.

On the evening of Jan. 30 the old lamps were lighted as usual at 5:30 o'clock and were burned until 7:30, when they were all extinguished. For several minutes the avenue then remained in darkness, until at a signal from Mr. W. C. Allen, electrical engineer of the District of Columbia, the new lamps were turned on.

Concrete Pole Butts

By Thomas H. Arnold

A few years ago when the writer was in charge of electrical work for an industrial company in the Southwest he made some interesting experiments on the use of concrete butts on wooden poles. Climatic conditions there are very favorable to a long life with this type of construction. The air is very dry, rains are infrequent, and the soil is usually rather impervious to water. The alkali in the soil in many places causes, however, a very rapid rot to set in. The life of an untreated pole will thus sometimes be as short as four years and is seldom more than six years. Treated poles last somewhat better, but if the treating has not been thoroughly done rot sets in under the outer shell and the treating is of no value. This rotting frequently starts in the weather and shrinkage cracks which seem to be unavoidable in the Southwestern climate.

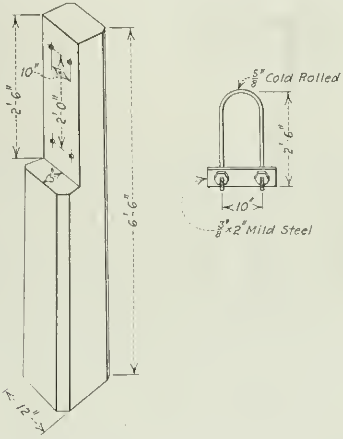


DIAGRAM OF CONCRETE POLE BUTT

Above the ground the pole shows every evidence of long life. A great many poles along railway lines were examined, some being native pine and cedar which had been set for more than twenty years. While the outside revealed considerable weathering, the center of the pole always showed sound wood. The weathering seldom went deeper than 1 in. These poles had all been cut off and reset several times, a fact which seemed to indicate that if some reasonably cheap method of keeping the poles out of the ground were devised a very long life could be expected from a comparatively cheap pole. Also, poles could be reset to the same height in taking care of renewals on existing lines.

The butt as designed was to take care of a pole 30 ft. or less in height, supporting a fairly heavy transmission line. It was employed as a general renewal butt and has also been used on a 35-ft. pole with the full length of pole set on it carrying three No. 8 wires.

As used the butt consisted essentially of a 12-in. by 12-in. column 6 ft. 6 in. long with beveled edges. At the top end one face was cut back 3 in. for a distance of 2 ft. 6 in., leaving a ledge for the pole to rest on. Four 11 16-in. holes were left in the butt for the U-bolts to go around the pole. A small amount of framing was necessary to make the pole fit the butt.

The form work required for this butt is very simple. Reinforcing in the shape of round and square bars was used. Six ⅜-in. bars bound with No. 8 steel wire were arranged about 1 in. from the outer edges, and one ¾-in. bar was placed in the center. This undoubtedly gave a much stronger pole than was necessary and could have been very much reduced. Some of the butts were however, put into use within two weeks after being poured, so that the extra strength was needed in these cases.

The cost of manufacture per butt was approximately as follows:

Sand	$0.15
Gravel	0.15
Cement	0.50
Reinforcing	1.60
Forms (pro rata)	0.30
Labor and supervision	0.30
	$3.00

The butts described were made in comparatively small quantities and at odd times, which considerably increased their cost. The forms can be used indefinitely, depending on the design and material used. The butts are practically indestructible and are much more readily handled than concrete poles. The poles can be set with the butts very quickly and with about the same number of men required to place them in the ground.

The design used has apparently given the results required and promises a cheap, long-lived construction at a very low cost. It has also enabled the resetting of a number of poles which otherwise would have been too short for use.

Revising the Lighting of a Composing Room

The accompanying illustrations show the results accomplished through a revision of the lighting arrangements in the composing room of the Stromberg-Allen Company, printers, Chicago, where the former system of drop-cord units was replaced with ceiling reflector lamps giving a clear overhead space.

The original installation consisted of a miscellaneous lot of 16-cp and 32-cp carbon-filament lamps hung on drop-cords and inclosed in tin shades. These lamps represented a connected load of about 4400 watts. The new arrangement employs thirty 100-watt tungsten lamps, besides three smaller 60-watt units, making a total load of 3180 watts.

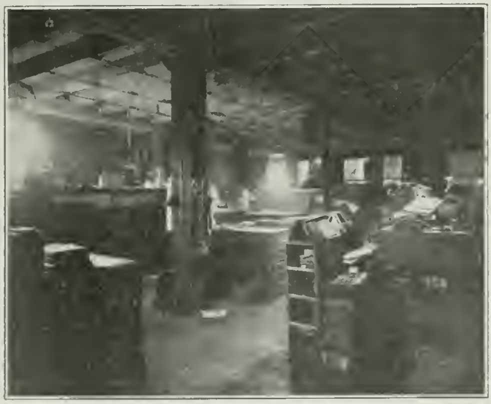


FIG. 1—COMPOSING ROOM LIGHTED BY DROP-CORD UNITS

Four different types of X-ray reflectors were specified to care for the widely varying requirements of the work done in different parts of the composing room. The proof press, for example, required a strongly concentrated illumination, while on the other hand the type cases demanded more distributed lighting. With the reflectors all mounted at practically the same height—within a couple of feet of the ceiling—these varying illuminating effects were accomplished by suitable choice of the focusing characteristics of the reflectors, after having determined the individual requirements of each position.

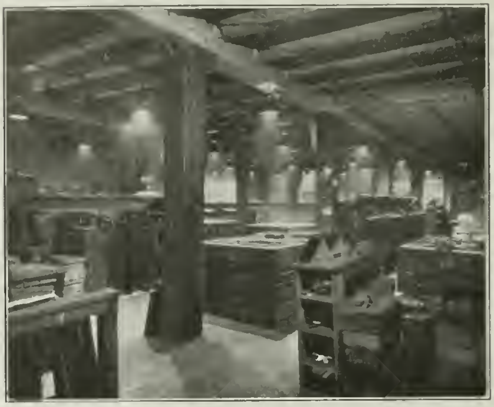


FIG. 2—SAME ROOM RE-EQUIPPED WITH CEILING REFLECTOR LAMPS

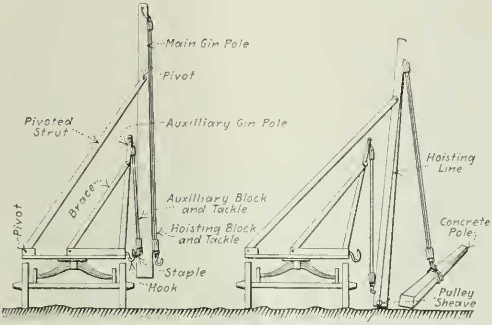
Photometer tests of the intensity of illumination obtained have not yet been made, but visual examination indicates that whereas the former average intensity on stones and cases was about 1.5 ft.-candles, with an expenditure of 4400 watts, the present mean illumination is about 4 ft.-candles in return for only 3180 watts.

In making the change to the ceiling system some of the old drop-cords were shortened and used, while for holding the large reflectors special stem supports were employed.

Gin-Pole Wagon for Erecting Concrete Poles

Described and illustrated herewith is a light-weight gin-pole wagon which can be drawn up at the roadside to set heavy concrete poles without obstructing the thoroughfare as would an ordinary portable gin-pole. When not in use the gin-pole is supported vertically at the side of the wagon, but when a post is being erected the base of the gin-pole rests on the ground. Since it is not subjected to excessive strains, the wagon itself can be constructed of lighter material than is usually employed in vehicles used for this purpose. With this pole-erecting outfit and a construction gang consisting of two men and a driver thirty to forty 1-ton concrete posts can be set in seven and one-half hours. Considerable time is also saved in moving from one pole-hole position to another because of the construction of the wagon.

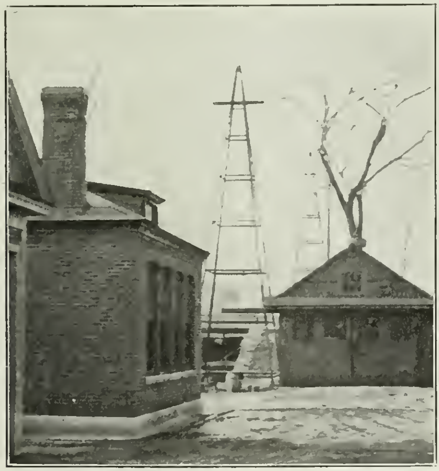
Fig. 1 shows a cross-section of the wagon with the gin-pole supported at the side and ready to move to the scene of the job. The gin-pole is hinged at a point two-thirds of its height to a pair of wooden struts, the lower ends of which are spread apart and pivoted to cross-beams on the wagon body. Near the lower end of the gin-pole is a heavy staple which fits over a hook at the side of the wagon supporting the pole when the wagon is being moved along the road. A block and tackle fastened to a small auxiliary gin-pole braced as shown is provided for raising the main pole off the hook and lowering it to the ground. Fig. 2 shows the gin-pole in position to set a post. Double-pulley blocks and tackle attached to the top of the main gin-pole are used to erect the concrete posts. The free end of the hoisting line from the upper sheave is passed through a pulley block strapped to the lower end of the gin-pole and can be pulled by one of the horses drawing the wagon. The pole wagon described is in use by the Consolidated Gas & Electric Company, Baltimore, Md.



FIGS. 1 AND 2—GIN-POLE READY FOR TRANSPORTATION AND IN POSITION FOR ERECTING POLE

A Steel Tower Line for Factory Use

At the plant of the Coes Wrench Company, Worcester, Mass., a 1300-volt loop line is run between the main substation of the company and a new factory owned and operated by the concern some 1760 ft. distant from the original shop. The line runs on the company's own property throughout its route, but traverses the edge of a stream which afforded no possibility of using wooden poles. The difficulty was overcome by installing four steel towers between the two plants and setting these on spread concrete foundations, the towers being about 40 ft. high and carrying a three-phase circuit as shown. Energy for the operation of the two factories is supplied by the Worcester Electric Light Company.



FACTORY STEEL-TOWER LINE AT WORCESTER, MASS.

Recent Telephone Patent

William Kaisling, of Chicago, Ill., is the inventor of an improved transmitter of the inverted solid-back type, The movable electrode is affixed solidly to the bridge. The front electrode, having a granule chamber, is secured to a flat spring which is mounted on the bridge piece. The usual rigid attachment to the main diaphragm is replaced by a spring tripod, the center of which is secured to the button and the legs of which rest upon the diaphragm.

Letters to the Editors

The Highest Voltage

To the Editors of the Electrical World:

SIRS:—In your issue of Jan. 3, 1914, you state that the Big Creek transmission system, 240 miles in length, operated at 135,000 volts, is the longest line for the highest voltage ever utilized. In this connection I wish to call your attention to the fact that the transmission system of the Southern Sierras Power Company has now been in operation for nearly a year. This system transmits energy from Bishop to San Bernardino, Cal., by direct line, the length of the line being 238 miles, and it has been designed for an emf of 150,000 volts. It is of interest also to note that this latter system, which represents the most recent electrical development, employs the outdoor substation and is controlled exclusively by air-break circuit-breakers.

San Francisco, Cal. AUG. J. BOWIE, JR.

World's Longest Transmission Line

To the Editors of the Electrical World:

SIRS:—Referring to the editorial in the *Electrical World* of Jan. 10, 1914, on the "World's Longest Transmission Line," we would call your attention to a criticism of the use of synchronous condensers which is evidently based on an erroneous view of their function in that plant. The condensers are not installed to compensate for the capacity effects of the line, as stated in the editorial, and any use of this kind made of them is incidental. The condensers are used because without them the cost of the line would have been greatly increased to give the degree of regulation absolutely necessary for proper commercial service. We would especially point out that the line capacity is not an important factor as regards regulation, and that the condensers would still be necessary had the line no electrostatic capacity. That is to say, the condensers are included as an integral part of the design, because economy has been obtained in the design as a whole through their use.

DWIGHT P. ROBINSON,
Boston, Mass. *President and General Manager Stone & Webster Engineering Corporation.*

[The fact that the synchronous "condensers" would be of value in improving the voltage regulation of the Big Creek system was mentioned in the concluding sentence of the editorial referred to by our correspondent, the inference being that this use of the machines was an incidental rather than the most important function. Our correspondent states that for the 240-mile, 150,000-volt Big Creek system synchronous condensers furnish the best and cheapest form of voltage regulation quite irrespective of any question of capacity in the line. Transmission engineers have not usually designed and operated their systems in accordance with this point of view. Such apparatus has, of course, been used previously for regulating purposes, but so far as we are aware, the Big Creek system is the first installation in which the prime function of the synchronous condensers is the maintenance of the proper delivered voltage, the advantages of improved power-factor by compensation for the excess wattless component of the current being considered incidental. The operation of the condensers on this system will be watched with much interest by all transmission engineers.—Eds.]

Standard Sizes of Catalogs

To the Editors of the Electrical World:

Sirs:—Most catalogs at the present day are valuable and are supplied to a carefully selected list of men to whom their contents will be of practical assistance. In the engineering field particularly a great reliance is placed on the file of catalogs maintained, which in effect becomes a reference library. In full recognition of this condition, many of the larger firms have their high-salaried engineers devote considerable time to providing the most valuable information in a lasting form. An attractive booklet reaching the desk of the general manager or purchasing official is much appreciated and after examination is placed on file.

The files of a busy man are carefully maintained and arranged for prompt reference. If the attractive catalog of the manufacturer is of the size generally favored, its filing is a matter of routine and a place is ready to receive it. If, however, it is larger than the other books in the file, there is no specified place that it will fit and the chances of its being thrown away are greatly increased. It may be thrown into a pile with similar odds and ends, where it soon becomes frayed and is destroyed at the next cleaning up.

When one considers the multiplicity of sizes of catalogs in use to-day, the advantage of a standard size is at once demonstrated. A committee appointed by the Technical Publicity Association to investigate and recommend standard sizes for catalogs recently measured 927 catalogs and found 147 different sizes, ranging from 3 in. by 5 in. to 11 in. by 14¼ in.

An argument advanced against uniform sizes of catalogs is that individuality would be sacrificed if all catalogs were uniform. A freak size does not tend toward individuality, but lessens the chance of the catalog being retained by the recipient. If individuality be desired, this can be provided on the inside pages and the cover. A catalog is not for the purpose of exhibiting the individuality of the house publishing it, but to give such information to customers as will be most useful to them.

This matter has been under investigation by the committee of the Technical Publicity Association for the past eighteen months, and its investigations have led to the recommendation of 6 in. by 9 in. and 8½ in. by 11 in. as standard sizes for all purposes. Both of these sizes can be cut to very good advantage with a minimum of waste of material from catalog papers now carried in stock by paper manufacturers. Another advantage of the larger size is that catalogs of these dimensions can conveniently be filed with correspondence, as this size will fit standard filing cabinets.

For paper-bound catalogs the cover should be trimmed to the exact size of the inside pages. Deckel edges and overlapping edges make catalogs less convenient to handle and should be discouraged.

For catalogs with stiff covers the inside pages should be trimmed to the sizes recommended, that is, 6 in. by 9 in. and 8½ in. by 11 in., with an overlap of ⅛ in.

This committee also recommended 8 in. by 10½ in. for bulletins, and this size was accepted by the Technical Publicity Association at its meeting on Oct. 9, 1913, because a large number of companies are now using a letterhead of this size and because bulletins frequently accompany letters and are filed with correspondence. This size is also the one that has been recommended by the Master Car Builders' Association as a standard for letter paper and specifications. When binders are furnished for bulletins they should be 8½ in. by 11 in. In this way they will be uniform with the 8½-in. by 11-in. catalogs and can be filed with them.

While the 9-in. by 12-in. size has been recommended by the Technical Publicity Association for technical and trade journals, it is not recommended as a standard for catalogs.

The report of the Technical Publicity Association is the same in all respects as the reports of similar committees appointed by the American Society of Mechanical Engineers and the American Institute of Architects, except that these committees recommended the 8½-in. by 11-in. size for both bulletins and catalogs.

It is to be hoped that all manufacturers will adopt these standards for all future catalogs and bulletins.

Arthur Haller,
New York. *Secretary Technical Publicity Association.*

Boilers Arranged for Quick Firing

To the Editors of the Electrical World:

Sirs:—I note in your issue of Jan. 24 a letter from Mr. B. W. Dennis with reference to the method of maintaining hot water in emergency boilers with tank and heating coil, as described in the Dec. 6 issue. He suggests that some of the expense and complications of installing the heating coil in the blow-off tank might be eliminated, and recommends that the live steam be injected directly into the bottom of the rear header or mud drum of the boiler. The injection of this quantity of steam directly into the boiler would localize the heat at the point of injection to such an extent that there would be a very objectionable water hammer. Aside from this, connecting up a jet of steam to each boiler would entail much piping and many valves, which would require much care and attention in shutting the boiler off in an emergency. With the tank system there were no extra connections made, and in case of emergency when the boilers are required the only valves to be shut are the blow-off valves.

The function of the tank and coil is to absorb the heat supplied in the live steam and impart it to the cool water slowly. This sets up a slow circulation, maintaining a high temperature without the danger from water hammer. It should be understood that the steam used for heating this water was a part of the steam-header condensation drainage, which is necessary as the headers are kept alive for emergency.

I take this opportunity to make a correction in the initial article. The 12½ lb. of coal per day noted therein should read 12½ lb. of coal per hour, and is comparable with the 130 lb. per hour noted as necessary for maintaining a hot bank. This was a typographical error.

Mr. Dennis also speaks of the use of fuel oil for aiding in bringing up an emergency boiler. We have found that the expense for fuel when using oil burners for this purpose is considerably greater than with the other method, and that there is nothing gained in the length of time required for bringing the boiler on to the header.

St. Louis, Mo. John Hunter.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

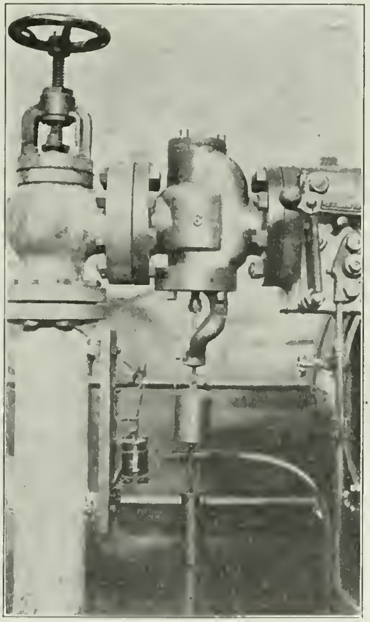
Electrically Operated Pumping Station for Boston Fire Service

The city of Boston, Mass., has awarded to the Westinghouse Electric & Manufacturing Company a contract for the equipment of a high-pressure electrically driven pumping station to be established in the heart of the city for use in fire fighting. The installation is to be completed in about a year. The station will be erected on Charles Street, between Boylston and Beacon Streets, and will be equipped with six six-stage centrifugal pumps, each of which will be capable of delivering 3000 gal. of water per minute against a discharge pressure of 300 lb. per sq. in., when operating at a speed of about 700 r.p.m., with a suction pressure of 40 lb. per sq. in. Each pump will be directly connected at one end to a 700-hp, 6600-volt, sixty-cycle induction motor, and at the other end to an 800-hp, 13,200-volt, twenty-five-cycle induction motor. Energy for the operation of the plant will normally be taken from the sixty-cycle and direct-current distribution systems of the Boston Edison company, the twenty-five-cycle service being of an emergency character and supplied from the South Boston station of the Boston Elevated Railway Company. The direct-current service will be supplied at 110 volts and 220 volts and will be employed in the operation of auxiliary motors and control apparatus.

The station will be built to house eight units, and there will be three independent sixty-cycle feeders, one twenty-five-cycle and two direct-current feeders. The building is to be laid out with a high-tension room divided into compartments housing busbars and switching appliances for the sixty-cycle and twenty-five-cycle systems, the secondary controlling equipment and resistances. On the sixty-cycle system the busbars are to be split into three sections and on the twenty-five-cycle system into two sections, with non-automatic switches between, each section being designed so that it can be operated singly or collectively as a common bus taking energy from one or more lines as may be desired. Oil switches will be of the electrically operated, remote-control type, capable of being opened or closed by hand and of interrupting a short-circuit of 100,000 kw on the sixty-cycle system and 45,000 kw on the twenty-five-cycle system. The wiring will be arranged so that the closing of the motor-control oil switch for any sixty-cycle motor will open the oil switch of the twenty-five-cycle motor on the same pump, and vice versa. A separate control equipment will be provided for each pump motor, consisting of a motor-control oil switch for the primary circuit, a secondary resistance-controlling device and a secondary resistance. All pump controls will be of the non-reversible type and designed to start the motors by gradually removing the resistance in the motor secondary circuit. Secondary resistance controls will be of the time-acceleration, remote-control type, motor-operated. Secondary resistance controls will be arranged to close the operating circuit to pump discharge valve controls, and thus cause the automatic opening of the discharge valves when the pump motors have reached a specified speed. The shutting down of any pump will cause its discharge valve to close automatically. Separate control boards will be provided for the sixty-cycle and twenty-five-cycle systems. The suction and discharge valves will be motor-operated, with remote-control and limit-switch equipment, and the pump discharge valves are to be controllable from either switchboard. Mr. L. K. Rourke is commissioner of public works.

Automatic Starting of Exciter Turbine

At the generating station of the Salem (Mass.) Electric Lighting Company a 75-hp exciter turbine of the Curtis type is equipped with the apparatus shown in the accompanying photograph to bring it into operation automatically in case the bus voltage fails. Ordinarily the station excitation service is motor-operated, but in case the alternating-current bus voltage drops materially the plungers in a pair of solenoids normally bridged across a secondary circuit derived from the 2300-volt buses are released, closing a contact and energizing a pair of trip coils mounted on a panel on the turbine steam supply pipe. The closing of the trip-coil circuit releases the 5-lb. weight shown and opens a governor valve at the right of the turbine stop valve, a dash-pot under the weight spindle regulating the rate of the valve's opening and protecting the turbine from an immediate application of the full steam supply. The



DEVICE FOR AUTOMATICALLY STARTING EXCITER TURBINE ON FAILURE OF EXCITATION ENERGY turbine is brought up to its full speed of 3300 r.p.m in eighteen seconds. Resetting of the trip and valve mechanism is done by hand. The arrangement was devised by Mr. A. Michaud, of the Salem company.

Boiler Tests with Illinois Coal

A paper of considerable interest was read by Mr. Bryant Bannister, of Kewanee, Ill., before the Chicago Section of the American Society of Mechanical Engineers recently. It related to tests made about three months ago at the new and carefully designed boiler plant in the Kewanee works of the National Tube Company. The complete boiler equipment consists of four Edge Moor water-tube four-pass boilers, each having 6132 sq. ft. of water-heating surface and 1200 sq. ft. of superheating surface, Foster superheaters being installed. Firing is done by a seven-retort Taylor stoker equipped with air-extension grate. Each stoker has its own fan and engine. Low-grade Illinois coal in the form of 1.25-in. screenings is burned in this plant with very high efficiency, and this fact makes the report of the tests of considerable importance. Comment was made in the paper on the fact that the tests compare well with those of the large boiler units of the Detroit Edison Company. The data and results of the evaporative tests (which were made by the National Tube Company) are as follows:

Date	Oct. 27 to Oct. 30, 1913, inclusive
Duration	72 hours
Kind of furnace	Taylor stoker
Grate surface	91 sq. ft.
Water-heating surface	6132 sq. ft.
Superheating surface	1200 sq. ft.
Kind and size of coal	Illinois bituminous screenings
AVERAGE PRESSURES AND TEMPERATURES	
Steam pressure by gage	117.6 lb.
Temperature of feed water entering boiler	194.9 deg.
Temperature of escaping gases leaving boiler	412 deg.
Draft in furnace	0.011 in.
Blast pressure under grate	1.95 in.
Degrees of superheat of steam	77.9 deg.
TOTAL QUANTITIES	
Weight of coal as fired	222,703 lb.
Percentage of moisture in coal	16.15
Total weight of dry coal consumed	186,736 lb.
Total ash and refuse	39,185 lb.
Percentage of ash and refuse in dry coal	20.98
Total weight of water fed to boiler	1,563,910
Total weight of water evaporated, corrected for moisture in steam	1,563,910 lb.
Total equivalent evaporation from and at 212 deg.	1,727,964 lb.
HOURLY QUANTITIES AND RATES	
Dry coal consumed per hour	2594 lb.
Dry coal consumed per square foot of grate surface per hour	28.5 lb.
Water evaporated per hour	21,721 lb.
Equivalent evaporation per hour from and at 212 deg.	24,000 lb.
Equivalent evaporation per hour from and at 212 deg. per square foot of water-heating surface	3.28 lb.
CAPACITY	
Evaporation per hour from and at 212 deg.	24,000 lb.
Boiler horse-power developed	695.6
Rated capacity in evaporation from and at 212 deg.	21,155 lb.
Rated boiler horse-power	613.2
Percentage of rated capacity developed	113.4
ECONOMY RESULTS	
Water fed per pound of coal fired	7.022 lb.
Water evaporated per pound of dry coal	8.375 lb.
Equivalent evaporation per pound of dry coal	9.254 lb.
Equivalent evaporation per pound of combustible burned	11.711 lb.
EFFICIENCY	
Calorific value of 1 lb. of dry coal	11,094 lb. Fahr. heat units
Calorific value of 1 lb. of combustible	13,773 lb. Fahr. heat units
Efficiency of boiler, furnace and grate	80.95 per cent

The attendance at the meeting was about 150, and much interest was manifested in the paper. Mr. Paul P. Bird, chairman of the section, presided, and the discussion was opened by Prof. G. A. Goodenough, of the University of Illinois. Mr. Joseph Harrington, consulting engineer, presented a carefully considered written discussion, with drawings, one of which showed the relative sizes of the combustion chambers of the Detroit and Kewanee plants. Others taking part in the discussion, besides the chairman and the author, were Messrs. H. B. Brydon, H. M. Byllesby & Company; Robert H. Kuss, Edge Moor Iron Company; Thomas A. Marsh, Green Engineering Company; A. Bement, consulting engineer; F. G. Gasche, Illinois Steel Company, and J. C. Bannister, National Tube Company.

Use of Diesel Sets at Isolated Generating Points in Central-Station System

With the extension of its transmission system from a central power plant, a large public-service company operating in the Southwest recently transferred a couple of Diesel-engine units to a new point of isolated generation. In commenting on the transfer, the general superintendent of the company says that the operating experience with these 225-hp Diesel units has been very satisfactory, and he expresses the belief that for small-plant operation they make a very desirable form of generating set. Maintenance charges are found to be very low and there seems no reason, he adds, why with proper supervision they should be otherwise. The greatest difficulty experienced has been in obtaining competent operators. Since being moved to their new location, the transferred Diesel units are again in active continuous service, while their former load is now being handled by energy transmitted from a central power house. Later the transmission lines will probably be extended to the community where the engines are now in service, at which time the displaced engines will then be again transferred to some new isolated power-plant site.

Efficiency of Rectifier Set

What is the ratio of the energy consumptions in the two cases which follow: A 25-amp motion-picture arc lamp operating on a 110-volt direct-current system, and the same lamp fed from a mercury-arc rectifier operating on a sixty-cycle circuit? F. L. W.

The energy consumed in the second case will be larger than in the first, as there will be a loss in the rectifier tube and in the reactance coils used with it. A rectifier tube delivering 110 volts has an efficiency of about 86 per cent, figured on an 18-volt drop in the tube. The loss in the reactance coils with the tube can be reduced to the extent that the customer is willing to pay for the copper and iron used in its construction. About 12 per cent more energy would therefore be required to operate the lamp from a rectifier set than would be necessary were 110-volt direct-current service available.

Connection of Exciter, Rheostat and Field Circuit

Is it correct to connect the field rheostat, exciter and field winding of a single-phase generator in series when only one rheostat is used to regulate the voltage of the alternator? O. F. D.

If the exciter furnishes energy to only one single-phase generator field and only one rheostat is employed for voltage regulation, it should be connected in the exciter-field circuit. Most exciting units are compound-wound, and to connect a single rheostat in a circuit as you mention would introduce complications which would be unwarranted by the results obtained. Moreover, the energy loss in resistance would be more than if connected in the exciter circuit as has been described. However, if the exciter delivers energy to more than one generator field it will be necessary to use additional rheostats in each field circuit.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Polyphase Induction Motor.—H. KAFKA.—A mathematical article in which the author gives analytical formulas for the components of the primary current, the secondary current and the magnetization current as functions of the slip for the polyphase induction motor (general alternating-current transformer) and notes on the method of plotting circular diagrams.—*Elek. u. Masch.* (Vienna), Jan. 31, 1914.

Transformer Oil.—W. BRAUEN.—The author discusses the requirements of good transformer oil and the nature of the decomposition products of mineral oil and vegetable oil. The decomposition phenomena are due to oxidation. The behavior of mineral oils and vegetable oils in transformers and their relative advantages and disadvantages are described. The author concludes that for transformer use vegetable oil has advantages over mineral oil.—*Elek. Zeit.*, Feb. 5, 1914.

Lamps and Lighting

Electrodes for Arc Lamps.—MOLLENKOPF.—An abstract of a paper read before the Württemberg Electric Society. The author discussed the fundamental difference between the arc of a pure-carbon direct-current lamp and the arc of a flame-arc lamp, 90 per cent of all the light coming from the arc in the latter case. He then described the method of making lamp carbons. The raw material for carbons of first quality is exclusively lampblack and carbon powder obtained by grinding pure carbon scrap. For carbons of inferior quality petroleum coke is partly used. Natural coal is unsuitable as a raw material. The methods of grinding, mixing and pressing are briefly described. As to cored carbons, it is stated that for pure carbons the core is a mixture of water-glass and fine carbon powder. Its purpose is to produce a vapor of high conductivity so as to force the arc to a certain point and to prevent its wandering away. In flame-arc carbons the core consists of mineral salts (especially fluorspar for yellow light and cerium and lanthanum for white light). For baking the carbons are collected in bundles and subjected for eight days to a temperature increasing slowly to 1500 deg. C. The baking must be carried out very carefully and the temperature increased and later on decreased very uniformly.—*Elek. Zeit.*, Jan. 29, 1914.

Temperature Distribution in an Incandescent-Lamp Filament.—A. G. WORTHING.—An abstract of an American Physical Society paper. The author gives the mathematical theory and applies it to a tungsten filament. In any single filament the temperature variation from the axial temperature across any right section varies quite closely with the square of the radial distance. In different-sized filaments of the same material operated under the same conditions at the same maximum temperature, the temperature differences between the axes and the surfaces in the neighborhood of that maximum temperature vary quite closely in proportion to the radii.—*Phys. Review*, January, 1914.

Railroad-Station Lighting.—H. VON GLINSKI.—An article describing an analytical method for calculating the most economical arrangement of lighting a railroad station or any other installation in which the lamps are placed in a row and the illumination in the direction of this row is of importance. The calculations are made for the direct-current Dia flame-arc lamp, for the direct-current Excello flame-arc lamp, for metallic-filament lamps, and for the new nitrogen-filled tungsten lamp.—*Elek. Zeit.*, Jan. 29, 1914.

Generation, Transmission and Distribution

Electricity Supply of Large Cities.—KLINGENBERG.—The continuation and conclusion of his long paper on the electricity supply of large cities, with statistical data on the conditions in Berlin, Chicago and London.—*Elek. Zeit.*, Feb. 5, 1914.

Cranes.—ERNST SCHWARZ.—An article, illustrated by diagrams, on a method for calculating the regulating resistances used in the lowering operation of cranes equipped with the electric-brake system.—*Elek. Zeit.*, Jan. 29, 1914.

Traction

Mountain Railway.—The first part of a description of the locomotives and electrical equipment of the new single-phase Lötschberg railway, which commenced operation in July, 1913.—London *Electrician*, Feb. 6, 1914.

Automatic Signals.—G. KEMMANN.—In Germany the use of a signal system actuated automatically by the trains was for a long time restricted to the Barmen-Elberfeld suspended railway. The present author has introduced it on the Berlin rapid transit roads. In the article the author begins an account of the extended preliminary studies on automatic signal systems which were made for this purpose. The article is to be continued.—*Elek. Zeit.*, Feb. 5, 1914.

Installations, Systems and Appliances

Rates Dependent on the Power-Factor.—R. ARNO.—An article giving a summary of various papers presented at the International Congress at Turin. An account is given of the system devised by the author by which the power-factor of the load is taken into account in making up the charge for electricity supply. The load measured in this system consists of two-thirds of the true power plus one-third of the apparent power. In other words, the "complex load" is represented by the sum of two-thirds of the watts and one-third of the volt-amperes. To employ this schedule meters of the usual type are used with slight modifications. The author first takes up the case of a motor load and shows in this case that the complex load can be measured with sufficient exactness by means of either an ordinary electrodynamic or induction meter, the only condition being that the phase displacement of the shunt-coil flux, with respect to the potential difference at the ends of the shunt-coil circuit, is suitably modified. In three-phase plants which are not loaded symmetrically the complex load can be measured with sufficient exactness by two ordinary meters of the electrodynamic or induction type, the only conditions being (1) that while the phase displacement remains unchanged in one of the instruments it can be modified in the other and can be varied from 0 deg. to 30 deg in the case of the electrodynamic instruments or reduced from 90 deg. to 60 deg. in the induction instruments; (2) that the instruments would be inserted in a three-phase system as in the ordinary two-meter method, but with a lagging phase difference of 30 deg. in the case of the induction instruments. The author then takes up the case of a lighting installation and shows that the "complex load" is there also of particular importance since lighting installations now often include step-down transformers, arc lamps, fans and motors for household use, resulting in decreasing the power-factor. The measurement of energy supplied by alternating current becomes similar to measurements of energy supplied by continuous current. The new measuring instruments are still effecively wattmeters and supply meters, and they present only the characteristic difference that the watts measured depend on cos θ, account being taken of the power-factor automatically. Ordinary alternating-current meters can be easily altered with small expense so as to be applicable to this new system of tariffs. In the case of electrodynamic instruments, it is sufficient to add a coil which may be easily made and constructed. In the case of induction-type instruments the method can be applied by making simple alterations to existing parts, and such modifications do not cause any increase in the loss in the instruments.—London *Electrician*, Feb. 6, 1914.

Protection of Wiring Installations.—A report of the committee of the German Association of Electrical Engineers on the protection of wiring installations by means of grounding, etc. The conclusion is reached that by means of good and correctly dimensioned ground connections protection can be obtained against high voltages to earth, but only in an indirect way in so far as the good ground connection causes the disconnection of the part of the installation where a fault develops. The same effect may be obtained in a simpler and safer way by connecting the switches, iron poles, stators, and all other parts to be protected, with the neutral wire. In this case the earth connection is necessary only in the transformer stations. The connection with the neutral wire at the same time prevents the occurrence of grounds at two different phases, which would result in the voltage of one of the outer wires rising above 250 volts measured to earth. The method of connection of the neutral conductor is, of course, effective as a protection only if properly carried out and if the dimensions are properly chosen.—*Elek. Zeit.*, Jan. 29, 1914.

Electrophysics and Magnetism

Electrification of the Atmosphere.—A note on a Kelvin lecture by Sir Oliver Lodge. The author indicated at some length the ways in which the probable weather can be predicted from the electrical conditions of the atmosphere. Thus, in fine weather, the earth is negatively charged, while the higher layers of the atmosphere are positively charged. These conditions vary in their intensity and in cloudy and rainy weather may even be reversed, so that phenomena of this kind give rise to the hope that a control of the electrical conditions of the atmosphere may be the proper line of research to follow in any attempt to control the weather. At any rate, as Sir Oliver pointed out, further investigation of the upper atmosphere is necessary to determine these points, and large-scale experiments ought to be carried out on the effect of discharging electricity from kites. Toward the end of the lecture Sir Oliver gave some interesting figures on the effect of high-tension current on the growth of crops, which had been obtained on an experimental farm in Worcestershire. This electrification appears to act as a supplement to the ordinary electrification of the atmosphere, and its botanical effect is now being studied at Leeds.—London *Electrician*, Jan. 30, 1914.

Some Electromagnetic Phenomena Relating to the Hall Effect.—E. P. ADAMS.—Corbino has discovered the following three electromagnetic effects: (1) If a metallic circular disk in which a uniform radial electric current flows is placed in a magnetic field at right angles to its plane, there results a circular current in the plane of the disk such that the current density is inversely proportional to the radius. (2) If the disk with the radial current flowing in it is suspended in a magnetic field so that its normal is inclined to the lines of force, a torque is produced tending to turn the disk. (3) If a radial current is induced in the disk on exciting a magnetic field at right angles to its plane, an equal and opposite radial current will be induced when the field is destroyed. The present author offers a theory to explain these effects in terms of the electrons and their characteristics.—*Phil. Mag.*, February, 1914.

Gamma Rays from Uranium Products.—H. RICHARDSON.—An experimental investigation in which it is shown that uranium X (by which are denoted the products uranium X_1 and uranium X_2 in equilibrium) emits three types of gamma rays having absorbing coefficients in aluminum $\mu = 24$, $\mu = 0.70$, and $\mu = 0.140 (\text{cm})^{-1}$. Evidence is given that the first two types are probably emitted by uranium X_1 while the third penetrating type is due to uranium X_2. The results obtained support also the view that the atomic weight of actinium is about 230 and that actinium is probably a branch product from uranium X_1.—*Philos. Mag.*, February, 1914.

Theory of X-Ray Reflection.—C. G. DARWIN.—The author discusses the structure of the lines photographed by Moseley in his method of finding the X-ray spectra of the elements. Proceeding on a theory exactly analogous to that of light, the intensity of reflection is found both for monochromatic and for heterogeneous radiation. The existence of a refractive index for both crystalline and amorphous substances is indicated by the theory. The correction for the temperature vibrations is calculated. The effect of the several electrons in an atom is calculated and is seen to account for the phenomenon of "excess radiation" observed in the scattering of X-rays by amorphous substances. The results are compared with the experimental results of Moseley and Darwin on rock salt.—*Philos. Mag.*, February, 1914.

Electrochemistry and Batteries

Ozone.—P. POSTEL-VINAY.—An illustrated article on the use of the Otto ozonizer for water sterilization in Paris. The construction of this ozonizer is shown in Fig. 1. The current from the high-tension transformer is carried directly through the conductor *C* to the high-voltage electrode *A*. This is placed between the two low-tension electrodes *B* and *B*₁, which are connected to earth through the conductor *D*. The electrodes are cooled by means of water circulation. Between the electrodes dielectrics are placed. At Paris water taken from the Marne River is first carried through some

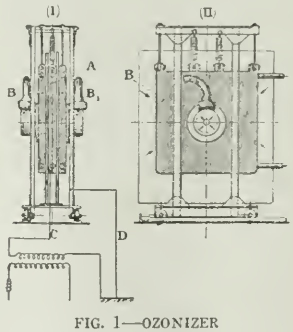


FIG. 1—OZONIZER

filters and then enters the ozonizer. Electrical energy is supplied in the form of three-phase currents at 220 volts with a frequency of fifty cycles. Three motor-generators transform this energy into single-phase current at 500 cycles. This frequency is particularly advantageous to raise the efficiency of ozone production. Under normal conditions 20 kw produces about 3 kg of ozone per hour with an average concentration of 10 milligrams of ozone per liter of air. The total capacity of the plant is sufficient for the sterilization of 120,000 cu. m of water per day. Fig. 2 shows a method of treating the water with the ozone. The water passes downward through *b* while the ozonized air enters through *a*. The sterilized water leaves at *c*. Statistical data are given on the bacteriological and sanitary results obtained with ozone treatment of water.— *La Revue Elec.*, Jan. 16, 1914.

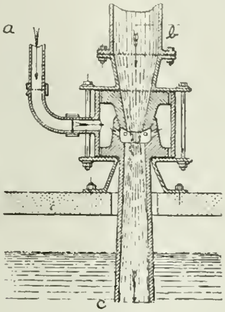


FIG. 2—MIXING OZONE WITH WATER

Units, Measurements and Instruments

Thermopile.—W. W. Coblentz.—An abstract of an American Physical Society paper on a thermopile of bismuth and a bismuth-tin alloy. The efficiency of these thermopiles is such that 1 microwatt of radiant energy produces a rise in temperature of 15 to 16×10^{-5} degrees in the receiver. The emf developed depends upon the number of junctions attached to the receiver and their manner of connection. This type of thermopile may be used in photometric and other investigations with rather insensitive auxiliary apparatus.—*Phys. Review*, January, 1914.

String Galvanometer.—Rudolf Forester.—The author analyzes the motion of the string galvanometer with and without air damping and measures its sensitiveness as a function of the frequency under the influence of a sinusoidal alternating current. The theory is compared with the results of practice.—*Elek. Zeit.*, Feb. 5, 1914.

Selenium.—P. J. Nicholson.—An article on the physical properties of selenium. The ultra-violet absorption of metallic selenium was roughly determined. Sensibility curves were obtained and a mathematical deduction is given with the electron theory as a basis, from which the most important facts known regarding the behavior of selenium cells are deduced.—*Phys. Review*, January, 1914.

Testing Materials.—An extract of the annual report for 1912 of the German Bureau for Testing Materials at Berlin-Lichterfelde. There are five departments relating to the testing of metals, testing of structural materials, paper and textile tests, metallography and general chemistry respectively.—*Elek. Zeit.*, Jan. 29, 1914.

Unipivot Instruments.—An illustrated article on unipivot instruments for alternating-current and direct-current circuits made by a British firm. The action of raising the instrument from the table automatically causes the coil to be lifted from its bearing. One type of instrument, called the cross-point instrument, is employed for determining the ratio of two varying electrical quantities, such as resistance, current or pressure, and can also be used in conjunction with a vacuum-junction or a barretter for the measurement of impedance, attenuation in telephone lines, etc. The instrument contains two of the large-size unipivot systems, both coils being mounted in the same magnetic circuit. This arrangement insures that any variation in the magnetic flux will affect both coils equally and will, therefore, not alter the ratio of the indications. The pointers are at slightly different levels, so that they may cross each other. Each pointer is provided with its own calibrated scale, which subtends an angle of 60 deg., and each instrument may be used independently for ordinary measurements. For measurements of ratios the point of intersection of the pointers is read off on a chart drawn between the two scale arcs, and this chart may be marked so as to give directly the ratio of the two quantities under test. This arrangement is also applicable for the simultaneous measurement of three factors, such as pressure, current and resistance. For example, one scale may be marked in millivolts, the other in microamperes, milliamperes or amperes, and the chart in resistance. Instruments for high-frequency measurements are also described—London *Electrician*, Feb. 6, 1914.

Crystal Rectification.—A. E. Flowers.—An article on the characteristics of crystal rectification especially at very low and very high frequencies. The rectification at high frequencies tends to be greater than at low frequencies with large currents, although but very little different for small currents. For very small currents the rectification tends to disappear, particularly for large contact areas and low current densities. The rectification ratio for small currents is nearly proportional to the square of the rectified current and nearly proportional to the first power of the total or root-mean-square current. Even very large contact areas will rectify well with large currents. The rectification ratio for very small currents may be improved by the use of very small contact points, but a much larger potential is required to get the same amount of current. The current density must be equal to or greater than a given minimum value for good rectification. Resistance in series with the galena-crystal rectifier greatly decreases the rectification ratio even for the same potential difference on the terminals of the rectifier.—*Phys. Review*, January, 1914.

Telegraphy, Telephony and Signals

Mechanical Analogy of Loaded or Unloaded Telephone Cables.—J. A. Fleming.—An abstract of a paper read before the British Physical Society on an experimental method for the production of vibrations in strings, illustrating the properties of loaded and unloaded telephone cables.—London *Electrician*, Feb. 6, 1914.

Telephone Exchanges.—J. Baumann.—An illustrated article on new improvements in traffic distribution for telephone exchanges. The author discusses the importance of distributing the traffic in an exchange and gives details of his modified system for attaining this end.—London *Electrician*, Jan. 30, 1914.

High-Frequency Alternating Currents in Telegraphy etc.—A. Maior.—A mathematical article on the use of high-frequency alternating currents in telegraphy, telephony and for power transmission. The author discusses a number of fundamental formulas connected with the propagation of high-frequency currents such as are used in telegraphy, telephony, and for power transmission. Various arrangements which have been tried for double telephony are given with certain experimental results.—London *Electrician*, Feb. 6, 1914.

Mercury-Vapor Telephone Relay.—A note on a recent British patent (No. 29,384, 1912) of H. De Forest Arnold and the Western Electric Company of this country. This invention comprises an arrangement of apparatus, including an ionized stream, such as that in a mercury-vapor arc, which is deflected under the influence of a magnetic field. There is a circuit in which the current variations in the incoming circuit are reproduced in circuits independent of the ionized stream. A non-arcing gap in the outgoing circuit is arranged transversely across the ionized stream and parallel to the magnet field produced by an electromagnet placed as near as possible to the longitudinal center of the ionized stream. The outgoing circuit is composed of a balanced differential circuit connected to electrodes of special design and arrangement.—London *Elec. Eng'ing*, Jan. 22, 1914.

Laying Telephone Cables.—A. Podmore.—An illustrated article on the laying of telephone cables across the Golden Horn at Constantinople, Turkey.—London *Electrician*, Jan. 30, 1914.

Miscellaneous

Electrical Engineering and Industry.—C. P. Steinmetz.—A Franklin Institute lecture on the effect of electrical engineering on modern industry. Electrical energy is the only form which is economically suited for general energy transmission and distribution. Civilization depends on the supply of materials and of energy as its two necessities. The supply of materials is taken care of by the transportation systems of the world. The supply of energy is being developed by electrical systems of transmission, which with regard to energy become what the railway system is with regard to materials. Introduction of electric energy in place of other forms of power rarely can be a mere substitution, but usually requires a change of the methods of power application, a reorganization of the industry to secure maximum economy.—*Journal Franklin Inst.*, February, 1914.

Book Reviews

Gas and Fuel Analysis. By Alfred H. White. New York: McGraw-Hill Book Company, Inc. 276 pages, illus. Price, $2.

As might be expected from the wide experience of the author, this little book is very comprehensive and well worth while. The clearness with which the various operations considered are described should render the work of value not only to the student of chemistry but particularly so to the engineer. An admirable feature is the stress laid on errors that may arise from improper methods of sampling, together with a discussion of the sources and limits of errors in analytical and calorimetric operations. The volume is brought up to date by the inclusion of the (1913) report of the joint committee of the American Chemical Society and the Society for Testing Materials on methods of analysis and determination of calorimetric value of fuels.

Wireless Telegraphy. By C. L. Fortescue. 1913. New York: G. P. Putnam's Sons. 143 pages, illus. Price, 40 cents.

This little book is intended for readers who already have some knowledge of applied science and who wish to extend their acquaintance to include the practice and principles of radio-telegraphy. The author shows himself to be familiar with current radio engineering and by clear explanations and analogues presents his points logically and forcibly. Through the first four chapters the book treats electrical quantities and phenomena concerned in radio transmission, and in the next two chapters the connection between the abstract principles and the actual apparatus is brought out. Six of the remaining seven chapters contain descriptions of modern applications of radio apparatus, including airship and aeroplane installations, and the text of the book is concluded by a chapter on "History," which is more nearly accurate than is common in publications on wireless telegraphy. A partial bibliography of the art is given as an appendix. While the author does not attempt to treat the subject in detail and has omitted or failed to emphasize some matters of interest, he has produced a very readable book which meets its purpose excellently. It is regrettable that he has fallen into the error of describing a traveling electromagnetic wave as having alternate rather than simultaneous maxima of electrostatic and electromagnetic forces. This may easily be righted in future editions.

Transformer Practice. By William T. Taylor. New York: McGraw-Hill Book Company, Inc. 278 pages, illus. Price, $2.50.

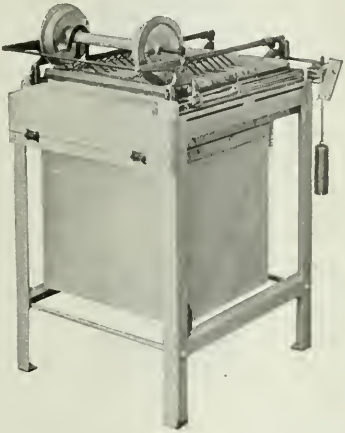
In its earlier edition this book was published under the title "Stationary Transformers." It has been entirely rewritten, and the second edition, which appears under the new title, contains many valuable additions. No attempt is made to treat of the fundamental principles underlying the action of static transformers or to enter deeply into details of design, the book being intended mainly for the use of operators and those engineers who may have to handle, install and connect transformers, possibly in out-of-the-way places where a man is compelled to rely on his own knowledge and experience or on such written information as he may have at hand. The various possible ways of connecting up groups of transformers for two-phase and three-phase work are fully discussed. The explanations are made in simple language without unnecessary verbiage, and the numerous excellent diagrams, showing both the actual connections and the vectors of the alternating quantities, add greatly to the value of this, perhaps the most important, section of the book. Almost every conceivable method of transforming two-phase to three-phase, and vice versa, is clearly explained, and a complete chapter is devoted to six-phase transformation and operation. Other matters dealt with include methods of cooling transformers, the installation and setting to work of large power transformers, drying out, testing and treating the insulating oil, connections of auto-transformers, and the operation of series transformers as used with current-measuring instruments. In Chapter XIII, which treats of feeder potential regulators and of compensators, the induction type of regulator receives its due share of attention, and its action is clearly explained; but a drawing showing a section through one of these regulators would have been helpful to the reader. Chapter XIV treats of the practical testing of transformers, while Chapter XV—the last—contains several examples of transformer specifications. Without doubt, the book is almost invaluable to the man for whom it has been written, for he can find herein collected together much useful and necessary information that he will frequently be in need of and which otherwise must be sought in multitudinous notebooks and back numbers of technical journals. Reliable information on the subject of temporary transformer connections, which one may want only occasionally in emergencies, but which he then requires urgently and in a usable form, is here given, along with the many other notes of interest which the author has gathered together during the course of his wide experience in various quarters of the globe.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Photographic Printing Machine

The printing machine shown in the accompanying illustration is being put on the market by the Stadler Photographic Company, 1322 Wabash Avenue, Chicago, Ill. The sensitized paper is held down by a flexible roller cushion, the rolling action of which has a tendency to remove any wrinkles or kinks in the paper. The distribution of pressure is very even and is obtained through two cross-bars which press down on springs, each spring in turn pushing down a small wooden bar which is fastened on the back of the roller cushion. Five 250-watt tungsten lamps provide the light. These lamps are switched on and off with an ordinary knife switch. The timing device is built on the gravity principle, and a fan and a weight are used to regulate the time of exposure. As soon as the proper length of time has elapsed to expose the paper, the cushion is released and at the same time the supply of energy is cut off; the cushion is then forced back by means of springs incased in aluminum casings.

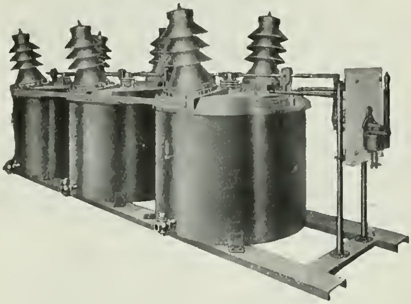

ELECTRIC PHOTOGRAPH-PRINTING MACHINE

High-Voltage Switch

The Condit Electrical Manufacturing Company, Boston, Mass., has developed a high-tension switch for pressures up to and including 70,000 volts. The breaker can be furnished for either hand or electrical operation.

The switch illustrated herewith is of the 200-amp, 70,000-volt, three-pole, single-throw, hand-operated type, each pole being a separate and distinct unit. The multiple-pole breaker consists of two or more units connected together by the operating or pull rods, which work the contacts and tripping mechanism. Each unit consists of a tank of heavy welded boiler-iron and is provided with an iron cover securely bolted to a flange on the upper edge of the tank, upon which is mounted the operating mechanism. This arrangement makes possible a mounting for multipole operation with any desired spacing. Use has been made of cylindrical instead of oval tanks to insure maximum mechanical strength.

The switches are filled with insulating oil, the height of which may be determined by sight gages. The break of the switch takes place near the bottom of the tank under the greatest available pressure of oil. Provision has been made in each tank to take care of any gases arising from arcing.

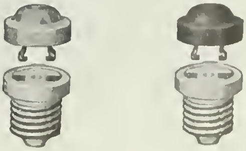

HIGH-TENSION SWITCH

The moving contacts consist of laminated brushes and are carried by heavy metallic cross-bars. The stationary terminals are protected by means of porcelain petticoat insulators which are securely fastened to the covers. The operating mechanism consists of a toggle arrangement and is so proportioned that the maximum closing effort is obtained with the minimum force on the handle.

Operation of the circuit-breaker is effected by the movement of a handle mounted either near the breaker or at some remote point and moving horizontally.

Attachment Plugs

Plugs that can be easily wired are shown in the accompanying illustrations. One is equipped with a porcelain cap and the other with a composition cap. The contacts "go home" in the base at any angle. The rounded part of the contact forces its way into the clip and holds it firmly. These attachment plugs are the product of the Trumbull Electric Manufacturing Company, Plainville, Conn.


FIGS. 1 AND 2—ATTACHMENT PLUGS WITH PORCELAIN AND COMPOSITION CAPS

Light-Weight Test Meter

An alternating-current test meter recently placed on the market by the General Electric Company, Schenectady, N. Y., has been designed to lighten the burden of the test man. The device weighs only 7.75 lb. and has outside dimensions less than 6 in. square and 7.5 in. high when closed. The meter is contained in an antique-finished oak case and is provided with a leather strap for carrying.

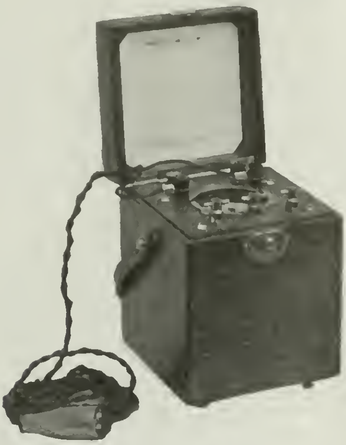


FIG. 1—TEST METER COMPLETE

The moving element consists of an aluminum disk mounted on a shaft of aluminum alloy. Attached to the shaft is a large hand which indicates on a large dial divided into 100 parts. Two smaller pointers with corresponding dials revolve on the large dial. One of these small pointers makes one revolution for every ten made by the large pointer, while the other makes one revolution for every 100 of the large one.

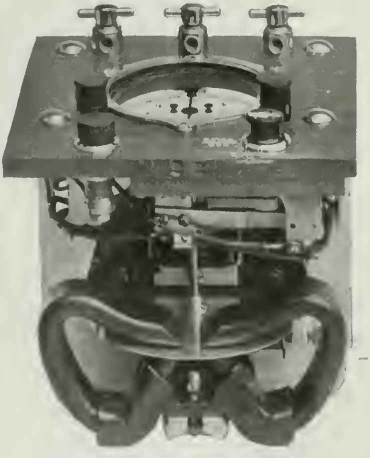


FIG. 2—METER REMOVED FROM CASE

The current coils are of 1-amp and 10-amp capacity, making the meter suitable for testing meters of capacities up to 15 amp on both heavy and light loads. In series with the 1-amp winding there is a fuse of small current-carrying capacity which protects this winding from burning out through an accidental overload or short-circuit. The meter is provided with a micrometer for full-load and light-load adjustments.

By the use of this meter 90 per cent of the alternating-current meters of the average central station, including polyphase meters, it is declared, may be tested quickly, conveniently and accurately at the point of installation.

The test meter described is known as the IB-5 instrument and is shown complete in Fig. 1. Fig. 2 shows the meter removed from its case.

Rotary-Converter Set for Tapered-Rate Battery Charging

The accompanying illustration shows a moderate-priced rotary-converter battery-charging set especially adapted for use in a private garage where it is expected to receive little attention. The equipment is designed to charge at a high initial rate which gradually tapers off, before gassing of the batteries commences, to a final rate which may be maintained indefinitely without overheating the cells. While the efficiency of this apparatus is 5 per cent to 7 per cent lower than that of a mercury-arc rectifier set, yet the actual cost of charging is lower, it is declared, because the depreciation and cost of repairs are negligible. The method of charging employed with this set, it is also claimed, will prolong the life of a battery from 25 per cent to 100 per cent over that obtained with a constant-potential charge.

ROTARY-CONVERTER BATTERY-CHARGING SET

The converter outfit is equipped with an automatic device which opens the charging circuit when the battery voltage reaches a predetermined value, independent of any variation in the voltage of the supply circuit. In case the circuit becomes grounded or overloaded, the charging switch will also open. If the alternating current supplied to the rotary converter is interrupted temporarily, an automatic device will start the charging operation again when the supply line is energized. The operation of the outfit is simple. After inserting the charging plug in the battery receptacle the main switch on the panel is closed. The charging will then continue until automatically shut off by one of the devices mentioned. It is simple to install the outfit, as only the alternating-current wires have to be connected.

Another feature of this apparatus is that energy from the battery may be pumped back into the alternating-current supply system through the rotary converter if it is desired to discharge the battery. No energy is therefore lost except that required to run the converter.

For use in public garages a double-voltage motor-generator is furnished to avoid the necessity of charging the batteries in series. This generator furnishes 75 volts and 115 volts, so that all batteries containing less than thirty cells may be charged on the lower voltage and those containing more cells are connected to the 115-volt charging plug. Both of these voltages may be varied at will, saving a considerable loss in resistances usually employed in charging.

The Lincoln Electric Company, Cleveland, Ohio, which manufactures these outfits, has furnished data which show the comparative cost of charging with one of its set and with a mercury-arc rectifier. Tests were made on 11-MV and 13-MV forty-cell lead batteries and A-4 sixty-cell Edison batteries, using 30-amp, 40-amp and 50-amp tubes respectively. The tube depreciations assessed per battery charge in each case were 45 cents, 55 cents and 65 cents respectively. These values were obtained by dividing the price of the tube plus the charge for installing a new one by the guaranteed life of the tube and multiplying by six the length of a normal charge. While the energy consumed by the rotary set was about 10 per cent more than that used by the rectifier in each case, the depreciation chargeable to the tubes brought the cost of rectifier charging above the rotary method. The range of percentage saving in each case is shown in the accompanying table.

SAVING DUE TO USE OF ROTARY-CONVERTER SET IN CHARGING BATTERIES

Cost of Energy	PERCENTAGE SAVED IN CHARGING		
	11-MV Forty-Cell	13-MV Forty-Cell	A-4 Sixty-Cell, Edison
2 cents per kw-hr.....	56.0	53.7	52.2
15 cents per kw-hr.....	8.2	7.1	6.2

Multi-Stage Turbines

The Kerr Turbine Company, Wellsville, N. Y., is now manufacturing turbines of the multi-pressure type rated at from 700 hp to 1800 hp. Turbines of smaller capacities and rated up to 700 hp were developed before the design of the larger sizes was attempted.

Fig. 1 shows an "Economy" turbine with a horizontally split casing and pedestal bearings. It also illustrates how the rotor may be inspected or removed entirely without breaking the steam connections. In Fig. 2 is shown a typical section of machines rated at from 500 kw to 750 kw. The diaphragms between the stage compartments are integral with the casing and are lifted off with the cover when the latter is removed; each wheel is, therefore, exposed down to the carbon packing on the shaft when this operation is performed. The guide vanes or steam nozzles are cast in the diaphragms.

Steam is expanded in a number of stages or steps, and the pressure drop at each set of nozzles is comparatively small. The velocity of the steam is not very great and is said to be rarely over 1000 ft. per minute. The leakage area from stage to stage is also small, being confined to the annular space where the shaft goes through the pressure chamber walls or diaphragms. Leakage from stage to stage at the shaft is prevented by floating carbon packing rings held in the diaphragms. In the high-pressure and low-pressure ends it is obviated by cover plates which are arranged so that they can move freely in any direction in case the turbine shaft should vibrate on account of a large amount of water being present. Owing to the fact that the steam pressure is higher on one side of the diaphragm than on the other, the carbon rings are kept tight against the ground seats. The large clearance permissible at the buckets is utilized to protect the buckets from stripping, and the hard, tough original skin left on the drop-forged buckets easily resists the tendency toward erosion.

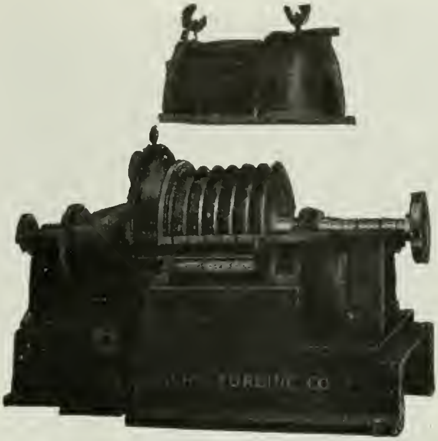


FIG. 1—STEAM TURBINE WITH COVER REMOVED

A small turbine-driven centrifugal pump with the impeller submerged in an oil reservoir forces oil to all the bearings before the machine is turned over. After starting, a spur-geared oil pump directly connected to the governor spindle forces oil under a pressure of 6 lb. per sq. in. to every bearing of the machine. The oil flows back to a large reservoir in the bed-plate, where it is strained and water-cooled. An independent emergency governor operating a quick-closing throttle valve is provided with each turbine. This governor is of the oil-relay throttling type, the valve being moved by oil under pressure of 30 lb. per sq. in.

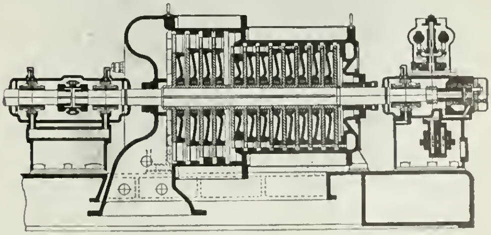


FIG. 2—SECTION OF TURBINE

Heavy pedestal bearings are used, and they are lubricated by means of oil rings. A marine-type thrust bearing which is adjustable and can be replaced maintains the rotor in its proper position. The entire unit is mounted on a heavy cast-iron bed-plate. The lagging outside the turbine cylinder is covered with enameled sheet iron.

Improvement in Alarm-Clock Time Switch

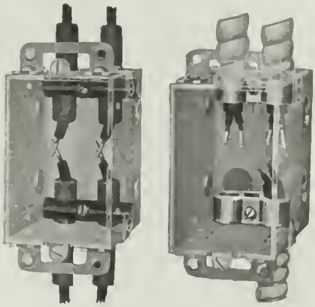
Improvements have recently been made in the alarm-clock time switch described in the Dec. 27, 1913, issue of the *Electrical World*, rendering it more nearly fireproof. As will be seen from the accompanying illustrations, the alarm clock has been placed inside a sheet-metal case and the actuating spring is extended through the switch handle and bent so that it will lift the trip lever automatically when the switch is closed. Otherwise the design of the time switch has remained unchanged.

FIGS. 1 AND 2—TIME SWITCH ACTUATED BY ALARM CLOCK

This device, which has been approved by the Underwriters' Laboratories, is being manufactured by Victor G. Jensen and will be marketed by the Kennedy-Webster Company, Rand-McNally Building, Chicago.

Loom and Cable Clamps

In Fig. 1 is shown a steel wall-box equipped with loom clamps and in Fig. 2 a similar box with cable clamps. Each clamp is provided with a ring or bushing which forms part of the clamp and protects the cable from abrasion. The bushings are heavily brass-plated to insure good electrical contact and to prevent corrosion. The boxes are furnished complete, and a few turns of the clamp binding-screw are sufficient to fasten the cable firmly in place. One or two cables can be clamped to the box.

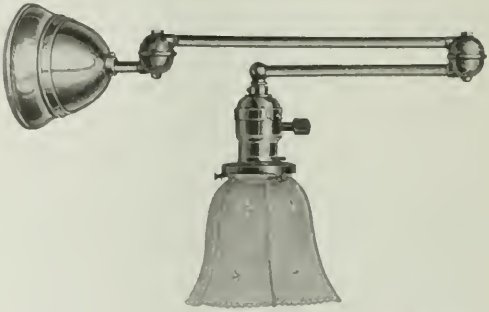


FIGS. 1 AND 2—BOXES FITTED WITH LOOM AND CABLE CLAMPS

The Machen & Mayer Electrical Manufacturing Company, Philadelphia, Pa., is placing these clamps on the market.

Flexible Fixtures with Improved Swivel Joints

Wires passing through swivel joints in electric fixtures are usually continuous and are apt to be broken if the fixture is bent very often. To obviate this objection to jointed fixtures, the Ohio Lighting Fixture Company, Toledo, Ohio, is manufacturing adjustable fixtures, similar to the one illustrated herewith, which are equipped with improved swivel joints. The joint consists of two hemispherical shells held together by a bolt and nut. Inside the shells, with the bolt as an axis, are mounted two insulated disks and embedded in the adjacent faces of these are two rings which slide on each other. Passing through the cores of the two disks and surrounding the bolt but insulated from it are telescoping metal tubes. The conductors leading to the joint connect onto the telescoping tube and sliding ring on one disk, while the outgoing wires are connected similarly to the other disk. With this sliding-contact construction inside the joint, it is possible to rotate the members of the fixtures through any angle without injuring the wires. It is also simple to wire or repair these fixtures as there are no sharp turns through which to thread the wire, and access to the interior of the joints may be readily had by removing the bolt and nut in the joint.



FLEXIBLE FIXTURE EQUIPPED WITH IMPROVED SWIVEL JOINTS

Improvements in End-Cell Switches

The Electric Storage Battery Company, Philadelphia, Pa., has recently developed an improved method of end-cell switch control for large central-station batteries. Switches are now being built for continuous use up to 10,000 amp and are capable of handling currents of more than 40,000 amp for a few minutes. The 5000-amp and 10,000-amp switches are made with two rows of switch points connected in parallel and two contact rails also connected in parallel, with four traveling brushes mounted on a common carriage, each brush being designed to carry one-fourth of the total load.

In this latest type of cell-switch control a combined control switch and indicator is provided on the switchboard which may be instantly set to indicate the point to which it is desired to adjust the cell switch, and the traveling brush on the switch will thereupon move to the point indicated and stop at that point without further attention from the operator. This combined indicator and control switch consists of a dial provided with a hand wheel at the center and an opening at the top through which an illuminated number is seen, which corresponds to the number of the cell connected to the bus through the end-cell switch. By turning the hand wheel, any desired number may be brought opposite the opening in the dial. At the same time connections are made by means of a series of contacts on the back of the board controlled by the motion of the hand wheel whereby the cell-switch mechanism is set in motion, and the brush travels to the point indicated by the new number thus brought to view.

When the cell switch is at rest the number visible on the dial is illuminated by a white light appearing from behind the apparatus. As soon, however, as the cell switch is put into operation by a movement of the hand wheel to a new position, a colored lamp takes the place of the clear lamp, red being used for motion in the direction to increase the number of cells and green for motion in the opposite direction. This colored illumination (red or green as the case may be) is intermittent as the switch travels from point to point and consists of a series of flashes separated by dark intervals. As soon, however, as the cell switch comes to rest at the point indicated by the number on the dial the steady white illumination is restored. The information given to the operator by this indicator is therefore positive in character, and as long as he sees the flashes of colored light he knows that the brush is traveling in the desired direction. If the switch should accidentally stop at the wrong point, this fact is indicated by a steady colored light without the flashes. If there should be any interruption in the control circuits, the fact would be indicated by the entire disappearance of illumination, since the same conductors which serve to control the operation of the cell switch also transmit current for illuminating the indicator. Fig. 1 shows a complete control panel for four end-cell switches, while in Fig. 2 there are shown the details which characterize the end-cell switch apparatus.

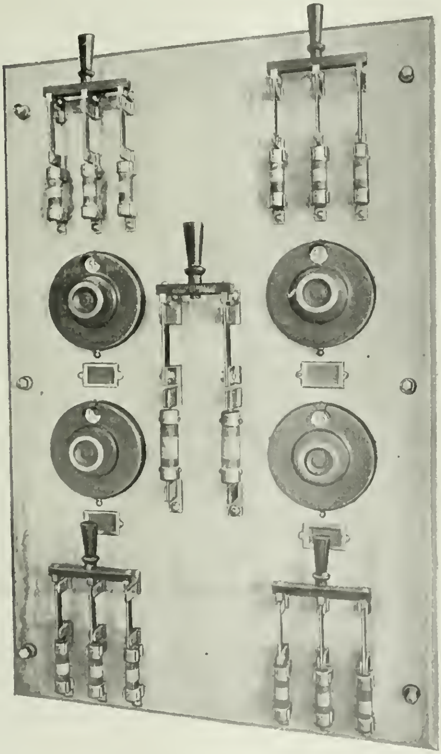


FIG. 1—CONTROL PANEL FOR FOUR END-CELL SWITCHES

This control system is said to be absolutely "foolproof." The operator may set the dial at any number and then immediately change his mind and reset it at another point without waiting for the cell switch to reach the point first indicated. In fact, he may change the setting as often and as rapidly as he may desire in either direction, and no harm whatever, it is declared, will result.

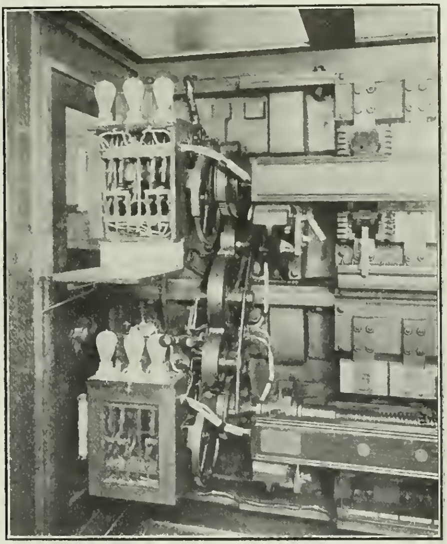


FIG. 2—DETAILS OF END-CELL SWITCH APPARATUS

The cell-switch brush will finally arrive at the point indicated by the last setting.

Gate Valve for Repacking Under Pressure

The Walworth Manufacturing Company, Boston, Mass., is offering for sale a brass gate valve with nonrising stem and solid wedge, which will permit of repacking while under pressure without the customary discomfort to the operating engineer. This packing process is accomplished by opening the valve as far as possible and drawing the stem collar down onto a fiber gasket which makes a steam-tight joint allowing the stuffing box to be removed without the escape of steam. The stuffing box screws are located on the outside of the bonnet.

The metal in the valve is distributed in a manner which gives maximum strength and results in a design of pleasing appearance. The hexagonal ends are made heavy so that they will withstand the strains imposed in connecting the valve to the line. These valves are regularly manufactured in sizes ranging from 0.25 in. to 4 in. with either threaded or flanged ends. They can also be furnished in quick-opening types and may be threaded for hose attachment. The self-packing feature will doubtless be appreciated by engineers who have had to pack valves under pressure with steam blowing out of the stuffing box.

Jobber, Dealer and Contractor

Officers of Louisville Contractors' Association

New officers were chosen by the Louisville Electrical Contractors' Association at its recent annual meeting at the Henry Watterson Hotel, Louisville, Ky. Mr. C. C. Childers, of Childers & Waters, succeeded Mr. Frank Good, of F. A. Clegg & Company, as president; Mr. Herbert Ottenheimer, of the Home Electric Company, was made vice-president; Mr. Gus Albrecht, of the Albrecht Hardware Company, was elected secretary, and Mr. James Clark, of the James Clark, Jr., Electric Company, was made treasurer. Arrangements are being made by the contractors to have the Kentucky Actuarial Bureau, a fire-insurance rating organization, handle all of the association's electrical inspection work, instead of only a part of it, as at present.

Need of Guarantee in Electrical Contracting Work

Speaking before the recent meeting of the New Jersey Electrical Contractors' Association, Mr. A. H. Moses, an architect, voiced the necessity of some sort of guarantee on the work of electrical contractors. Since the work of the electrical contractor has assumed such importance, and since there is in many places an association of master electricians, it has been suggested that it would be wise for each association to have a committee of experts upon whom the architects could call for advice and who would state in an impartial way whether the electrical contractor had fulfilled honorably and fairly the terms of the contract or whether he had slighted the work. This committee, in the opinion of Mr. Moses, should be composed of men who would render a fair and just decision in the various cases that might come before them for their action. Then, in the event of the committee finding that the electrical contractor was doing "shoddy" work, he should be amenable to punishment in some way and, if severe treatment is necessary, possibly expelled from the contractors' association. When the architects and good builders find that the contractors' association stands only for straight, honorable and efficient work, and that a dishonest practitioner has no place in its ranks, then membership in such a contractors' association will be of great value to its members and to the public at large and will do much to build up the electrical contracting business as a responsible factor in construction work.

Varieties of Estimators

An electrical contractor speaking to a gathering of about 300 of his fellows divided contractors into four classes, based upon their abilities as estimators. The first class embraces the contractor that knows the cost of the work as well as the overhead charges incident to the business. The second class includes the contractors who have a general knowledge of the business but do not know what the cost of doing business is. The third class includes the fly-by-night concerns with financial backing. This class of contractor usually lasts about a year, since it takes about that length of time to complete the various jobs. The manager usually makes one job wash another. The time he remains in business also depends of course on how much money the financial backer can be made to put up. In one case as high as $50,000 was spent before the financial backer was convinced of the futility of expending any more money. The erratic bidder was put in the fourth class. A contractor of this type causes much trouble, since on some work his bids are very low and on others very high. The high bid is laughed at and thrown into the waste basket, and the low bid, if it receives any consideration at all, is sometimes used to sandbag the man who has put in a legitimate estimate for the work. The fourth type of contractor is, in the majority of cases, convinced that the successful bidder is going to lose money on the job, because he imagines the work was awarded at a figure less than his.

Separate Contracts for Electrical Work Essential

According to a prominent New Jersey architect, the practice of having a general contractor and sub-contractors for different parts of work is not conducive to the attainment of the architect's ideal. The reasons given for this conclusion are: (1) The general contractor, in order to secure the contract, will use the lowest estimate received from a sub-contractor, often without proper knowledge of the man and his ability to do the work, simply because he gave a low bid; (2) after a general contractor has secured a contract, instead of giving the work to the sub-contractor whose bid he used, he will often see various people in the same line of work and, by hook or crook, try to get their bid down and make an extra saving to himself thereby—not realizing that if the estimate of the sub-contractor were cut below a proper charge for his work, he could not afford to give as good service as when he is fairly and properly paid for it.

The work of the electrical contractor is of a special kind, because the application of electricity to buildings is of recent origin, and for the safety of the user certain rules and regulations have to be enforced. It is therefore necessary that the person installing the wiring should have some knowledge of the force with which he is dealing and of the variety and kind of appliances available and suitable for the work. Consequently, in electrical work, the money consideration should never be the only one. The reason for making a contract with a general contractor was the desire to have some one responsible for the whole work who should engage to see that each part was executed properly and who should be able to control the craftsman on the job and deliver up the completed work to the architect and owner for a certain stipulated sum. However, the public is gradually realizing that work can be had at very little if any more expense by placing the architect in full control and letting through him separate contracts for each part of the work.

It is obvious that an architect cannot master all the details of the electrical contractor's business any more than he can master all of the technical details of plumbing, painting, masonry and the numerous other trades involved in the completion of a modern building. His practice is therefore to consult with experts in every important branch so as to get in touch with the latest appliances, and to prepare contracts and specifications on which reliable estimates can be made. A carefully prepared set of plans and specifications wherein nothing is left to the imagination gives the owner what he wants at a reasonable cost and enables the contractor to figure on a profit. Inasmuch as the general contractor knows very little about electricity, why should he employ the electrician, and why should the owner pay a profit to two parties—that is, a profit to the electrical sub-contractor and another profit to the general contractor who is supposed to shoulder the responsibility?

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

High-Voltage Oil Switches Sold.—The Pacific Electric Manufacturing Company, of San Francisco, Cal., has just recently shipped to the Peninsular Power Company, of Madison, Wis., seven 70,000-volt, type 166, electrically operated oil switches, part of a repeat order for eleven switches of this type, which have been in use by the latter concern for several years.

Century Electric Company Doubling Floor Space.—On moving into its new eight-story modern reinforced-concrete building, whose ground dimensions are 75 ft. by 115 ft., the Century Electric Company, St. Louis, will expand each of its departments, and will occupy about twice the floor space taken up by the present factory. Electrical energy for driving the factory machines will be delivered from the mains of the Union Electric Light & Power Company at 13,200 volts, with a frequency of twenty-five cycles.

Electric Vehicles Shown in Louisville.—Electric vehicles had a prominent place at the annual automobile show in Louisville, Ky., held Feb. 11-14 at the big First Regiment Armory in the Kentucky metropolis. The Kentucky Wagon Manufacturing Company, of Louisville, showed a full line of its electric trucks, while other electric vehicles shown include the Detroit, Waverley, Rauch & Lang, Baker, Ohio, Chicago and Woods. Dealers in electric vehicles report that sales of this type of car have been rapidly increasing during the past few years.

Interurban Construction Work Resumed in Wisconsin.—The Badger Railway & Light Company, 403 Grand Avenue, Milwaukee, Wis., has given the contract for the construction of an electric railway between Lake Geneva and Whitewater, Wis. (a distance of about 22 miles), to the Raulf Construction Company of Milwaukee. This contract includes all necessary grading, ties, rails, trenching, railroad crossings, special work, telephone equipment, etc. This contract is said to be the first of its kind to be awarded since the creation of the Railroad Commission of Wisconsin.

Goodman Manufacturing Company Celebrates an Anniversary.—About 280 persons attended a dinner given by the Goodman Manufacturing Company at the Hamilton Club, Chicago, on Feb. 2. The event marked the completion of twenty-five years' business by the Goodman company and its predecessors, the Independent Electric Company and the Sperry Electric Mining Machinery Company. Elmer A. Sperry, of New York, gave an illustrated address on applications of the gyroscope, and speeches were also made by Frank S. Washburn, Judge J. A. Baldwin and H. E. Goodman.

Argentine Commercial Customs.—Supplementing a note in the Feb. 21 issue on the South American customs concerning foreign business representatives, the following information may be of value to American electrical manufacturers and others who are anticipating export trade with Argentina: The license taxes on commercial travelers in the several Argentine provinces vary greatly and are subject to frequent change. The lowest rate recorded is about $50 per year and the highest is about $500 per year, with an average of about $200 per year. The character of the goods handled and the number of lines carried bear some relation to the rate. In all but one province the licenses run from the issue date to Dec. 31, but in some of them reductions are made when the issue date is later than June 30. A special license is required for transacting business of this kind in the city of Buenos Aires, and this license covers also the national territories. Agents' samples, classing as dutiable merchandise, are admitted duty free for a maximum period of ninety days, on furnishing of satisfactory security for the payment of the regular duty, in case of sale or failure to re-export within the given time for any other reason.

Branch Offices of Bureau of Foreign and Domestic Commerce.—Branch offices of the Bureau of Foreign and Domestic Commerce have been opened in New York, Chicago, New Orleans and San Francisco, where the bureau's publications, samples of foreign-made products, plans and specifications of construction work abroad, lists of foreign dealers in various lines, manuscript consular reports and similar documents are available to interested individuals and firms. Reserved addresses in connection with "Foreign Trade Opportunities" published in the Daily Consular and Trade Reports may be obtained by application in letter form to these offices. It is suggested that firms in the districts served by these branch offices acquaint themselves with the material available through them, as time may frequently be saved by application to the branch office instead of the bureau at Washington. The addresses of the branch offices are as follows: New York, Room 315, United States Custom House; Chicago, 629 Federal Building; New Orleans, Association of Commerce Building, and San Francisco, 76 and 78 Appraisers' Stores Building.

Co-operative Freight Station Saves Dealers Delays.—Cupples' Station, St. Louis, Mo., is one of the few co-operative freight depots in this country, and the dispatch with which incoming and outgoing freight is handled for dealers and manufacturers in the association recommends the plan for other similar districts. The station was originally endowed by Samuel Cupples, of the Cupples Envelope Company, and it has since been maintained from a portion of the rents collected from property in the vicinity of the depot, whose occupants use the freight service. The St. Louis branches of both the General Electric Company and the Western Electric Company are shipping from Cupples' Station and it is said that delays with this system have been reduced to a minimum. Mixed cars consigned to several firms at Cupples' Station are unpacked at the co-operative depot and each firm's goods loaded upon separate trucks. These trucks are then driven to the back doors of the respective recipients. Outgoing freight is handled in a similar manner, loaded trucks being set at the back doors to be picked up by the station employees and made up into filled cars at the depot. Delays incident to handling freight through crowded railway terminals are in this way avoided, the firms still retaining all the advantages that accrue from carload shipments.

Expansion of a Maine Utility System.—In the Nov. 22 issue of the *Electrical World* note was made of the consolidation of the Cumberland County Power & Light Company and the York Light & Heat Company, both operating in the State of Maine and controlled by E. W. Clarke & Company, of Philadelphia. Word has just been received to the effect that the former company has secured right-of-way for a transmission line connecting its system to the lines of the York company. The new line will be a single-circuit, three-phase, sixty-cycle section, operating at a pressure of 38,000 volts and costing about $45,000. Contracts for the poles, towers and electrical apparatus have been placed, and it is proposed to complete the construction during the spring. The Cumberland County Power & Light Company recently constructed a new tie line, 12 miles long, between its hydroelectric stations at Bonny Eagle and North Gorham, in Cumberland County. The linking of these plants and of a third at West Buxton completes a double transmission line which insures continuous service to Portland, Maine, and vicinity and makes it unnecessary, except during seasons of unusually low water, to operate the auxiliary steam generating stations. For the year ended Dec. 31, 1913, the Cumberland County Power & Light Company made an excellent showing. Gross earnings and net earnings gained 10.6 per cent and 12.4 per cent, and surplus also increased.

Recent Sales of Morris Turbines.—The I. P. Morris Company, of Philadelphia, Pa., has recently received orders for turbines from the following utilities: The Turners Falls Company, Turners Falls, Mass., has contracted for the design and construction of three 9700-hp turbines to operate under a head of 54 ft. at a speed of 97.3 r.p.m., to be installed in its new hydroelectric plant on the Connecticut River. The Canadian Light & Power Company, of Montreal, Canada, has awarded the contract for one 7200-hp turbine to operate under a head of 48 ft. at a speed of 150 r.p.m. This turbine is of the horizontal-shaft, twin-volute casing type. The contract also includes an I. P. Morris governor. The Pennsylvania Water & Power Company has awarded the contract for one 16,500-hp vertical-shaft, single-runner turbine, with I. P. Morris governor, for its plant at Holtwood. The existing power-house substructure is arranged for ten vertical-shaft, two-runner units, of which type seven units have already been installed. The vertical-shaft, single-runner unit, with spiral casing formed in the concrete, will be installed in No. 8 setting, and slight modifications of the substructure will be required to accommodate this type of wheel.

Electrical Display at Building Material Exhibit.—An interesting permanent exhibit of building materials is on view on the second floor of the Insurance Exchange, 175 West Jackson Boulevard, Chicago. All sorts of building material, supplies and devices are exhibited in attractive fashion, the exhibit company utilizing the entire floor. It is said that the entire exhibit occupies about 22,000 sq. ft. It has been divided into exhibit spaces of various sizes and there are assembly and committee rooms as well as a reading room. Several electrical concerns have exhibits, the most conspicuous being that of the Commonwealth Edison Company, which, in addition to a very handsome collective display of electrical supplies and fittings in showcases, has a model of a two-story house cut in half to show the interior fittings. The house is equipped with miniature lighting fixtures, switches, electric washing machine, electric vacuum cleaner, floor outlets and all the other electrical accessories of the most up-to-date residence. The various models are carefully made to scale and this "doll's house," which perhaps stands 6 ft. from the first floor level, is in every way a dainty and interesting attraction. Among other exhibitors of electrical appliances are the Eden Washing Machine Company, Conlon Washing Machine Company, Capitol Washing Machine Company, Atwood Vacuum Cleaner Company, Premier Vacuum Cleaner Company, Burdett-Rowntree Company, Robert W. Hunt & Company and Electric Products Company.

Recent Purchases of Electric Apparatus.—Generating and motor apparatus and accessory electrical equipment have been ordered from the General Electric Company recently by a number of industrial concerns, the variety of the service to which this equipment is turned being shown by the following record: The Texas Portland Cement Company, Dallas, Tex., has arranged to make a large installation of apparatus for electric drive in its mills, comprising seventy-one motors ranging from 5 hp to 500 hp, with switchboard, controllers and accessories. The Dunellen Phosphate Company, Rockwell, Fla., is equipping its plant for electric drive and will install fifteen motors ranging from 50 hp to 300 hp. The Oklahoma Portland Cement Company, Ada, Okla., will place in operation in its power plant a 500-kw Curtis horizontal turbo-generator and a 625-kva alternating-current generator. The Oneida Community, Oneida, N. Y., will equip a power plant at Sherrill, N. Y., with a 750-kva Curtis turbo-generator. The Chicago & Alton Railroad Company, Bloomington, Ill., will install in substations four 300-kva two-unit three-bearing motor-generator sets, three 150-kva transformers and switchboard apparatus. The Boston & Maine Railroad Company, Boston, Mass., will add to the equipment of the power station at the east portal of the Hoosac Tunnel three 1500-kva water-cooled transformers. The Upper Hudson Stone Company, New York, will install electric-drive equipment in its plant at Marlboro, N. Y., consisting of five motors ranging from 50 hp to 300 hp, three 200-kva transformers and switchboard apparatus. The Hebard Cypress Company, Hebardville, Ga., will place in operation in its power plant a 750-kva Curtis turbo-generator and switchboard. The American Bottle Company, Streator, Ill., will equip its power plant with a 500-kw Curtis turbo-generator complete with switchboard and accessories. The Crescent Portland Cement Company, Wampum, Pa., has ordered for power-plant equipment a 2500-kva Curtis turbo-generator with switchboard apparatus. The Alpha Portland Cement Company, Philadelphia, Pa., will add electric apparatus to the equipment of its plant, including four 1000-kw rotary converters, four 1050-kva water-cooled transformers and a switchboard. The Singer Manufacturing Company, South Bend, Ind., has ordered two 2500-kw Curtis turbo-generators with 75-kw turbo-exciters, a 300-kw generator and accessories. In addition to the apparatus above mentioned a large amount of equipment has been ordered recently from the General Electric Company by operating companies. The Great Northern Power Company, Duluth, Minn., has purchased for installation at Fond du Lac, Minn., a 12,000-kva alternating-current generator, a 12,000-kva water-cooled transformer and accessories. The Mount Whitney Power & Electric Company, Visalia, Cal., will add to the equipment of its power stations twenty 500-kva transformers. The Appalachian Power Company, Bluefield, W. Va., has ordered a 345-kva motor-generator set and three 125-kva transformers. The Central Iowa Light & Power Company, Fort Dodge, Ia., will install three 300-kva transformers, switches and accessories.

Foreign Generating Station Projects.—Continued activity is seen in many foreign countries in the expansion of electric generating facilities. In India there are large power resources, and these are being gradually developed, accompanied by the general progress of the country along industrial lines. The first hydroelectric plant in that country was installed in Darjeeling in 1896, and the most important installations are at Cauvery Falls, near Mysore, and at Tata, near Bombay. The capacity of the Cauvery Falls plant is being increased at the present time, and a plant is being built in Afganistan which will be equipped with generating machinery of American make. In Sweden still greater activity in this direction is apparent. Generating plants for municipal service, aggregating 9200 hp, are under construction, and the iron-fabricating, mining and pulp-mill industries are increasing their generating capacities in the same proportion, so that about 33,000 hp additional capacity is anticipated with the completion of present projects. Several single plants of large capacity have been just recently finished. Plans are under way in the Austrian cities of Graz and Marburg for the erection of a large hydroelectric generating station on the Drave River. About 24,000 hp will be furnished by this station when completed, and it is expected to cost in the neighborhood of $2,500,000. At Wenchow, in the province of Chekiang, China, there is a generating plant now under construction in which American apparatus and American engineering are used exclusively. This station is being built by Anderson, Meyer & Company, the Shanghai representatives of the General Electric Company, and its rating is about 1500 kw

NEW YORK METAL MARKET PRICES

	Feb. 17		Feb. 24	
Copper:	Bid	Asked	Bid	Asked
Standard spot*	14.12½	14.50	13.75	14.37½
	Selling Prices		Selling Prices	
	£ s. d.		£ s. d.	
London, standard, spot*	65 2 6		64 12 6	
Prime Lake	14.87½	to 15.12½	14.75	to 14.87½
Electrolytic	14.60	to 14.70	14.50	to 14.60
Casting	14.40	to 14.50	14.30	to 14.40
Copper wire base	15.75	to 16.00	15.75	to 15.87½
Lead	4.00		4.00	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.25		7.25	
Spelter, spot	5.40	to 5.45	5.40	to 5.50
Tin, spot	39.65	to 39.85	38.50	to 39.00
Aluminum:				
Prompt delivery	18.75	to 19.00	18.50	to 18.75
Future	18.50	to 18.75	18.50	to 18.75

*OLD METALS

Heavy copper and wire	13.75	13.75
Brass, heavy	8,87½	8.87½
Brass, light	7.87½	7.87½
Lead, heavy	4.05	4.05
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to Feb. 24 25,800

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*From daily transactions on the New York Metal Exchange.

Corporate and Financial

El Paso Electric Company Increases Dividend Rate.—The El Paso (Tex.) Electric Company, a Stone & Webster property, has declared a quarterly dividend of $2.25 per share on its outstanding stock, representing an increase of 25 cents per share per quarter.

California Utility Planning Bond and Note Issues.—The San Joaquin Light & Power Company has made application to the California Railroad Commission for approval of an issue of $3,145,000 refunding bonds and an issue of $200,000 of short-time notes, for meeting present expenses.

Massachusetts Utility Plans Stock Increase.—The Board of Gas and Electric Light Commissioners has authorized the Cambridge (Mass.) Electric Light Company to issue 500 shares of new capital stock at $200 per share to meet the cost of plant extensions. The proceeds of 425 shares are to be devoted to the cancellation of notes outstanding on Dec. 31 and the proceeds of seventy-five shares to the payment of the cost of additions made since that date.

Brooklyn Companies' Directors Re-elected.—At the stockholders' meeting of the Kings County Electric Light & Power Company and the Edison Electric Illuminating Company of Brooklyn, on Feb. 24, the following directors were re-elected for the ensuing year: Frank Bailey, William Berri, J. C. Brady, N. F. Brady, W. C. Courtney, D. J. Creem, H. C. Du Val, Walton Ferguson, Bernard Gallegher, W. V. Hester, A. T. Kiernan, T. E. Murray, W. F. Sheehan, J. N. Wallace and W. F. Wells.

National Carbon Company Declares 50 Per Cent Stock Dividend.—A 50 per cent common-stock dividend was recently declared by the directors of the National Carbon Company, of Cleveland, Ohio, following the announcement of an increase of $7,600,000 in the capital stock of the company. The dividend is payable March 20 to holders of the 55,000 shares of common stock on March 10. At the same time announcement is made of the election of Conrad Hubert as vice-president and director, succeeding Webb C. Hayes. The annual report of the company for the year ended Dec. 31 showed net earnings of $1,476,622, combined preferred and common dividends of $645,000, and a balance of $495,907. The combined assets of the company are given as $11,695,121.

First Six Months of Mississippi River Power Company.—Gross earnings for the first six months' operation of the Mississippi River Power Company's property at Keokuk, Ia., amounted to $612,578. The operating expenses are given as $18,111 for the month of December alone. The largest single contract held by the company is for 60,000 hp to be delivered for distribution in St. Louis, Mo., and it holds numerous contracts with the smaller towns in the vicinity. The aggregate load contracted for so far is 88,000 hp, and on a delivery of 80,000 hp in December the gross earnings amounted to $123,040. Stone & Webster estimate the 1914 statement as: Gross earnings, $1,700,000; operating expenses, $300,000; bond interest charges, $990,000; balance for dividends, $200,000.

Milliken Brothers, Inc., Show Favorable Annual Report.—In the Jan. 3 issue of the *Electrical World* an account was given of the arrangements by which the Milliken Brothers Company was taken over by the new corporation. The report of Vice-president Francis Dykes, recently given out, contains some information of general interest that was not available at the former writing. Owing to the fact that the actual operations of the new organization covered only a few days in December, no statement of the results of that operation were included. The old company secured during 1913 work in eighteen different states and in six foreign countries. It constructed in the past year about 1000 miles of steel-tower transmission lines, of which the old company furnished the steel for about 800 miles. The volume of business in this field of the company's activities is subject, however, to large fluctuations from year to year. The output of the shops for 1913 was 34,389 tons. Mr. Dykes expressed the opinion that trade conditions appear to be gradually improving. The total assets of the company are given as $4,808,935, of which $1,129,000 represents capital assets and $1,273,041 current assets. The capital liabilities amount to $4,531,516.

American Public Utilities Company Growing.—Kelsey, Brewer & Company, who control the American Public Utilities Company, of Grand Rapids, Mich., have secured control of practically all the public utility rights in the Mississippi Valley between La Crosse, Wis., and St. Paul, Minn. In addition to the already extensive holdings of the American Public Utilities Company in Minnesota, the new deal takes over all the trolley properties of the Chippewa Valley Railway, Light & Power Company, which operates the street railway in Eau Claire and Chippewa Falls, together with the interurban line between these two cities, a distance of 22½ miles; the Chippewa Falls Water Works & Light Company, the Menominee Electric Light & Power Company, the water-power plant at Menominee, and rights along the Red Cedar and Chippewa Rivers with a capacity for developing approximately 100,000 electrical hp, together with other public utilities in Menominee, Elmwood, Spring Valley and other small adjacent towns. The deal covers an approximate investment of $3,000,000. These new holdings will be operated by Kelsey, Brewer & Company in connection with properties already controlled in Minnesota and Wisconsin.

Carolina Power & Light Company Report.—The report of President C. E. Johnson of the Carolina Power & Light Company, recently issued, covers many interesting data on that company, as well as on its subsidiaries, the Yadkin River Power Company and the Asheville Power & Light Company. The three concerns serve a population of about 134,000, and at the beginning of the present year had an aggregate connected load of 36,390 hp. in comparison with 12,504 hp. on Jan. 1, 1912. The first-mentioned company was incorporated in 1908 and now operates 188 miles of high-tension transmission lines, connecting two hydroelectric and three steam generating plants, with an aggregate capacity of 10,000 hp. Its gross earnings during 1913 amounted to $525,213; net earnings came to $190,655 in the same period, and a balance of $105,019 was realized. The Yadkin River company owns and operates a hydroelectric generating station of 32,000-hp rating on the Yadkin River, at Blewett Falls, N. C., and has in operation also 184 miles of high-tension transmission line. The Asheville Power & Light Company has its own generating stations, but is now purchasing energy, under a favorable contract, from the North Carolina Electrical Power Company. The combined statistics for the three companies show, for the year 1913, 8587 electrical customers, 76,668,656 kw-hr. feder output, gross earnings of $1,121,849, net earnings of $548,270, and a balance of $176,302.

Annual Report of Commonwealth Edison Company.—At the regular annual stockholders' meeting of the Commonwealth Edison Company of Chicago, on Feb. 24, President Samuel Insull reported that for the year 1913 the operating revenue of the company was $16,838,743. Deducting operating expenses of $7,957,300 and depreciation of $1,547,127 left net operating revenue of $7,334,316. Taxes and municipal compensation to the amount of $1,353,916 were paid. Adding to operating income a comparatively small amount for other income, the total net income of the company for the year 1913 was $6,241,927. From this was paid $1,600,000 in bond interest and $544,000 was set aside for depreciation reserve under the requirements of the company's general mortgage. There was paid in dividends $2,816,864. The amount carried to surplus account was $1,281,063, and this account on Dec. 31, 1913, stood at $2,838,210, a stock dividend of $3,695,000 having been paid during the year in addition to the cash dividends. The income of the company for the year 1913 was $1,477,094 greater than in 1912. On Oct. 19, 1913, the consolidation with the Cosmopolitan Electric Company was effected. This brought to the Commonwealth company over 5000 new customers. On Sept. 26, 1913, the company's authorized capital stock was increased from $40,000,000 to $50,000,000. The stock dividend heretofore referred to and declared from the company's surplus amounted to 10 per cent of the outstanding capital stock as of Oct. 4, 1913. The additional 10 per cent capital stock issued at par to stockholders was fully subscribed. The company has issued capital stock to the amount of $45,838,936 and there are outstanding bonds to the amount of $32,000,000. The depreciation reserve stands at $4,521,839, and the total assets of the company are given as $87,626,505.

Business Notes

The Kentucky Electrical Company, Owensboro, Ky., has entered the manufacturing field with a drawn-wire tungsten lamp.

The Wagner Electric Manufacturing Company, St. Louis, Mo., is opening an office at 731 Wells Building, Milwaukee, Wis. W. R. Patton, formerly of the Chicago office, will be manager of the office at Milwaukee.

The S. D. Dalbey Electric Company is the new name of the Katterjohn & Dalbey Electric Company, of Paducah, Ky. The concern has purchased the building that it now occupies at 525 Broadway and will remodel and enlarge it. The firm does a general electrical contracting business and is planning to enter the jobbing field, handling electrical supplies in larger quantities.

The Edison Storage Battery Company, Orange, N. J., has recently made two important organization changes. W. F. Bauer, formerly manager of the railway department of the United States Light & Heating Company in Chicago, has been made assistant manager of the Edison company's railway department, retaining his headquarters in Chicago, at 2025 Michigan Avenue. Bertram Smith, lately manager of the battery department of the United States Light & Heating Company in Chicago, has been appointed assistant manager of the Edison Storage Battery Supply Company of San Francisco, which handles the Pacific Coast business of the Edison Storage Battery Company. Both men were at one time connected with the National Battery Company, before its absorption by the United States Light & Heating Company.

The Holophane Works of the General Electric Company opened on Feb. 1 a district office in the Frisco Building, St. Louis, Mo., from which sales in the states of Iowa, Nebraska, Missouri, Kansas, Oklahoma, Texas, Louisiana and Arkansas will be directed. J. G. Barrett is in charge of this office, with R. H. Lyon as his assistant. A complete display room has been equipped and a full line of Holophane products can be seen at this location. The Chicago district office has been transferred from 425 South Wabash Avenue to Room 715, Mallers Building. The territory covered by this office has also been increased to include North and South Dakota, Minnesota and Wisconsin. J. W. Foster is sales manager in the Chicago district. R. E. Perry, who has handled Holophane sales in the Cleveland district, has been transferred to the Chicago district, with headquarters at Minneapolis.

New Industrial Companies

The Independent Electrical Supply Company, of Los Angeles, Cal., has been incorporated with a capital stock of $25,000 by I. E. Irvine, James Irvine and Hyman Schwartz.

The Wagga Company, of New York, N. Y., has been chartered with a capital stock of $50,000 to manufacture and deal in electric supplies and novelties, by L. E. Warren, C. A. Burr and O. H. Cacciola, of New York, N. Y.

The Maroa Manufacturing Company, of Maroa, N. Y., has been incorporated by G. Conover, H. R. Harpstrite and J. A. Worsham. The company is capitalized at $25,000 and proposes to manufacture mechanical and electrical specialties.

The Electrical Maintenance Company, of Youngstown, Ohio, has been incorporated by Max Hain, Samuel Hain, Mark Gunlefinger and E. Gunelfinger. The company is capitalized at $25,000 and proposes to do a general contracting business.

The Service Battery Company, of Chicago, Ill., has been incorporated with a capital stock of $5,000 to deal in storage batteries, electric supplies and automobile parts. The incorporators are Nathaniel A. Stern, Maurice Alschuler and M. Richardson.

The Penn Yan Cable Company, of Penn Yan, N. Y., has been incorporated with a capital stock of $50,000 by E. R. Ramsey, W. H. Neefus and G. S. Sheppard, of Penn Yan. The company proposes to manufacture and deal in insulating safety devices.

The Acorn Insulated Wire Company, of Brooklyn, N. Y., has been chartered with a capital stock of $100,000 to manufacture and deal in insulated wire. The incorporators are Walter V. Donovan, 34 Pine Street, New York; Joseph Quittner and Joseph T. McMahon, New York, N. Y.

The Bourn Insulated Wire & Cable Company, of Portland, Maine, has been incorporated with a capital stock of $150,000 to manufacture and deal in insulated wire and cables, rubber and all allied products. J. H. Pierce, of Portland, Maine, is president and S. W. Bourn, of Providence, R. I., is treasurer.

The Bond Electric Company, of Hornell, N. Y., has been organized with a capital stock of $10,000 for the purpose of doing a general contracting and electrical engineering business and to deal in supplies. The directors are P. M. Bond, Hornell; W. S. James and C. D. Miller, both of Buffalo, N. Y. P. M. Bond is general manager.

Trade Publications

Charging Outfits.—A booklet, size 2¾ in. by 9½ in., has been issued by the Electric Products Company, Cleveland, Ohio, referring to the "Vertical Wotton" charging outfits for use in unattended garages.

Vacuum Cleaner.—The Menominee Electric Manufacturing Company, Menominee, Mich., has issued a folder on its "Menominee" vacuum cleaner, in which are illustrated and described the construction features of this modern labor-saving device.

Copper Prices.—The Rome Wire Company, Rome, N. Y., has compiled and printed in leaflet form a copper history as told in prices. A table is printed showing the monthly average price of copper from 1884 to 1914. The yearly average for 1913 was 15.833 cents.

Connectors.—A four-page leaflet bearing the imprint of the Delta Star Electric Company, 617 West Jackson Boulevard, Chicago, Ill., refers to Dossert connectors for tapping high-tension leads to high-tension buses and other purposes. The leaflet is fully illustrated.

Electric Stoves.—A booklet issued by the Olston Electric Stove Company, Inc., 217 Mercantile Place, Los Angeles, Cal., illustrates its portable and wall types of electric stoves. Some practical data are given as to the operation of the portable electric range and its advantages are clearly set forth.

Steam and Oil Separators.—The Harrison Safety Boiler Works, 3159 North Seventeenth Street, Philadelphia, Pa., have just issued a thirty-six-page pamphlet as an introduction to their general separator catalog, which latter will treat the separator problem in five main sections. The introductory pamphlet touches briefly on the main points to be considered in connection with both oil and steam separators.

Aluminum.—"Aluminum in the Construction of Chemical Plants" is the subject of publication No. 144, issued this month by the British Aluminum Company, Ltd., 109 Queen Victoria Street, London, E. C., England. The use of aluminum in the chemical industry for almost every chemical process is discussed in this pamphlet, and many interesting facts are given, as well as tables showing the comparative physical and mechanical properties of brass, steel and aluminum, weight of aluminum sheets and sizes and weights of aluminum tubes.

Mine Locomotives.—A pamphlet on Baldwin-Westinghouse electric mine locomotives has just been issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., and the Baldwin Locomotive Works, Philadelphia. The pamphlet describes the construction of the modern electric locomotives and the illustrations show construction details. The new bar-steel frame locomotive is described and illustrated and also controllers, circuit-breakers, trolleys and gathering reels. Specification blanks for mine-haulage locomotives are included.

Personal Mention

Mr. Thurston Owens has resigned as general manager of the La Crosse (Wis.) Gas & Electric Company.

Mr. John Vanderwerp has been elected president of the Muskegon (Mich.) Traction & Lighting Company as successor to the late F. A. Nims.

Mr. H. A. Lewis, New York manager of the Hot Point Electric Heating Company, sailed for Europe two weeks ago and will be absent for about a month.

Mr. C. R. Ablett has been appointed New York sales manager of the Hygrade Incandescent Lamp Company and Bay State Lamp Company as successor to the late James Kennedy.

Mr. August Weiss, superintendent of the electrical department of the Citizens' Light, Heat & Power Company, Johnstown, Pa., has been appointed assistant to the general manager, Mr. P. J. Morrissey.

Mr. John Wales has been appointed manager of the Boston sales office of the American Electrical Works to fill the vacancy caused by the appointment of Mr. R. W. Lillie as New York sales manager.

Mr. Henry Madison has been appointed chief electrician of the new municipal lighting plant at Franklin, N. J. Mr. Madison was formerly connected with the Newton Gas & Electric Company, Newton, N. J.

Mr. W. F. Gilmen, formerly superintendent of District D for the Central Illinois Public Service Company, with headquarters at Tuscola, Ill., has been transferred to Jacksonville, Ill., and is to have charge of Districts I and G.

Mr. J. B. Anderson, for many years engineer of power stations of the Savannah (Ga.) Electric Company, has been transferred to the Baton Rouge (La.) Electric Company. He will become superintendent of lighting in Baton Rouge on March 1.

Mr. J. Beaumont, until recently signal engineer of the Chicago Great Western Railroad, with headquarters in Chicago, has resigned to become senior signal engineer of the board of railroad valuation engineers of the Interstate Commerce Commission.

Mr. A. G. Gibbony has been appointed manager of the Burlington Power Company, with headquarters at West Burlington, Ia. For the past five and a half years Mr. Gibbony was superintendent of the Massena (N. Y.) Electric Light & Power Company.

Mr. Samuel Scovil, formerly vice-president of the Cleveland (Ohio) Electric Illuminating Company and well known in the electrical industry as the active head of that corporation, has been elected president of the company as successor to Mr. James Parmelee, retired.

Mr. R. W. Lillie has been appointed manager of the New York sales office of the American Electrical Works, vice Mr. Frank Donahoe, resigned. Mr. Lillie was formerly in charge of the Boston sales office and previous to that served for five years with the Holtzer-Cabot Electric Company.

Mr. W. R. Patton, for several years in charge of out-of-town sales in the Chicago office of the Wagner Electric Manufacturing Company, has been appointed manager of the new Milwaukee office of the same company. Mr. Patton is a Jovian of low potential and an electrical man of wide acquaintance.

Mr. E. W. Reed, who has been general superintendent of the Chattanooga (Tenn.) Railway & Light Company for some years, has been continued in that capacity with widened authority. The office of general manager has been abolished, and to Mr. Reed have been given all powers formerly exercised by such an official. He will have complete authority in the operation of both the street-railway department and the electric-light department of the corporation.

Mr. James Parmelee has resigned as president and director of the Cleveland (Ohio) Electric Illuminating Company and has been succeeded as president of the company by Mr. Samuel Scovil, and by Mr. Harrison Williams, of New York, as chairman of the board of directors. Mr. Parmelee, with Mr. Myron T. Herrick and their local financial following, sold the controlling interest of the Cleveland Electric Illuminating Company more than a year ago to the Central States Electric Corporation.

Mr. Putnam A. Bates, consulting engineer of New York City, has been appointed chief of the Bureau of Fire Alarm Telegraph of New York City by Fire Commissioner Adamson. Mr. Bates, who is well known in engineering circles in New York, is a graduate of Columbia University, and the heating and lighting plant in the Engineers' Club of New York City and that for the group of buildings in Hartford, Conn., erected by the late J. P. Morgan in memory of his father are among the many plants designed by him.

Mr. Julius C. Smith, manager and chief engineer of the Shawinigan Water & Power Company and also hydraulic engineer of the Cedar Rapids Manufacturing & Power Company, both of Montreal, has been awarded the Gzowski medal by the Canadian Society of Civil Engineers for his paper on "High-Voltage Transmission Lines." The silver medal which is struck off yearly and paid for by a fund provided for that purpose by the late Col. Sir Casimir Gzowski, past-president of the Canadian Society of Civil Engineers, is awarded on the recommendation of a committee of five for the best paper presented before that society during the year.

Mr. F. W. Hoover, who is general manager of the Tennessee Power Company, one of the two companies which have developed 150,000 hp in the Chattanooga district, has been designated executive officer of the Chattanooga (Tenn.) Railway & Light Company, reporting directly to Mr. M. H. Hopkins, first vice-president. Mr. Hoover is second vice-president of the railway and light company, having been elected to that office by the directorate in Philadelphia some time ago. He was in a position of authority with the Chattanooga Railway & Light Company prior to the resignation of Mr. W. E. Boileau as general manager of that company, which is controlled by the Clarks of Philadelphia. Mr. Hoover continues to act as general manager of the Tennessee Power Company, with offices in the Hamilton National Bank Building, Chattanooga, Tenn.

Mr. Theodore Beran, New York district manager for the General Electric Company, was the guest of a number of his friends and business associates at a dinner at the Machinery Club, New York, Feb. 20, to mark the twenty-fifth anniversary of his advent into the electrical field. It was in 1889 that Mr. Beran became cashier for the old Sprague Electric Company, which afterward, merging with the Edison General and Thomson-Houston companies, became the present General Electric Company. In 1893 Mr. Beran was appointed manager of its supply department, and he continued in that position until 1902, when he went to Rugby, England, where he organized the supply department of the British Thomson-Houston Company. After two years abroad, he returned to New York City and succeeded Mr. Charles T. Hughes as acting manager of the New York district office of the General Electric Company. Since 1905 Mr. Beran has served as district manager.

Obituary

James Kennedy, for twelve years manager of the New York office of the Hygrade Incandescent Lamp Company and the Bay State Lamp Company, both of Danvers, Mass., died of heart and kidney trouble last week.

Cecil A. Howell, superintendent of the test department of the Southern California Edison Company, Los Angeles, Cal., died at the Crocker Street Hospital, Los Angeles, Feb. 13, from the effects of a burn received the night before while superintending the installation of new instruments in the company's substation at Castaic.

Franklin Phillips, head of the foundry and machinery firm of Hewes & Phillips, died at his home in Newark, N. J., Feb. 9, from pneumonia. Mr. Phillips was born in Newark, N. J., fifty-seven years ago and was graduated from Cornell in 1878. He immediately became connected with the firm of Hewes & Phillips, founded by his father, and soon established a reputation as a mechanical, steam and hydraulic engineer. He was a trustee of the Newark Technical School, president of the Foundrymen's Association of New Jersey and a member of the Newark Board of Trade, the Essex Club and the American Society of Mechanical Engineers. He is survived by his widow, one son and a daughter.

Construction

New England

CLAREMONT, N. H.—The Claremont Paper Co. has begun work on the construction of a new power house. A 500-kw General Electric steam turbine will be installed.

CLAREMONT, N. H.—A petition has been in circulation asking the Public Service Commission to grant permission to the Sunapee El. Lt. & Pwr. Co., of Sunapee, to erect a transmission line into Claremont. Surveyors are still at work on the company's water-power project in Corydon.

WOODSTOCK, VT.—The Woodstock El. Co. expects to purchase some materials for its distribution and lighting system; also electrical appliances and supplies. Wilfred Smith is superintendent.

LUNENBURG, MASS.—At a special town meeting held recently the citizens voted in favor of establishing a municipal lighting plant and water-works system in Lunenburg.

WORCESTER, MASS.—Plans have been prepared for an addition of 20 ft. by 70 ft. to the Webster Street power house of the Worcester El. Lt. Co. Contract has been placed with the Westinghouse El. & Mfg. Co., of Pittsburgh, for a 6250-kw steam turbine.

Middle Atlantic

NIAGARA FALLS, N. Y.—Plans are being considered for connecting up the present ornamental street-lighting systems between the north and south ends of the city. The present plans provide for 160 steel trolley posts with single brackets part way and double brackets the rest of the way; 160 lamps or 254 lamps (not yet decided), to be maintained by overhead wires. The cost of the system is estimated to be $30,000 Mayor William McLaughlin is chairman of lighting committee and M. J. Donohue is city electrician.

ONEIDA, N. Y.—J. M. Hutton, city engineer, advocates the installation of a municipal electric-light plant. He recommends the development of a water-power site on Sconondoa Creek, near Knoxboro, 12 miles from Syracuse, which would develop sufficient power for lighting the city. The cost of the dam, installation of dynamo and erecting transmission line is estimated at about $30,000.

ONEIDA, N. Y.—Application has been made to the Public Service Commission by Holton V. Noyes, of Oneida, individually, also by Mr. Noyes as proprietor of the Kenwood El. Lt. Co. and the Oneida Community, Ltd., for construction of electric transmission lines and for the approval of franchises in the city of Oneida and the town of Vernon, together with the purchase of wires, poles and other appurtenances by Holton V. Noyes from the Oneida Community, Ltd., for $682.

SARATOGA SPRINGS, N. Y.—Bids, it is reported, are being received by Harry Croker for the installation of an ornamental lighting system, consisting of 48 lamps, in Saratoga Park, to cost about $4,000. It is reported that bids are being received by John C. Graul, superintendent of streets, for the installation of 60 ornamental street lamps and a conduit system on Broadway, to cost about $9,000.

BLOOMSBURG, PA. — Arrangements have been completed by the Columbia & Montour El. Co., of Bloomsburg, to extend its high-tension transmission line from Danville to Northumberland, and from there to Sunbury, where connections will be made with the high-tension line between that town and Milton.

COATESVILLE, PA.—If sufficient patronage is assured, the Chester Valley El. Co. may extend its system to Lionville and Byers to furnish electrical service in those towns. The company has a line to Bradford Hills.

ERIE, PA.—Plans are being considered for the installation of underground conduits on State Street from Eighteenth to Second Street, to be owned and maintained by the municipality, to cost approximately $50,000.

PITTSBURGH, PA.—The Department of Public Safety is considering the installation of an electric-light alarm system in connection with police department. Investigations are being made to ascertain the cost of the proposed system.

PITTSBURGH, PA.—Bids will be received by the board of inspectors, Western Penitentiary, North Side, Pittsburgh, until March 4, for furnishing and delivery f.o.b. cars, Rockview Station, Centre County, materials for construction of concrete building, including structural steel concrete tower complete, with chutes for elevating and placing concrete, Portland cement, reinforcing steel, etc.; also for furnishing and installing complete plumbing, heating and ventilation, electric wiring and equipment. Plans and specifications may be seen and proposal forms obtained at the following places: office of the board of inspectors, Western Penitentiary, Pittsburgh; at the prison, Rockview Station; Builders' Exchange, 18 South Seventh Street, Philadelphia; Builders' Exchange, Fulton Building, Pittsburgh; office of John T. Windrim, Commonwealth Trust Building, Puttsburgh, and at office of Thompson-Starrett Co., Second National Bank Building, Pittsburgh. John Francies is superintendent of construction.

POLK, PA.—Bids will be received by the board of trustees of the State Institution for Feeble-Minded of Western Pennsylvania, at the institution at Polk, until March 11, for the general construction of girls' cottage group, bakery building and addition to laundry building. Separate bids will be received for the plumbing, heating and electric work respectively. Plans, specifications and form of proposals can be seen at the institution and at the office of F. J. Osterling, architect, Commonwealth Building, Pittsburgh. Marvin F. Scaife is secretary and Dr. J. M. Murdoch is superintendent.

SELLERSVILLE, PA.—The Excelsior El. Lt., Pwr. & Gas Co., of Sellersville, expects to purchase ten transformers, 2 miles of wire and 25 meters within the next three months. F. Howe Kift is superintendent.

MERCHANTVILLE, N. J.—The Public Ser. El. Co. has submitted a proposal to the Borough Council for the installation of new 32-cp and 80-cp street lamps.

NEWARK, N. J.—A power house will be erected in conjunction with the new abattoir to be built by A. Fink & Sons, meat packers, at 810 Frelinghuysen Avenue.

NEWARK, N. J.—The Beaver Engineering Co., of Newark, has been awarded the contract for electrical work and elevators for the new Center Market, to cost about $30,000.

SOUTH RIVER, N. J.—Bids will be received by the Borough Council until March 9 for the construction of an addition to the municipal electric-light plant, including the installation of a gas producer, gas engine, generator and switchboard in accordance with plans and specifications prepared by C. S. Partridge, superintendent board of public works, which may be obtained from Charles Anderson, borough clerk, or C. S. Partridge, superintendent of public works.

RAVENSWOOD, W. VA.—At an election held Feb. 21 the proposal to construct a water-works system and to make improvements to the municipal electric-light plant was carried. As yet full details have not been arranged. C. O. Nilsson is superintendent of the municipal electric-light plant.

WASHINGTON, D. C.—A city council is considering the erection of an electric power plant for lighting the city, the installation of a brick-making plant with a daily capacity of about 4000 bricks and the construction of a water-works system. For further information address No. 12,503, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or the branch office of the bureau, Room 337, United States Custom House, New York, N. Y.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 10, for furnishing at the navy yard, Brooklyn, N. Y., the following supplies: Schedule 6303—steel sashes, operating devices, trolley track; Schedule 6304—asbestos sheets; Schedule 6305—aluminum wire, lead washers, iron or steel clips; Schedule 6401—furnishing and erecting electrically operated gentry crane; Schedule 6402—pneumatic tools; Schedule 6416—calcium chloride, etc.; Schedule 6419—electric cables; Schedule 6423—crucibles, electric wire, composition unions, etc. Applications for proposals should designate the schedule desired by number. Blank proposals will be furnished upon application to the New York navy pay office or to the above bureau. T. J. Cowie is paymaster general, U. S. N.

WASHINGTON, D. C.—A resident of a Latin-American country informs an American consulate that he would like to receive information from American firms able to supply the following classes of materials: Aerial cable systems, with a capacity for transporting 40 to 60 tons of coal per day of 10 hours, distance about 500 yd., wire cables and fixtures for use in inclined mine entries, endless cable devices; railway materials, such as rails, flat cars, coal cars, mine cars, etc., gage of railway 42 in.; electric plants operated by steam power, gasoline motors, 1½ hp up, and gasoline launches for business purposes For further information address No. 12,516, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or the branch office of the bureau, Room 337, United States Custom House, New York, N. Y.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 17 for furnishing at the various navy yards and naval stations the following supplies: Annapolis, Md., Schedule 6449—miscellaneous hydraulic apparatus, etc., miscellaneous galvanometers, etc. New London, Conn., Schedule 6457—two metal coal chutes; Schedule 6441—one engine-driven centrifugal pump. Norfolk, Va., Schedule 6454—100 brass-case, air-pressure gages (3-in., to read 160 lb.), 100 galvanized-steel air-whistle tanks (9 in. in diameter by 28 in. long); Schedule 6443—one vertical, double-acting, duplex pump, one vertical, double-acting, simplex pump, Schedule 6454—100 2-in. diameter compressed whistles, complete, miscellaneous screwed, low-pressure, rough composition pipe fittings, 276 lb. drawn, seamless brass tubing, 112 lb. drawn, seamless copper tubing, 200 2-in. screwed, low-pressure, rough-composition unions. Brooklyn, N. Y., Schedule 6458—one 12-in. reach, pneumatic compression punch; Schedule 6452—1100 ft. 9 in. (outside diameter) steel tubing (18.429 lb. per ft.). Washington, D. C., Schedule 6450—miscellaneous seamless brass pipe (iron pipe size), 2860 lb miscellaneous seamless copper pipe (iron pipe size). Bids will also be received until March 24 as follows: Philadelphia, Pa., Schedule 6435—one oil-burning, water-tube testing boiler. Brooklyn, N. Y., Schedule 6439—11 centrifugal pumps; Schedule 6432—four 300-kw turbo-generator sets, with spare parts. Bids will also be received until March 31 as follows: Brooklyn, N. Y., Schedule 6459—for 12 turbine-driven forced-draft blowers. Bids will be received until April 7 for the following: East and west, Schedule 6462—annual supply of miscellaneous boiler gaskets. Bids will also be received until April 14 as follows: Pearl Harbor, Schedule 6433—miscellaneous lead-covered, paper-insulated cable, 40 ft. lead-covered, wool-insulated, telephone cable, miscellaneous telephone accessories and 6000 ft. twisted pair, telephone wire. Application for proposals should designate the schedule desired by number. T. J. Cowie is paymaster general, U. S. N.

North Central

BAY CITY, MICH.—The plant now being erected by Walter D. Young for the manufacture of the Aladdin houses in Salasburg will as far as possible be equipped with electrically driven machinery. Energy for operating the plant will be supplied by the Bay City Pwr. Co. The building will be 120 ft. by 350 ft.

DETROIT, MICH.—The contract for electric equipment in the new 10-story building for Gregory, Mayer & Thom, on Cadillac Square, Detroit, has been awarded to the Gray Brothers Electrical Co., of Detroit.

GRAND RAPIDS, MICH.—The merchants on West Leonard Street are agitating the question of installing an ornamental street-lighting system. They agree, it is reported, to furnish the lamp standards, provided the city will furnish the wire and maintain the lamps.

MONROE, MICH.—The River Raisin Paper Co., of Monroe, it is reported, is preparing plans for the construction of a new power plant. H. Wood, of Monroe, is owner, and James Gilmore, architect.

RIVERDALE, MICH.—The Alma Illuminating Engineering Co., of Alma, it is reported, is interested in a project to utilize the power of the Pine River developed at the J. W. Johnson dam. It is said that arrangements have been made for the erection of transmission line to furnish electricity for lamps and motors in Vestaburg, Riverdale, Elm Hall, Sumner, Elwell, Cedar Lake, and possibly Edmore and Alma.

CANTON, OHIO.—Application has been made to the City Council by O. C. Barber, of Akron, to supply electricity in Canton. The proposed electric plant is to be situated in Howenstein, a few miles from Canton, at the entrance to the coal mine there, owned by Mr. Barber. When the plant is completed electricity will be transmitted to Alliance, Massillon, New Philadelphia and other towns and cities.

CINCINNATI, OHIO.—Bids will be received by the board of hospital commissioners, Burnet Avenue, Cincinnati, Ohio, until March 17 for furnishing material and construction of the administration building, nurses' home, dining hall, reception cottage, laundry and power building, stack and stable of the new Cincinnati Tuberculosis Hospital, and additions and alterations to porches on present ward buildings No. 2 and No. 3, in Lick Run, Hamilton County, as follows: (3) For reinforced concrete work; (4) brick work, cut-stone work, hollow-tile partitions and furring; (5) stack; (6) cork insulation; (7) carpenter work; (8) hardware; (9) structural iron and steel work; (10) lathing and plastering; (11) sheet-metal work and roofing; (12) painting and glazing; (13) tile and marble work; (14) cement work; (15) elevator work; (16) electrical work; (17) plumbing and gas fitting. Plans and specifications are on file in the office of hospital commissioners and the office of Tietig & Lee, architects, Lyric Building, Cincinnati. Proposals may be submitted on any branch of the work, on any number of branches, and for the work in aggregate, including all branches. Bids will also be received at the same time and place for labor and materials required in the heating and engineering work in the new Cincinnati Tuberculosis Hospital, Lick Run, as follows: (1) For boilers, stokers, smoke connection, coal cars, tracks and scales; (2) power piping, steam transmission lines and heating systems; (3) covering and insulation; (4) electric transmission system; (5) refrigerating plant; (6) laundry equipment. Plans and specifications are in file at the office of the hospital commissioners and in the office of Walter G. Franz, consulting engineer, Union Trust Building, Cincinnati. Proposals may be submitted on any branch of the work, on any number of branches, and for the work in aggregate including all branches. Frederick S. Speigel is president of the board and E. L. Kennedy is clerk.

DE GRAFF, OHIO.—The International Harvester Co. is reported to have submitted a proposal to the Village Council, offering to install an electric-light plant, to cost about $4,000. Kerosene oil engines are suggested.

LOWELLVILLE, OHIO.—The Mahoning & Shenango Ry. & Lt. Co., of Youngstown, has awarded the contract for the construction of a brick, steel and concrete power house in Lowellville to A. & S. Wilson. The company, it is said, expects to purchase new machinery and general equipment.

MASON, OHIO.—The Village Council has engaged Seidl & Hausman, Sweetland Building, Cleveland, to prepare plans for the installation of a municipal electric-lighting system in Mason.

SALEM, OHIO.—The Buckeye Engine Co., of Salem, has submitted a proposal to the City Council offering to furnish electricity to operate the new street cars and the water-works station.

ST. BERNARD, OHIO.—Bids will be received by the city of St. Bernard, addressed to William F. Rolf, director of public service, until March 2, for furnishing prime movers, boiler, generators, switchboard, etc., for the extension of the municipal electric-light plant, in accordance with plans and specifications on file in the office of the director of public service. Post office address, St. Bernard, Cincinnati, Ohio.

VAN WERT, OHIO.—The City Council is arranging for the installation of a new lighting system for the residential section of the city. It is proposed to use smaller lamps and increase the number.

WARREN, OHIO.—Within the next year the Trumbull Pub. Ser. Co., of Warren, expects to erect a substation in Niles, to be equipped with three 200-kw transformers and 22,000/2200-volt apparatus; also to purchase within the next 30 days one feed-water pump for 1200-hp boiler capacity and to purchase in the near future a series street-lighting panel, 6.6-amp. recording meter and constant-current transformer; also within the next few months to purchase a 2000-kw or 3000-kw steam turbine, condenser, etc., and electrolytic lightning arresters. The company is now in the market for electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. M. L. Derge is general superintendent.

YELLOW SPRINGS, OHIO.—The Council is considering the question of issuing $1,000 in bonds for extensions to the municipal electric-light plant.

BOWLING GREEN, KY.—Plans, it is reported, are being prepared by Howard & Merriam, Capital Trust Building, Columbus, Ohio, for the erection of a power house for the Bowling Green State Normal College, to cost about $50,000.

CADIZ, KY.—Alexander Brothers & Co., of Cadiz, who operate an electric-light plant in connection with their ice factory, are planning to extend the lighting service to the business houses in the village.

CAVE CITY, KY.—A company, it is reported, is being organized to install an electric-light plant and ice factory. S. B. Davis is interested in the project.

COLUMBIA, KY.—Arrangements are being made by Green H. Smith for the erection of a flour mill, which will be equipped with electrically operated machinery. Energy will be secured from water-power on Russell's Creek.

HAZARD, KY.—The Hazard Lt. & Pwr. Co. will install two generators, one 100-kw alternating-current and one direct-current, directly connected to engines with necessary switchboard equipment and paralleling arrangements and one tower. Contracts will be awarded on March 15 and construction work will begin May 15. W. E. Hemphill, of Hazard, has charge of the work.

LOUISVILLE, KY.—The Merchants' Ice & Cold Storage Co., of Louisville, it is reported, will install two electric freight elevators. N. A. Hardin is manager.

LOUISVILLE, KY.—Plans are being considered by George Dunham, Paul Jones Building, Louisville, for the erection of a woolen mill in Louisville or vicinity, and he will install electrically operated machinery. Mr. Jones will probably install an electric generating plant.

MOREHEAD, KY.—The municipal electric-light plant in Morehead was destroyed by fire recently, causing a loss of about $10,000. The city officials, it is reported, are planning to rebuild the plant at once.

SHELBYVILLE, KY.—The Kentucky Utilities Co., of Shelbyville, is planning to construct an additional dam on Clear Creek for the purpose of increasing its water supply.

FORT WAYNE, IND.—The Fort Wayne & Northern Indiana Trac. Co., of Fort Wayne, has been authorized by the Public Service Commission to issue $600,000 in notes and $320,000 in bonds, the proceeds to be used for improvements and extensions to its system.

FORT WAYNE, IND.—Plans are being considered by the Municipal Electric Light Department for extensions to the municipal electric plant and distribution system. It is proposed to install an additional turbo-generator, build an addition to power house, etc., and erect 40 miles of distribution lines. F. J. Dix is superintendent.

CHICAGO, ILL.—Bids will be received by the city of Chicago at Room 406, City Hall, until March 7 for furnishing and installing one switchboard and accessories at the municipal reduction plant of the city of Chicago at Thirty-ninth and Iron Streets. Proposals must be made out on blanks furnished by the above office. George B. Young is commissioner of health.

JOLIET, ILL.—The Joliet Mfg. Co., it is reported, has decided to install an electric plant to supply electricity for lamps and motors for its factory in Cass Street.

URBANA, ILL.—Bids will be received by the University of Illinois, Urbana, until March 7 for construction of addition to power house and addition to library building at the University of Illinois. Plans and specifications may be obtained upon deposit of $10 from James M. White, supervising architect, University of Illinois, Urbana.

URBANA, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 30 for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Urbana, Ill. Drawings and specifications may be obtained from the above office or from the custodian of site at Urbana. O. Wenderoth is supervising architect.

GREEN BAY, WIS.—The Wisconsin Railroad Commission has granted the Wisconsin Pub. Ser. Co., of Green Bay, permission to purchase the property of the Minahan El. Co., of Green Bay; also authority to issue $110,000 in bonds to take up a like amount of bonds of the latter company.

LOWELL, WIS.—Preparations are being made by the Lowell El. Lt. & Pwr. Co. for the construction of an electric power plant to furnish electricity for lighting and industrial water-power at source. The equipment will include one 100-hp Samson waterwheel, two 37½-kw, three-phase, 60-cycle, 2300-volt, 1200-r.p.m. generators, two switchboards (48 in. by 24 in. by 1¼ in.), voltmeter (175-volt scale), ammeter (15-amp scale), six 75-kw (potential) 2200/110-volt, four 50-kw (current), four 4-kw, 2300/110 220-volt transformers, overhead-line materials for 5 miles of line (carrying distance 3 miles), 350 meters (approximately), 40 arc lamps (clusters), and 1200 incandescent lamps of 32 cp. The company will carry electrical supplies, including heating devices, etc. Contracts have not yet been awarded. The cost of the plant is estimated at about $10,000. Webster F Pease is manager.

NEENAH, WIS.—The city of Neenah is contemplating purchasing the distribution system of the Wisconsin Trac., Lt., Ht. & Pwr. Co., which furnishes electricity here, and to secure energy from the company to operate the system. The contract with the company expires this year.

ROSENDALE, WIS. — The Wisconsin Railroad Commission has authorized the Wisconsin Lt., Pwr. & Milling Co. to issue $10,000 in capital stock, the proceeds to be used for the purpose of building and equipping a hydroelectric plant and erecting transmission system in the vicinity of Rosendale, Fond du Lac County.

GEORGETOWN, MINN.—We are informed that the Farmers' Elevator Co., of Georgetown, has not yet taken any steps toward the installation of an electric-light plant and probably will not install a plant Reported in the issue of Jan. 21 to be contemplating the installation of a plant Theodore Spelsin is secretary and treasurer.

HECTOR, MINN.—The Renville County El. Co., of Bird Island, has been granted a franchise to furnish electricity for lamps and motors in Hector. A transmission line will be erected from the company's plant in Bird Island to Hector.

LISMORE, MINN.—Bids will be received by the village of Lismore until March 18 for the construction of a municipal electric-light plant. Plans and specifications may be seen at the office of Earle D. Jackson, Capital Bank Building, St. Paul, Minn. Ned Smith is recorder.

MINNEAPOLIS, MINN.—The Power Distribution Co., which is now operating several plants on the Great Northern R. R., between Dassel and Delano, and also at Eden Valley, is erecting transmission lines to various other points in that territory and will eventually take its energy from the lines of the Union Pwr. Co., running from St. Cloud. The company is not making any arrangement to build a power plant in St. Cloud as stated in the issue of Feb 7. W. Baer Ewing is vice-president.

NEW PRAGUE, MINN.—Bids will be received by the City Council of New Prague until March 10 for a 66-in. high-pressure horizontal tubular boiler in accordance with specifications on file in the office of John F. Bruzek, city clerk, from whom copies may be obtained.

WILLMAR, MINN.—Plans, it is reported, have been prepared for the installation of additional equipment in the municipal electric-light and water-works plant, which includes one 125-hp engine, one 150-hp engine and accessories, one 100-kva generator, one 150-kva generator, two exciters, one of at least 9 kw and the other of 12 kw, one six-panel switchboard with all necessary apparatus. It is understood that bids will soon be called for the above equipment.

BUFFALO, IA.—The Town Council has decided to call an election to submit the question of installing a municipal electric-light plant to the voters. A committee, consisting of S. H. Moorehead, LeRoy Eggers and George Rausch, has been appointed to make investigations and secure the probable cost of a plant.

SABULA, IA.—Plans are being considered by J. A. Bradley, of Sabula, for the erection of transmission lines into the country near Sabula to furnish electricity in the rural districts. Electricity for operating the system will be purchased from the local plant.

WATERLOO, IA.—Bids will be received by the Board of Supervisors of Black Hawk County, Waterloo, Ia., until March 20 for construction of building for poor and insane in accordance with plans and specifications prepared by J. G. Ralston, architect, Waterloo, which may be seen at the office of the county auditor, Waterloo, and of the architect after March 6. Separate bids will be received as follows: (a) general construction of building, including power plant; (b) heating and plumbing. Copies of plans and specifications may be obtained from the architect upon deposit of $15, which will be refunded upon return of same. J. J. Rainbow is auditor.

BISMARCK, MO.—The installation of an electric-light plant in Bismarck is reported to be under consideration.

KANSAS CITY, MO.—Bids will be received by the board of directors of the school district of Kansas City, at the office of the secretary of board in the Public Library Building, until March 19 for furnishing and installing the following: Plumbing, drainage and gas fitting; heating and ventilating apparatus; galvanized and sheet-iron work; pipe covering, fuel oil-burning equipment; air washer; automatic temperature regulation; electric generating sets and switchboard; electric wiring, lighting fixtures, vacuum-cleaning system, program clock system and equipment for manual training shops in the new Central High School now being erected on Linwood Boulevard and Indiana Avenue. Kansas City. Plans and specifications may be seen at the office of J. H. Brady, chief engineer, 517 Finance Building, Kansas City. James B. Jackson, Jr., is secretary of board of directors.

RICHLAND, MO.—The Richland Lt. & Pwr. Co. will install an electric-light plant in Richland for which contract has been awarded to the Missouri Electrical Co., 1120 Chestnut Street, St. Louis, Mo. The equipment will consist of one Remington oil engine, Fort Wayne generator, switchboard equipment, one 5-kva, and seven 1-kva Fort Wayne transformers, voltmeter with 0-125-volt scale and three ammeters with 0.50-amp scales, 2½ miles of overhead distribution line and 100 Fort Wayne meters (type K5). G. J. Harris, of Lebanon, Mo., is engineer in charge.

MINOT, N. D.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 17 for the construction complete (including mechanical equipment, except elevator and approaches) of the United States post office and court house at Minot, N. D. Drawings and specifications may be obtained at the above office or at the office of the custodian of site at Minot. O. Wenderoth is supervising architect.

PORTLAND, N. D.—A special election will soon be held to vote on the proposal to issue bonds for the installation of a municipal electric-light plant.

DALLAS, S. D.—Within the next two months the Martin El. Lt. & Pwr. Co., of Dallas, expects to purchase a turbine and generator and electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc. B. H. Martin is president and manager.

FLANDREAU, S. D.—The Flandreau Lt. & Pwr. Co. expects to erect a 9-mile 13,200-volt transmission line and to install 100 kw in 13,200-volt transformers within the next four months. A. H. Savage, of St. Paul, Minn., is treasurer.

DORCHESTER, NEB.—Bids will be received until March 6 for improvements to the electric-lighting system in Dorchester. The Martz Engineering Co., of Lincoln, has charge of the engineering work. M. M. Wall is city ilerk.

SIDNEY, NEB.—We are informed that bonds have not yet been sold for the proposed electric-light plant and an engineer has not been engaged as yet. Will probably begin work on the plant in the spring.

BARNARD, KAN.—Plans, it is reported, are being prepared by Henrici, Kent & Lowry, Reserve Bank Building, Kansas City, Mo., for a municipal electric-light plant and water works system in Barnard.

ESBON, KAN.—The city of Esbon will award contracts on March 18 for construction of an electric-light plant and waterworks system. Plans and specifications may be obtained from Henrici, Kent & Lowry, 715 Reserve Bank Building, Kansas City, Mo., upon deposit of $3. Boyd Chandler is city clerk.

HOLYROOD, KAN.—Plans are being prepared, it is reported, by E. E. Harper, consulting engineer, Grand Avenue Temple, Kansas City, Mo., for a municipal electric-light plant in Holyrood, to cost about $10,000.

LEAVENWORTH, KAN.—The Mayor and city commissioners are considering the question of establishing a municipal electric-light plant. J. H. Kirmeyer is city clerk.

LE ROY, KAN.—Bids will be received by the city of Le Roy until March 4 for furnishing material and construction of the municipal electric-light plant as follows: (1) For one 60-hp crude-oil engine erected complete, with piping, belt, etc., on foundation furnished by the city; (2) one 50-kva, three-phase generator with exciter attached, switchboard and street-lighting apparatus, delivered f.o.b. cars; (3) pole-line equipment, consisting of poles, wire, street-lighting equipment, f.o.b.; (4) power-house building, brick, 30 ft. by 45 ft., complete, including machinery foundations; (5) erection of generator, switchboard, etc., and construction of pole line, equipment and material furnished by the city. Specifications are on file at the office of the Mayor and city clerk, Le Roy, also at the office of E. T. Archer & Co., New England Building, Kansas City, Mo., where copies may be secured at $1 per section, or $3 for complete set, including drawings. S. A. Green is Mayor.

VERMILLION, KAN.—The installation of an electric-light system in Vermillion is under consideration. It is expected that an election will be called in the spring to submit the question to the voters. If the proposition carries electricity will be secured from the electric plant in Frankfort. In the issue of Feb. 14 it was stated that the city of Vermillion was contemplating the installation of a municipal plant. A. M. Cooke is city clerk.

Southern States

HAZLEWOOD, N. C.—Preparations are being made for the installation of a municipal electric-light plant and waterworks system, for which bonds to the amount of $15,000 have been issued. W. H. Cole is chairman of finance committee.

BENNETTSVILLE, S. C.—Within the next 12 months the board of electric light commissioners expects to purchase a 200-kw engine-driven generating unit for the municipal electric light and water plant; also to purchase in the near future a motor-driven turbine pump. E. C. Morrison is manager.

CHARLESTON, S. C.—The Charleston-Isle of Palms Trac. Co., of Charleston, has completed the erection of a substation in which switchboard and wiring is now being installed (primary voltage 6600, railway 550). Rotaries will be installed within the next two months. The company has just completed the work of laying cable across Cooper River, 1¼ miles wide (three-phase, 6600 volts, having a capacity of 4000 hp), connecting the new city power station of the Charleston Consol. Ry. & Ltg. Co. with the substation of the Isle of Palms Trac. Co. Equipment for substation has been purchased from the General El. Co., consisting of two 300-kw rotaries, nine-panel switchboard, etc. This cable will furnish electricity for lamps and motors in Mount Pleasant, Sullivan's Island, Government Reservation on Sullivan's Island, Atlanticville and the Isle of Palms. The power house of the Isle of Palms Trac. Co. has been closed down and will be used as an auxiliary. W. W. Fuller is chief engineer and general superintendent of the company.

GREER, S. C.—The city of Greer, it is reported, will ask for bids for the construction of an electric-light plant, waterworks and sewer system, for which, it is said, $67,000 in bonds have been issued.

LAKE CITY, S. C.—The contract for the construction of the municipal electric-light plant is reported to have been awarded to J. Newton Johnston, of Florence. The cost of the plant is estimated at $12,000, and it is to be completed within three months.

CARTERSVILLE, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 31, for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Cartersville. Drawings and specifications may be obtained at the above office or from the custodian of site at Cartersville. O. Wenderoth is supervising architect.

HARTWELL, GA. The Franklin Lt. & Pwr. Co., it is reported, contemplates the construction of two steam electric generating plants in Hartwell, to develop 5000 hp, with hydroelectric developments to follow. The company will erect a 40-mile transmission line, to cost $50,000, connecting Hartwell, Lavonia, Conan, Bowersville and Royston, Ga. The total cost of the plants is estimated at $100,000.

BUNNELL, FLA.—Lambert & Moody, owners of the local electric-light plant, it is reported, contemplate enlarging their plant.

JACKSONVILLE, FLA.—The special committee of the board of bond trustees has accepted the plans submitted by Sargent Hamilton, architect, for the erection of a new pump house and electrical substation. The cost of the work is estimated at $35,000.

MICANOPY, FLA.—At an election held recently the citizens voted to issue bonds to the amount of $10,000 for the installation of a municipal electric-light plant.

CHATTANOOGA, TENN.—The Chattanooga Plow Co. is reported to have decided to substitute electricity for steam power and will install 300 hp in motors. Electricity for operating the plant will be obtained from the Chattanooga Ry. & Lt. Co.

DAYTON, TENN.—The Dayton Lt. & Pwr. Co., recently incorporated with a capital stock of $100,000 by J. L. Frost and others, will distribute electricity generated at the plant of the Tennessee River Pwr. Co. on the Ocoee River. The company will erect its own transmission line from Dayton, Tenn., to connect with the main line of the Tennessee Pwr. Co.

DRESDEN, TENN.—The corporation of Dresden has engaged Phillip A. Porter, of Clinton, Ky., engineer, to take charge of the construction of the proposed municipal electric-light and water plant, for which bonds to the amount of $27,000 were recently voted. Work will begin on the proposed plant as soon as the weather will permit. W. W. Fuller is recorder.

JACKSON, TENN.—We are informed that the $25,000 bond issue, recently authorized, will be issued to pay for the present plant. No new work is contemplated. Reported in the issue of Jan. 31 to have issued bonds for improvements and extensions to the municipal plant. H. M. Harris is secretary.

OVOCA, TENN.—An electric-lighting system will be installed at the Widows & Orphans' Home of the Knights of Pythias at Ovoca, to furnish electricity to light the buildings and grounds. The plant will have an output of 11 kw and will be driven by a waterwheel, using water from Lake Ovoca transmitted through a 6-in. pipe. The cost is estimated at $2,000. All supplies have been purchased. G. M. Whitson, of Tullahoma, is engineer in charge.

ARKADELPHIA, ARK.—The Arkansas Pwr. Co., which recently took over the property of the Arkadelphia El. Lt. Co., is reported to be contemplating improvements to the electric-light plant and water-works system, to cost about $15,000. H. C. Couch, State National Bank Building, Little Rock, is president.

LITTLE ROCK, ARK.—The Arkansas Railroad Commission has granted extensive water-power rights on White River and its tributaries to Charles A. Burton, of Chicago, Ill., who, it is said, represents a syndicate which is prepared to erect a large hydroelectric power plant, to cost from $2,500,000 to $3,000,000, and to transmit electricity to Little Rock and eastern Arkansas.

NEW ORLEANS, LA.—Initial plans for the installation of an ornamental lighting system on North Rampart Street have been perfected by E. E. Lafaye, commissioner of public property. This is the nucleus of a lighting system which will extend along Rampart Street to Esplanade Avenue and on Esplanade Avenue to the City Park.

AMARILLO, TEX.—The City Lt. & Wtr Co., of Amarillo, has just completed a new fireproof power house and has purchased a 750-kw Allis-Chalmers condensing turbine with Le Blanc condensers and two 350-hp Heine type boilers. Guy W. Faller is general superintendent.

ARANSAS CITY, TEX.—The city of Aransas Pass, it is reported, has engaged M. Griffin O'Neil & Sons, of Dallas, to prepare plans and specifications and supervise the construction of the proposed municipal electric-light plant and waterworks system. Present plans provide for the development of 125 hp. Oil engines will be used.

BARTLETT, TEX.—Within the next three months W. V. Irvine, owner of the local electric-light plant, expects to purchase two boilers, two engines and two dynamos.

BAY CITY, TEX.—The Texas Pub. Ser. Co., Bay City division, expects to erect within the next 30 days a fireproof boiler room and make general repairs to its light and ice plants; also to purchase three 125-hp boilers. Robert M. McCandlish Engineering Co., Midland Building, Kansas City, Mo., has charge of construction. W. C. Duncan is manager.

BRYAN, TEX.—The Bryan Pwr. Co. expects to erect within the next four months 5 miles of three-phase, 2300-volt transmission line to the Agriculture and Mechanical College; also to purchase one 300-kva, alternating-current, 60-cycle, 2300-volt generator for direct connection to a 500-hp Diesel oil engine. Jordan T. Taylor is vice-president and manager.

CISCO, TEX.—The Western Lt. & Pwr. Co., of Cisco, expects to erect within the next six months 72 miles of transmission lines and to purchase material for same. The company carries electrical appliances and supplies, which are bought as needed. Henry Benham is manager.

CORSICANA, TEX.—Since Jan. 1 the Corsicana Gas & El. Co. has been furnishing electricity in Kerens and Powell for lamps and motors over a 14-mile transmission line (11,000 volts, three-phase, 60 cycles). Other extensions and improvements are being made by the company to its service in Corsicana, it having recently equipped the plant of the Corsicana Brick Co. for electrical operation. It also has recently closed a contract with the Oil City Iron Works to equip its plant with motor-driven machinery, replacing gas engines. J. W. Carpenter is president and manager

DALLAS, TEX.—Bids will be received by the County Commissioners of Dallas

County, addressed to C. E. Gross, county auditor, Dallas, until March 11, for the complete installation of high and low pressure power-plant piping, engines, boilers, generators, motor-generator set, switchboard, cabling of generators, switchboard wiring, etc., to be installed in the Dallas County Criminal Courts and Jail Building. Bids are to be submitted for the entire work. Separate bids may be submitted on each of the different types of apparatus. Plans and specifications can be obtained at the office of H. A. Overbeck, architect, 501 Juanita Building, Dallas, upon deposit of $25, to be refunded upon return of same.

EDNA, TEX.—The Edna Ice & Lt. Co. expects to change its system from direct current to alternating current in the near future, and will purchase a 75-kw generator and a 90-hp crude-oil engine. When this change is made the company will establish a day service. Rudolph Limiartz is manager.

FENTRESS, TEX.—The Fentress Gin Co. expects to erect within the next 30 days 2500 ft. of No. 2 wire line for lighting purposes. J. C. Dauchy is owner.

GIDDINGS, TEX.—Within the next six months owners of the Giddings electric-light works expect to erect 2½ miles of aerial transmission lines and to purchase 5-kva transformers, one car load of 30-ft. poles, 7 miles of No. 6 and No. 8 B. & S. wire; also 75 meters to complete meter system, one transformer and complete outfit for a series street-lighting system of 100 lamps and a general line of household labor-saving devices and fans within the next three months; also to purchase within the next six months one 175-hp boiler. The Giddings Cotton Oil Co. has purchased the interest of H. M. Walters in the plant. L. B. Adams is foreman of the electric plant.

GONZALES, TEX.—The Citizens' El. Lt. & Pwr. Co., of Gonzales, is building an auxiliary steam power plant.

MARSHALL, TEX.—The Marshall El. Co. is now installing two 400-hp Heine boilers, one 500-kw turbo-generator, one 200-kw rotary converter for railway service, exciter unit and switchboards. Charles A. Heyck is superintendent.

MIDLOTHIAN, TEX.—Within the next six months Charles J. Miller, manager of the local electric-light plant, expects to purchase one 60-hp steam engine; also to expend within the next 12 months $400 for incandescent lamps, $300 for heating and cooking apparatus and $1,000 for wiring supplies.

MISSION, TEX.—The Chamber of Commerce is reported to be interested in a proposal to construct an electric-light plant and ice factory in Mission.

Pacific States

TACOMA, WASH.—The City Council has passed an ordinance requiring all electric-light, power, telephone and telegraph wires on A Street, Pacific Avenue and C Street, in the business section of the city, to be placed in underground conduits before the installation of the new ornamental street-lighting system.

EUGENE, ORE.—The City Council has authorized the installation of new street lamps on Lawrence Street, Tenth Avenue West, Hillyard Street, Fifteenth Avenue East, Sixteenth Avenue East, Fairmont Boulevard and Eleventh Street, plans for which are being prepared by the city engineer.

HOOD RIVER, ORE.—The citizens of the valley at a mass meeting held at the Commercial Club recently voted to organize about 10 square miles of the valley into a municipality under a commission form of government to develop public utilities. The first project to be undertaken will be the establishment of a municipal lighting plant. Farmers in this section and prominent business men of this city have agreed to finance the project if the proposition of forming a municipality fails to carry at a special election. A. I. Mason, of Hood River, is at the head of the movement.

MILTON, ORE.—At the election to be held in March the proposal to issue $1,800 in bonds for extensions and improvements to the municipal electric-light plant will be submitted to the voters.

CALEXICO, CAL.—We are informed that the city of Calexico does not contemplate the installation of a municipal electric-light plant, as reported in the issue of Feb. 14. R. L. Glasby is city clerk.

HUNTINGTON BEACH, CAL.—The Pacific Oil Cloth & Linoleum Co., which is establishing a factory in Huntington Beach, has decided to equip the plant with electrically operated machinery. Gustav Frenkel is manager.

LOS ANGELES, CAL.—The State Railroad Commission has granted the Southern California Edison Co., of Los Angeles, permission to issue $1,500,000 in bonds, the proceeds to be used for general improvements to its system and for promoting several individual projects. R. H. Ballard, of Los Angeles, is secretary and assistant general manager.

RIVERSIDE, CAL.—The residents of Seventh Street are arranging for the installation of ornamental electroliers along that thoroughfare in the near future. The cost of the system is estimated at more than $4,000.

SAN FERNANDO, CAL.—Application has been made to the State Railroad Commission by the San Fernando Mission Land Co. and John T. Wilson for authority to sell their distributing systems in the San Fernando Valley to the Pacific Lt. & Pwr. Corpn., of Los Angeles. The San Fernando Mission Land Co. has agreed to sell its property for $7,835, and Mr. Wilson places a valuation of $16,000 on his holdings. It is understood that extensions will be made to these systems when they have been taken over by the Pacific Corpn.

SOUTH PASADENA, CAL.—The public utility corporations in this city have been instructed by the city trustees to place their lines either in underground conduits or along the alleys. All the wooden poles are to be taken from the streets.

FOUNTAIN GREEN, UTAH.—The Bix Springs El. Co., of Fountain Green, will receive bids for equipment for its new power plant until March 10. The new power house will be completed about June 1 and will have an output of about 200 kw. A three-phase system will be installed. Ernest Anderson is superintendent.

SALT LAKE CITY, UTAH.—Bids will be received by the University of Utah, Salt Lake City, Utah, until March 7, for furnishing and installing electric-lighting fixtures in the central building, University of Utah, at Salt Lake City, according to plans and specifications prepared by Cannon, Fetzer & Hansen, 506 Templeton Building, Salt Lake City, where plans and specifications may be seen.

SUPERIOR, ARIZ.—The Board of County Commissioners of Pinal County has granted a franchise for the installation of an electric-light plant and water-works system in Superior.

THATCHER, ARIZ.—The Town Council has called an election to be held March 14 to vote on the proposal to grant the Gila Valley El., Gas & Wtr. Co., of Globe, a franchise in Thatcher.

GLENDIVE, MONT.—The City Council has passed an ordinance providing for the installation of an ornamental lighting system on Merrill Avenue, to cost about $5,000. For further information address Einar Rivenes.

HAYDEN, COL.—The Hayden Concrete Gas & El. Co. expects to purchase next summer one primary switch, 2300-volt, and small board for same, material for street-lighting system and from 14 to 25 100-watt tungsten lamps. The company's contract for incandescent lamps expires in April. M. F. Hofstetter is secretary.

GOLCONDA, NEV.—J. B. Fayant has applied to the Board of County Commissioners of Humboldt County for a franchise to erect and operate electric transmission lines in the town of Golconda.

ROCHESTER, NEV.—Application has been made to the State engineer by H. J. MacSherry, of Rochester, for permission to appropriate water rights from Coyote Creek for power purposes.

Canada

CALGARY, ALTA.—The Eau Claire & Bow River Lumber Co. is installing two 50-in. Samson turbines in its water-power plant; it also contemplates the installation of gas engines to develop 1500 hp. This company is closely associated with the Calgary Wtr. Pwr. Co. P. A. Prince is manager.

MEDICINE HAT, ALTA.—Plans are being prepared for an electric (high-tension) distributing system, to cost about $10,000; for a street-lighting system to cost $20,000; also an addition to the municipal electric generating station.

PORTAGE LA PRAIRIE, MAN.—The city of Portage la Prairie has applied to the Provincial Legislature for an extension of its charter rights allowing it to erect a transmission line outside of the city and to supply electricity for power purposes.

BURFORD, ONT.—A by-law authorizing the Council to contract with the Hydro-Electric Power Commission of Ontario for electricity for the municipality will be submitted to the ratepayers on March 9.

COBDEN, ONT.—A committee has been appointed by the Village Council to investigate and report at the next meeting of Council upon the probability of obtaining a suitable water-power site for the purpose of generating sufficient electricity to light the streets and residences and for general use in the village.

EMBRO, ONT.—The question of securing electricity generated at Niagara Falls from the Hydroelectric Power Commission is under consideration by the Council.

FORT WILLIAM, ONT.—The Kaministiquia Pwr. Co., Ltd., will increase the output of its power plant by 14,000 hp. Contracts for material have been placed. W. L. Bird is secretary and manager.

GALT, ONT.—The Town Council is contemplating the installation of an electric fire-alarm system in Galt.

NIAGARA FALLS, ONT.—The town engineer recommends the installation of a lighting system on the River Road, for a distance of 2 miles, using ornamental standards, with arc or incandescent lamps.

STRATFORD, ONT.—A by-law has recently been passed authorizing an expenditure of $20,000 for extensions and improvements to the municipal electric-light system.

SUDBURY, ONT.—The Town Council is considering the installation of an ornamental street-lighting system on Main Street; also an addition to the municipal electric-light plant.

TORONTO, ONT.—The possibility of utilizing the water-power on the Quinze River, near the head of Lake Temiskaming in northern Ontario, for generating electricity is under consideration. M. J. O'Brien, who owns water rights for a distance of 2 or 3 miles, including falls and rapids, has engaged Messrs. Sutcliffe & Neelands, civil engineers, of Toronto, to make investigations with a view of developing same.

BUCKINGHAM, QUE.—The Town Council is contemplating the installation of an electric-lighting system.

BURY, QUE.—The Westbury Ht., Lt. & Pwr. Co. is negotiating with the Town Council for a 20-year franchise to furnish electricity to this municipality.

HUMBOLDT, SASK.—The town of Humboldt has awarded the contract for equipment for the municipal electric-light plant to the Canadian General Electric Co., of Toronto, including two 100-hp Leonard & Sons boilers, a 200-hp tandem compound engine, one 125-kw, 60-cycle, 2200-volt generator, general switchboard apparatus, transformers (50-kw), 300 cedar poles, 10 miles of overhead line, 100 Packard meters and 700 incandescent lamps. F. K. Martin is electrical superintendent.

New Incorporations

CANAAN, N. H.—The Canaan El. Lt. Co. has been chartered with a capital stock of $12,000. The incorporators are Harris J. Ross, B. M. Barnard, Joseph Tighe and Ernest Noyes, of Canaan; C. F. Gardner, of Raymond.

BENNINGTON, OKLA.—The Bennington Ice, Lt. & Pwr. Co. has been incorporated with a capital stock of $5,000 by H. C. Clark, W. S. Murphy and J. S. Dawson.

HUNTINGTON, OKLA.—The Huntington El., Lt. & Pwr. Co. has been incorporated with a capital stock of $8,000. The officers are: John Degen, president; J. A. Finney, vice-president; H. E. Cunningham, secretary; H. Mayer, treasurer; O. B. Young, general manager. Huntington has not a post office.

ANDERSON, S. C.—The Walhalla Lt. & Pwr. Co. has been granted a charter with a capital stock of $10,000. The incorporators are William A Strother and Jesse W. Bell.

TORONTO, ONT.—The Interurban Co., Ltd., has been incorporated with a capital stock of $5,000,000 with the names of the incorporators nominally given as clerks in a Toronto legal office usually associated with the MacKenzie & Mann enterprises. The company is empowered to deal in all kinds of bonds and debentures, to develop water-power, establish and develop lighting or power plants and generally to carry on any kind of manufacturing or industrial enterprise.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 17, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,087,113. Machine for Receiving Electric Waves; R. Goldschmidt, Berlin, Germany. App. filed Dec. 10, 1912. Renders intercepted energy of electric waves perceptible in telephones by commutator rotated asynchronously to frequency of intercepted waves.

1,087,120. Indicating Means for Inclosed Fuses; D. C. Hooker, Farmington, Conn. App. filed Feb. 7, 1913. Paper of dielectric strength insufficient to resist potential after the fuse is disrupted sets off fulminate.

1,087,126. Arrangement for Producing Slightly Damped Electrical Oscillations, B. Macku, Brunn, Austria-Hungary; L. Mandelstam and N. Papalexl, Strassburg, Germany. App. filed April 26, 1911. When discharge at spark-gap takes place spark is immediately quenched and circuit oscillates further without a spark-gap and is accordingly but slightly damped.

1,087,127. Telephonic Receiver; A. Marr, Manchester, Eng. App. filed Jan. 8, 1913. Diaphragm loosely held at the edge so as to vibrate with greater freedom.

1,087,128. Telephonic Receiver; A. Marr, Manchester, Eng. App. filed Jan. 8, 1913. "Western Electric" type in which no screws enter the ends of the magnet limbs.

1,087,131. Electric Contact Device; T. H. McQuown, Cambridge, Mass. App. filed Jan. 5, 1909. For ignition circuits; time of contact is constant irrespective of engine speed.

1,087,143. Primary Battery; A. L. Saltzman, East Orange, N. J. App. filed Oct. 4, 1911. Special construction of bolt and supporting frame or hanger for the suspended electrode.

1,087,166. Dynamo-Electric Machine; A. M. Gray, Milwaukee, Wis. App. filed Sept. 30, 1909. Ventilating ducts and fan blades on rotor.

1,087,170. Controller; A. J. Loguin, Norwood, Ohio. App. filed March 23, 1912. Potential starter with means for positively stopping the controller handle in certain positions before it can be moved further.

1,087,180. Apparatus for Amplifying or Detecting Electrical Variations; G. W. Pierce, Cambridge, Mass. App. filed Nov. 26, 1913. Gaseous conducting medium upon which the electrical variations are impressed in such manner as to modify the current in a local circuit through the gas.

1,087,189. Measuring Instrument; E. O. Schweitzer, Chicago, Ill. App. filed Feb. 14, 1912. For measuring flow of liquid or gaseous fluid.

1,087,198. Electric Heating Unit; C. S. Steward, Chattanooga, Tenn. App. filed Nov. 12, 1913. Disk carrying resistance wire and having trunnions which connect with source of current when placed in the heater.

1,087,199. Electric Stove; C. S. Steward, Chattanooga, Tenn. App. filed Nov. 12, 1913. Heating chamber beneath the stove utilizes waste heat from the heating units and prevents upward rush of cold air against units.

1,087,200. Electric Oven; C. S. Steward, Chattanooga, Tenn. App. filed Nov. 12, 1913. For cooking with either a dry or a moist heat; heater units at top and bottom of oven, independently controlled.

1,087,218. Carburetor; H. M. Dalton and C. M. Conklin, Cincinnati, Ohio. App. filed Aug. 9, 1912. Has primary and secondary air and fuel valves and avoids use of float

1,087,231. Automatic Controlling Device for Heating Apparatus; E. E. Gold, New York, N. Y. App. filed Jan. 29, 1913. For cars, etc.; thermostat controls and electric heater which actuates thermostatic controlling means to cut off flow of steam to radiator

1,087,236. Storage Battery Electrode and Process of Making Same; H. C. Hubbell, Newark, N. J. App. filed June 6, 1911. Nickel strips alternated with cadmium oxide.

1,087,237. Process of Making Storage-Battery Electrodes; H. C. Hubbell, Newark, N. J. App. filed June 8, 1911. Alternate layers of copper, cobalt and nickel.

1,087,238. Electric Switch; G. L. Hughes, Chicago, Ill. App. filed Nov. 18, 1912. Combined manually and automatically operated switch having plurality of circuit closers.

1,087,251. Electric Switch; J. A. Meaher, Cleveland, Ohio. App. filed Dec. 19, 1911. Actuated by fluid pressure to throw pump motor into and out of operation.

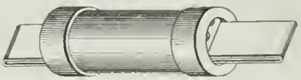
1,087,289. Storage-Battery System; E. A. Halbleib, Rochester, N. Y. App. filed Dec. 16, 1910. For car lighting.

1,087,355. System of Control; L. Dreyfus, Nieder-Schönhausen, Germany. App. filed July 18, 1912. Voltage impressed on armature winding may be varied but remains substantially in phase with voltage induced in the armature by the resultant field.

1,087,357. Cut-Out and Fuse Mechanism; E. B. Ellicott, Chicago, Ill. App. filed Jan. 4, 1909. For high-tension systems.

1,087,377. Arc Lamp; C. C. Hughes, Philadelphia, Pa. App. filed Aug. 31, 1911. One of the carbons is automatically adjusted through the medium of a thermo-expansive wire.

1,087,381. Brush for Dynamo-Electrical Machines; E. C. Ketchum, Boston, Mass., and D. H. Andrews, Newton, Mass. App. filed Oct. 16, 1912. Copper plates separated at base ends by narrow copper shims and all soldered together.



1,087,853—Renewable Cartridge Fuse

1,087,383. Device for Preventing Formation of Burs in Electric Welding; W. A. Kilmer, De Kalb, Ill., and A. T. Weaver, Joliet, Ill. App. filed Aug. 23, 1912. Brushes rotate transversely of wire being welded.

1,087,384. Method of and Apparatus for Preventing Formation of Burs on Electric Welds; W. A. Kilmer, De Kalb, Ill.; A. T. Weaver, Joliet, Ill. App. filed Aug. 23, 1912. Rapidly rotating brushes wipe off the surplus metal during the welding operation.

1,087,417. Fuse Holder, H W. Young, Chicago, Ill. App. filed Oct. 7, 1912. Longitudinally divided hollow casing.

1,087,453. Electric Distributing Device; R. H. Manross, Forestville, Conn. App. filed March 4, 1912. Lighting switch for automobiles.

1,087,461. Current-Controlling Mechanism; L. T. Rhoades, Mont Clare, Pa. App. filed March 19, 1913. Igniter producing a single uniform spark for every explosion, regardless of speed.

1,087,494. System of Electric-Motor Control; H. D. James, Pittsburgh, Pa. App. filed May 9, 1908. For operating top mechanism of blast furnaces, etc., brings motor to rest after it has performed its predetermined cycle of operations.

1,087,500. Circuit-Breaker; H. G. MacDonald, Pittsburgh, Pa. App. filed June 8, 1908. Oil-immersed.

1,087,518. Electric Heater; J. G. Wallmann, Oakland, Cal. App. filed March 18, 1913. Boiler with non-contacting resistance wires.

1,087,537 Circuit-Changer for Electric Railways, B. F. Hutches, Jr., Allendale, N J. App. filed March 14, 1912. Avoids collisions by cutting off current to cars in safety zones adjoining that zone through which a car is traveling

1,087,549. Receiver for Wireless-Transmission Signals; V. Poulsen, Copenhagen, Denmark. App. filed Sept. 16, 1905. Wave detector normally has current from the source passing continuously therethrough.

1,087,556. Electric Motor; H. K. Sandell, Chicago, Ill. App. filed Nov. 7, 1911 Reciprocatory type.

1,087,592. Electric Heater; F. Kuhn, Detroit, Mich. App. filed April 5, 1912. For attachment to a coffee urn or other cooking utensil.

1,087,593. Electrically Heated Foot-Warmer; F. Kuhn, Detroit, Mich. App filed April 9, 1912. Resistor wire surrounded by insulating material inclosed in a frame.

1,087,594. Electric Heater; F. Kuhn, Detroit, Mich. App. filed Oct. 5, 1912 May be engaged with different utensils and the heating element may be detached from both the base and the utensil.

1,087,595. Electric Heater; F. Kuhn, Detroit, Mich. App. filed Oct. 5, 1912 Stand with cup receiving the heater unit on the bottom of the utensil.

1,087,596. Circuit-Opening Switch for Electric Heaters; R. Kuhn, Detroit, Mich. App. filed Oct. 10, 1912. Connector plug performs the additional function of a snap switch; for use with sadirons.

1,087,607. Electric Steam Heater; C. C. Ponting, Medford, Ore. App. filed March 13, 1913. Radiator receives steam from an electric heater incorporated in the base of the radiator.

1,087,612. Dry-Cell Battery; C. W. Simmons, East Cleveland, Ohio. App. filed Feb. 11, 1913. One cell unit is nested within another like unit.

1,087,637. Separator for Storage-Battery Plates; C. C. Carpenter, Niagara Falls, N. Y. App. filed June 22, 1912. Body of wood or the like, impregnated or coated with rubber.

1,087,651. Spark Collector and Distributer; M. Gerardy, Wathena, Kan. App. filed July 27, 1912. Timer and distributer for use on magneto or battery.

1,087,673. Steady Strain Device for Trolley Construction; O. S. Lyford, Jr., New York, N. Y. App. filed Aug. 12, 1909. For holding trolley wires against lateral displacement, especially in catenary trolley constructions.

1,087,704. Head Support for Telephone Receivers; C. Adams-Randall, Boston, Mass. App. filed Feb. 19, 1913. Head band secured on head without pressure on the ears, and the receivers are frictionally held in adjusted position.

1,087,705. Method for Producing Abrasive Compounds; T. B. Allen, Niagara Falls, N. Y. App. filed July 3, 1913. Produces "garnet" from mixture of magnesia, alumina and silica, which is melted, slowly cooled, removed from furnace while still heated, and crushed in the presence of water.

1,087,853. Renewable Cartridge Fuse; N. D. Urquhart, Glenwood Springs, Col. App. filed May 6, 1913. Has end contact blades folded to embrace and grip the ends of the fuse strip.

1,087,880. Electrical Controller; D. J. Hauss, Aurora, Ind. App. filed June 29, 1911. Single-controller lever has one movement for varying the speed of the motor and another movement for starting and stopping the motor.

1,087,887. Electric Water Heater and Steam Generator; A. P. Nichols, Seattle, Wash. App. filed April 5, 1911. Water is caused to flow through the heater in a thin sheet.

1,087,892. Means for Receiving Electrical Oscillations; W. Schloemilch and O. von Bronk, Berlin, Germany. App. filed March 14, 1913. Amplitude of oscillations is increased to extent permitting use of a detector such that oscillations can be perceived more distinctly

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Selling Public Utility Bonds In some recent cases the Board of Public Utility Commissioners of New Jersey has held that a public utility should get competitive bids when it sells bonds. This is, we believe, in accord with present public opinion. It is better for the large, ably managed public utility company to be free to market its securities when and where it chooses at the best prices that it can get. Many still cling to the practice that they have found successful in the past and do not like to sever relations with a single banking house. However, utilities have a credit standing that they did not have in earlier days. When a company was new a banker's name was generally needed to recommend securities and create a market for them with investors. The name of a well-known utility company on a bond means more now than it did then. The association of a single banking name with all of the bond issues of a company has dwindled in importance. If a solvent company has ability in its management to sell securities profitably and has resources ample to protect it reasonably well in panic, it can obtain better average prices by a consistent policy of competitive selling than by confining itself to a single banker who is undisturbed by competitors. On the other hand, if it lacks these qualities it may protect itself by affiliating closely with strong bankers who feel morally bound to provide for its needs. It should be borne in mind that the advantage of competitive buying is less apparent with small companies than with large properties. The reason for this lies in the fact that frequently the small amounts of bonds sold from time to time by the plant having little output can be disposed of at a minimum of expense by a banker who, through a previous transaction, has become familiar with the property.

The Problem of Distribution The description in this issue of the engineering work of the Commonwealth Edison Company of Chicago gives the reader a vivid idea of the immensity of the task of the great central-station organization outside of its generating plant. Delivering the energy at the switchboard is the least of the difficulties of a modern electricity supply company. The greatest of its tasks is to maintain continuous service over the increasing territory and to give approximately uniform voltage to its consumers. When the duties of the engineering staff lie in a metropolitan territory they are serious indeed. In the first place, the company does most of its own construction work and supervises rigorously all the rest. Such construction ranges from substations and cable conduits to high-tension transmission lines and tunnels under the river to accommodate more cables. For the past five years the engineering department has had to handle about 1,500,000 lb. of copper annually in paper-insulated, lead-covered cable. A hundred thousand feet of miscellaneous standard sizes of such cable are often kept in stock. The overhead circuits consist of 20,000-volt, sixty-cycle, 12,000-volt, sixty-cycle, 9000-volt, twenty-five-cycle, and a large amount of 4000-volt, four-wire, three-phase distribution circuits. More than 3000 miles of wire has been erected for the overhead service. At the present rate of extensions, a very considerable force will have to be kept busy merely on the installation and maintenance of such lines. Then there are forty-eight substations to be operated, with 184,000 kw in equipment of miscellaneous apparatus, including twenty-three storage batteries. The complete operation, maintenance and management of these substations with the accompanying necessity of united working is a problem of the gravest character, for the conditions are vastly more severe than if these forty-eight were separate central stations scattered over three or four states. Such magnitudes are involved in the every-day working of the Commonwealth Edison Company. Even the most well-seasoned engineer will find in reading about them a new light on the real meaning of electricity supply on a large scale.

Recording Devices for Central Stations In his A. I. E. E. convention paper Dr. C. P. Steinmetz makes a plea for the use of suitable recording devices in a central station to indicate the sequence of surges or disturbances in the system on such a time scale as will enable the entire series of phenomena to be unraveled at the leisure of subsequent investigation. Even trained observers who are warned in advance as to the nature of the phenomenon that is about to occur are likely to err in their records of an event as smooth and long-lasting as a solar eclipse. What reliance, then, may be placed upon the unrecorded statements of untrained observers, suddenly roused to a pitch of high mental excitement by an unlooked-for violent disturbance, which may last only a few seconds? Nevertheless, when damage is done, it is important to know what particular part of the system first gave way. Hence some trouble and expense may well be borne, by way of insurance, in providing for suitable automatic recording devices such as the multi-recorders advocated by Dr. Steinmetz.

The Late Prof. E. J. Houston

The sudden death of Dr. Edwin James Houston, whose obituary notice appears in this issue, has taken from the ranks of electrical engineers in this country one of the most notable pioneers. Professor Houston was eminent as a scientist, writer and inventor, but he was pre-eminent as a teacher. In the early days of electric arc-lighting, in association with Prof. Elihu Thomson, he did much to improve the dynamo and the electric lamp. Many a man less gifted in engineering ability than he would have preferred to give his entire time to the development of the Thomson-Houston Company in the days of its early success. He elected, however, to retain his post as a teacher in the Philadelphia Central High School; so that, although connected with engineering and engineering business throughout his life, he always regarded his teaching work as of the first importance. Hundreds of Philadelphia men in every walk of life to-day are stronger, clearer-thinking and finer men because in their youth they came under Houston's influence. In his later years the recognition of so many of his boys of earlier days was a constant source of pleasure to him.

Intellectually, he was always a champion and exponent of clear and simple expression in speech or writing. He liked strong, terse Anglo-Saxon sentences. He vigorously disliked rambling and indefinite utterances or writings. His school textbooks on natural philosophy, applied electricity and forestry were very widely used and are models of the English literary style he advocated. In return, that simple directness of expression was one reason for the popularity of his books among young people. Personally, Professor Houston was a hard worker, earnest, persistent, temperate and enduring. A strong advocate and friend, he always recognized courage and self-reliance in others. He was a powerful man who contributed much to the earlier growth of electrical engineering and, in every phase of a long and active career, rounded out a life of widespread usefulness.

Operation of Suspension Insulators

Mr. H. W. Buck's paper on suspension insulators, read before the midwinter convention of the American Institute of Electrical Engineers, brought out some very interesting facts concerning the wind deflection of suspension insulator strings supporting conductors in a transverse gale cf wind. Allowing 15 lb. per sq. in., or 7.5 gm per sq. cm, of projected conductor area as the maximum wind pressure to be taken into account, the author showed that all but the smallest sizes of copper-stranded conductor have sufficient weight for the longitudinal area to keep the angle of deflection within 60 deg. from the vertical. On the other hand, aluminum conductors are relatively so much lighter per unit of longitudinal area that, with the same wind velocity, they are capable of deflecting some 70 deg. or more. This range of deflection becomes a serious matter, not only in regard to the electrical behavior of the insulator but also in regard to mechanical impacts and entanglements. It is pointed out that the use of cast-iron weights, suspended below the aluminum wires at the insulator, have been found to produce satisfactory results in anchoring the lines against wide deflections as well as against accidental longitudinal displacements.

Recommendations are also made in favor of dead-ending the lines at frequent intervals and of not permitting more slack than is necessary to guard against the stresses of heavy gales in cold weather. Some engineers are inclined to allow extra slack as an extra safeguard of strength, but it is pointed out that this may do more harm than good in a gale of wind.

The Cost of Electrical Energy

Mr. H. M. Hobart's A. I. E. E. paper on the cost of generating electrical energy in bulk started as lively a discussion as we have had the pleasure of hearing for a long time. We preface our consideration of it by stating in the plainest possible terms that we do not agree fully with either side. It is quite certain that the costs stated by Mr. Hobart are lower than there is a reasonable chance of obtaining in practice in any concrete instance. In other words, the author's values are irreducible minima requiring a highly improbable combination of favorable circumstances. On the other hand, the resulting discussion raised in general a ground of objection which we consider thoroughly unsound, in that it took exception to the figures given by the author not so much on the ground that they are too low as from the fear that, being too low, they would exercise a baneful influence on central-station interests by setting up for the benefit of state commissions and the like unattainable figures of excellence. This attitude we do not consider a wise one because the time has come when producers of electrical energy —whether they like it or not—must play with their cards on the table. We do not approve of the implication that the cards should be kept up their sleeves. It is time to face issues of this kind with absolute frankness and to show the public, represented by its commissions, as reasonable business men, the actual conditions which have to be met in furnishing public electricity supply. Moreover, we think there are very few big, broad-gage central-station men in this country who would hesitate to lay before a commission the true switchboard costs of their energy provided the conditions could be fully and fairly explained.

Nevertheless, Mr. Hobart's values are open to criticism as conveying too strong an impression of extreme cheapness, not because the assumptions are impossible, but because they are highly improbable. We do not believe that any electric plant capable of operating with the economy required by the conditions can be built in this country now or at any time in the near future for $35 per kw. If a plant capable of high economy in operation could be installed for $50 per kw, we should be very much surprised, particularly if such plant were within reasonable striking distance of any metropolitan market. If it were conveniently situated with respect to such market, the cost would run very much higher still on account of investment in real estate.

Our chief criticism would be that Mr. Hobart's minimum first cost is too low for practical conditions, and that his load-factors, on which the extremely low costs are estimated, run to a range quite too high for ordinary practice. A 50 per cent load-factor is attainable, a 75 per cent load-factor is not without the range of possibility, but a load-factor of 100 per cent may as well be dismissed without discussion, as every central-station man knows to his sorrow. Taking account of these things, it is clear that the actual costs, with any reasonable value of the load-factor and price of coal, are quite certain to run much nearer to half a cent per kilowatt-hour than to the quarter cent or less used by Mr. Hobart. Unless we are much mistaken, there are some large plants now operating at not far from the figure indicated. However, from the standpoint of those who object to the moral effect of Mr. Hobart's statements, it makes little difference whether the real cost be 3 mills, 5 mills or 7 mills per kw-hr. Any and all of these figures are so far below the market price of delivered energy as to leave the bulk producer in about the same situation. It is not the cost of the raw material, so to speak, which counts in central-station supply, but the enormous and rapidly increasing cost of making it available to the consumer. We have faith enough in the public to believe that it can be brought to a comprehension of this fact in the same way that it realizes the difference in equitable price per pound between wool and broadcloth.

Single-Phase for Swiss Railways

Recent numbers of *La Lumière Electrique* contain a most instructive résumé of the studies made on the Swiss railway system for a general scheme of electrification now in process of being carried out. The fundamental situation in Switzerland differs somewhat from that found elsewhere. Since Switzerland is liberally supplied with water-power while entirely without native coal supply, there exists the natural desire to be independent of foreign coal supply for the operation of the national system of railways, over and above any economic advantage to be gained in railway operation through electrification. The very distinguished commission on which was laid the burden of selecting a system was directed to make a most thorough investigation, including not only the utility of electrical traction in general but also the most advantageous system to be employed and the details of cost in concrete projects which might show the actual economic advantages of electric traction in each. The commission took up the investigation in great detail and examined the three familiar systems now in use, the continuous-current system with third-rail or overhead conductor, the three-phase system with high-voltage contact line and the single-phase system with commutator motors, each of the three to be supplied with energy from hydroelectric plants. Consideration was given to continuous-current contactor voltages up to 3000, three-phase up to 8000 and single-phase up to 15,000.

From the installations already in use it was found that locomotives of adequate power could be obtained with any one of the three systems. In investigating the proper maintenance of the schedule requiring economical speed variation, the preservation of the running time with trains of all weights and the surmounting of grades at full speed, if necessary, the commission gave its preference to the single-phase commutator motor. In studying the relation of output to weight of the locomotives surprisingly little difference was found between the three systems, the weights ranging as follows: For continuous current, 110 lb. to 120 lb. per hp; for three-phase, 100 lb. to 130 lb., and for single-phase, 110 lb. to 165 lb. It will be noted that the minimum weights stated are extraordinarily close to one another, a slight advantage on the whole resting with the continuous-current machinery. In the matter of efficiency from busbars to wheels comparisons were more difficult, average values favoring the single-phase system, with continuous current a good second and three-phase very nearly the same.

As to the security of operation of the distributing system, the commission favored the single-phase line, and in its final report gave it the preference as possessing the greatest technical advantages, all things considered. According to the commission's final conclusion, for the conditions of the Swiss network of railways, both from the technical and from the economic point of view, the advantage lay with the single-phase commutator system operated at about fifteen cycles per second and 15,000 volts on the contact wire. The commissioners stated that the official studies made on Prussian, Bavarian, Austrian and Swedish railways led to the same positive conclusion, so that Switzerland would run no risk in following their example. Of course, it does not necessarily follow that the conclusions of the Swiss commission here set forth are to be considered applicable to all railways and all conditions, the margin of advantage in favor of any one of the systems not being conspicuously great. Moreover, in the investigation of every large system special local factors must be taken into consideration in deciding what is best to be done. However, from the character of the Swiss report and the consensus of opinion among engineers of other countries, one may safely say that the single-phase system is rather far from being out of the competition for heavy railway work. A close analytical study of the work of the Swiss commission is certainly worth making on the part of all those interested in heavy electric traction, proper account being taken of the varying factors which might not lead inevitably to the same result under different circumstances.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Storms Play Havoc with Overhead Lines

March was ushered in with severe snowstorms along the Atlantic Coast, which, although not unprecedented in fury, left a trail of death and suffering and a loss of millions. The steam and electric trunk lines had to suspend their regular schedules, the electric surface lines were completely tied up in many cities, telephone and telegraph communications were almost entirely cut off, and in not a few cities the overhead systems of the lighting companies were severely damaged. Owing to the entanglement of telephone and telegraph wires falling over the electric light wires, electric service was shut off as a precautionary measure in many places. Throughout the State of New Jersey, including Trenton, Newark, Jersey City, Hoboken and Camden, darkness prevailed owing to the breaking of wires under the weight of wet snow. Other places in which electric light service was entirely or partially interrupted were Staten Island, all of Poughkeepsie except Main Street, portions of Brooklyn, all of New London, Conn., portions of Scranton, Pa., large sections of Long Island, and sections of Philadelphia. On March 2 all of the cars of the Washington Railway & Electric Company and the lights of the Potomac Electric Power Company were put out of commission by a peculiar phenomenon. The strong wind blew most of the water out of the Eastern Branch of the Potomac River and the Bennings plant of the combined companies was obliged to shut down from lack of water. Wireless communication was utilized in places where the telegraph lines were down for transmitting news and commercial messages. The wireless of the Lackawanna Railroad was also pressed into service, although the railroad right-of-way itself was blocked by heavy snowdrifts in the Pocono Mountains.

Doherty Organization of Ohio Meets at Warren

Operators and managers of the Ohio properties of the Doherty Operating Company held their regular monthly meeting at Warren, Ohio, Feb. 28. After Mr. Edward Quillen, Alliance, had read a paper outlining methods of handling business in all branches, discussion turned to the subject of caring for troubles in the customer's home. The sentiment of all was voiced by Mr. C. H. Felker, of Toledo, who stated that patrons should be taught to look to the public-service corporation for relief from any electrical trouble and that troubles promptly remedied show the people that they can depend on the company. In a paper entitled "Accounting and Its Relation to Other Departments," by Mr. H. N. Beckett, Elyria, it was brought out that the new-business department could render valuable assistance by affixing to the signed contract a note relative to the credit of the customer. After a noonday dinner presided over by Mr. George Daugherty, of Warren, the seventy-five delegates witnessed a demonstration of the nitrogen-filled lamp manufactured by the Ohio Lamp Works of the General Electric Company. A paper on "Utilization of By-products of Steam Generating Stations," by Mr. A. C. Rogers, of Toledo, showed that generating units can be operated economically at back pressures if the exhaust steam is sold for steam heating in winter and for refrigeration in the summer. In discussing the sale of ashes as a by-product it developed that several plants had created a market for ashes and were selling them at 25 cents a load for use in concrete building and sidewalk construction. At a Jovian rejuvenation following the convention about thirty candidates were taken into the order. A Jovian delegation from Youngstown assisted in conferring the degrees.

Decision Preventing Re-sale Prices Upheld

In a decision rendered on March 2 the United States Supreme Court dismissed the appeal of the Waltham Watch Company from a decision of the Circuit Court of Appeals of New York in favor of a New York jeweler who sold watches below retail prices named in a contract. The company brought suit for an accounting and damages and an injunction restraining Charles A. Keene, the jeweler, from violating the agreement fixing re-sale prices.

Institutes of Radio and Electrical Engineers

The Institute of Radio Engineers will participate in the meeting of the American Institute of Electrical Engineers to be held at New York, March 13, under the auspices of the A. I. E. E. committee on telegraphy and telephony. Three papers will be presented, namely, "A Comparison of the Telegraph with the Telephone as a Means of Communication in Steam Railroad Operation," by Mr. M. H. Clapp, superintendent of the Northern Pacific Railway Company; "Traffic Studies in Automatic Switchboard Telephone Systems," by Mr. W. Lee Campbell, general superintendent Automatic Electric Company, Chicago, and "The Goldschmidt System of Radio-Telegraphy," by Mr. E. E Mayer. The last-named paper will be illustrated by lantern slides. At the close of the technical session the meeting will adjourn to the A. I. E. E. headquarters, where a smoker will be held.

Buffalo Electric Show

The Jovian League of Buffalo, N. Y., has incorporated the Buffalo Electric Show Company, which will hold an exhibition in the Elmwood Music Hall, Elmwood Avenue and Virginia Street, Buffalo, N. Y., on March 9-14 inclusive. The electrical industry of Buffalo is back of the show and has raised a guarantee fund of $15,000 to insure its success. The show is designed to demonstrate to householders and manufacturers within a radius of 150 miles of Buffalo the economy, simplicity and convenience of electricity in all its uses. It is estimated that about 25,000 people will visit the exhibition, because there has never been a show held in Buffalo of its kind, and there probably will not be another in years to come. The decorations will be very lavish, and the hall within and without will be brilliantly illuminated.

The central feature of the interior as planned will be an immense electric fountain, from which avenues will radiate past the exhibits. Mr. W. D'A. Ryan, illuminating engineer of the General Electric Company, who is also in charge of the illuminating effects of the Panama-Pacific Exposition, is acting as consulting engineer on lighting, so that artistic and spectacular illumination is assured. Special invitations have been issued to contractors, central-station managers, architects, consulting engineers and engineers of large municipal plants, who will be the guests of the show committee. The electrical fraternity is well represented on the committees. Mr. W. E. Robertson, general manager of the Robertson-Cataract Electric Company and one of the best known jobbers of the country, is chairman of the space and exhibit committee; Mr. E. D. McCarthy is general chairman of the show, and Mr. H. S. Hilliker is secretary. The general offices of the show are in the Electric Building.

Proposed Electrical Code in Wisconsin

Tentative rules governing the installation and maintenance of electrical equipment in Wisconsin have been drawn up for the Industrial Commission of that State by a committee consisting of Messrs. Thomas E. Barnum, Milwaukee, Cutler-Hammer Manufacturing Company; Charles Dietz, Milwaukee, Commonwealth Power Company; W. F. Gute, Milwaukee, Federated Trades Council; Walter Nield, Milwaukee, Illinois Steel Company; P. A. Schroeder, Milwaukee, Henry Newgard Company; S. B. Way, Milwaukee Electric Railway & Light Company, and C. W. Price, assistant to the Industrial Commission. This committee has given several months of careful study to the subject and has consulted all available authorities in order to fix a Wisconsin standard. Hearings will be held in the rooms of the Industrial Commission in the State Capitol at Madison, beginning at 10 a. m. on March 13. After public hearing the manner of carrying the electrical code into effect will be indicated by the Industrial Commission under the authority conferred upon it by law.

Co-operative Movement in Chicago

A Chicago committee to further the work of the Society for Electrical Development has been announced. It is made up of Messrs. W. R. Bonham, Triumph Electric Company; E. H. Cheney, Wagner Electric Manufacturing Company; W. H. Colman, General Electric Company; J. S. Corby, Bryan-Marsh Electric Works; W. T. Dean, General Electric Company; G. B. Foster, Commonwealth Edison Company; Ernest Freeman, Freeman-Sweet Company; Stephen Gardner, Westinghouse Electric & Manufacturing Company; T. P. Gaylord, Westinghouse Electric & Manufacturing Company; John F. Gilchrist, Commonwealth Edison Company; H. L. Grant, Western Electric Company; A. A. Gray, *Electrical Review and Western Electrician;* W. E. Keily, *Electrical World;* W. W. Low, Electric Appliance Company; William McGuineas, United Electric Construction Company; J. C. Monroe, Bryan-Marsh Electric Works; H. E. Niesz, Commonwealth Edison Company; Franklin Overbagh, Overbagh & Ayers Manufacturing Company; E. D. Payne, General Electric Company; W. R. Pinchard, Westinghouse Electric & Manufacturing Company, and D. H. Wyre, Buckeye Electric Division. Mr. A. A. Gray, who has done much earnest and effective work for the society, is the secretary of the committee. Mr. Niesz is the chairman of the central-station division of the committee, Mr. Gaylord of the manufacturers, Mr. Freeman of the contractors, and Mr. Grant of the jobbers. A preliminary meeting of members of the committee was held on Feb. 27.

Meeting of New York Electrical Society

The 326th meeting of the New York Electrical Society was held on Feb. 27 at the recently completed generating station of the United Electric Light & Power Company at 201st Street and Harlem River, New York City. About 300 were in attendance. Mr. Frank W. Smith, vice-president and general manager of the United Electric Light & Power Company, reviewed briefly and illustrated by means of lantern slides some of the interesting incidents in connection with the early history and development of the company. Mr. Smith is one of the pioneers in the electrical field in New York City, and he has had an unbroken connection with the United Electric Light & Power Company and its predecessors for the past thirty-three years. The data given by Mr. Smith were very much the same as those published in the *Electrical World* of Feb. 7 in connection with the description of the company's station, obtained from the same source. Following Mr. Smith's talk, Mr. Leitch, electrical superintendent of the company, gave an illustrated detailed description of the plant (see *Electrical World*, Feb. 7 and 14), after which those present were conducted on an inspection tour of the station.

Electric Vehicle Dinner at Boston

To mark the third anniversary of the inauguration of its electric-vehicle campaign the Edison Electric Illuminating Company of Boston tendered a complimentary dinner on March 3 to the Boston Electric Motor Car Club and other invited guests. More than 150 persons were present. Mr. Day Baker, Boston, introduced as toastmaster Mr. Frank W. Smith, New York, president of the Electric Vehicle Association of America, and brief addresses were made by Messrs. W. J. Keville, Boston; E. S. Mansfield, Boston; J. M. Curley, Mayor of Boston; C. H. Miles, Boston; P. D. Wagoner, Long Island City, N. Y.; H. H. Rice, Indianapolis, Ind.; D. C. Jackson, Boston; W. D. Sohier, Boston, and J. H. McAlman, Boston.

Mr. Mansfield reported that in 1910 at the outset of the campaign there were 119 electric passenger vehicles and 50 electric trucks in Boston. In 1913 the pleasure cars numbered 255 and the trucks 208, making a total of 463, or an increase of 174 per cent. In the Boston suburban territory there were in 1910 238 pleasure cars and 173 trucks, a total of 411. In 1913 these numbers had been increased to 604 pleasure cars and 409 trucks —a total of 1013 electric vehicles, showing a gain of 146 per cent during the three years of the Edison company campaign. Half of the electric vehicles in the State of Massachusetts are supplied with energy from the lines of the Boston Edison company.

Mr. Miles declared that 34,075 electric passenger cars and 17,687 electric trucks are in use in the United States. Recent experiences with the successful operation of electric trucks during heavy snows have demonstrated the superiority of this form of haulage where other types of cars were being towed in. Mr. Wagoner said that the cost of horse mortality aggregates $130,000,000 per year. He estimated that about a million trucks would be required to perform the haulage now done in various ways, and showed that at $1,000 each this possible truck business would represent a value of $1,000,000,000. Mr. Rice insisted that the vehicle salesman believe thoroughly in the product he sells. In discussing the effect of the predicted "cheap" electric car on other established lines of vehicles, Mr. Rice said he would welcome such a car since it promises to introduce the electric vehicle to a widening group of prospective purchasers, but he expressed hope that the promised cheap car would be well built and "a good car."

A feature of the dinner was the state entry of President Smith enthroned on a dais carried on a battery-driven industrial truck, which was afterward employed by Mr. L. D. Gibbs, in charge of advertising for the Boston company, who, garbed as Lucifer, motored among the diners dispensing good cheer and song.

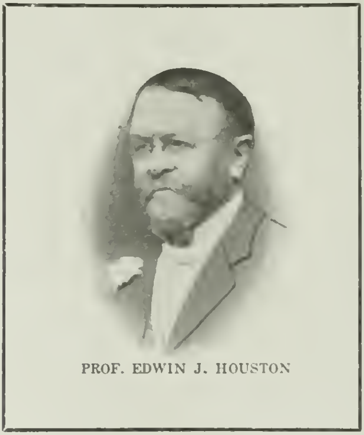
Prof. Edwin J. Houston Dead

Prof. Edwin James Houston, whose intimate association with the development of electric arc lighting has made his name familiar to every one even casually interested in electrical affairs, died at his home in Philadelphia of heart disease on March 1. Professor Houston was also widely known as an educator and author. He was born in Alexandria, Va., July 9, 1847, and educated principally in the public schools and in the Central High School of Philadelphia, which institution he served long and faithfully as professor of physical geography and natural philosophy. He first taught at Girard College, and not long afterward was elected professor of civil engineering in the Central High School, only to be transferred a year or two later to the chair of natural philosophy, of which he was professor emeritus at the time of his death.

About 1879 Professor Houston took up the then comparatively new subject of electric lighting and in conjunction with Prof. Elihu Thomson, who like himself was a teacher in the Philadelphia public schools, elaborated the Thomson-Houston system of arc lighting which in 1881 made its appearance and not long afterward won its way into prominence all over the civilized world, although it is now gradually being superseded by mercury-arc rectifier sets. The Brush arc machine was already in use at that time, and the appearance of the Thomson-Houston dynamo created somewhat of a sensation. Its spherical armature was unique among armatures; its cup-shaped field magnets were unique among field magnets, and its three-part commutator was unique among commutators. The dynamo embodied many novel features, not the least of which were the air blast used to extinguish the sparks occurring as the segments passed under the brushes, and the regulating magnet and gear used for automatically shifting the brushes so as to maintain a constant current.

Of the splendid work accomplished during the partnership of Professors Thomson and Houston little need be said, as it forms part of the history of modern electricity. Professor Houston was one of this country's pioneers in electric arc lighting, and his numerous inventions met with deserved success. In 1884 he was appointed by the national government a member of the United States Electrical Commission, which convened in Philadelphia, and he was also elected by the Franklin Institute chief engineer of the International Electrical Exhibition. A very large amount of interesting scientific work was accomplished at that time, and the Philadelphia exhibition was well carried out and was singularly successful. The practical tests of electrical apparatus then made were a valuable contribution to science.

Since 1884 Professor Houston had become prominent in electrical research and investigations of every sort, and he devoted not a little time toward the popular exposition of the science in which he had attained so enviable a reputation. He resigned from the Central High School about 1895 and became associated with Dr. A. E. Kennelly, now of Harvard University, as a consulting electrical engineer, and he maintained an office in the Roger Williams Building, Philadelphia, as a consulting engineer up to the time of his death. His contributions to the literature of natural science have been numerous, and a considerable number of meritorious books have come from his ready pen. Of his fifty-two books the best known to the electrical fraternity are the "Dictionary of Electrical Words, Terms and Phrases," "Electricity in Every-Day Life" and the electrotechnical series written in collaboration with Dr. A. E. Kennelly and published by the *Electrical World* years ago. The latter were among the first primers on electrical subjects appearing in any language.



PROF. EDWIN J. HOUSTON

In his long professional career Professor Houston gave a large amount of attention to public lecturing and did admirable service to the advancement of science by his course of public lectures. It was as a stanch friend of the boys of the Central High School that Professor Houston was known and loved by thousands of alumni through the United States. His keen sympathy with boyish problems and his intelligent understanding of their aims and ambitions endeared him to many men once his students but now among the most prominent business and professional men in Pennsylvania. Professor Houston was president of the American Institute of Electrical Engineers in 1893, 1894 and 1895. He was professor emeritus of physics at Franklin Institute, professor of physics at the Medico-Chirurgical College, a member of the American Institute of Mining Engineers, the American Philosophical Society, the Electrotherapeutic Society, the American Historical Association, the New York Electrical Society, the Philadelphia Academy and numerous other scientific organizations. He was president of Section C of the Electrical Congress held in Chicago in 1893 and the first president of the electrical section of the Franklin Institute. He received the honorary degree of Ph.D. from Princeton University. Professor Houston was a bachelor. A brother and two sisters survive him.

In Memoriam—Prof. Edwin J. Houston

By Elihu Thomson.

Thirty-five years ago, while Professor Houston and I were colleagues in the Central High School in Philadelphia, we were closely associated in work which later gave rise to the Thomson-Houston Company and its branches in other countries. It happened that after I left Philadelphia, in 1880, to become electrician for the new enterprise, which afterward took our joint names, we met only occasionally, so that the memory of Professor Houston in those early days is naturally now uppermost in my thought.

There were many reasons why at that time the bonds of sympathy and friendship should be closely drawn around us. From 1870 to 1880 we taught in closely allied branches of science, and in adjoining rooms in the old school; we assisted each other in planning and preparing lectures; we served on committees together; we collaborated in experimental work and in publication of results.

Though my senior by eight or nine years, he did not lack in youthful buoyancy of spirit and enthusiasm for any work undertaken, a quality which I think must have remained with him through life. He dealt with the students under him as a sympathetic friend, as well as instructor, and though he held them to a high standard he was a general favorite among the professors in the school. He was keenly alive to the then growing importance of science in education, and spared no effort to build up his department by securing for it the best apparatus for physical demonstration then available. In those early years, as later, he was a prolific writer, chiefly of review articles and textbooks. One of these books I well remember. It was his "Physical Geography," which became widely used in schools, and which went through several editions. Our joint inventive work covered but the short period of about two years, during which a number of patents which formed the basis of the Thomson-Houston arc lighting plant were taken out. While this work was in progress Professor Houston never shrank from the hard effort involved, lasting in many instances past midnight, or all night. His aid and sympathy in these early and strenuous days were invaluable when, as was natural, many discouragements arose.

Though after 1880 he took no active part in the inventive or engineering work of the enterprise bearing our joint names, he was always eager to follow its development, founded as it was upon the early trials and experiences in which he took so prominent a part.

Round-Table Convention of Commercial Men of Ohio Central Stations

Approximately seventy delegates, representing the new-business departments of Ohio central stations, electrical contractors and manufacturers in the State, convened at the Elks' Home in Toledo on Feb. 25, to interchange ideas on central-station commercial methods. The convention was welcomed to the city by Mr. F. R. Coates, president of the Toledo Railways & Light Company. In opening the sessions Mr. T. F. Kelly, Dayton, chairman of the committee on new-business co-operation of the Ohio Electric Light Association, called attention to the fact that this was the first time the new-business men of a state association had attempted getting together at any time other than the annual meeting. Round-table spirit with free and open discussion marked the convention.

Plans for Securing New Business in Small Cities

In his paper entitled "Plans for Securing New Business in Small Cities" Mr. H. G. Bonner, Elyria, pointed out that the basic element on which all new-business operations should be conducted is an up-to-date card index containing all information which can be obtained by a house-to-house canvass of the city. While a wiring schedule upon which contractors have agreed is often useful in residence campaigns for wiring old houses, it is impracticable to attempt such methods where store wiring is chiefly concerned. Likewise, the speaker said, while 1-cent postage is sufficient in many cases for circular letters sent to prospective residence customers, 2-cent stamps should always be used when business houses are being circularized. All advertising of this or any other character should be followed by calls from solicitors. Morning meetings of solicitors were recommended to instil enthusiasm into the men.

Speaking of show-window and sign lighting, Mr. Bonner said that the former could be handled by the local sales organization but the latter should have the attention of a special sign salesman. Original design in electric signs helps sell signs to competitors among local merchants, on account of the ever-prevalent desire of the retailer to outdo the most spectacular feat of his business rival. In closing, the speaker said that fair and courteous treatment of customers would more than any other one thing increase the success of the new-business department of any central station.

Discussion

A spirited discussion followed the paper and lasted throughout the entire morning session. Mr. T. F. Kelly, Dayton, commented on the fact that in an organization where there are but four solicitors, as at Elyria, daily sales meetings are held. He also reiterated the author's statement that enthusiasm is one of the greatest assets of the successful salesman. "Set a high mark and strive for it," was his advise to new-business men.

In reply to a question asked by Mr. F. C. Morrison, Newark, Mr. Bonner said that in following the wiring schedule used by the Cleveland Electric Illuminating Company a general reduction of 28 per cent had been made to accord with the lower overhead costs among contractors in Elyria. The prices under the schedule used in Elyria range from $13.68 for five outlets to about $78 for fifty-five outlets, these prices not including hardware and fixtures. In Mr. Bonner's belief it is better to start with the price schedule high enough to insure profit to the contractors, later reducing prices if found feasible.

Answering a question asked by Mr. E. H. Cobb, Toledo, Mr. Bonner explained that with proper division of card indexes the Elyria solicitors visit every customer at least once in sixty days and see all "live prospects" oftener.

Mr. W. J. Young, Toledo, in bringing up the subject of postage on circular letters, said that the first letter sent in a campaign should bear a 2-cent stamp although the remaining letters might fare just as well with 1-cent postage. Mr. E. R. Kelsey, Toledo, said that although many advertising men favor the 1-cent stamp for residence customers, he personally recommended the 2-cent stamp and would surely advise its use in small communities where mailing lists are not large. Mr. J. E. North, Springfield, solved the stamp problem, he said, by using 2-cent stamps only for the better residence districts and business districts. In reply to a question from Mr. H. L. Montgomery, Newark, Mr. Kelsey said that in Toledo letters are addressed to the mistress of the house when her name can be obtained.

Following a short talk by Mr. O. E. Wessel on methods used in Columbus campaigns, Mr. P. A. Staples, Sandusky, said that some new-business men of Ohio might be surprised, as he was, to learn how many wired houses on their lines are not using service. A survey in Sandusky, he said, had shown 300 of these houses. However, a solicitor placed at this class of work regained 20 per cent of the 300 in one month.

Manufacturer, Contractor and Central Station

After luncheon had been served in the convention room, a paper dealing with methods of co-operation between manufacturing, contracting and central-station interests was presented by Mr. P. L. Miles, National Quality Lamp Division of the General Electric Company, Cleveland. In this paper the speaker outlined the various methods through which central stations and contractors are combining their efforts in old-house-wiring campaigns and explained how the electrical manufacturers stand ready to help enterprising contractors with advertising literature and attractive window displays. The speaker pointed out, however, the fallacy of using a good window display and keeping a disorderly shop behind it. A contractor's store should be one to attract the woman, for it is she who is the buyer of electrical appliances just as she is the purchaser of groceries for the home. In commenting on the expedient of hiring girls as saleswomen for contractors' stores, the speaker declared that manufacturers' salesmen are always ready to instruct such clerks in the talking points, prices and advantages of electrical wares, and he said further that this plan has been particularly successful where the girl is able to help with bookkeeping and typewriting. Contrasting this method with the former practice in which "Bill" the wireman was both salesman and journeyman, Mr. Miles pointed out the increased effectiveness of the improved plan.

Discussion

Speaking of the manufacturers' co-operative attitude, Mr. T. F. Kelly, Dayton, told of an offer made by Mr. S. T. Doane, Cleveland, inviting electric-service properties in Ohio to send a man to the National Quality Lamp Works for two or three weeks' free training in the science of illumination.

Mr. E. F. Miller and Mr. G. T. Groff, Toledo contractors, both spoke highly of the co-operative fixed-schedule plan for old-house wiring, stating that its success in Toledo had been marked and that it had afforded profit to all.

Evils in the Lamp Trade

Mr. A. A. Pointer, Antwerp, opened an interesting discussion by asking Mr. Miles why the lamp companies put lamps on commission in hardware and grocery stores and even blacksmith shops, while he was required to sign an annual contract in order to receive his discount. He said the sum involved was small but that the discrimination did not seem fair to him. Mr. D. L. Davis, Salem, said that a like condition existed in his city.

Mr. L. C. Anderson, Franklin, stated that this condition was not a purely local affair, for he had heard similar complaints from small central stations in all parts of the State. He said further that in his territory one lamp company's salesman had sold a retail dealer 112-volt and 114-volt lamps for 106-volt and 108-volt circuits to establish a life record for his product. Mr. Anderson said that his companies in no way considered the loss of profit from lamp sales, but they did object strenuously to the sale of lamps which lowered the quality of their service. He added, however, that he felt sure such things were due to the efforts of over-enthusiastic salesmen rather than to company policy.

The next meeting of the new-business men of the Ohio Electric Light Association will be held at Dayton April 8, and a later session has been planned for Cleveland during the forthcoming electric show in that city.

Price-Fixing on Electrical Devices

Most of the testimony presented before committees of Congress in regard to the pending trust legislation has come from other industries than the electrical industry. Recently, however, several prominent business men connected with some phase of electrical activity have offered testimony. Abstracts of the testimony of several are given herewith:

Testimony of Mr. James H. McGill.

Mr. James H. McGill, president of the McGill Manufacturing Company, of Valparaiso, Ind., testified that it had been his experience that fixing of the price to the consumer by the manufacturer tends to monopoly and to make it possible to charge a high price for the commodity. One of the chief arguments used is that manufacturers have built up the reputation of a trade-marked article and established the reputation of a trade name, and that if a cut in the price is allowed the reputation will be rendered valueless.

Mr. McGill said it is true that manufacturers have built up a reputation, but he failed to know from his personal knowledge where the expense of building it up was not paid by the consumer ultimately. The profit pays for building up the business. If the growing trade is stopped in an artificial way, it will be easier to create a monopoly. A good device may be brought out, but it is difficult to get the jobbers to handle it and promote its sale unless a guarantee of control of the price can be given. Another article that is well known will be offered and people will argue that it will answer the same purpose and that they like it and they are protected in selling. That comes from the fact, which is true of nearly all forms of business, that there are associations which meet at certain stated intervals and talk co-operation. They are co-operating against the consumer in most cases, Mr. McGill said.

In asking about the large electric companies, Representative McCoy said that there is a suspicion that they largely control the people who are making electrical devices of any kind. If he invented something, for instance, as he understood it, he could not get it on the market unless he came to terms with one of the large companies. Mr. McGill replied that that was wrong. Congressman McCoy declared that some of the companies will not permit the thing invented to be used in connection with any article that they are selling. If the thing can be sold under the law at a fixed resale price, would not that fact cut into the arrangement which the companies are said to make?

Mr. McGill said that he hardly thought so. The General Electric Company is not engaged in the general jobbing business as the General Electric Company. He added that there is no question, however, about its being interested in and controlling some jobbing houses. Mr. McGill said that he did not believe that the fixing of re-sale prices would help as much as it would hurt in other ways. The company does not control a large enough percentage of the jobbing output. Of course, the policy is changing from year to year.

Mr. McGill declared that if the source of supply is open to the coming generation, if it is not restricted in one way or another, the man with small capital has certain advantages over the man with large capital. A large aggregation of capital alone will not stifle competition, because there will have to be high-class men to take care of that business and the point will be reached where the large unit is not especially efficient.

Continuing, Mr. McGill said that there will not be monopoly if there is not restraint of trade. The question of price maintenance in relation to the so-called advertised article goes a long way into the question of the high cost of living. He came to this conclusion by observation and what he had seen in his life of the change in business. When he went into the electric business, twenty-five years ago, it was comparatively a small business. There was no price maintenance.

In speaking of the changes, Mr. McGill said that three or four times a year the jobbers at considerable expense meet in some good place and talk over the situation. He had never been a member of that association and never attended any of the closed meetings, but understood that the leading jobbers who go to the meetings get up and tell the other jobbers, their competitors, how much it costs them for an order, what percentage is gross and what their gross percentage was on last year's business, and that the large jobbers use this information in meeting competition. As far as he knew, this is lawful, but the result is that the price stays up for the consumer.

Continuing Mr. McGill took up the subject of sockets. He said that in the Canadian market, where there is the keenest competition on the same article, with no attempt at fixing re-sale price, where the volume of business is very much greater and where a considerable part of the sockets consumed are imported and duty is paid thereon, the price is about 20 per cent less to the consumer. Mr. McGill declared that prices were fixed on sockets formerly, but that that could not be done now after the recent decisions of the Supreme Court. In answer to a question from Representative McCoy as to whether there had been any effect on the price, Mr. McGill replied that there had been a little but not much. He added that the price could not be fixed by law, but "they are all good friends."

In closing, Mr. McGill said that he believed it wrong in practice to allow the manufacturer to fix the re-sale price and it seemed to him that every man had a right to his own. It is good morals to prevent monopoly, and the fixing of prices is an aid to monopoly.

Mr. Herbert Noble, Representing John A. Roebling's Sons Company

Mr. Herbert Noble, representing John A. Roebling's Sons Company, said that the Sherman anti-trust law was a great piece of remedial legislation. The Sherman act provides that every restraint of trade which harms the public interest is unlawful. There is no such thing as a reasonable restraint of trade which harms the public interest. The right of freedom of contract is quite as important to preserve as any other of our great rights so long as that freedom of contract does not invade the public interest and do harm to the public.

Mr. Noble declared that anything that means healthy growth of man's business has always been permissible and is not a restraint of trade harmful to the public interest, although it may be argued that there has been a restraint of competition or even a restraint in fact to some extent of trade. There may be the making of many contracts which, under a given set of trade conditions, made for a given set of purposes, are perfectly lawful, whereas exactly the same combinations, partnerships and contracts if made under other trade conditions and for different purposes would be unlawful. To attempt to say that the making of all combinations, partnerships or contracts which in any way restrict free and unlimited competition or restrict trade is unlawful is to extend the common-law doctrine in respect to restraints of trade and attempts to monopolize and to enlarge the meaning of the Sherman act to such an extent as will make combinations, partnerships, contracts and the normal and healthy growth of industry, which are utterly without harm to the public, unlawful.

Decisions of the courts, Mr. Noble added, have gone to such an extent as to make it perfectly clear that no matter what means, methods, devices, combinations or conspiracies men may enter into, the effect produced may become unlawful if there is a restraint of trade harmful to the public interest. If those contracts and combinations do not produce a restraint of trade harmful to the public interest, they are innocent and may be protected.

Mr. Noble made a number of suggestions for changes in the various bills. He declared that the Sherman act when applied is effective. The decisions of the court are clear. The change in the public view in the last few years is marvelous. Instead of having the country trying to evade the law, the sentiment of the country is to obey the law. If new laws are passed which create difficulties and do not go to the result but go merely to the means, a condition will be produced where men are thrown into doubt and perhaps evasion.

In the course of his testimony Mr. Noble defended holding companies which control and finance lighting properties and are able to improve the service rendered to the public. Representative Morgan raised the question of over-capitalization through holding companies. Mr. Noble thought that the people are now protected by state public service commissions. He suggested that, in the case of a manufacturing company which he cited, subsidiary companies be required to state that they are branches of the parent company. Similarly operating companies whose stocks are held by a holding company that does not operate could be obliged to publish the fact that their stock or a certain percentage is held by the holding company. As to the prohibition of interlocking directorates, Mr. Noble suggested that responsibility be fixed by a provision that everybody who owns stock enough by a cumulative system of voting has to hold office.

The true way to meet the difficulty about an interstate trade commission, Mr. Noble believed, is to create a court or a body with quasi-judicial functions to which business men may resort. He did not propose a court to give immunity but a body to which business men might go with their affairs, have them heard and learn where they stand. This would not take away from the courts any of their present jurisdiction or take away activities of the Attorney-General or the district attorneys.

Hearing on New York State Water-Power Bills

The Velte-Smith hydroelectric bills were considered at a hearing before committees of the Legislature at Albany on March 3. The first part of the hearing was devoted to statements of those who opposed the bills while the remaining time was given to speakers who favor the measures.

Mr. George Clinton, of Buffalo, who spoke first, declared that the use of surplus waters of the barge canal for generation of power would lead to increase of these waters so as to generate as much power as possible. This is contrary to the principle of true conservation, as such an increase would lessen the flow of rivers. He expressed opposition to entrance by the State into the field of private enterprise. Various speakers representing commercial undertakings in cities of the State followed Mr. Clinton with arguments against public ownership and operation of electric enterprises. Among those who spoke in opposition to the bills were Messrs. Charles W. Carpenter, Chamber of Commerce, New York City; Frederick B. De Berard, Merchants' Association, New York City; Edward N. Smith, Watertown; George H. Cobb, Watertown; William Dalton, Schenectady; Lorenzo Semple, Cohoes, and J. T. Hutchings, Rochester, and Prof. Olin L. Landreth, Union College, Schenectady, and Prof. W. L. Robb, Rensselaer Polytechnic Institute, Troy.

On account of lack of time, several who had prepared themselves to discuss the question were not heard and it was decided that they should file statements giving their opinions.

On behalf of those who favor the passage of the bills it was stated that they were not intended to interfere with developed water-powers but were designed to develop a plan for harnessing the undeveloped water-powers of the State. Among those who spoke for the bills were Mr. George E. Van Kennen of the State of New York Conservation Commission, Mayor Burns of Troy and Mayor Stevens of Albany.

Mr. Tripp on Anti-Trust Legislation

Mr. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, made an address on "The National Government and Business" at the annual dinner given jointly by engineering societies in Boston on March 4. Mr. Tripp devoted his address to the subject of pending anti-trust legislation and enlarged on the ideas which he expressed in his paper before the Chamber of Commerce of the United States, an abstract of which was published in the *Electrical World* for Feb. 21, 1914. In his remarks at Boston Mr. Tripp described the proposed laws briefly and added that if anything he said should help to arouse his hearers to a study of the measures for themselves he would be satisfied.

Good business, Mr. Tripp declared, is the art of taking chances on probabilities, and poor business is perhaps the mistake of taking chances on possibilities; but almost no business is an exact science. That is to say, no business can be done without certain risks which have come to be called "business risks." Hence, after a lifetime given in that direction, a business man becomes educated to taking risks, and when he comes to view business legislation it is impossible to shake off his life's experience, and he finds himself saying: "Oh, well, if the law is so bad that it prohibits ordinary business methods, it will not be enforced and I will take chances on it. It is only another 'business risk.' "

Mr. Tripp called attention to the fact that every man who does an interstate business, however small and of whatever nature, will be affected by the legislation unless a specific limit of size is written into the bills, which would give an "immunity bath" to all violators of law who happen to be under statute size. Mr. Tripp expressed his belief that some regulation is necessary, not, however, from the standpoint of business efficiency or economical development of the wealth of this country, but because under our political institutions he prefers to see the menacing qualities of monopoly held in check by the establishment of conditions of sane competition rather than by strong direct governmental interference such as Germany exercises. He prefers to see conditions for fair competition established by proper legislation, if it can be done, rather than to see governmental ownership of railroads and other business enterprises for the purpose of securing the needed balancing influence. However, it would be regrettable if, in order to do this, a line should be drawn at say $3,000,000 and the men above that line should be told, "You may not do something," and the men below the line, "You may do it." That appears to be repugnant to the principles on which this government is founded.

After commending the Canada plan, Mr. Tripp declared that a modification of that plan, preserving the idea of a trade commission, might be desirable as one of the means for setting the machinery of investigation in motion and providing a flexibility which would render unnecessary the Sherman law definitions bill, which undertakes to define certain acts to be in restraint of trade that are now interpreted by the courts one way or the other as they are more or less small and insignificant.

Mr. Tripp believes that this commission might also assume the responsibility for bringing about the results sought in the trade relations bill, some of the provisions of which are well intended and aim at doing away with practices which should be condemned; but, in order to forbid them specifically, it may be necessary to use language which will make the statute apply to such an extent that business would be greatly, if not dangerously, hampered if the law were enforced.

Personally, Mr. Tripp thinks that it would be practically impossible fully to enforce the acts as they are now drawn; but it is objectionable to have laws on the statute books which cannot be fully enforced, and a properly framed trade commission bill seems to be a good substitute for specific legislation which leads no one knows where. For example, discrimination in prices for the purpose of injuring or destroying a competitor, or contracting that a purchaser shall not deal in the goods of a competitor, should be prevented; but, if it cannot be prohibited by definite statutes without causing more harm than good, to place the determination of the facts within the jurisdiction of a flexible trade commission is an admirable compromise. There might also be included among the powers of the commission the right to recommend the approval of the legality of a consolidation or merger, and when an approval has been so obtained the lawfulness of the exact thing approved should be beyond question.

The business legislation now proposed at Washington, Mr. Tripp declared, is probably more far-reaching than any other business legislation that has been attempted at any time in any country. It will be useless for "standpatters" to condemn indiscriminately all the measures proposed, because the great preponderance of public opinion favors the principles which the bills aim to sustain. Constructive criticism is needed. Condemnation will not destroy sound principles. Constructive criticism encourages safe and sound legislation.

One of the great principles supported by a public opinion that is little short of unanimous is that competitive conditions should be maintained, but it is quite likely that the public at large does not discriminate between free competition and fair competition. Free competition, Mr. Tripp added, would permit the manufacturer of a widely advertised article to say to jobbers and retailers, "I will not sell you my goods unless you agree not to sell any goods of my competitor," and thus gradually drive the competitor out of the market. This has been done and it was the intention to prohibit it by the trade relations bill. Instead of framing specific statutes to meet these conditions which are almost sure to ramify further and forbid quite harmless and proper business transactions, the duty of deciding whether a specific act is in violation of the principles of fair competition might well be performed by a commission.

Public Service Commission News

New York Commissions

The New York Public Service Commission, Second District, has rendered a decision on the application of the Canadian-American Power Corporation to engage in business, to issue stock and to acquire the Niagara Falls Electrical Transmission Company. The company sought to acquire a contract with the Electrical Development Company for furnishing 46,000 electrical hp produced in Canada and providing for the sale of this power in the United States, principally on or near the Niagara frontier. The company desired to issue $3,000,000 stock on account of the contract and $435,000 for the purchase of the Niagara Falls Electrical Transmission Company stock, bonds and debt.

The decision of the commission is that the applicant shall be restricted to a total of $1,250,000 stock on account of the contract and the acquisition of the Niagara Falls Electrical Transmission Company, of which $435,000 may be 7 per cent cumulative preferred, on condition that before any stock shall be issued or the entry of any order permitting issue of the stock or merger of the two companies shall be made effective, the applicant shall secure authority for the location of its transmission and distributing systems and shall file a stipulation as follows:

(1) Every contract with purchasers of energy shall provide that the price, terms and conditions affecting price and duration shall be subject to revision by the commission upon complaint or upon motion of the commission, any ruling of the commission to be subject to judicial review.

(2) That charges for all of the service and customers shall not, on the average, exceed $19 per hp sold, but this shall not prevent the commission from requiring a lower price for particular kinds of service from that which the applicant may establish upon finding after hearing that the price charged is unjust, unreasonable or otherwise in violation of the public service commissions law. Such ruling shall be subject to judicial review.

(3) Until further order of the commission the company shall reserve at least 23,000 electric hp for sale to consumers of energy for light or power.

(4) Upon merger of the two companies the stock, bonds and floating debt of the Niagara Falls Electrical Transmission Company and the third mortgage bonds, floating debt and $92,000 first consolidated mortgage bonds of the Niagara Falls Gas & Electric Light Company shall be canceled.

In regard to the continued exportation of electricity from Canada the commission says it must assume that relations between the United States and Canada, affecting the means of continuing great industries which have grown up in reliance upon the use of electric power imported from Canada, and also the interests of the Canadian electric producing companies themselves, have become fixed and subject only to such changes as will protect the great commercial and industrial interests and rights now served by electrical power brought from Canada. This is particularly so in this case as it appears that the percentage of export power to plant capacity is the same as has been and is allowed by Canada to other exporting electrical companies. Discrimination in prices charged by Canadian electrical producing companies whereby Canadian purchasers are favored to the prejudice of American customers, and the existing shortage of electrical power on the Niagara frontier, are discussed in the opinion. It is declared that the various contracts with the producing companies should be revised as to prices charged American distributing companies, that there is a large shortage of electrical power in western New York with a strong demand for greater supply which is not being met by existing companies, and that the contracts mentioned tend to perpetuate high rates to consumers.

The commission points out that the Hydro-Electric Commission of Canada has contracted for electricity delivered at a Canadian producing plant for $9 per hp in large quantity, while the charge for Canadian electric energy to the American company for a large amount of power is $12.50 per hp.

The opinion states that it was not good policy for New York companies at the outset to take on these contracts at prices so high as to compel in a city like Buffalo, 25 or 30 miles from the Canadian line, an intermediate company to pay so much as $16 per hp to supply part of the power users in Buffalo, and to make the Buffalo General Electric Company pay about $25 for such energy and base its prices to the public thereon. The Buffalo electric power situation resulted largely from the old practice of forming numerous companies with almost unlimited power of capitalization to do a limited business within a limited territory. As a whole, the Buffalo and Niagara frontier electrical development from Niagara power, because unregulated at the outset and practically not regulated at all until 1905, has been an economic disappointment.

The commission states that the financial and corporation methods employed have been followed with high rates to the public at large; that the price for Canadian power to the American company seems fixed only at such figure as the American company can accept and do business upon; that the Cataract company has no true economic place in Buffalo, and that the Buffalo General Electric Company or some other corporation should be the sole distributing company; that the Niagara Falls Power Company, both Canadian and American, should sell power to that company at the lowest price consistent with expense and investment and maintenance, and that the power concerned in this contract should be sold to the Buffalo distributing company, and in such sale there should be no need for the formation and operation of the Canadian-American Power Corporation; that the contract under consideration should be revised so that the price at the Electrical Development Company's busbars shall be the same as the price charged there for a like quantity of power used in Canada; that if there shall not be a general change soon in the price generally paid to producing companies by distributing companies in and about the Niagara frontier, the interposition of the United States and State governments may be confidently expected.

The commission, says, however, that in saying this contract price and other similar contract prices in Buffalo and vicinity are unsatisfactory it must deal with the situation that has been forced by the formation of companies and issuance of securities and the making of contracts before this law became effective. So far as it is advised, the existing contracts are legal and enforcible.

Capitalization of a contract for the furnishing of electrical horse-power whereby stock would be issued to represent all estimated available profits from the distribution and sale of such power is condemned by the commission as a practice, and in this case it is not indorsed. The commission reaffirms its decision in the Cataract Power & Conduit Company case and distinguishes that case as a rate case, while this involves the issuance of stock for the purpose of engaging in business. The contract in question is a desirable contract which, if acquired on a reasonable basis, will in the sale of electrical power under it benefit the people in that section of the State.

Commissioner Sague filed a dissenting opinion.

Current News Notes

Roosting Birds Dim Broadway Signs.—During the cold weather which descended on New York City in the latter part of February the appearance of some of the electric signs in the Times Square theater section was interfered with by the hundreds of birds which nestled near the lamps to get such warmth and comfort as the bottled incandescent filaments afforded. Sparrows and pigeons were reported to be the worst offenders.

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Public Service Commission Wanted in Kentucky.—A resolution has been put before the lower house of the Kentucky Legislature providing for the appointment of a commission of three to draft a measure creating a public utilities commission to be presented to the 1916 Legislature, the speaker of the House to name one member of the first-named commission, the president of the Senate to name another, and the two thus named to name the third.

* * *

Annual Concert of Commonwealth Edison Orchestra.—The second annual concert of the Commonwealth Edison Orchestra in Orchestra Hall, Chicago, on Feb. 12, was both an artistic and a social success. The opening feature of the program was a grand selection from Wagner's "Tannhäuser," and the music throughout was of high class and most acceptably given. Luella Chilson Ohrman, soprano soloist, assisted the orchestra. Mr. Morgan L. Eastman was the conductor. To him is due much of the credit for the exceptional success of the organization.

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Operation of Induction Motors.—On page 303 of the *Electrical World* for Feb. 7, 1914, in the report of the discussion of a paper by Mr. K. W. Adkins, Mr. F. A. Barron was reported to have stated that the amount of overfusing of induction motors varies from about four times the rated motor current in 1-hp sizes to about twice the current in large sizes. The values given should have been about two and one-half times rated full-load current for motors up to 7.5 hp; twice full-load current for motors rated at from 8 hp to 35 hp, and from one and three-quarters to one and one-half times full-load current for motors of from 40 hp to 200 hp.

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Attorney-General Seeks to Revoke Five Claims on Nooksack River, Washington.—The United States Attorney-General has filed suit through the local district attorney's office at Seattle, Wash., against the Puget Sound Traction, Light & Power Company for the revocation of five claims on the Nooksack River, near Bellingham, Wash., where the company has a two-million-dollar power plant. It is charged in the complaint that the patents to the claims were obtained through fraud and misrepresentation, the government alleging that the claims were filed by Messrs. P. D. Cornwall, a San Francisco capitalist; Alvinza Hayward, and others, in 1902, and that Cornwall obtained deeds to the claims from the other interested parties and later made application for patents.

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SOCIETY MEETINGS

Railroad Engineers' Convention.—The American Railway Engineering Association will hold its annual convention at the Congress Hotel, Chicago, on March 17 to March 20 inclusive. The office of the association is at 910 South Michigan Avenue, Chicago, and Mr. E. D. Fritch is secretary. During the convention there will be the usual exhibit of railroad appliances in the Coliseum.

Radium and its Phenomena.—Dr. Patrick S. O'Donnell delivered an illustrated lecture on radium before the Western Society of Engineers, Chicago, on Feb. 16, and with 5 milligrams of radium bromide performed several experiments to show how radium ionizes the surrounding air, making it a conductor of electricity. In the discussion Dr. J. Rawson Pennington reviewed the history of the science of radioactivity.

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National Efficiency Exposition and Conference.—The first National Efficiency Exposition and Conference will be held in New York City, April 4 to 11, at the Grand Central Palace. This purpose of this exposition is to direct attention to everything that makes for the saving of time and labor, consequently introducing new mechanical devices and displaying those already employed. At the conference discussions will relate to how efficiency may be attained. Mr. Walter H. Tallis, exposition director, has offices at 41 Park Row, New York.

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Officers of Electrical League of Cleveland.—At a recent meeting of the Electrical League of Cleveland, Ohio, the following officers were elected for 1914: President, Mr. George S. Milnes, Erner Electric Company; first vice-president, Mr. M. H. Moffett, National Carbon Company; second vice-president, Mr. F. M. Grant, Harrington & Grant; third vice-president, Mr. J. T. Kermode, Cleveland Electric Illuminating Company; fourth vice-president, Mr. N. H. Boynton, National Lamp Works; secretary-treasurer, Mr. R. G. Pate; trustees (two years), Messrs. Harry Swindell, A. E. Beling, H. B. Gay and M. E. Turner.

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Boost Electric Truck, Says Mr. Street.—At a meeting of the Chicago Jovian League on March 2 Mr. C. A. Street, general sales manager of the Walker Vehicle Company, discussed commercial electric vehicles. Mr. Street asked all his hearers to boost the electric vehicle. It has been shown, he said, that the electric truck or delivery wagon is more economical than either the horse-drawn or the gasoline vehicle for perhaps 75 per cent of city haulage. The manufacturers of storage batteries are making tremendous strides in reducing the weights of vehicle batteries. Mr. Street presented a number of arguments in favor of the use of electric wagons and made the interesting statement that Marshall Field & Company, of Chicago, hold the "world's record" as the owners and operators of the largest number of electric vehicles in one city.

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Gas, Electric and Street Railway Association of Oklahoma.—The Gas, Electric and Street Railway Association of Oklahoma will hold its 1914 convention at the Lee-Huckins Hotel, Oklahoma City, May 13, 14 and 15. The Oklahoma meeting will precede by a week the convention of the Southwestern Electric and Gas Association at Galveston, Tex., thus enabling out-of-state visitors to attend both meetings. Among the papers to be presented at the Oklahoma convention are the following: "Results of Prepayment Features in Car Design," by Mr. J. J. Johnson; "Motor Drive," by Prof. A. P. Little; "The Grounding of Secondaries," by Mr. Burton French, engineer for the Public Service Company of Oklahoma; "Commission Order No. 774, Relating to the Filing of Profiles and Plan Drawings by Public Utility Corporations," by Mr. George A. Henshaw, member of the Oklahoma Corporation Commission, and "Central Station Rates," by Mr. W. J. Norton, formerly secretary of the rate-research committee of the National Electric Light Association. Prof. Harold V. Bozell, Norman, Okla., is secretary-treasurer of the association.

Electrical Distribution Engineering in Chicago—I

Design, construction and operating methods of the Commonwealth Edison Company in its transmission, substation and distribution departments—Work of inspection and repair

APPROXIMATELY 400 employees are required to perform the tasks in connection with the production and distribution of the output of the Commonwealth Edison Company's Chicago power plants, which have an aggregate rating of a third of a million horse-power. Of these employees the larger part are occupied directly or indirectly in distribution work, and a considerable portion of those are in the engineering departments.

Some idea of the magnitude of the engineering problems of design, construction and maintenance continuously confronting the engineering departments is afforded by an examination of the rate of growth of the local service requirements. Within ten years practically all of the present business has been built up, and during the past year service connections were made at an average rate of two per hour, night and day. Poles are being set at the rate of 9000 per year and line transformer rating is increasing by about 13,000 kw annually. Power plant and substation equipment is being expanded with corresponding rapidity.

As the load increases in different parts of the system and in different classes of service, not only must the lines be extended but existing cables and pole lines must have their loads redistributed so that there may be neither overloading nor excessive line drop.

The following paragraphs give in some detail the plans successfully developed by the Commonwealth Edison Company for coping with the rapid growth of the business.

Organization of Staff

The engineering work divides itself naturally into two parts, one involving mainly design, supervision of construction, and testing; the other, principally operating. These are known as the engineering and operating departments respectively. While a sharp dividing line between two such departments is not possible in general, it may be said that the engineering department determines standards of construction in general, supervises part of the actual construction, lays out the transmission and distribution system and changes it to meet changing service conditions, and designs both substations and the electrical features of power plants. The mechanical engineering of power plants is done by

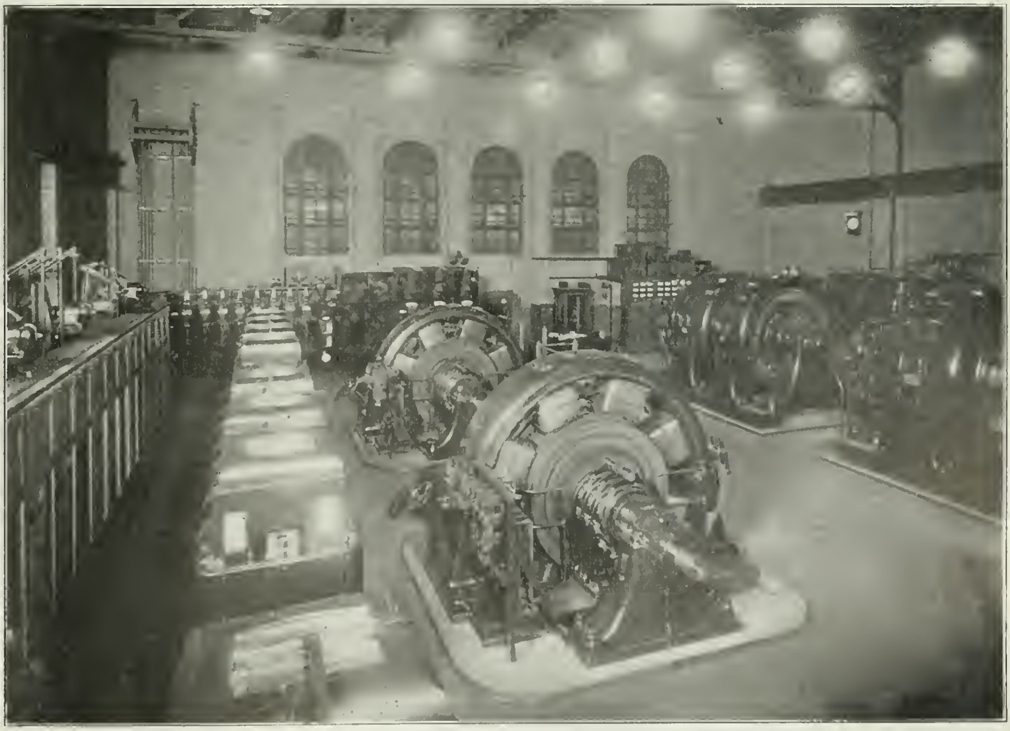


FIG. 1—INTERIOR OF SOUTH CHICAGO SUBSTATION, COMMONWEALTH EDISON COMPANY

the company's consulting engineers, Sargent & Lundy. The operating department, in addition to the large duty of operating all equipment, does all construction on transmission and distribution systems, excepting conduit for which the expenditure exceeds $2,000. Mr. W. L. Abbott is chief operating engineer and his assistant is Mr. D. W. Roper. The electrical engineer is Mr. R. F. Schuchardt, with whom is associated Mr. H. B. Gear in charge of distribution.

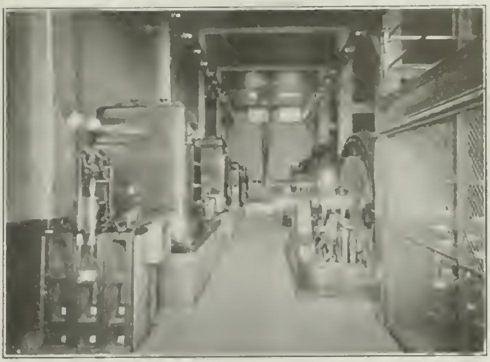


FIG. 2—INTERIOR OF MARKET STREET SUBSTATION

The great power plants and many of the substations of the company have been fully described in previous issues of the *Electrical World*. The power-plant operation is directed by three chief engineers, one for the Fisk and Quarry Street stations, one for Northwest station, and one for the elevated-railway plants recently acquired. The fuel supply is purchased by the fuel agent under the general direction of the chief operating engineer. It is tested by the chemist of the testing department. The operation of the substations is under the direction of a superintendent, Mr. E. F. Smith, who has made a special study of the training and discipline of employees, with a view to maintaining a high degree of operating efficiency in the widely scattered forces under his control. The battery plant, comprising a large number of batteries, is looked after by a superintendent of batteries in close co-operation with the substation department.

To illustrate the way in which the work divides itself, the activities of a few of the more conspicuous divisions of the company will be given in some detail. The street department has charge of the maintenance of conduits and cable and overhead construction, makes all service connections and does considerable construction work. A large group of employees is engaged in making repairs to customers' equipment, installing and removing meters and taking care of inside troubles. Sixty or seventy men are required for this service. Nearly 200 more are necessary in the meter department, where meter stock is maintained and customers' meters are read, tested and repaired. A small but most vital section of the operating department's work is that of the load dispatcher, whose work was fully discussed in these columns, Sept. 27, 1913.

The distribution work of the engineering department is divided into a number of sections, the titles of which indicate their functions. Each engineer of one of these has a corps of assistants numbering up to thirty men as required. The engineers of underground and overhead lines respectively attend to design and construction, and a civil engineer connected with these subdivisions gives special attention to contracts for conduit and tunnel construction. Inspection of new construction and of present condition of lines and auxiliaries requires a large corps, as does also the clerical work of making records of orders, transformer changes, etc. A pressure-maintenance division is occupied in reading recording voltmeters placed at various points in the system and in planning rearrangement of feeders to meet load requirements from the regulation standpoint. A map-record division is constantly occupied in preparing proper records of all changes in the distribution system which are made from preliminary sketches furnished by the engineer of overhead and underground line extensions.

In a system such as this, having so many and diverse lines of work and so many new problems constantly arising, a flexible organization is required. While each individual knows what his duties are and to whom he is responsible, there is constant adjustment of duties and shifting of individuals to secure the best possible adaptation of men to tasks.

Construction Methods

Projects for new distribution construction originate in a "street investment committee," consisting of representatives of all departments concerned. All overhead, conduit and other construction is performed according to rigid specifications, the standards being revised from year to year. Conduit specifications agree with those of the Board of Supervising Engineers, Chicago Traction, and the National Electric Light Association. Both tile and stone conduit are

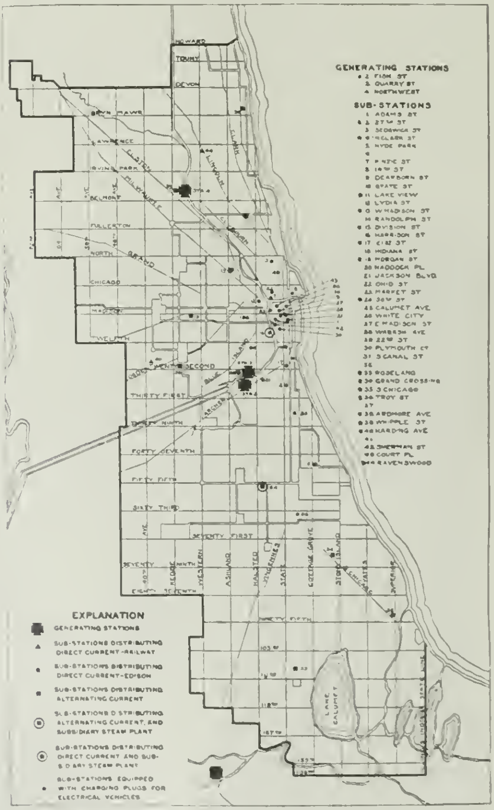


FIG. 3—MAP SHOWING POWER PLANT AND SUBSTATIONS

used. With the former the ducts are laid as close together as possible and the joints and triangular spaces are filled with one-to-three cement mortar. Ducts of stone conduit are separated horizontally and vertically by 1-in. spaces filled with fine concrete. All conduit is surrounded with 3 in. of concrete and laid in general on a grade of 1.5 in. per 100 ft.

Manholes are built of sewer brick laid in one-to-three cement mortar with rigid requirements as to wetting the brick before laying in hot weather and heating of sand and water in freezing weather. The manhole floors are of 4-in. concrete and the roofs of 8-in. concrete in all cases. Typical manhole layouts are shown in the accompanying figures.

On account of the necessity for crossing the Chicago River in many places tunnels form an important feature of underground construction. There are now nine tunnels in use averaging about 400 ft. in length, and they are being built at a rate of one per year. They are used in place of submarine cables, on account of their greater reliability, wherever the number of cables is sufficiently large to warrant the expense. The design of these tunnels falls to the civil engineer, but, as in the case of the conduits, he consults all departments concerned. In fact, a committee of representatives from all such departments goes over the plans. The recommendations of this committee go to the street investment committee, which finally decides upon the practicability of any construction proposition. While each tunnel presents its own construction problems, the general plan consists in sinking a circular vertical shaft at each end to a depth depending upon the nature of the ground, a hard clay being desired if it can be found. The shafts are about 8 ft. in diameter and they are lined, like the tunnels, with concrete. The tunnels are about 6 ft. by 7 ft. inside, with vertical walls and circular-arch roofs. Conduits are provided for the electric cables in shafts and tunnels.

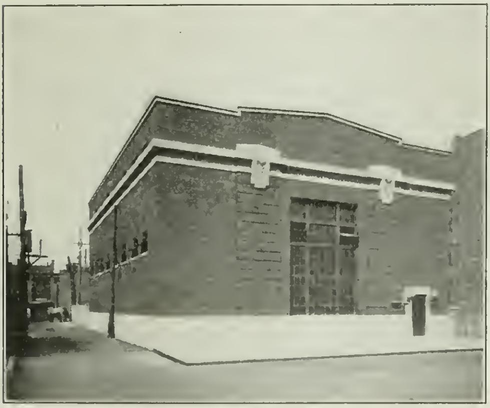


FIG. 4—CALUMET AVENUE SUBSTATION

Use of Underground Cables

The requirements of the various classes of service are such that it is necessary to use a large number of cable sizes. This cable is practically all paper-insulated For the twenty-five-cycle railway work three-conductor cable is used in four sizes—300,000 and 250,000 circ. mil and No. 0000 for 9000-volt service and No. 00 for 20,000-volt service. In the sixty-cycle lines four-conductor No. 0 and single-conductor Nos. 0 and 6 are standard. The direct-current needs are various, necessitating keeping in stock single-conductor cables of 2,000,000, 1,500,000, 1,000,000, 750,000, 500,000 and 350,000-circ. mil area in addition to No. 0000. Very occasionally 1,000,000-circ. mil concentric cable is also used. No. 14 three-conductor pressure cable is used for connecting all feeder ends with the switchboard nearest to them.

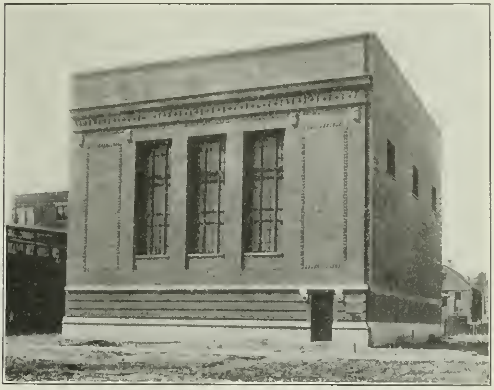


FIG. 5—HARDING AVENUE SUBSTATION

The consumption of cable is shown by Table I, on the following page.

On all large jobs, such as transmission-line and sixty-cycle feeders, cables are ordered in individual lengths. A list of the required lengths is sent to the factory, and reels come suitably marked. A large spare stock is always maintained, and this may contain a total of 100,000 ft. or more of standard sizes.

The design features of cables and specifications for their installation are in the hands of the distribution engineer, Mr. H. B. Gear. In his office such matters as the types of cable to be employed and the loading to be allowed are decided. The investment in cables is so great that the utmost care is taken to insure them against overloading. The operating department pulls in the cables and connects them up, and finally they are tested out by the testing department before being put into service.

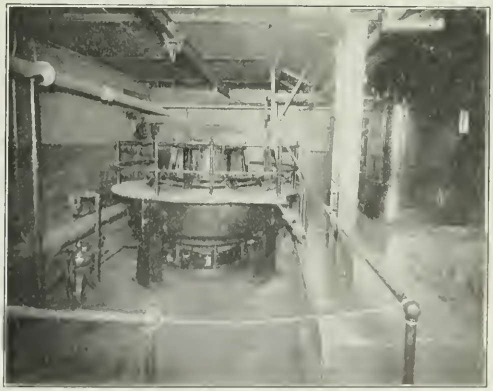


FIG. 6—VERTICAL ROTARY CONVERTER IN RANDOLPH STREET SUBSTATION

All overhead construction work is done by the company under specifications recently revised. Approximately 75 per cent of the pole line is occupied jointly with the telephone company. The overhead transmission comprises 20,000-volt, sixty-cycle, 12,000-volt, sixty-cycle, and 9000-volt, twenty-five-cycle lines. There is also a large amount of 4000-volt, four-wire, three-phase distribution line with grounded neutral. Most of the pole line is single-circuit line. In all, more than 8000 miles of wire is required in these lines. This is largely of No. 6 section, but there were about 300 miles of No. 0000 wire up to the close of 1912. This wire is mounted on both porcelain and glass insulators, the former being used for high-tension and the latter for low-tension lines. In making taps triple-groove glass insulators mounted on buck arms are employed.

FIG. 7—WASHINGTON STREET TUNNEL UNDER CHICAGO RIVER

In pole-line construction nothing but Northern white cedar is used. The standard pole is 40 ft. in length and has a 7-in. top. Tree trimming along the pole line is done by professional trimmers, frequently men who have done similar work for the city, and in this way a common source of complaint is avoided. About seventeen construction gangs, with wagons, averaging eight men and a foreman each, are employed in the heavy work of pole setting, wire stringing, etc. In addition, there are fifteen gangs averaging four each, engaged in making service connections and placing transformers. Large jobs are frequent owing to the taking on of large customers, as is evident from the statement that customers requiring banks of three 50-kw transformers are secured at an average rate of one per month. The largest of the recent large line constructions is a 12-mile, 20,000-volt line from South Chicago to Blue Island to supply energy to the cement mills at Buffington.

TABLE I—CABLE CONSUMPTION FOR 1910 AND FOR THE FIVE YEARS FROM 1908 TO 1912 INCLUSIVE

	Lb. Copper
1900	109,474
1908	1,088,336
1909	2,328,153
1910	1,719,474
1911	1,187,185
1912	1,355,032

For the making of service connections, now numbering over 18,000 per year, the city is divided into three districts, each with an office manned by a general foreman and a force of clerks. The gangs and their foreman report on their jobs, where they receive instructions on printed forms which are also used as reports to economize labor in writing.

In the service and repair work use is made of a special design of electric truck of which the company has now a dozen. This truck is a veritable supply store and its contents are accessible from outside through doors which let down at the sides. The truck is made by the Walker Vehicle Company at its Chicago factory and was exhibited at the National Electric Light Association convention.

Keeping track of new line construction and repairs in such an extensive system as this requires unusual methods. One plan used involves a large routing map mounted on the wall in the central office. On this chart service orders are recorded by means of tacks with heads of different colors for different days. The tacks are connected by strings showing progress from day to day, strings of different colors being used to designate different gangs. Two route clerks are engaged in keeping track of the work, and they change the strings daily, laying out the route of the work as modified by conditions existing at the different jobs. Repair orders are followed on the same map by means of seals of colors corresponding to the tack heads.

An excellent idea of the development of the line work of the company can be gathered from the statement that the new business has required an increase in transformer equipment amounting lately to more than 1200 a year. Table II gives data showing the recent growth of this equipment.

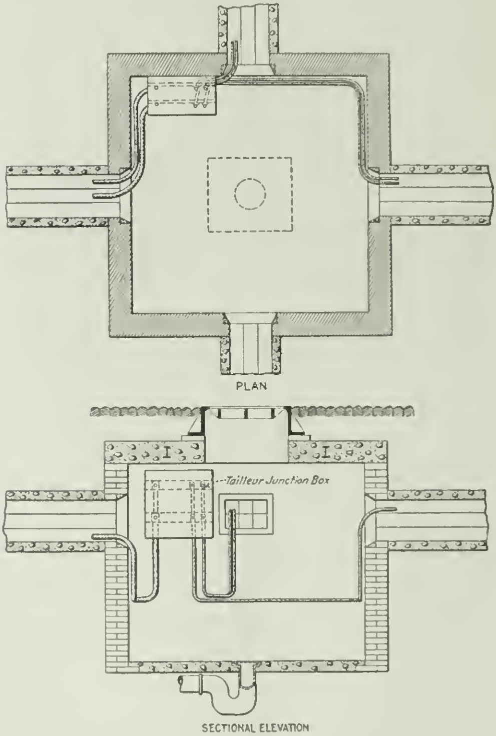


FIG. 8—TYPICAL MANHOLE CONSTRUCTION FOR LOW-TENSION DISTRIBUTION

Engineering Features of Line Operation

In a plant of this kind plans must be kept well ahead of requirements. With the rapidly growing load annual revision of the distribution of the load on the lines is necessary. Revision is made on the basis of voltage fluctuation and of loading. The division of voltage maintenance is constantly testing for line drop by means of sixty recording voltmeters placed near the centers of circuits. Causes of fluctuations are studied and the necessary changes in lines are recommended. The maximum fluctuation allowed at distribution centers is from 117 volts to 114 volts, although in outlying districts the range may be a volt more either way. The intention is to deliver to the most remote customer a pressure of 113 volts.

TABLE II—LINE TRANSFORMERS IN OPERATION

Year	Number	Rating, Kw
1909	8,123	62,771
1910	9,556	76,547
1911	10,776	88,985
1912	11,972	101,959

During the present year there have been seventy-nine sixty-cycle circuits in operation. Of these sixty have been revised, the largest revision in the company's history. This was made necessary by the 18,000 overhead services installed last year.

All transmission lines so far have been operated without parallel connection owing to the danger of heavy short-circuits in case of cable trouble. It is expected that shortly the reverse-power relay will be developed to a point to permit cable operation in parallel. Until last year it was standard to limit the rotary capacity on any section of station or substation bus to 2000 kw and to assign a transmission line to each section. This practice was based on the assumption that the rotaries could safely carry 50 per cent overload and that a No. 0000 cable could carry 3500 kw at 9000 volts. This was standard practice all over the country a few years ago. Until recently 2000-kw rotaries were standard, but lately the size has been increased to 3500 kw for lighting and 4000 kw for railway substations. As high as 4500 kw per bus has been used on the sixty-cycle lines. The standard lighting cable has therefore been increased to 250,000 circ. mil and the railway cable to 300,000 circ. mil. This is the limit for a 3.5-in. duct with 350-ft. or 400-ft. draw. The railways used proportionately larger cables as, owing to the fluctuating nature of the load, railway cables are more apt to be overloaded.

The company is looking forward to parallel operation as the next step. In the "Loop" district there is already a 28,000-kw load. With the subdivision into several units as at present a cable capacity of 42,000 kw is necessary, allowing a 50 per cent reserve. The best that could possibly be done with individual operation in any case would be one reserve cable for three substations, say 15 per cent reserve. Parallel operation will permit a more efficient use of copper. It is the live problem in underground transmission.

The loading of lines is ascertained from weekly reports furnished from all substations showing the maximum loads on every feeder and the times when these occurred. On the basis of these and the voltage records the engineering department specifies on Jan. 1 of each year what circuit revision work is necessary. New maps showing changes are made, a diagram in standard form being made for each change. The general maps are revised as soon as the changes have been made. When changes have been made the street department notifies all departments concerned and especially the load dispatcher, so that they will know of new cable cut in and of the condition of all cables. Two men are constantly engaged in private right-of-way work, so that routes for necessary lines may be available when required.

The matter of safety has been already mentioned. Rules are useless unless understood and enforced. To insure intelligent compliance the general foremen hold weekly meetings with one of the superintendents, and together they form an overhead-line examining board. They examine the men on safety matters and on their understanding of the proper way of doing line work—that is, making joints, cutting-in transformers, etc.—without interfering unnecessarily with service and with the elimination of the element of danger. Outside foremen and linemen are all examined at least once a year and some are up for this purpose every week. While engaged in this work the examining board also considers methods of making repairs and reports recommendations to Mr. D. W. Roper, assistant to the chief operating engineer. The close co-operation secured by these weekly meetings insures progress in method and spirit. The chairman of the board is the engineer of the street department, Mr. A. Balsley. He follows out the recommendations of the board and keeps in close touch with the work of all of the foremen who compose it.

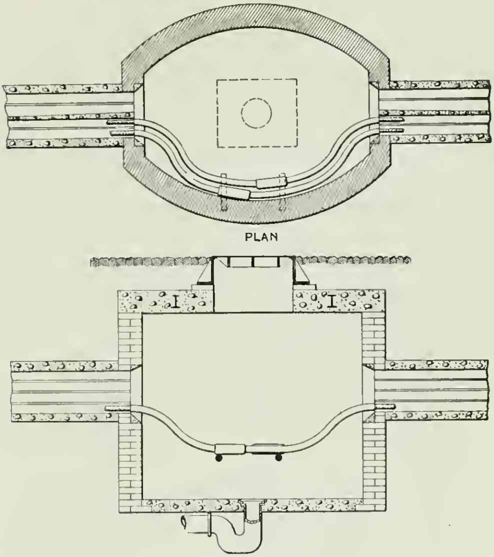


FIG. 9—TYPICAL MANHOLE FOR HIGH-TENSION DISTRIBUTION

In connection with line operation studies are being made in the hope that definite conclusions can be reached later as to the best means to be used for protecting apparatus from lightning. Eight of the circuits have been equipped with lightning arresters on every transformer pole. The transformers on eight other circuits have been replaced by others having submerged terminal boards or no terminal boards at all, as arcs across terminal boards have been found to give considerable trouble.

In a later issue of the *Electrical World* there will be given descriptions of substation and battery equipments and accounts of the inspection and repair of cables and pole lines, the prevention of electrolysis, and operating methods.

Meeting of American Institute of Electrical Engineers

Papers dealing with generation, transmission and distribution of electrical energy, protective apparatus and economics of power-house design, and discussion incident thereto

IN last week's issue of the *Electrical World* was published an account of the first day's session of the second midwinter convention of the A. I. E. E., including reports on engineering data and the feasibility of an A. I. E. E. handbook, and papers on protective reactances and indoor and outdoor substations. This week's account covers the proceedings of Feb. 26 and 27, and of a publicity meeting on the evening of Feb. 25.

I. E. C. Publicity Meeting

On Wednesday evening, in the auditorium of the Engineering Societies Building, a publicity meeting to stimulate interest in the International Electrical Congress, San Francisco, 1915, was held under the auspices of the Congress committee on organization. The addresses touched particularly upon the popular and more interesting phases of the forthcoming Congress, the Panama-Pacific Exposition, and the trip to San Francisco, and were illustrated with lantern slides and moving pictures.

Dr. C. P. Steinmetz, Schenectady, N. Y., honorary president of the 1915 congress, recounted briefly the achievements of past electrical congresses in acquainting the engineers of one nation with the methods and practices of others, often so radically different. Each international electrical congress, declared Dr. Steinmetz, has marked some great step in electrical engineering, and he predicted that the 1915 meeting will witness the inauguration of interstate and international transmission networks paralleling the railways and transporting energy developed at one point for consumption in other centers.

Dr. William Rader, Pottstown, Pa., presented an illustrated address on the Panama-Pacific International Exposition, and Mr. W. D'A. Ryan, Schenectady, N. Y., described the plans for lighting the grounds, buildings and interior exhibition spaces of the exposition, for which he is illuminating engineer.

Mr. J. A. Cruikshank, New York, gave an illustrated lecture on scenic features of the trip across the continent, and Mr. Paul M. Lincoln, Pittsburgh, Pa., reviewed briefly the principal electrical developments of the United States.

Problems of High-Tension Transmission Lines

Some important problems which have to be considered when building and operating high-voltage lines were pointed out in the report of Mr. P. W. Sothman, chairman of the sub-committee on transmission. Routes crossing streams or mountain ranges and passing through districts frequented by lightning storms should be particulary avoided. Short cuts may be made across cultivated land, but it is preferable to follow highways, steam or electric rights-of-way, etc., to facilitate patrolling. The author emphasized the need of having the A. I. E. E. adopt specifications for line cross-overs. Factors determining the type of towers to be employed were enumerated and the square or four-legged type was pointed out as being generally more economical to construct than the three-legged type. Companies should proceed with caution when considering the adoption of flexible towers. Where transmission lines are liable to be coated with ice or snow, it is not advisable to support the conductors in a vertical plane as they may come in contact with each other. In the East ice has been observed to collect mainly at the center of wire spans; therefore conductors should be designed with this in view. The method of designing towers should be standardized, so that instead of its being necessary to order special-design towers it will be possible to obtain orders immediately by specifying a certain loading. Recommendations were also made on the strength of material required in towers and the minimum degree of disturbance to allow for. Erecting towers by tilting them into place sometimes weakens them; therefore a final inspection should be made after installation. Galvanizing of towers, because of its durability, is usually preferred to painting, but the latter, if done periodically, affords good protection. Hard-drawn copper cables should not have hemp centers, as a semi-chemical and mechanical action usually sets in, weakening the strands. It is reported that aluminum cables with steel cores are not considered satisfactory by English manufacturers, for similar reasons. The report suggested that a set of curves be evolved, based preferably on the catenary, from which sags can be quickly and accurately determined. While overhead ground wires generally afford protection against lightning, the reports of damage on protected and unprotected lines make this a much-mooted question. The experience of several companies with disk-type suspension insulators failing after being in service a year or two is probably due to aging of the porcelain from electrical fatigue. For equalizing the potential gradient over suspension insulators on lines carrying 110,000 volts or higher, shields may be used on the end units, but this practice is not necessary at lower voltages. Attention was called to the neglect of designing line clamps with smooth outlines to reduce the surrounding electrostatic field. The improved results obtained with transformers designed to withstand severe disturbances show the advisability of strengthening apparatus rather than installing devices to protect it. Most of the telephone disturbances now experienced are caused by poor insulation. The report closed with a description of a method of eliminating disturbance on a transmitting company's telephone line. Abstracts of the four appendixes to the transmission sub-committee's report follow:

Deterioration of Porcelain Insulators in Service

In his appendix to the sub-committee's report on transmission Mr. J. A. Brundige said that engineers are beginning to believe that a large number of porcelain and glass-insulator failures can be attributed to electrical fatigue just as with rubber and compound-treated fabrics. While the cause of the fatigue is uncertain, evidence seems to point to transient over-voltages. It is possible to obtain high dielectric strength and toughness, the two principal requisites of insulators, if the porcelain is fired properly. Insulators must be designed to withstand temperature changes and prevent flash-overs, or failures may ensue in spite of high dielectric strength if the outline is not smooth. A good test for revealing minute cracks in insulators is to draw a line of ink across the surface of the insulator. The ink will be drawn by capillary attraction along the cracks, if any are present. A high-range megger is recommended for locating insulator faults which cannot be discovered by any other means. A boiling-water test for ascertaining the ability of an insulator on a pin to withstand temperature change was described. Enough data are now available, it is declared, to design insulators properly so that less trouble will be experienced with them in the future.

Radius of Influence of a Direct Lightning Stroke

Through a continued personal inquiry the author of this report, Mr. L. C. Nicholson, has obtained an estimate of the radius of influence of direct lightning strokes. His paper pointed out that it is doubtful if any insulator in use at the present time will withstand a direct lightning stroke on the line, whether the latter is equipped with protective devices or not. Observations show that some lightning strokes have a diameter of about 20 ft., showing that a single ground wire cannot be expected to intercept a direct stroke. Extended observations on lines supported by 60,000-volt pin-type insulators and unprotected by ground wires led to the estimate that the radial influence due to induction from lightning is rarely in excess of 2000 ft. The extent of radial influence is probably proportional to the energy dissipated in the lightning stroke. Better insulated lines are not so easily affected by induction. In New York about 10 per cent of all 60,000-volt line disturbances from lightning are caused by direct strokes.

Transmission-Line Problems in the West

Conditions met with near the San Antonio Light & Power Company's transmission system in southern California were brought out in Mr. P. M. Downing's appendix to the sub-committee report. The company, which had a pioneer 10,000-volt transmission, originally employed ten 1000-volt transformers because higher-voltage units were not available at that time. Snow and lightning do not have to be contended with generally in that locality, so that protective devices are not usually installed, a horn-gap arrester being satisfactory in most cases. During the dry seasons, however, salt sea fog condenses on the insulators and leakage sometimes causes the pole and conductors to burn off. Cleaning the insulators improves conditions and the rains during the wet season help considerably in removing the deposit. Trouble due to this leakage is prevented most effectively by tying the pins together electrically. They are not grounded as this might cause arcs to be established between the conductors and ground.

Regulation of voltage is secured by floating synchronous condensers on the line at important distributing centers. Automatic outdoor oil switches are used quite extensively on the branch circuits and for sectionalizing trunk lines. The trip relays are connected in series with the main line, to avoid the use of current relays. The author pointed out the fact that manufacturers have failed to support transformer windings sufficiently to prevent distortion when short-circuits occur. Instead of using vertical spacers between transformer coils, he recommended employing short strips placed diagonally across the coils, or wave-shaped strips which will allow free oil circulation and also support the coils.

Switching

The conditions under which high-tension switching will produce the greatest disturbances were brought out in the appendix by Mr. G. Faccioli. Two of the most undesirable conditions are to connect a dead line at zero potential to another alternating-current circuit when the instantaneous emf in the latter is passing through its maximum value, and to disconnect a short-circuited line from a supply source when the instantaneous current is at its maximum value.

Oscillations may occur between inductance and capacity massed at separate points or distributed along the circuits. If switching is accompanied by arcing, the potential rise may become dangerous, as the oscillations sent out may strike a localized oscillatory circuit having the same natural frequency. High-tension switching should therefore be done judiciously, and then only when special precautions are taken to avoid disturbances. The blowing of fuses is accompanied by similar but more exaggerated disturbances as fuses usually open under load. Low-tension switching is considered preferable to high-tension operation.

Practical Operation of Suspension Insulators

In the paper by Mr. H. W. Buck it was pointed out that unlimited deflection of suspension insulators requires large conductor clearances and consequently more expensive towers. By attaching auxiliary weights to the insulators and by employing the proper-size conductor, insulator deflection may be minimized. A table accompanying the paper indicates the size of conductor and auxiliary weight to use for definite wind pressures and deflections. Insulators should be counterweighted, especially when supporting aluminum cables, as the latter are light and expose relatively large areas to wind pressure. Use of weights on insulators also equalizes the slack in cables which might cause a short-circuit if allowed to become excessive especially when the conductors are arranged in a vertical plane. The whipping action caused in cable transmission lines when a span is struck by a sudden gust of wind may be minimized by installing dead-end insulators at frequent intervals. Ballast weights are also advantageous on these insulators in preventing side-swing of jumper connections, but the latter should be designed to allow lateral movement. Other suggestions made in the paper were that considerable clearance be permitted between the over-

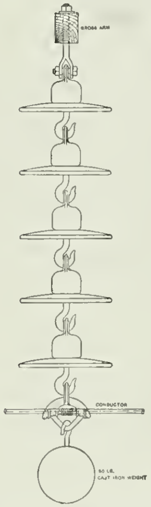


FIG. 1—BALLAST WEIGHT FOR TRANSMISSION-LINE INSULATORS

head ground line and the conductors, but that too much should not be allowed between the latter.

Discussion

In opening the discussion on Mr. Sothman's paper, Chairman Rushmore made the comment that insulator design has now reached a point where exact mathematical methods must be applied. Mr. H. W. Buck, New York, referred to the fact that exact scientific considerations are sometimes neglected when meeting the practical conditions of field erection and he recommended that specifications in design consider the problems of the construction crew.

Mr. F. W. Peek, Jr., Schenectady, N. Y., enumerated the factors of energy, wave-shape, time-element, voltage, etc., necessary for a study of transmission-line phenomena. To illustrate the significance of the "time element" of a spark-gap, the speaker showed that if two gaps be connected in parallel the one having the smallest time-element will be bridged in spite of the reduced sparking distance of the other gap.

Mr. C. E. Waddell, Asheville, N. C., recommended the method of obtaining easements in securing rights-of-way for transmission lines as being preferable to outright purchases. Wider routes are usually thus secured more cheaply, the agreement often including a proviso for the cutting of the timber back from the property line. For transmission lines of 70,000 volts and under, Mr. Waddell expressed a leaning back toward wood-pole construction with non-grounded fittings. In the case of a certain steel-tower line which parallels a wooden-pole circuit, Mr. Waddell said that the tower line has shown innumerable interruptions, while the wooden-pole circuit has been without a single accident. He suggested that suspension-type insulators be pivoted with a hinge permitting them to swing freely in the direction of the conductors but restricting their movement transverse to the line. A given insulator may be tested in the laboratory as being satisfactory, said the speaker, but when installed in service and carrying a mechanical load the same insulator will often break down at a pressure much lower than the test voltage. In closing the speaker recommended the use of steel-core aluminum conductors as effecting savings of 10 to 15 per cent over copper.

Mr. P. H. Thomas, New York, declared that the trouble developed by insulators after a period of service is not due to deterioration of the porcelain nor to the presence of electrical potential, but appears to be an inherent result of the process of manufacture. During the twisting operations to which the insulator material is subjected planes of separation probably form, and these, although glazed over and concealed, ultimately result in trouble. In the respect of avoiding such troubles the two-piece insulator has an advantage, since if one shell is defective it is not likely that the other will be.

In a written communication, Dr. William McClellan, New York, discussed the subject of transmission-line towers, and advised that out of a given design or group at least one tower be tested to destruction. He recommended replacing the usual factor of safety with a "margin of safety" based on the difference between the ultimate strength and the working stress. Such a nomenclature, he pointed out, will avoid the tendency on the part of the construction man to consider a tower good for any load not exceeding that for which it has been tested. Mention was also made of the use of special semi-tension strings of insulators for anchoring, two strings being arranged like an inverted V at angles of 45 deg. to prevent one span from robbing an adjoining span of its sag.

Prof. V. Karapetoff, Ithaca, N. Y., objected to the form of expression of Mr. Rushmore's recommendation that line conductors be drawn up tight, and asked that this be modified so as not to discredit the desirability of calculating sags in conductor spans.

Mr. P. M. Lincoln, Pittsburgh, Pa., reported that he had never observed any bad effects due to switching on the high-tension side. The surges due to switching, he pointed out, are slight, and a system disturbed by such slight surges would not withstand the effects of lightning. Mr. A. O. Austin, Barberton, Ohio, pointed out the difficulty in outlining the cost of a given class of line construction unless local conditions are known. He called attention to the fact that the suspension insulator has a higher flash-over point than the corresponding pin-type insulator and will not spill at pressures at which an equivalent pin-type unit breaks down. Mr. Austin also exhibited a number of lantern slides showing the failures of pin-type and suspension-type insulators. Among the number were several micro-photographs showing the formation of calcium-sulphate crystals in the cement used in the insulators. The formation of these crystals, it is explained, develops considerable bursting action. Circuits were also shown for the manufacturer's final tests, using high-frequency alternating-current and rectified unidirectional potential.

Mr. Farley Osgood, Newark, N. J., declared that the operating engineers of the country are not doing their share in helping manufacturers solve their insulator problems. He asserted that it is impossible for a busy electrical system to avoid frequent switching operations, and he insisted that apparatus must be designed to meet the conditions imposed by ordinary operation.

Mr. J. A. Sandford, Jr., East Liverpool, Ohio, said that the kaolin used in insulator manufacture is practically identical in composition for a large number of the principal deposits from which the porcelain industry is supplied. He decried the existence of fatigue in porcelain and declared that troubles which develop with use have their causes in original flaws in the insulator.

Mr. Julian C. Smith, Montreal, Quebec, said that there is no reason to believe that suspension-type insulators are worse than pin-type insulators in showing trouble of this kind, although the fact that suspension insulators are usually operated with one end grounded involves more severe conditions for this type of unit. He also pointed out the fact that the line must be insulated for the maximum pressure which it is likely to have to withstand from whatever cause, regardless of the nominal operating voltage.

Mr. E. A. Lof, Schenectady, N. Y., urged the placing of transmission conductors high enough to be out of the way of any possible contact from the ground. He also questioned the necessity of grounding steel towers provided with concrete bases.

Mr. E. M. Hewlett, Schenectady, N. Y., said that it has not yet been proved that well-vitrified porcelain undergoes fatigue. Such troubles as develop can usually be traced to faults which are concealed for a time by the glaze covering.

Mr. S. Haar, New York, pointed out the large number of high-tension transmission lines now in operation or shortly to be inaugurated, both in the United States and abroad, including such remote countries as Tasmania, Japan, South Africa, India and South America.

Thursday afternoon's session, which was in charge of Mr. H. W. Buck, New York, was devoted to the presentation and discussion of papers on the economics of power generation. The first paper was an elaborate treatise on the method of properly proportioning the sizes of combining steam-hydraulic plants.

The Economical Capacity of a Combined Hydroelectric and Steam-Power Plant

Mr. Cary T. Hutchinson's paper described a general method for determining the economical capacity of a combined steam and hydroelectric development. The scheme suggested involved the use of a "per-cent-deficiency" diagram, summarizing the stream-flow data, and a "per-cent-load" curve, showing the characteristics of the load. The first diagram represents the percentage that the stream flow must be increased to bring the minimum flow up to any assumed value, and therefore indicates the percentage which must be compensated for by steam power. The second curve, based on the energy demand, shows directly the percentage of the total energy which is delivered above any percentage of the maximum power output of the combined plants. The rating of the reserve steam station is therefore determined by the latter curve. The diagrams are used differently, depending on whether the hydroelectric plant has pondage or not. When the energy demand drops for a considerable period below the minimum amount of energy which can be supplied by the hydroelectric plant, it is advisable to supply the base load from the stream and the peak load from the steam plant. In solving numerical examples to show how to estimate the size of the reserve plant, it was pointed out that the cost of the auxiliary energy supply affects the degree to which the main hydraulic plant should be developed. The cost of any hydroelectric development is made up of an amount independent of the rating plus other items which are proportional to the rating. Estimated from a number of developments, the average ratio of the fixed to the total cost is 68 per cent. For hydroelectric plants the fixed annual charge is generally about 14 per cent, while for steam stations it is 20 per cent.

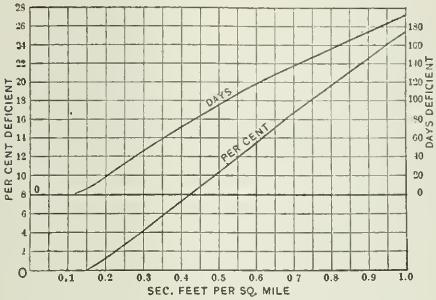


FIG. 2—AVERAGE PER-CENT-DEFICIENCY AND CORRESPONDING AVERAGE DURATION CURVES

The Cost of Electricity at the Source

By employing the Stott-Gorsuch method, Mr. H. M. Hobart showed that three-phase energy can be delivered to outgoing cables at from 0.91 cent to 0.41 cent per kw-hr. from a 100,000-kw, sixty-cycle generating station operating at 0.5 load-factor with coal costing from $5 to 50 cents per ton. Curves accompanying the paper indicate at a glance the relation between the load-factor, cost of coal and cost of delivering electricity to outgoing cables. These curves are plotted on the assumption that the total investment in the plant per kilowatt is only $35. For water-power plants where there is no charge for water fuel may be considered as negligible in cost. A method was indicated for tracing the increase of cost of electricity at later stages of its journey from the original source to the ultimate consumer.

Discussion

In the heated discussion which followed the delivery of Mr. Hobart's paper, the opinion was generally expressed that too low values had been assumed in determining the cost of generating electrical energy. It was also stated that this paper might be detrimental to the electrical industry as A. I. E. E. proceedings are often quoted as evidence in court proceedings concerning equitable rates to be charged for electric service. Moreover, there will be a tendency for municipal bodies to conclude from this A. I. E. E. paper that all plants can be built for $35 per kw installed, and the low cost of generating energy will be looked upon as the price at which energy can be delivered to customers' premises.

Mr. H. W. Buck, New York, declared that the decreasing cost of energy produced by steam generating stations will make them serious competitors of hydroelectric plants.

Mr. J. W. Lieb, Jr., New York, stated that under conditions obtaining in metropolitan cities like New York $35 per kw of generating equipment installed in a station will rarely cover the bare investment in real estate and buildings.

Mr. H. R. Summerhayes, Schenectady, N. Y., pointed out that now, in a time of mine and railway strikes, the cost per kilowatt of equipment installed is increased considerably by the necessity of providing coal storage.

Dr. C. T. Hutchinson, New York, declared that the buildings and real estate alone for the Fifty-ninth Street plant of the Interborough Rapid Transit Company, New York, cost approximately $65 per kw installed, while the equipment increases this value by $80. The Keokuk installation, where the cost of equipment is about $180 per kw, was cited as another case proving that the value assumed by Mr. Hobart is extremely low. If an investment of $35 per kw installed were sufficient, a steam plant could be operated at extremely low load-factors and still compete in rates with this mammoth hydroelectric development.

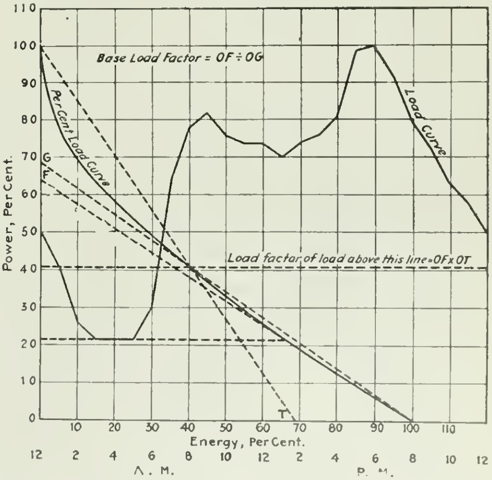


FIG. 3—A PARTICULAR LOAD CURVE AND THE PER-CENT-LOAD CURVE CORRESPONDING TO IT

Mr. H. W. Buck pointed out that the investment required for a steam plant does not necessarily have to be so large as that for a hydroelectric plant since the company operating the former is not compelled to construct expensive high-tension transmission lines or to maintain a right-of-way to deliver energy to the consumers.

Mr. F. A. Scheffler, New York, said that a company in the West considers that it will be constructing a 120,000-kw station with extreme economy at $45 per kw, but added that it is doubtful if the work can be completed at this figure. The plant will include 20,000-kw turbine units and 2400-hp boilers.

Mr. H. L. Wallau, Cleveland, Ohio, called attention to the unjustifiable demands to adjust rates which, he said, will probably be made by some municipal bodies after reading Mr. Hobart's paper on generating costs. At present an ordinance is pending in Cleveland for a maximum energy rate of 3 cents per kw-hr.

Mr. H. B. Alverson, Buffalo, N. Y., said that load-factors of 50 per cent and higher are rarely obtained, being more often between 30 per cent and 45 per cent.

Dr. Hutchinson advised against the publication of Mr. Hobart's paper as it would be detrimental to the central-station industry, he said.

Mr. O. K. Harlan referred to a paper presented before the American Society of Heating and Ventilating Engineers in which an early installation was traced down to the present time, showing the equipment replacements made necessary by obsolescence, depreciation, etc. The speaker pointed out how these replacements materially increase the cost of energy production. Apparatus which is operating in a perfectly satisfactory way has often been superseded by more efficient apparatus requiring more capital investment. Twenty years was quoted as a useful life for some plants, but this value should be modified because of obsolescence.

Mr. C. F. Scott, New Haven, Conn., declared that the assumptions and results in Mr. Hobart's paper may be ideals to be attained in the future but are certainly not present realities. Floor-space requirements for generating units have been reduced by modern improvements, but the resulting building economies are usually counterbalanced by equipment replacement charges, as there have been several generations of electrical apparatus developed in the last twenty years. He added that Mr. Hobart's generating-cost figures may be mistaken by the lay public to mean total cost, which is not correct as the distribution expenses alone may equal those of generation. As protective equipment is more elaborate than ever, the total cost of delivering energy has been increased rather than decreased.

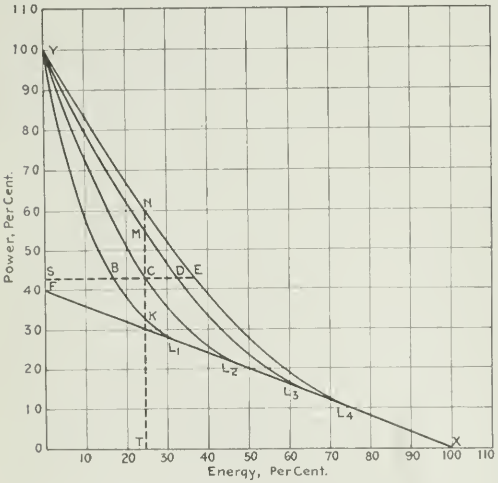


FIG. 4—PER-CENT-LOAD CURVES WITH SAME LOAD-FACTOR SHOWING DIFFERENT AUXILIARY POWER REQUIREMENTS

Mr. H. C. Abell, New York, took exception to Mr. Hobart's assumption of 5 per cent for interest, saying that this was too low. He added that depreciation is more important in estimating expenses than is amortization.

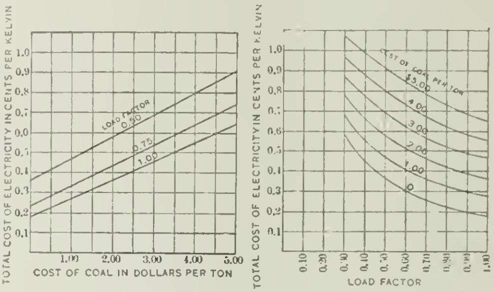


FIG. 5—CURVES SHOWING RELATION OF ENERGY PRODUCTION COST, PRICE OF COAL AND LOAD-FACTOR

Mr. A. H. Kruesi, Schenectady, N. Y., expressed the belief that obsolescence is still more important to consider than either depreciation or amortization. While some boilers have a life of twenty-five years, they generally become obsolete in eight to ten years. Switchboards have become out of date in fifteen years. Fixed charges should not be assumed to be less than 15 per cent, he declared.

Dr. Hutchinson pointed out that since 1886 five complete changes have been necessary in the equipment of the New York Edison Company, making an effective life of about six years for each installation.

Prof. Vladimir Karapetoff, Ithaca, N. Y., said that while the principle employed in Mr. Hobart's paper is correct and the numerical results used are more effective than symbols, the substance of the paper will be misused in court testimony. It would be better to attach the example to some specific case. The speaker also suggested that the Thury system of direct-current generation and transmission receive consideration in the form of an Institute paper giving comparative costs with other systems.

In closing the discussion, Mr. Hobart substantiated his assumptions by values obtained from central-station practice near London, England. He emphasized the fact that his figures were not intended to be representative of conditions in or near large cities, and acknowledged that his assumptions on fixed charges might be low. In one plant in England 6000-kva generating units were purchased from a German concern at $6.50 per rated kw.

Distribution of Electrical Energy

In the report of the sub-committee on distribution, submitted by Mr. P. Junkersfeld, chairman, there were outlined certain recommended distribution practices. Unified operation of generating plants is universally advantageous, as has been amply demonstrated. Substations serving two independent railway systems have also been similarly operated to good advantage in Chicago. By serving railway, lighting and motor circuits from the same substation considerable economies have been effected because of the use of less land and reserve high-tension cable, better load-factor, lower cost per kilowatt installed and decreased operating expenses. The importance of laying out distribution lines properly is shown by the fact that in large cities the fixed charges and operating expenses of a distribution system are about three times those of the generating system. An interconnected distributing system is also considered advisable.

Three-Wire Direct-Current Distribution

The permanency of usefulness of the three-wire direct-current system is emphasized in Mr. Philip Torchio's paper. The method of interconnecting feeders, arrangement of subway ducts, types of service connections and equipment of substations as used in a particular case were described. The feeders are interconnected at each street crossing, the total amount of copper in the neutral feeders being about 12 per cent of that in the positive and negative conductors combined. The author said that if the multiple tungsten lamp encroaches into the field of the arc lamp, the advantages of first cost and greater radius of the high-voltage systems will assume greater prominence than they have done heretofore.

Among the latest developments which make possible economical and simplified station operation are the split-pole converter, the synchronous booster and the commutating-pole synchronous converter, with graphite brushes, slotted commutators and self-lubricating copper-graphite brushes for collector rings. Six-phase converters connected diametrically will operate under practically the same conditions as the double-delta type and require simpler connections with the transformers. The installation of storage batteries in substations is a distinctive feature of modern equipment.

Alternating-Current Distribution

For bulk distribution of alternating-current energy, 6600 volts, said Mr. H. B. Gear in his report, is generally used where the radius of energy delivery does not exceed 6 miles; above that distance 20,000 volts is commonly employed. The paper calls attention to the extensive use of 30,000-volt underground cables in Germany. When the direct-current load predominates twenty-five-cycle energy is usually generated, frequency changers being used to supply the alternating-current circuits. If the load on the latter is largest, it is considered best to generate sixty-cycle energy. Bulk-supply systems are preferably built with radial lines and interconnected circuits. As large cables as can be handled should be installed since the kilowatt-carrying capacity increases more rapidly with the size of a cable than does the cost. About $1,000,000 invested in surplus cables in New York and Chicago could have been saved if the circuits could have been operated in parallel and larger converting units had been available prior to 1910. Mr. Gear called attention to a modification of the Merz-Price system of operating circuits in parallel, using "split conductors" which eliminate the use of pilot wires. The equipment of alternating-current substations was described, it being pointed out that induction-type regulators are generally superseding the transformer type. The transformer investment in modern 5000-kw substations is less than one-third of the total cost of the stations.

Single-phase distribution is usually cheapest for small lamp and motor loads, and four-wire, three-phase primary distribution is more economical than the three-wire system when the load exceeds 2000 kw. By supplying lamp and motor loads over the same circuit the power-factor can usually be kept up, and the diversity of demand allows considerable reduction in feeder sizes when the loads have the same magnitude. Since primary feeders cannot be operated in parallel practically because of difficulties in fuse protection, feeders should terminate as close to the center of distribution as possible. Diagrams were published to show methods of laying out single-phase and three-phase systems with this in view. Where possible facilities should be provided for making emergency connections between adjacent feeders, the disconnecting type of pot-head being well adapted to this purpose. Secondary distributing circuits can be connected in a network, for if the load is dropped by one transformer it will be divided among the remaining transformers without danger. Each transformer feeding a network may be equipped with a "network protector" which will automatically disconnect the transformer if it becomes defective. These protectors, which are small transformers having the same ratio as the main transformers, have their windings connected in series with the primary and secondary circuits so that their fuses will blow if the main transformer becomes defective. Secondary circuits may also be fed from centrally located substations or transformers installed in vaults. When the load in a city block exceeds 150 kw it is generally advisable to use direct-current distribution. Checking transformer loads with demand indicators to show the size of transformers required was recommended as a means of minimizing transformer investments. Figures were also presented to give an idea of the average energy demand of individual consumers and groups of consumers. Underground construction should be employed only where required, as on 2200-volt systems it costs from three to five times as much as overhead work.

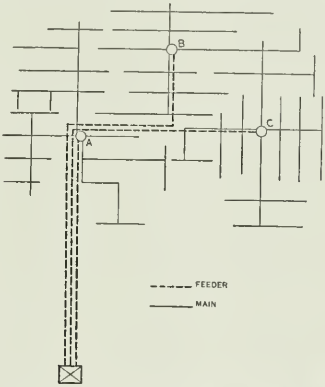


FIG. 6—DIAGRAM OF A THREE-PHASE, FOUR-WIRE DISTRIBUTION SYSTEM

Effect of Consumer's Apparatus and Wiring on Distribution

Mr. H. Goodwin in his report emphasized the importance of limiting the size of motors which may be connected on single-phase and polyphase lines. The minimum horse-power which electric-service companies allow to be connected on polyphase circuits ranges between 1 and 7.5. Polyphase motors are especially desirable in respect to cost and operating characteristics from both the consumer's and the central station's viewpoints, but the investment in lines, transformers and meters for small motors is greater than for single-phase units. To limit the starting current of elevator induction motors, the resistance change in the rotor-circuit should be made to depend on the current in the feeders. To avoid meter burn-outs it is preferable to connect wireless apparatus to separate transformers. When connected to a primary line designed for a total load of 100 kw or more, electric welders and riveters, used singly, will not cause much disturbance. Best practice on single-phase lines now demands 220-110-volt distribution, a rating of 220 volts for all motors of 1 hp or over, and balancing of load circuits of twenty-four lamps or over. As the continuity of electric service is now quite generally established, the restrictions placed by the Underwriters on motor-driven fire pumps should be readjusted. The policy of running underground service from underground lines is quite common, but not so from overhead circuits. Consumers can be induced to use apparatus having a high power-factor if the energy rate is made to depend on the maximum energy demand. It would also be desirable to base the minimum energy charge on the motor starting current rather than on the rating.

Direct-Current Distribution for Surface Railways

Street-railway substation and feeder equipment was described in the paper by Mr. R. H. Rice. Because of the increasing reliability of modern electrical apparatus traveling cranes are now being omitted from substation equipment, making it possible to employ lower buildings. Attention was called to the practice of interconnecting converter equipment for emergency operation. The investment in and space occupied by large rotary converters is considerably less per kilowatt than for the small units. Methods of running feeders and supporting trolley wires were described. The radial system of feeding trolley circuits is not so economical as the network system, but is more generally employed because of the ease of sectionalizing in emergency. The author recommends grounding lightning arresters to moist earth rather than to track return circuits. When feeders are supported overhead about five or six lightning arresters should be used per mile. The author recommends using about three insulators between a trolley wire and the span pole. In a system with many feeders and frequent taps the conductivity of the trolley wire is not so important, but its toughness and tensile strength are. A method of computing feeders from the operating schedules was briefly described. Feeders should be designed to carry the current estimated from a two-hour average. A 1,000,000-circ. mil cable is a desirable maximum size to use as it may be easily installed in 3-in. or 3.5-in. ducts. It was suggested that some tests be conducted on the allowable carrying capacity of cables laid in ducts in the earth. When several stations supply energy to a trolley system it is advisable to connect them with equalizing bus-tie circuits. Methods of installing grounded and insulated track returns were described. Negative-return feeders should be connected to each other and to the tracks at frequent points, and the rail joints should preferably be welded to prevent electrolysis of surrounding pipes by stray currents. Short return feeders near the substations may become overloaded unless resistance is inserted to make the drop similar in all returns. Negative boosters may be used with the insulated return system, but they add many operating difficulties.

Direct-Current Distribution for Underground and Elevated Railways

Third-rail systems with track returns as used in this country were discussed in Mr. E. J. Blair's report. Reference was also made to unique equipments in Paris and London operating on the three-wire system. In the latter city where a double-track tube is installed and the traffic practically balanced the third-rails of each track serve as the outer conductors of a three-wire system, while the running rails are used as a grounded neutral. In Paris the third-rail, trolley wire and running rails are used as the three conductors of a three-wire system. In both cases the stray currents are minimized and the running rails are not required to carry much current. Common methods of sectionalizing track circuits were described. One double-track system was recommended in which the track circuits were separated and divided into sections with practically no track switches. A substation feeding a double-track system in two directions should not be required to deliver more than 5000 kw. Where the feed is in four or six directions, as at junction points, a single station may economically supply 10,000 kw. Single sections should be restricted to a length of 2 miles and a load of 4000 amp. By using small substations installed at frequent intervals the track drop can be considerably reduced.

Direct-Current Distribution for Interurban and Steam Railroads

Mr. W. G. Carlton's report gave a brief history of the application of electricity to interurban and steam railroads. It was stated that storage batteries are no longer being used as a part of railway equipment to any great extent, as substation, transmission and generating apparatus is more reliable than formerly. The tendency is to employ 1200 volts or higher on all interurban and electrified steam roads of considerable length. Twenty-eight railroads in this country are now employing or are preparing to use 1200 volts with overhead trolley.

Energy at this voltage is generated directly in a few cases, but as a rule is furnished by converters or motor-generators connected in series. A brief summary of the Butte & Anaconda Railroad equipment closed the paper.

Alternating-Current Distribution for Interurban and Steam Railroads

Mr. W. S. Murray declared in this report that the alternating-current contact wire has no place in the interurban field where the same equipment must be also operated on direct-current city systems. Economies in electrified steam-railroad operation can be secured by delivering twenty-five-cycle high-voltage alternating-current energy through a single overhead conductor. Single-phase, split-phase and even direct-current motors (through the medium of a rectifier) can be used with this system.

The Relation of Distribution Problems and Switching Apparatus

In his paper Mr. E. B. Merriam stated that switching and auxiliary apparatus should be capable of maintaining safe and continuous service, opening overloaded circuits without disturbances, and operating the system at maximum efficiency. On alternating-current systems of 2500 volts or higher switches should be mounted remote from the switchboard on iron or steel bases. It was declared that remote-control 750-volt direct-current switches are becoming standardized. Methods for indicating faults in a distributing system were described. One device consisting of a special series transformer surrounding a three-phase cable operates an indicator when the currents in the cable are unbalanced because of a ground or other fault. Another scheme which required long auxiliary wires depends for its operation on the difference between the current entering the supply end of a feeder and that leaving it. A modification of this device not employing auxiliary wires requires the separation of the feeder in two parts and balancing the currents entering and issuing at the ends of the two sections. Overload, reverse-power and kindred relays were also briefly described. Improvements in alternating-current oil switches are needed, such as facilities for breaking a circuit more rapidly, better confinement of the oil around the arc and an increase in the number of breaks in series. Among methods used for relieving the duties imposed on oil breakers were mentioned the placing of reactances in the circuits to limit short-circuit currents, automatically introducing reactance in the circuit after an abnormal disturbance but before the oil breakers open, and automatically inserting resistance in shunt with the switch during operation to assist in dissipating the energy. Attention was called to the use of ironclad switches of all kinds for protection of life.

Distribution for Street-Lighting Service

Street lamps should preferably be fed from a special distributing circuit, Mr. Paul M. Lincoln asserted, so that they may all be controlled from one point. Series distribution permits of central control, but if the lines are required to be installed underground it is usually cheaper to obtain energy from the general electric-service network and to switch the lamps in section. Constant-current direct-current machines for street-lighting circuits are being rapidly replaced by constant-current transformers and rectifiers. Other advantages of a series-lamp circuit were given as follows: Small investment in copper; no loss in ballast resistance as with constant-potential arc lamps; more durable metallic-filament lamps can be used, and reduced radiation from smaller filament areas (especially advantageous with nitrogen-filled lamps). Combination constant-current, constant-potential lamp systems were described. The paper also mentioned a special method employing a reactance shunt to by-pass a broken-filament lamp in a series system.

Discussion

Mr. H. L. Wallau, Cleveland, Ohio, pointed out how lack of centralization in a power generating system involves duplication of investment in land and equipment, as well as of labor. By concentrating the generating units, advantage is taken of the increased diversity, the improved efficiency of larger units, and lower operating costs. The Cleveland Electric Illuminating Company makes use of a special wholesale motor-service schedule in which credit is given the customer for a desirable power-factor.

In answer to an inquiry by Mr. S. D. Sprong, Brooklyn, N. Y., Mr. D. W. Roper, Chicago, Ill., said that short-circuits of the neutral conductor have given no trouble in the Chicago system, nor has any case of the neutral opening caused serious interruption except in a few instances where some outlying customers were affected. According to the present revised practice, the relay settings are now being raised, the idea being to protect the lines not from overloads but from short-circuits.

Mr. E. M. Hewlett, Schenectady, N. Y., pointed out that the operation of the "safety first" clause of the workmen's compensation act may involve serious requirements in the protection against accidental contact of all circuits or apparatus charged at a potential above 220 volts. He advised that proper distinction be drawn between electrical installations in industrial plants and those in power houses and substations under expert attention.

In reply to an inquiry by Mr. H. R. Summerhayes, Schenectady, N. Y., concerning the value of making the neutral conductor of the same size as the "outside" mains, Mr. Philip Torchio, New York, brought out the point that if the neutral is comparatively small and an unbalanced load occurs on the system, the resistance drop in the neutral conductor will tend further to accentuate the voltage unbalancing. The saving in cost between a smaller neutral and a full-sized conductor is so small that Mr. Torchio advised the use of full-sized copper throughout.

Mr. P. S. Taylor, Riverside, Cal., pointed out that in the case of opening an oil switch there is no more inherent reason why energy should be dissipated in the switch itself than in the parallel case of a valve controlling a water-supply system. The series system of arc-lamp operation, said Mr. Taylor, was not developed as a convenience in centralized switching, as explained by one of the authors, but resulted from the regulative characteristic of the arcs themselves and their familiar property of "negative resistance."

Mr. E. W. Trafford, Richmond, Va., described his plan of distributing 4000-volt, three-phase energy in a circuit feeding a total of 200 kva of regulator transformers installed at convenient points about the street-lighting system. In this way separate series circuits are employed having any desired current or voltage. It is also further proposed to improve the power-factor of such lighting circuits by employing static transformers in connection with constant-current units used as regulators, since it is not likely that all the members of a group of arc circuits will open simultaneously.

Mr. A. P. Kelly, Baltimore, Md., told of the trouble formerly experienced with induction motors dropping out when momentary interruptions occurred on the system. To avoid this difficulty, relays have been devised which within 0.7 second automatically close the switch and restore operation on the lines before the moving machinery has come to rest. An equipment of these relays is now receiving a practical test at Baltimore, and it is expected the device will prove particularly useful in substations where no attendants are employed. The relays can be set to close the switches successively once, twice or three times in case of continued trouble, and then failing, they remain out.

Mr. C. Schwartz, New York, presented a written communication in which he made the comment that the cost of generating electrical energy is generally less than the fixed costs of distributing the same energy to customers. He also described the system of distribution employed on the New York Central's 600-volt third-rail electrification entering the New York terminal. A proper comparison of alternating and direct current for any use, said Mr. Schwartz, should involve a study of over-all efficiency measured from the coal pile to the final point of application whether at the drawbar of a locomotive or the shaft of a motor.

Mr. W. A. Delmar, New York, called attention to the distinction which should properly be drawn between distribution and transmission and urged care in preserving correct terminology in the discussion of distribution problems.

The last session of the midwinter convention, held on Friday afternoon with President Mailloux presiding, was devoted to the subject of protective apparatus.

Recording Devices

In this paper Dr. Charles P. Steinmetz called attention to the importance of keeping electrical operating records, pointing out that accurate ones can only be secured by employing automatic devices as the personal element in manual recording is uncertain. The revolving-disk, endless-tape or photo-film, and multi-recording types of instruments were described and their characteristics and limitations commented upon. The first two types produce such condensed records that the sequence of fluctuations cannot be ascertained. With the multi-record device, however, which operates only when an abnormal disturbance takes place, events occurring one-quarter of a second apart can be easily distinguished.

Dr. Steinmetz elaborated upon his paper, emphasizing the importance of knowing what to protect against rather than how to accomplish it, as the latter is of secondary importance.

Discussion

The discussion which ensued related almost entirely to the multi-recorder mentioned in Dr. Steinmetz's paper.

President Mailloux read a written discussion contributed by Mr. Charles L. Clarke, New York, in which parts of Dr. Steinmetz's paper were emphasized, the merits of the multi-recorder commented upon, and the unreliability of personal observations pointed out. Mr. Clarke's discussion also explained how the device can be used to make power-station operation more automatic and how it can be applied to railway, police and fire-department operations and manufacturing processes.

Dr. E. E. F. Creighton, Schenectady, N. Y., briefly described the multi-recorder and referred to a more detailed description in Dr. Steinmetz's paper presented before the A. I. E. E. in 1912.

Dr. Steinmetz pointed out that the device records the exact sequence of events irrespective of the locality in which the disturbance occurs, thereby facilitating the comparison of happenings over an entire system.

The Present Status of Aluminum-Cell Lightning Arresters

According to the paper presented by Dr. E. E. F. Creighton, recent investigations have shown that lightning discharges from the clouds have wave-fronts of various degrees of steepness and are simply impulses and not high-frequency disturbances, as was believed at one time. Reference was also made to recent experiments conducted along this line by Messrs. D. W. Roper and L. A. De Blois. It was pointed out that as long as lightning is believed to have a low frequency and a sloping wave-front, the present types of arresters will endure in principle at least. If, on the other hand, it is proved that strokes have steep wave-fronts and frequencies in excess of 500,000 cycles the existing types of arresters will probably be superseded by "frequency absorbers." Two of the main protective features of an aluminum-cell arrester are its small dielectric-spark lag and its ability to absorb high-frequency potential of less value than normal line voltage.

The discharge rate of a direct-current aluminum-cell arrester at double normal potential is about a million times the leakage current at normal voltage. While the cost and upkeep of this arrester are greater than for older types, the increased expenditure is justified by the better service maintained. Dr. Creighton expressed belief that this type would not be superseded in principle, but thought it might possibly be supplemented in detail, as by the adoption of a cone film which will not deteriorate so quickly when disconnected from the circuit. He justified the use of resistance in series with alternating-current arresters as this arrangement limits the rush of charging current and assists the cell in radiating the energy of a high-potential discharge to ground. Attention was directed to foreign criticisms of aluminum cells which have not been duplicated in this country, and which may be due to inferiority in product, poor voltage regulation, high temperatures or improper supervision of the apparatus. In general, the trouble from these causes may be eliminated by employing charging resistances and the arrester made more nearly immune to damage thereby. Dr. Creighton stated that if a stroke is so intense that it will jump the horn-gap and go directly to ground through the cell without passing through the charging resistance, the menace to the arrester will be insignificant when compared with the damage which might have been done to the line insulation had the short cut not been taken.

Discussion

Mr. W. F. Peek, Jr., Schenectady, N. Y., said that an average of two to three interruptions per day due to electric storms on a mountain line in Colorado have been practically eliminated by the use of aluminum cells, and a larger load has been secured because of increased reliability of service. The line operates at 50,000 volts and the distribution system at 17,000 volts. The arresters were assembled and the electrolyte prepared on the ground about five years ago.

Mr. L. C. Nicholson, Buffalo, N. Y., declared that there is little danger to station apparatus from lightning disturbances on remote parts of the transmission line unless the conductors are highly insulated to ground as the charge is then usually compelled to follow the conductor. By employing gaps which will break down at 100 per cent over-voltage sufficient protection can usually be secured. Aluminum-cell arresters are very reliable, Mr. Nicholson believes, but the principal menace from lightning is directed at the line and insulators instead of at the station apparatus except in direct strokes. He recommends the use of charging resistances on aluminum cells.

President Mailloux suggested that the steepness of a wave-front arriving at a station may depend on the distance away that the disturbance originated and on the intervening reactance.

Dr. Steinmetz pointed out that in order to know where aluminum cells are adaptable operating companies should report when these devices protect against disturbances and when not. The greatest trouble from lightning or surges is caused by the local massing of voltage across a few turns of a reactor. He declared that multi-gap arresters are sensitive to high frequencies, but not to steep wave-fronts. A condenser itself is no protection against lightning, but it acts as a relative short-circuit to high-frequency energy, and a resistance in series with it will dissipate the energy of the disturbance. At a frequency of 100,000 cycles the power-factor of an aluminum cell is practically unity, and it therefore acts as a dead resistance to ground. While gradually relieving a line of an excessive voltage would cause less line surge, it is better to allow immediate relief to prevent the disturbance traveling to damageable equipment. Dr. Steinmetz corroborated President Mailloux's suggestion by saying that the steepness of a wave-front arriving at any point depends on the distance from that point to the place at which the disturbance originates. This can be shown by formulas if the inductance and effective resistance are expressed as functions of the frequency as they should be. He referred to a 90,000-volt line on which a steep wave-front was entirely flattened while traversing 20 miles of transmission line.

Dr. Creighton referred to Mr. Nicholson's remarks and stated that 100,000-volt insulators will usually confine a lightning disturbance to traveling along the conductor, thereby damaging at its terminus the station apparatus. As insulators should be sufficiently large to prevent lightning flash-overs, there is more need of aluminum cells to protect against over-voltages. He stated that considerable trouble has been eliminated by employing aluminum cells. Dr. Creighton closed by saying that he believed porcelain has different insulation values with different wave-fronts and frequencies.

The session was adjourned after President Mailloux had called attention to the success of the last two mid-winter conventions and expressed hope that each succeeding meeting might be equally beneficial.

Ceylon's New Cable Service to London

With the opening of the present year the Eastern Telegraph Company's new cable circuit from Penang to Colombo was completed and communication established between London and the Far East. The Ceylon government is transmitting all of its foreign telegrams over the new cable instead of via India as hitherto.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Sixty-Ton Electrically Equipped Ice Plant at Keokuk

One of the concerns taking advantage of the hydroelectric energy generated by the Mississippi River Power Company at Keokuk, Ia., and distributed locally by the Keokuk Electric Company, is the Purity Ice Company, of Keokuk. Energy for its 60-ton ice plant is brought to the premises at 2200 volts and stepped down to 440 volts by means of three outdoor transformers each rated at 75 kw. The three-phase service entering the 300-amp oil switch may be seen in Fig. 1 just above the small motor in the foreground. Control and metering apparatus for all machines in the compressor room has been been grouped on the wall above the service entrance.

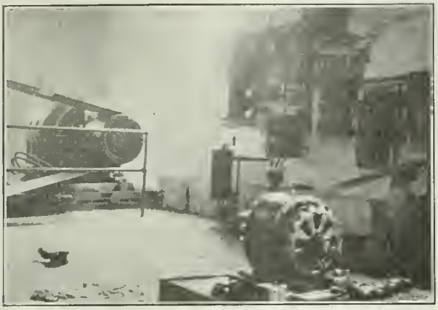


FIG. 1—SWITCHING AND METERING EQUIPMENT AND MOTORS

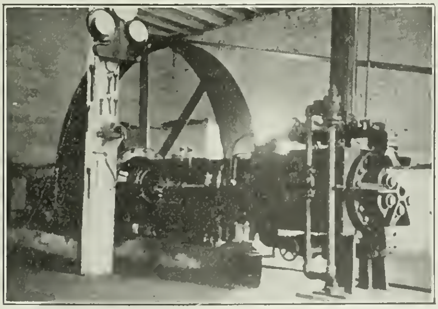


FIG. 2—60-TON BELT-DRIVEN AMMONIA COMPRESSOR

The ammonia compressor (Fig. 2), a Ball's Giant 60-ton machine, is belt-driven by the 200-kw, three-phase, twenty-five-cycle motor shown at the left in Fig. 1. It is started from the drum-type controller shown near the motor. Other motor applications about the plant are given in the accompanying table.

Air supplied from a motor-driven pump is used in an air hoist for lifting the cakes from the freezing tank.

For lighting the tank room, the compressor room and the offices a 5-kw pole-type transformer has been hung on the wall near the switching equipment, reducing the potential from 440 volts to 110 volts. Direct illumination is supplied from tungsten lamps in enameled-steel reflectors.

MOTORS USED IN KEOKUK ICE PLANT

Motors	Applications
10-hp.	Belted to Connersville blower delivering 2.06 cu. ft. of air per revolution.
5-hp	Belted to two-cylinder, 6-in. by 6-in. air compressor.
10-hp	Direct-connected to centrifugal pump.
5-hp (two motors, 2.5 hp each)	Belted to brine agitators.

Exchange Value of Burned-Out Carbon Lamps

In selling tungsten lamps to its customers the Union Electric Light & Power Company, of St. Louis, allows full value, in renewals, for burned-out carbon lamps. A returned carbon lamp, if originally furnished by the company, is valued at 15 cents. Thus if one 60-watt tungsten lamp, priced at 45 cents, is purchased, the customer can pay for it by turning in three burned-out carbon lamps. If the applicant has but two carbon lamps to turn in, he must add 15 cents to get a 60-watt tungsten lamp, and so on.

A Company Tea Room for Women Employees

When the offices of the Merchants' Heat & Light Company, Indianapolis, Ind., were recently moved from the first to the second floor of the building because of the necessity for more room, it was decided that the young women employees of the company should be well taken care of. With that end in view, a 15-ft. by 15-ft. rest room was built at one end of the office, the partition being of board so that there would be absolute privacy.

The company bought a dining table, chairs, knives, forks and spoons and also gave the girls an electric samovar for tea making, an electric stove and toaster and a chafing dish. Each day the young women prepare their lunches in this room, and it has been found that the cost does not exceed $1.50 per week, or about 15 cents per girl. The company pays for all the bread, butter, tea, sugar and cream, which cost about $1.50 per week. Eleven girls are employed and seldom less than ten stay for lunch. The girls figure that they save at least 10 cents each per day, which in the course of a year means a saving to them of at least $300. Not only is the economy appreciated, but in bad weather they find it very convenient not to be compelled to go outside for their lunches.

Eighty Electric Sign Slogans

During the campaign recently conducted by the Edison Electric Illuminating Company of Lebanon, Pa., to install an electric slogan sign for Lebanon, Mr. A. L. Scott, sales agent, issued and distributed an attractive booklet of arguments concerning electric-sign publicity, a feature of which was the accompanying compilation of the electric-sign slogans that have been adopted by a number of American cities. Some of the towns listed have populations of only a few thousand, but are not the less behindhand with their displays for the attention and instruction of visitors and persons on passing railroad trains.

ELECTRIC SLOGANS OF AMERICAN CITIES

Name of City	Population	Electric Sign Slogans
Albany, Ore	4,275	"The Hub of the Willamette Valley."
Allentown, Pa	51,913	"Dwell Here and Prosper"
Attalia, Wash.		"On the Columbia"
Birmingham, Ala	132,685	"Trade in Birmingham."
Boston, Mass	607,585	"Bigger, Busier, Better Boston."
Bristol, Tenn	13,395	"Push—That's Bristol."
Bristol, Va	6,247	"Push—That's Bristol."
Brooklyn, N. Y	...	"Brighter Brooklyn."
Buffalo, N. Y	423,715	"Buffalo Means Business, Boost Buffalo."
Canton, Ohio	50,217	"Welcome."
Chattanooga, Tenn	44,604	"The City That Pays Dividends.
Chicago, Ill.	2,185,283	" 'I Will'—Chicago the Great Central Market."
Cleveland, Ohio	560,663	"Onward, Cleveland!"
Colorado Springs, Col	29,078	"She Sits Forever in the Sun."
Coos Bay, Ore	....	"Oregon's Deep-Sea Harbor."
Dayton, Ohio	116,577	"Greater, Brighter Dayton."
Denver, Col	213,381	"The City of Lights."
Duluth, Minn	78,466	"The Zenith City of the Unsalted Seas.'
Durham, N. C.	18,241	"Durham Renowned the World Around.'
East Liverpool, Ohio	20,387	"East Liverpool."
Easton, Pa	28,523	"Easton, City of Resources."
El Paso, Tex	39,279	"El Paso, the Pass, Don't Pass El Paso."
El Reno, Okla	7,872	"Watch It Grow to 100,000."
Enid, Okla	13,799	"All Roads Lead to Enid."
Everett, Wash	28,814	"The City of Smokestacks and Opportunity."
Fargo, N. D	14,331	"The Biggest Little City in the World
Faribault, Minn	9,001	"Athens of the Northwest."
Fort Smith, Ark.	23,975	"The Southwestern Factory City."
Fort Wayne, Ind	63,933	"Fort Wayne with Might and Main."
Fort Worth, Tex.	73,312	"Seventeen Railroads—Manufacturing Center."
Galveston, Tex	36,981	"The Treasure Island of America."
Garden City, Kan	3,171	"Welcome, Garden City."
Grand Forks, N. D	12,478	"The Home City of the Northwest."
Great Falls, Mont	13,948	"Watch Our Smoke."
Hattiesburg, Miss	11,738	"Hattiesburg—The Hub."
Hood River Valley, Ore	2,331	"The University of Apple Culture."
Houston, Tex	78,800	"Keep Boostin' Houston."
Hume, Tex	... .	"Boom Hume."
Indianapolis, Ind	233,650	"No Mean City."
Jackson, Miss	21,262	"Share Jackson's Opportunities."
Kalamazoo, Mich	39,437	"In Kalamazoo We Do."
Lansing, Mich	31,229	"Larger, Livelier, Lovelier Lansing."
Little Rock, Ark	45,941	"Little Rock's Population 1920, 200,000."
Mankato, Minn	10,365	"Mankato for Mine."
Marinette, Wis	14,610	"A Home for You."
Massillon, Ohio	13,879	"Massillon Invites Industries."
Menominee, Mich	10,507	"Welcome."
Mobile, Ala	51,521	"Queen City of the Gulf."
Montgomery, Ala	38,136	"Your Opportunity."
Mott, Mo	... ...	"Mott is the Spot."
Muscatine, Ia	16,178	"Come Blow Your Whistle with Us."
Muskogee, Okla	25,278	"Welcome to Muskogee."
Nashville, Tenn	110,364	"Nashville Offers Opportunity."
New Haven, Conn	133,605	"Old Elms, but New Ideas."
New Orleans, La	339,075	"New Orleans—Gateway to Panama Canal."
New Philadelphia, Ohio	8,542	"Welcome to Our City."
Norristown, Pa	27,875	"Watch Us Grow."
Oklahoma City, Okla	68,000	"The Center of Commerce in the Land of Promise."
Parkersburg, W. Va	17,842	"Parkersburg—Biggest Little City on Earth."
Pasco, Wash	2,083	"Keep Your Eye on Pasco."
Pittsburgh, Pa	533,905	"Pittsburgh Promotes Progress."
Redmond, Ore	....	"A Garden Spot of the Inland Empire."
Rochester, N. Y	218,149	"Here Quality Dominates."
Salem, Ore	14,094	"The Cherry City of the World."
San Diego, Cal	39,578	"First Port of Call."
Sapulpa, Okla	8,283	"Salpulpa—The Oil City of the Southwest."
Schenectady, N. Y	72,826	"Schenectady Lights and Hauls the World."
Scranton, Pa	129,867	"Watch Scranton Grow."
Shreveport, La	28,015	"Shreveport Spells Success."
Silverton, Ore	1,588	"The Heart of the Willamette Valley."
Spokane, Wash	104,402	"All Roads Lead to Spokane."
St. Joseph, Mo	77,403	"The City Worth While."
St. Louis, Mo	687,029	"St. Louis Has the Goods."
Syracuse, N. Y	137,249	"Syracuse Spells Success"—"If You're in Syracuse You're in Right."
Tacoma, Wash	83,743	"You'll Like Tacoma"—"Watch Tacoma Grow."
Toledo, Ohio	168,497	"You Will Do Better in Toledo."
Topeka, Kan	50,000	"Topeka, Kan., Topeka Will."
Tuscaloosa, Ala	8,407	"Try Tuscaloosa, Ala."
Walla Walla, Wash	19,364	"What Walla Walla Wants Is You."
Warren, Ohio	11,081	"Opportunity! It's Here!"—"Warren, City of Modern Methods."
Waterloo, Ia	26,693	"Waterloo's Ways Win."
Wheeling, West Va	41,641	"Wheeling Means Business."
Wichita, Kan	52,450	"Watch Wichita Win."

Denver's Electrically Driven 75,000-Loaf Bakery

By Frank D. Burr

In Denver, Col., the demand for bread years ago exceeded the capacity of hand manufacture. The high quality required and the large quantities consumed within an accessible territory have proved that the best results can be obtained by mechanical means. The Campbell-Sell Baking Company, of Denver, long ago recognized these advantages and through the use of electric power has built up the largest baking business in the Rocky Mountain region.

Flour is hauled to the bakery directly from the mills and is delivered to two flour elevators (Fig. 1), each driven by a 2-hp, 220-volt Westinghouse motor. Each elevator is capable of elevating 600 100-lb sacks of flour per hour from the driveway to the storage rooms on the second and third floors, where the flour is allowed to stand exposed to a strong current of air for the purpose of aging it. Enough is kept stored ahead in this condition for a run of twenty-four hours. Four kinds of flour are here blended together by gravity mixers and sifters. Three bucket elevators, each driven by a 10-hp, 220-volt, three-phase motor, elevate the flour to the roof of the second floor, where it is emptied into a hopper, and from there it is dropped through automatic scales to the mixer. Hot and cold artesian water of proper quantity and proper temperature is mixed with the flour, the water being itself pumped from a depth of 700 ft. by means of a Leyner air compressor driven by a 5-hp, 220-volt, three-phase motor.

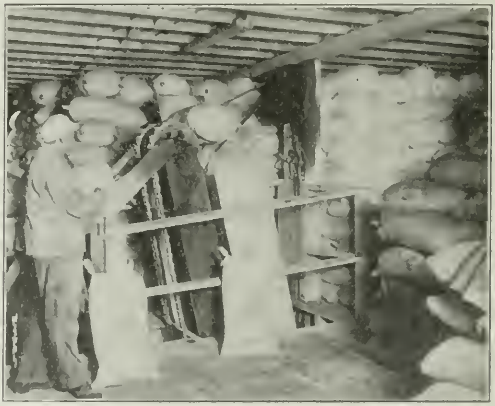


FIG. 1—ONE OF THE FLOUR ELEVATORS

Mixing is started each day at 2 a. m. Two mixers are used, one a 5-barrel Day mixer, driven by a 10-hp, 220-volt, three-phase General Electric motor, and the other a 10-barrel "New Era" unit, driven by a 15-hp motor. The latter mixer is largely used since it is a double revolving-arm equipment. The inner revolving arm goes faster, tearing up the dough and thus getting the best effect of the starches and glutens. The above contents are mixed in batches of about 1000 lb. each for twenty to thirty minutes, after which yeast, sugar and starch are added. After these are mixed, the mixer tilts automatically, emptying the dough into a large trough (Fig. 2), where it is kept at a temperature of 80 deg. Fahr. The dough is then allowed to stand in the fresh air and light at this temperature for about eight hours, where it rises and is "rammed down" (or kneaded) three times. It is next deposited in the hopper on the second floor, from which it drops by gravity to two dividers made by Werner & Pfleinderer and driven by a 2-hp, 220-volt, three-phase motor. The dough in each machine is forced in by a weight, four plungers simultaneously producing four loaves at the rate of 3600 loaves per hour. The loaves are thence dropped upon a conveyor belt, flour is sifted over the belt and loaves, and the latter are conveyed to a Zerah helical baller driven by a 2-hp, three-phase motor.

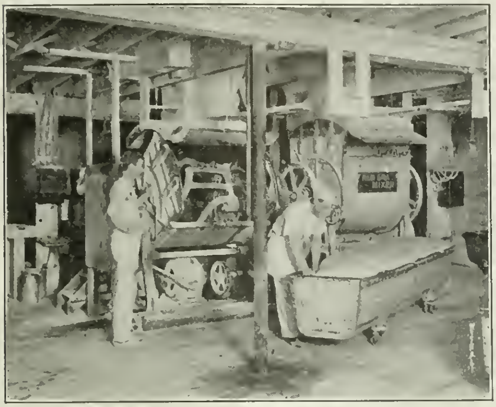


FIG. 2—DOUGH MIXERS AND TROUGH

The interior cylinder rotates, carrying the loaves from the bottom to the top of the helix. The machine produces the effect of kneading the loaves, creating a tough skin so that they will not stick to the belt conveyor. The loaves are then deposited upon a belt conveyor driven by a 2-hp, 220-volt, three-phase motor which carries them to the top of the "proofing" conveyor. This device is a patent of the Campbell-Sell Company itself and consists of six endless belts, each 110 ft. long. The speed of the machine depends upon the softness of the dough. The loaves are dropped upon the top belt at one end and conveyed to the opposite end, where they are dropped upon the next endless belt, extending a foot beyond the upper one but running in an opposite direction in the same cabinet. Reaching the end of this belt, the loaf is dropped upon the next belt below, which runs in the same direction as the first, and so on down until it has passed over all six endless belts, the operation requiring seven to sixteen minutes. The belts run in an inclosed cabinet, which retains the moisture and is kept at the proper temperature for the rising or proofing of the loaves. This machine is driven by a 5-hp, 220-volt, three-phase motor. Next the loaves are carried to a loaf-molding machine, made by the C. A. Thompson Company and driven by a 2-hp, 220-volt, three-phase motor.

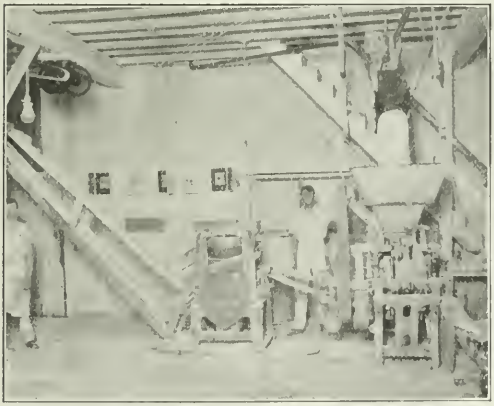


FIG. 3—DOUGH DIVIDER AND HELICAL BALLER

The milk-and-cream bread is automatically returned to a 9-in. brake molder, thence passing on to a 17-in. molder, after which it is placed in pans. The pans are greased by a Gottschalk machine which has two sets of rotating brushes, one set brushing out the crumbs from the pans which have been used and the second set carrying oily matter to grease the pans. This machine is driven by a $\frac{1}{4}$-hp motor.

After being properly molded, the loaves are deposited in pans and placed in pan racks supplied with castors, so they can be pushed over the floor to the steam-proofing cabinets. Here each pan rack loaded with bread loaves is placed in the proofing cabinet until the loaves have risen sufficiently. The pan racks are then withdrawn and conveyed to the steam peel ovens. They are kept in these ovens until the bread has properly risen, when they go to the draw-plate ovens shown in Fig. 4.

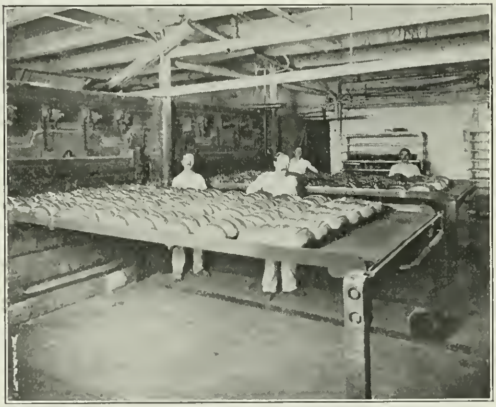


FIG. 4—TWO DRAW-PLATE OVENS

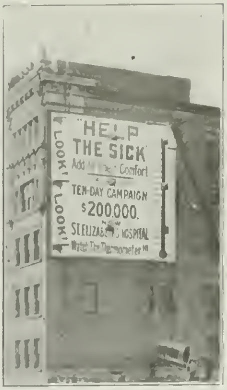
The pans containing the loaves are then placed in racks and taken to the cooling room to form their crusts. The present plant puts out 75,000 loaves per day during the summer. After the crust is formed sufficiently, the loaves are automatically wrapped in waxed paper and sealed by a Haysen wrapping machine, driven by a $\frac{1}{4}$-hp motor.

Many of the bakery's customers who are supplied with bread have insisted also upon being furnished with pastry. It was therefore found necessary to run a pastry department making various kinds of cakes. This department includes a 2.5-barrel Day mixer with an automatic sifting and elevating arrangement, driven by a 3-hp, 220-volt, three-phase motor; an icing mixer, driven by a 1-hp, 220-volt, three-phase motor; an automatic cake depositor, driven by a 1-hp, 220-volt, three-phase motor, and a three-speed cake mixer, by a 1-hp motor.

Illumination and Wiring

Large Electric Sign in Boston Hospital-Fund Campaign

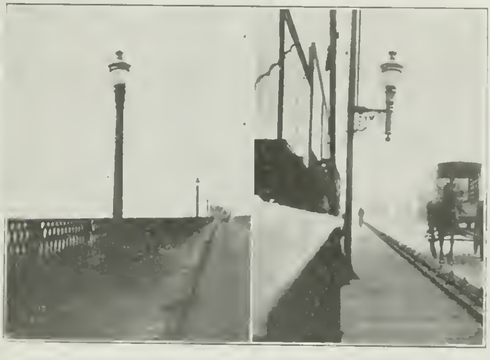
An electric bulletin about 28 ft. high and 26 ft. wide, mounted on the wall of the Filene-Ditson Building, in the heart of the business district of Boston, Mass., was the most conspicuous feature of a recent successful ten-day money-raising campaign for the new St. Elizabeth's Hospital. The display included a "thermometer" 28 ft. long with a mercury column formed of red ribbon 6 in. wide. As subscriptions increased, the advance of the campaign was recorded on this "instrument." The display was illuminated by six 100-watt tungsten lamps screwed into bases in metal reflectors 18 in. square and 10 in. deep, the reflectors being hung from 10-ft. brackets about 6 ft. away from the wall. The reflectors were painted white on their inside surfaces, and service was maintained from dusk until midnight throughout the campaign. Energy was supplied by the Boston Edison company.



ELECTRIC SIGN IN HOSPITAL CAMPAIGN

Better Lighting for the Eads Bridge, St. Louis

The famous Eads Bridge across the Mississippi River, connecting St. Louis, Mo., and East St. Louis, Ill., is now brilliantly lighted by inverted magnetite lamps, and the improved illumination is creating much favorable comment. Lamps on the Illinois end of the bridge are supported on ornamental iron standards set at the outer edge of the pedestrian walk, as shown in Fig. 1. On the western end of the structure the lamps have been placed on iron brackets attached to the trolley poles of the electric-railway company operating on the bridge, as shown in Fig. 2. Energy for operating the fifty new magnetite lamps is secured from the St. Louis & East St. Louis Electric Railway Company.



FIGS. 1 AND 2—LIGHTING ON EADS BRIDGE, ST. LOUIS, MO.

The Economic Design of a Distributing System

By M. D. Cooper

The determination of the amount of money which can profitably be invested in a new electrical distribution system or in the reconstruction of an old one is a problem which can often be solved in very definite terms. Its solution is dependent upon the considerations which govern all commercial and engineering problems: "How can the most be got out of a dollar?" or "Will it pay?" These questions can be answered only when it is known how much income can be derived from the investment and how much the charges against the investment and the operating expenses will be.

It is not proposed in this article to treat quantitatively of the fixed charges and expenses of a distribution system, for they depend largely upon local conditions. The point it is desired to emphasize is that oftentimes a much greater investment in lines can be justified on an economic and commercial basis than could be justified by the method of analysis heretofore largely used.

Kelvin's Law of Investment and Losses

This analysis is based on Kelvin's law, which may be stated as follows: "An electric line is built and operated at the least total expense when the fixed expenses on the investment in copper are equal to the cost of the line losses."

The following example illustrates the truth of this law. Suppose that with an investment in copper of $100,000, the cost of energy consumed in the line amounts to $20,000 per year. If the fixed charges—interest, depreciation, taxes, etc.—are 20 per cent of the investment, these fixed charges amount to $20,000 per year, an amount equal to the cost of the line losses. If the copper were increased twofold the line losses would be cut in half, and conditions would be as follows:

Investment in copper	$200,000
Fixed charges on copper (20 per cent)	$40,000
Cost of line losses	10,000
Total annual expenses	$50,000

This amount is seen to be more than in the former case, when the fixed charges were equal to the cost of the line losses. Table I shows what conditions would prevail with various changes in the copper investment. It is seen that the most economical operation of the line is secured when the copper investment is such that the fixed costs and the cost of the line losses are equal.

This analysis is based on the primary assumption that a given amount of energy is to be transmitted from one place to another, and therefore that any decrease of line losses will decrease the coal consumption correspondingly. Such a method of analysis can properly be applied only to problems in transmission. When we come to consider distribution, there enter other factors which modify the application of the analysis.

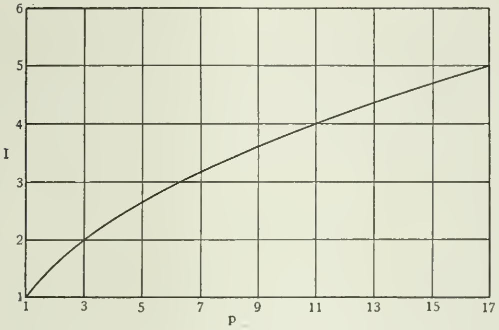
TABLE I—LOSSES AND CHARGES WITH VARIOUS COPPER INVESTMENTS

Investment in Copper	Relative Investment	Annual Fixed Charges, 20 per Cent	Relative Line Losses	Cost of Line Losses	Total Annual Expense
$50,000	0.50	$10,000	2.00	$40,000	$50,000
75,000	0.75	15,000	1.33	26,666	41,666
100,000	1.00	20,000	1.00	20,000	40,000
150,000	1.50	30,000	0.66	13,333	43,333
200,000	2.00	40,000	0.50	10,000	50,000

As applied to the distribution system as a whole, Kelvin's law can still be applied to give approximate results, for an increase in the copper investment would decrease the line losses and allow the maintenance of the same average delivered pressure with a reduction in the station voltage. The intangible but positive value of good regulation as an asset in favor of greater line investment makes it impossible, even in this case, to make strict application of Kelvin's law. As applied to a single feeder (without a regulator) or to a limited district, an increase in copper investment will decrease the line losses by some certain amount, but if the same total amount of energy is delivered to the feeder or district, the energy sales must be increased by the amount of the decrease in losses.

Decrease of Wattage with Terminal Pressure

Direct-current motors, incandescent lamps, flatirons and all energy-consuming devices of the resistor class decrease in wattage consumption as the applied voltage is decreased. For this kind of load, therefore, the effect of line loss between the station or the center of distribution and the load is to cause not only a loss of energy in the line but also a decrease in the energy consumed by the load. Moreover, an increase of voltage means a more than proportionately increased energy consumption by the load itself; hence in this case the increase in copper investment results not only in a saving of line loss or a transfer of part of the loss to the energy sold, but also in the sale of additional energy over and above the transfer of line loss.



CURVE SHOWING MOST ECONOMICAL COPPER INVESTMENT

The question of how much the total increase in energy sale will amount to depends upon the characteristics of the load. If the load is a constant resistance, for which the wattage varies as the square of the voltage, the total increase in energy consumption will be twice as great as the decrease in the line losses. If the wattage varies directly with the voltage, the transfer from line loss will constitute the whole of the increased energy consumption.

TABLE II—RELATION BETWEEN WATTAGE AND VOLTAGE

Load	Exponent n
Direct-current motor (constant torque load)	0.8 to 1.0
Direct-current motor (generator load)	About 1.0
Alternating-current motor	About 1.0
Flatiron	1.9
Toaster	2.0
Arc lamp	2.0 to 2.2
Incandescent lamp, carbon	1.9
Incandescent lamp, metallized filament	1.8
Incandescent lamp, tungsten filament	1.6

Table II gives data showing the relation between wattage and voltage for various classes of load. The second column, giving empirical exponents in the assumed relation wattage, varies as (voltage)^n. This table establishes the fact that about 1.5 is a conservative figure for the average exponent in the assumed relation of wattage to voltage.

In general, it can therefore be said that a line reconstruction which decreases the energy loss in the lines by a certain amount in kilowatt-hours will increase the energy sales by about one and one-half times that amount.

The effect of this reconstruction is, therefore, not only to decrease the losses but to increase the sale of energy. In applying Kelvin's law the decreased loss is taken into account but no consideration is given to the increased energy sale. Since the sale price of energy is often many times the direct or increment cost of generation, it is evident that a most important item has thus been neglected.

TABLE III—RELATION BETWEEN COPPER INVESTMENT AND COSTS

	RELATIVE COPPER INVESTMENT				
	1.00	1.75	2.00	2.25	2.50
(1) Copper investment	$100,000	$175,000	$200,000	$225,000	$250,000
(2) Fixed charges	20,000	35,000	40,000	45,000	50,000
(3) Cost of line losses*	20,000	11,430	10,000	8,888	8,000
(4) Total expense	40,000	46,430	50,000	53,888	58,000
(5) Transfer from losses to energy sales, $20,000 minus (3)	....	8,570	10,000	11,111	12,000
(6) Extra energy generated and sold, half of (5)	....	4,285	5,000	5,555	6,000
(7) Total increase in energy sales (5) plus (6)	....	12,855	15,000	16,666	18,000
(8) Gross profit on same, two times (7)	....	25,710	30,000	33,333	36,000
(9) Net expense, (4) minus (8)	40,000	20,720	20,000	20,555	22,000

*The values given neglect the extra line loss due to the increase in line current. This affects the final result less than 1 per cent.

Returning to the previous example, Table III is given to determine the most economical copper investment, assuming that the selling price of energy is three times the direct or increment cost of generation.

This table shows that when the sale price of energy is three times the direct or increment cost of generation the most economical copper investment is twice as much as the amount that would be indicated by applying Kelvin's law.

It can be shown that if the ratio of sale price of energy to the direct cost of generation is p, then, considering this fact, the ratio I of the actual economical copper investment to the apparent economical copper investment as derived by Kelvin's law is given by the relation

$$I = \sqrt{\frac{3p - 1}{2}}$$

The accompanying curve shows this relation in a graphical form.

The advisability of investing more money in copper in the reconstruction of old lines and the determination of the amount of copper to use in new lines are problems which require study from several standpoints, one or more of which may govern the final solution. As has been brought out in this article, ordinary conditions of operation will almost always commercially justify a much greater investment in copper than could be justified on the basis of Kelvin's law.

Electricity's Part in Holiday Celebrations

Aside from the revenue derived from the temporary load furnished by electrical decorations erected for festive occasions, the advertising value of such displays should not be overlooked by electric-service companies. In nearly every city of any consequence such occasions often arise and the growing tendency to use electric lighting for temporary decorations should be carefully encouraged.

STREET DECORATIONS DURING "VEILED PROPHET" WEEK, ST. LOUIS, MO.

The accompanying illustration shows the festoons erected on Seventh Street, St. Louis, Mo., for what was locally known as "Veiled Prophet Week." This event, an annual affair, has been celebrated in the city since the foundation of the secret order of the Veiled Prophet in 1876. This year approximately 2000 16-cp red, white and green carbon lamps were used in the decorations, the expense of which was defrayed by the merchants' associations. The floats of the parade, although drawn by horses, were electrically lighted with energy taken through trolley poles reaching the overhead conductors of the street-railway company along the route of the procession.

Track, Scale and Railroad-Yard Lighting

At the meeting of the Pittsburgh Section of the Illuminating Engineering Society held a short time ago Messrs. H. Kirschberg and A. C. Cotton presented a paper on the subject of "Track, Scale and Railroad-Yard Lighting."

In order to prevent congestion and delay in receiving and classification freight yards, it is important, as pointed out by the authors, that proper lighting be provided. Savings in first cost, energy consumption or maintenance should not be allowed to interfere with the proper selection of the illuminating equipment, although it has been truly said that on railroads in general good lighting, so far from being a matter of course, is conspicuous by its absence.

Of the many special problems of illumination on railroad properties, none perhaps is of greater importance than that of proper track-scale lighting. The cars pass over the scale at a speed of about 2.5 miles per hour, and not only must the weighing be done but the car numbers and weights must also be read from the ends or side of the cars in passing. The entire operation takes only eight to twelve seconds. It is therefore important that efficient lighting be provided in the scale house to permit rapid and accurate weighing, while outside in the yard there must be sufficient illumination to enable trainmen to cut loose the cars and to aid the scale attendants in reading the numbers and the figures giving the weights.

All scale lamps should be controlled by a circuit separate from the yard lamps. The outside lamps should not be visible by the weighmaster, although with the low roofs generally used on scale houses the problem of placing units of sufficient strength and low intrinsic brilliancy is not an easy task.

The lighting of a classification yard should provide space for poles on which to mount lamps, but as this layout is usually drawn up by the maintenance-of-way department, it often happens that the space allotted to the lighting is not only insufficient but also poorly located. Many engineers have treated classification yards as open spaces, lighting them accordingly. As a matter of fact, classification-yard lighting may be more involved than any street or park lighting. A classification yard consists of a series of "streets," each 3 ft. to 4 ft. wide, with "buildings" about 14 ft. high on both sides. The ideal system, therefore, would be to provide light on and between every pair of tracks, although this condition cannot always, of course, be realized.

In brief, the requirements of classification-yard lighting enumerated by the authors are: (1) Illumination of the grade leading from the scale to the yard; (2) illumination of the switches at the head of the yard, to facilitate control of car movements; (3) illumination of every track irrespective of position of adjacent cars; (4) illumination of every car in the yard, and (5) absence of glare from any position in the yard.

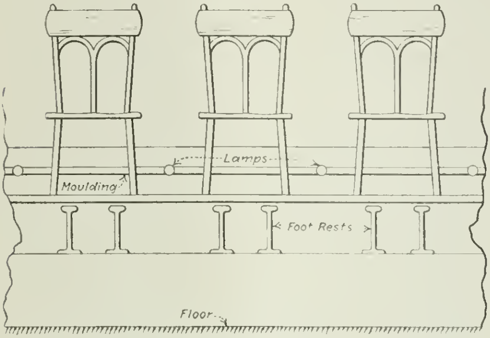
Economic Aspects of Lighting

Mr. H. H. Magdsick, of Cleveland, of the engineering department of the National Quality Lamp Division of the General Electric Company, gave an instructive talk on incandescent lighting at a well-attended luncheon of the Chicago Jovian League on Feb. 23. He explained how the introduction of an inert gas in the bulb will allow the operation of the lamp filament at a higher temperature than in a vacuum. However, the heat of the filament is dissipated much more rapidly than with a vacuum lamp. But with the smaller tungsten filament possible with large units this heat dissipation may be disregarded, so far as lamp efficiency goes. Mr. Magdsick devoted much of his time to a consideration of the problem of waste in electric lighting. Owing to the inefficiency of application, as of lamp shades, fixtures, etc., it is probable that half of the electrical energy used for lighting in the United States is wasted. This waste amounts, no doubt, to $150,000,000 a year. The effort to make more efficient incandescent electric lamps is therefore amply justified on economic grounds. But, considering individual installations, the cost of very good lighting is only a very small proportion of the cost of conducting an industrial plant. It is perhaps equivalent to the wages of one man to every 300 employed.

In many office buildings the cost of lighting is often no more than that of towel supply or pure-water service. Perhaps it is because lighting is, comparatively, so small an item in factory or office expense that it is treated with such indifference. However, it is to be remembered that perhaps 25 per cent of factory accidents are due to poor illumination. In every aspect correct lighting plays an important part in the "safety-first" movement. A small expenditure for improved illumination may mean a great saving in accidents.

Lighting Behind Chairs in Shoe-Shining Shops

Another useful place for electric lamps has been discovered by the new-business department of the People's Light Company, Davenport, Ia. In neat rows behind the chairs of several shoe-shining parlors in the city small lamps have been placed, illuminating the bench on which the chairs for patrons are placed. The light which they shed behind the chairs also plainly reveals spots of dirt and shoe blackening, with the result that in these shops where the dark corners are lighted dirt and spots do not linger and customers may seat themselves without fear of soiling the bottoms of overcoats or dresses.



ELECTRIC LAMPS IN SHOE-SHINING PARLORS

Recent Telephone Patent

Mr. P. G. Burgess, of Jamaica, N. Y., is the patentee of an intercommunicating system using jacks of the various stations for line terminals, selection of any desired line being effected by inserting a plug of insulating material in the corresponding jack. Ringing is effected by use of ringing keys. The parts and circuits are so arranged that it is impossible for any station to disable the system by careless operating. Ringing and talking currents are supplied from two independent common batteries. It is proposed also to use the set in connection with a dictagraph, and the transmitter is therefore made very sensitive.

Letters to the Editors

The Nitrogen-Filled Lamp

To the Editors of the Electrical World:

SIRS:—In connection with the "new" nitrogen incandescent lamp, about which so much is being said at the present time, it may be of interest to know that the idea of using a nitrogen vacuum in an incandescent lamp is not new. As early as 1880 the writer was engaged with William E. Sawyer (the pioneer incandescent-lamp man) in the development of the then celebrated Sawyer-Man lamps, and at that time all of the Sawyer-Man incandescent lamps were made with nitrogen "vacuums," and the writer now has in his possession two of these lamps containing nitrogen "vacuums." History repeats itself very frequently in this world, and what was then experimental in the beginning of a great industry now is likely to become an important feature in one of the latest developments

New York, N. Y. E. R. KNOWLES.

To the Editors of the Electrical World:

SIRS:—In a letter from one of the prominent incandescent lamp manufacturers to its local office the employees were urged to apply the name "gettered" to the new nitrogen-filled tungsten lamp which is being brought on the market. In a conversation with a factory representative of the same company, the writer learned that the word is derived from the verb "to get." I presume a "getter" would be "one who gets," and "gettered" would be a participial adjective.

It seems to me that the electrical industry should not have fastened upon it such a meaningless word if there is any possible way to escape it, and that the matter should be referred to the terminology committee of some of our prominent electrical organizations, or the manufacturers themselves, with the request that they adopt some more descriptive name for this new lamp.

BAYARD W. MENDENHALL,
Commercial Agent Utah Light & Power Company
Salt Lake City.

[The word "getter" is commonly used in the lamp factories when referring to means for producing the desired vacuum, but it has not been adopted generally by the public.—EDS.]

Mr. William Cooper—An Appreciation

To the Editors of the Electrical World:

SIRS:—On Jan. 23, after a short illness, there died in Wilkinsburg, Pa., at his home, Mr. William Cooper. Mr. Cooper was born on a farm near Watertown, N. Y., on Nov. 24, 1861. He had a strong bent for engineering problems which led him to seek scientific training at Cornell University. At twenty-five years of age he went to Ottumwa, Ia., and engaged in the building of automatic screw machines. He left Ottumwa to start a shop in Minneapolis, being at that time very much interested in the utilization of compressed air. The older generation among us well remember how alluring the use of compressed air seemed to the engineers thirty years ago. We all remember the great compressed air power stations at Paris and Mr. Bion J. Arnold's enthusiastic advocacy of the use of compressed air in combination with single-phase alternating currents. Mr. Cooper's labors at the time resulted in the invention of a rotary reciprocating pump and of a power-transmitting and speed-regulating mechanism, which were patented by him and Mr. Hampton on Dec. 19, 1893. A great deal of effort was expended to develop these. After their re-invention by Mr. Harvey D. Williams and improvement by Mr. Reynold Janney, they have been successfully manufactured by the Waterbury Tool Company, of New Britain, Conn., for the moving of turrets on battleships and for other purposes.

After these inventive labors, there followed for Mr Cooper an active connection as master mechanic and chief engineer of the Twin City Rapid Transit Company of Minneapolis. The interest taken in electric traction work, which had thus been stimulated, induced Mr. Cooper to join Mr. W. B. Potter, of the General Electric Company, in the active development of railway problems. Here Mr. Cooper added greatly to knowledge of commutation of railway motors by calling attention to the advantage of high saturation in the armature cores, this being one of the most important steps toward a proper appreciation of saturation for successful commutation. Mr. Cooper was intrusted with the supervision and operation of the large electric hauling engines built by the General Electric Company for the Baltimore & Ohio tunnel.

After the completion of this work, Mr. Cooper went to Boston to join the firm of Blood & Hale, consulting engineers. The most notable work he did at that time was the design of a complete line of railway motors for the Steel Motor Company, of Johnstown, Pa., a concern which was later acquired by tne Westinghouse interests.

On Sept. 1, 1897, Mr. Cooper became connected with the Bullock Electric Manufacturing Company, of Cincinnati, Ohio, as general superintendent. At this stage the writer became intimately associated with him, and he may be excused for dwelling more particularly on some phase of their personal relationship. Mr. Cooper's unbounded energy and his remarkable personality were a tremendous factor in the development of the Bullock company. His courage, daring and enterprise marked the beginning of the ascendency of that company. Endowed with an unusual gift for the solution of difficult problems, he devoted himself to the development of the "teaser" system for the operation of printing presses and to the development of the multiple-voltage system for electrically operating machine tools at adjustable speeds. He was most ably assisted in this work by Mr. Albert Wessling, then chief engineer of the company, and Mr. Charles W. Johnson, then chief draftsman and now general superintendent of the Westinghouse Electric & Manufacturing Company, who had come from the Steel Motor Company, where Mr. Cooper's railway motors had been built. Mr. Cooper's personality carried opposition before him. In my early association with the Bullock company I was chiefly interested in the development of alternating-current machinery and plants, a field to which Mr. Cooper had then given less attention. With one single exception, to which I would not now here refer were it not for the fact that it did more than anything else to bring home to me the great qualities of Mr. Cooper's heart, our relations were cordial and, I believe, implied mutual respect. I was at that time rather young and inexperienced and eager and impatient of results, and I apprehend that I was unjust to Mr. Cooper in occasional criticisms. But to show the more clearly Mr. Cooper's true personality, if I was unjust to him at that time, there came another time when he extended to me the help and assistance and support of his big generous nature; when he evidently buried what friction or disagreement there might have existed, coming out with all his influence and personality to my support. This happened at a time when had he dwelt on retaliation he would have found the widest scope therefor. A personality which can rise so far above personal feeling is one of the rarest types in human nature, and those who have wandered through this wilderness of a world in search for men of honesty and integrity will yield a large meed of admiration to the man whom we have just lost for a breadth of vision and a bigness of heart which are the true marks of nobility of human nature.

Succeeding his connection with the Bullock interests, Mr. Cooper engaged in general consulting engineering, accepting later an offer from the Westinghouse Electric & Manufacturing Company to become connected with its railway department. Here he developed the electro-pneumatic system of multiple-unit control, which has been used by the Westinghouse company successfully in numerous installations. He was vitally interested in the electrical equipment of the New York, New Haven & Hartford Railway and of the St. Clair Tunnel and in the Pennsylvania Railway Company's electrification at New York. But this enumeration does not sum up his influence in the Westinghouse organization. It became my good fortune to meet Mr. Cooper, after several years of separation, at the Westinghouse works. Then I thought that, perhaps, if there lurked in his heart any trace of previous disagreements I should find his influence either arrayed against me or, at least, not with me in the difficult tasks which were confronting the organization and in which I had some part. Instead, I had no truer friend, no more loyal supporter, than William Cooper. He did not confine himself to the times when we came in contact to render me support; he went out of his way to influence members of the organization in my behalf and to impress them with a high opinion of my work. I am loath to mention these matters of intimate personal relationship, but Mr. Cooper has now gone from us and my own active participation in the business to which I refer is also past. And I want all those who have known William Cooper and who may read these lines to know that his was a personality in a million, loyal to his convictions, for better or for worse, a bitter enemy when he believed himself right and a stanch friend when his conviction so dictated. Many men who may read these lines are filling responsible positions which they owe to his exertions in their behalf, and they would gladly acknowledge their share of gratitude to him. He wanted none of it; he seemed not to care for public approval or applause. He severed his connection with the American Institute of Electrical Engineers, of which he was a full member, but he refrained from criticism with dignity and self-control.

WILLIAM COOPER

Mr. Cooper was fond of literature. He delighted in quoting passages from the Bible and from Tennyson. He loved his wife and his home, and he was a good citizen.

The influence and effect of a man's work in the field of engineering is not, and should not be, limited merely by his own engineering achievements. The influence which he casts about him, the principles which he inculcates by his own example and insistence, the atmosphere which he spreads around his field of work, these count for as much as, if not for more than, the engineering achievements which may go with his name. It was well for the corporation which he served almost till his dying day that its president and vice-presidents attended his funeral service, because, though it would have seemed to him, as to us, only slight honor, conjuring up an amused smile to his honest features, it was a healthy sign for the corporation which appreciated the fearless qualities of the man and his opinions, which were never rendered by a desire to pander to the officials of his corporation.

"Hears he now the Voice that lov'd him? Who shall swear it cannot be?
Earth would never touch her worst, were one in fifty such as he'"

Boston, Mass. B. A. Behrend.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Advantages and Disadvantages of Oil Fuel

BY R. T. STROHM

Oil as a fuel has several well-defined advantages over coal and other solid fuels. Perhaps the most apparent of these is the ease and rapidity with which the rate of firing may be changed. In a plant in which regulation is carried out by hand, the simple operation of turning a valve or a cock suffices to increase or decrease the flow of oil to the burners, whereas if automatic regulation is used the ratio of steam to oil and of oil to load are all taken care of by the automatic devices. The result of this action is that the rate of combustion follows the load so closely that the steam pressure can be kept very nearly uniform. In addition to this feature, it is possible to extinguish the fires almost instantly, in case of accident to some part of the plant, and thus prevent further disaster.

Inasmuch as the rate of firing can be increased from almost nothing to the maximum in the short space of time required to open a valve, the response to a sudden increase of load on the boiler is much quicker with oil fuel than with coal. For with coal firing an increase of load is met by throwing greater quantities of fuel on the grates, the immediate result of which is to chill the fire and reduce the amount of heat liberated. After the fresh fuel has become heated and ignited it gives off increased heat, but this requires appreciable time. With oil, the generation of heat is proportional to the amount of oil fed and is simultaneous with the injection of the oil into the furnace. The advantage of this in a plant that is subject to frequent and wide variations in load must be apparent.

In the hands of an ignorant and untrained fireman, however, this ease of control may prove to be a source of trouble and danger. For in getting up steam from a cold boiler or in bringing a banked boiler into normal working condition he may force the firing to such an extent as to burn the plates or tubes and render the boiler unsafe.

An increase of steaming capacity is made possible by a change from solid to liquid fuel, provided, of course, that reasonable precautions are taken to arrange the furnace for the economical use of oil. The increase of capacity is attributable to a number of causes. In the first place, oil has a greater calorific value per pound than coal. A pound of high-grade steam coal will yield 13,500 British thermal units and a pound of oil of average quality will contain 18,600 British thermal units. The difference, 5100 British thermal units, represents 38 per cent of the heating value of the coal; therefore, it may safely be stated that oil has from 30 to 35 per cent greater calorific value than coal.

When burned in the furnace, a greater percentage of the heating value of the oil is utilized than in the case of coal. In the first place, a smaller excess of air is required for oil, because the mixing with the fuel is more thorough. The combustion is therefore more efficient, a greater percentage of the available heat is developed, and the temperature of the furnace is higher than with coal because the weight of gases produced by combustion is smaller. As a consequence, these gases give up more heat to the boiler than do the products of combustion of coal.

The heating surfaces of a properly managed oil-burning boiler are cleaner than those of a coal-burning boiler because the improved furnace conditions lessen the formation of soot, and there are no solid particles to be carried into the tubes by the draft. This renders the transfer of heat from the gases to the water more rapid and raises the evaporative efficiency. Again, with oil fuel there is no necessity for opening the fire doors at frequent intervals, as is done in the hand firing of coal; therefore, the furnace conditions are kept more nearly uniform, there is a better distribution of the heat generated, and the stresses due to the cooling effect of large volumes of cold air admitted to the furnace are avoided.

There are just two fundamental ways of increasing the efficiency of a boiler, and they are to increase the amount of heat generated and to reduce the amount of heat thrown away. With oil as a fuel, less heat is used to raise the temperature of the excess air and more heat is transferred to the water. The net result of these two actions is that a smaller percentage of heat escapes up the chimney in the gases, and so the efficiency is increased.

Because of the slight excess of air that is required in an oil-burning installation the weight of gases formed per pound of oil is less than the weight resulting from the combustion of a pound of coal, and a chimney of smaller capacity can be used. Again, the draft needed for oil fuel is from one-tenth to one-half that necessary for the efficient burning of coal; consequently, the height of the chimney need not be so great when oil is used. In the case of a plant converted from coal burning to oil burning, the existing chimney would be used without alteration, and this particular advantage would be of no immediate benefit; but in the case of a new plant designed for oil fuel the cost of chimney construction would be considerably less than for a coal-burning plant of equal capacity, because of the reduced height and diameter of the chimney.

Another striking advantage of oil as a fuel is the lessening of manual labor by its use. Instead of transporting the fuel from the storage bins in trucks or barrows and feeding it to the furnaces with scoops, as in the case of coal, the oil is drawn from the storage tanks and sent to the burners by steam pumps. As a consequence, the number of firemen may be reduced to one-half or even one-fifth of the original number, depending on the size of the plant and its arrangement. Even a coal-burning plant equipped with conveyors and other mechanical devices requires far more power for handling the fuel than does an oil-burning plant of equal capacity. Moreover, oil can be pumped through pipes to far greater distances and at much smaller expense than would be possible in the case of coal. For example, take the case of a plant situated near a river or other deep waterway, to which fuel could be brought by barges or steamers. If coal were used, expensive machinery would be required to transfer it from the barges to the plant over the intervening distance; but if oil were the fuel, all that would be required would be a pipe line between the plant and the edge of the river, as compared with the structural work required to carry the coal-handling machinery.

In the matter of storage space required, oil has a vast advantage over coal. Oil possesses about one-third more heating value than an equal weight of coal and a pound of oil occupies about three-fifths of the space required for a pound of coal; therefore, the heating value of the oil that can be stored in a given space is almost 50 per cent greater than that of the coal that could be put in the same space. To put it in another way, the storage space required when oil is used as fuel is only about two-thirds of that for coal, assuming the same boiler horse-power in both cases.

The ashes produced in the burning of coal must be removed periodically. The handling of these ashes in the boiler room produces dust, and the whole process of removal involves expense. Oil produces no ashes and no dust, and, if properly burned, no soot. The result is that there is no expense for removal of ashes, the wear and tear on the pumps in the boiler room is reduced by the absence of dust, and the tubes and surfaces of the boiler remain clean for longer periods than when coal is used. This last condition lessens the frequency of cleaning the tubes and so reduces labor and expense.

The apparatus used in connection with oil burning is simple and is not apt to get out of order; therefore, the cost of maintenance is not great. Burners may wear, owing to the erosion of the oil and steam, or may warp under the effect of the intense heat so as to require renewal; but the absence of moving or sliding parts reduces the repair bills to a minimum. There are no grates to be replaced, and no firing tools are used, so that damage to the bridge wall or to the furnace lining brought about through the careless use of tools is wholly avoided.

It is well known that coal, when stored for any length of time, deteriorates in heating value because of slow oxidation and the escape of hydrocarbons; but oil may be stored for long periods in properly ventilated tanks without losing appreciably in its heating value.

Again, there is the matter of smokelessness to be considered. By reason of the efficient combustion that may be obtained oil can be burned without smoke; so that, in a city in which the production of smoke by manufacturing plants is punished by fines, the use of oil fuel may prove to be the means of solving a trying problem.

One of the chief disadvantages attending the use of oil fuel is imposed by the regulations of insurance companies. To protect the plant from fire that might occur from the ignition of the inflammable oil, it is required that the storage tank shall be 30 ft. from the nearest building and 2 ft. below the surface of the ground, or 200 ft. from inflammable property if located above ground. It may be difficult to comply with these regulations if the ground surrounding a plant is in great demand or is already occupied.

Another disadvantage of oil is the inflammability of the gases given off from it. The danger of explosion of these gases and the subsequent ignition of the oil, however, become of small importance if the oil used has a flash point of 140 deg. Fahr. or more, and if reasonable precautions are taken by engineers and workmen in storing and using it.

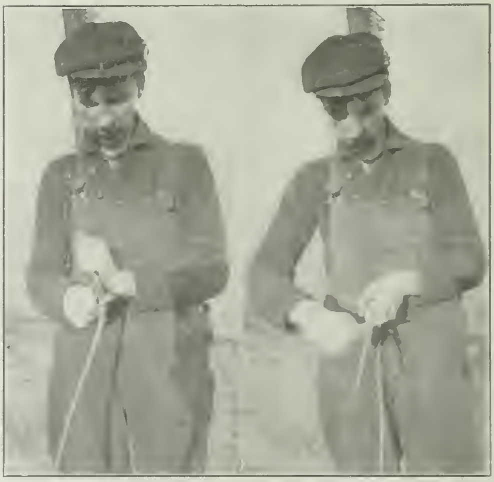
If the boiler feed-water contains a large percentage of scale-forming material, the use of oil fuel may entail increased expense for repairs and tube renewals; for the intense heat generated in an oil-burning furnace is apt to cause more rapid deposit of scale and result in a greater number of burned tubes and plates than with a coal fire.

Preventing Electrical Accidents

In summarizing causes of acidents in the electrical department of the Inland Steel Company, Indiana Harbor, Ind., Mr. Robert L. McIntosh, chief electrical engineer, calls attention to the fact that at least three-quarters of the causes were other than electrical. The following figures for 1912 give the causes of accidents and the percentage that each cause contributed:

Burned by flash or short-circuit	23
Handling material, injured self with same	14
Skinning wire, cut self with knife	10
Fell off ladder, column, etc.	8
Struck self with hammer	6
Grinding, emery flew in eye	6
Wrench slipped	4
Tripped, slipped, stumbled or fell	4
Ran nail in hand	4
Miscellaneous—no two alike	21
Total	100

The dangers peculiar to electrical work may be classified under four general heads—shocks, burns, flashes and falls. Many accidents incidental to the work are due to handling material and in connection with the use of tools and machinery. To avoid these accidents men must exercise due care and caution not to drop material on their hands or feet, to cut away instead of toward them when stripping wires, to keep their fingers clear when striking with a hammer, to wear goggles when grinding at emery wheels, to select and use wrenches that fit and are suitable for the work, to watch their steps so as not to slip, trip, stumble and fall, and to be careful when handling boards containing nails.



FIGS. 1 AND 2—THE DANGEROUS AND THE SAFE WAY TO STRIP WIRE

Shocks may be received from any electric circuit, and the severity of the injury will depend on the amount of current passing through the body. A fatal shock may be received from even a 125-volt circuit. Treat all electrical circuits as though they were alive, is the advice of the steel company's safety department.

Moreover, in handling any circuit known to be alive, men should when possible use only one hand, keeping the other hand behind the back. They should work on one wire at a time and take means to insulate themselves from the ground and other wires of the circuit. Each joint as it is made should be insulated before starting on another wire. There are numerous ways to receive shocks. Care should be taken not to open the shunt field of a motor in such a way as to allow the inductive discharge to cause shock.

Burns are caused by electric arcs. Arcs may be caused by short-circuits due to getting a tool in contact with both wires of a circuit. To avoid this, handles of tools should be covered with fiber. There is danger of an arc when opening a switch and frequently hands are burned in this way. An arc may also be caused by closing a switch on a line which is short-circuited.

FIG. 3—A KNIFE SWITCH MAKES A DANGEROUS CIGARETTE LIGHTER

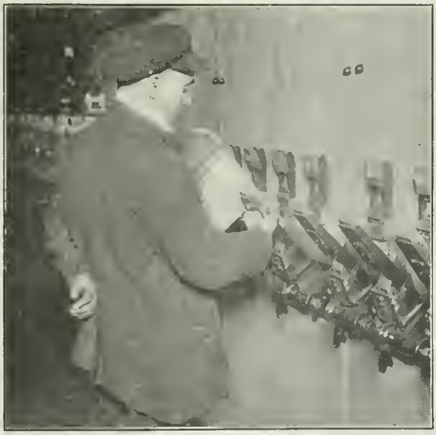


FIG. 4—USE TAPE-HANDLED TOOLS AND KEEP ONE HAND BEHIND BACK

Flashes usually accompany electric arcs and cause injury to the delicate nerves of the eyes. The pain of exposure does not manifest itself for several hours, and to avoid suffering it is advisable to secure medical attention immediately after exposure.

Falls may be caused by slight shocks. When working overhead the workman should be sure he is protected from falling from scaffold, cranes, etc., in case of shock. When working on poles or doing other overhead work he should wear a belt and safety strap.

Iron Tie-Wires on Copper Transmission Line

What effect, if any, will salt air have on a bare copper transmission line using galvanized-iron tie-wires? A. A. C.

The wire used for tying into insulators should be of the same material and composition as the line conductors themselves, lest local electrolytic action be set up between the dissimilar metals, eating away both and causing the spans to break at the necks of the ties. Especially is this important if the line is installed in a moist or salty atmosphere which would tend to accelerate the electrolytic and destructive action.

Electric Heating of Dwellings

In the Northwest, I am informed, use is made of electricity for heating dwellings and buildings. Can you supply figures on the connected load in heaters required for an average residence, together with some idea of the cost compared with heating by coal? K. N. G.

In Idaho, where a number of dwellings and other structures are heated electrically, it is the practice to allow at least 10 kw for the average house of five or six rooms. Used continuously such a 10-kw heating equipment will consume 240 kw-hr. per day, or 7200 kw-hr. per month. In the Western States where surplus water-power is running to waste several companies have offered special house-heating rates as low as $16 per connected kw for the winter season, making the cost of heating a dwelling of the type above described about $160 per season. Compared with coal at $6 per ton, this cost is not excessive. The energy furnished under the above season schedule is, however, sold at a rate of less than ½ cent per kw-hr.

Size of Feeder Cables for Single-Phase and Polyphase Motors

What formula should be employed in determining the size of feeder cable for delivering energy 500 ft. to a 1600-hp, 2200-volt motor operating at 80 per cent power-factor, both when the motor is a single-phase machine and also when three-phase? The generator develops 2300 volts. G. J. N.

Assuming a motor efficiency of 90 per cent, the power required to operate the motor will be

$$\frac{1600 \times 746}{0.9} = 1{,}327{,}000 \text{ watts (approx.)}$$

The current required on a 2200-volt single-phase circuit at 80 per cent power-factor will be

$$\frac{1600 \times 746}{0.9 \times 0.8 \times 2200} = 755 \text{ amp.}$$

Allowing 4 per cent power loss, or 53.1 kw, the following relation exists

$$I^2R = 53{,}100, \text{ or } R = \frac{53{,}100}{755^2}$$

$$= 0.0932 \text{ ohms, total resistance of circuit.}$$

No. 00 copper cable has a resistance of 0.0788 ohms per 1000 ft. at 75 deg. Fahr., but will not carry 755 amp within an allowable temperature rise. Lead-sheathed, jute-covered cable having 600,000-circ. mil cross-section may be used, as it will carry 763 amp with a temperature rise of 50 deg. C. The feeder circuit for a three-phase motor operating under the same conditions would consist of three conductors having one-half the cross-section of those used in the single-phase case.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Open and Semi-Closed Slots in Induction Motors.—TH. HOOCK.—Although European designers have strictly adhered to the semi-closed slot for three-phase induction motors, American designers early adopted the open slot. The author discusses the advantages and the disadvantages of the open slot and the advantages and the disadvantages of the semi-closed slot, and refers to the effect of the two types of slots on the characteristics and design of a motor. He finally gives a comparative example for a design with open and semi-closed slots in the stator, while the rotor slots are supposed to be semi-closed in both cases. It is shown that motors with open slots can be built having a power-factor equally high with that of motors with semi-closed slots, but the efficiency is somewhat lower, especially for less than full load.—*Elek. u. Masch.* (Vienna), Feb. 15, 1914.

Rotary Converters.—A note on a recent British patent (No. 11,905) of A. H. Railing and C. C. Garrard, of the (British) General Electric Company. The currents which flow in the windings of rotary converters connected to a common alternating-current generator or transformer are equalized by means of a differentially wound choke coil. When the currents are equal the device is neutral, but when the balance is upset a potential difference is produced which tends to restore the current balance.—London *Elec. Eng'ing*, Feb. 12, 1914.

Large Three-Phase Turbo-Generators.—ROBERT POHL.—An illustrated article on large American three-phase turbo-generators with reference to recent papers by B. F. Lamme and H. G. Reist.—*Elek. Zeit.*, Feb. 12, 1914.

Testing Induction Motors.—In a continuation of the long illustrated serial on shop-testing of electric apparatus, tests of induction motors are described using the circle-diagram method and the Prony brake method.—*Electric Journal*, February, 1914.

Efficiency of Transformers of Partial Load.—ARTHUR PALME.—The author describes a method for determining the efficiency of a transformer at any partial load by means of two simple diagrams. The method is credited to the General Electric Company of this country.—*Elek. u. Masch.* (Vienna), Feb. 15, 1914.

Lamps and Lighting

Rating Lamps.—JUSTUS ECK.—A letter in which the writer points out that until recently metallic-filament lamp makers used, largely to their advantage, the horizontal candle-power as their unit while arc-lamp makers adopted the mean hemispherical candle-power, but circumstances have changed, and the present moment seems fitting for the establishment of a correct standard practice. The polar curve of the light-giving unit should be considered when it shows good resultant light distribution. In a certain well-known flame-arc lamp, measured with both inner and outer globe in place, nearly 6000 cp is regularly and constantly obtained at about 20 deg. below the horizontal plane passing through the arc, at a consumption of 600 watts. Are the manufacturers entitled to call this a 0.1-watt lamp, or, in view of its mean hemispherical candle-power, should they call it a 1/6-watt or 1/7-watt lamp? Nitrogen-filled incandescent lamps seem to require a globe to protect either them or the human eye, and this globe unfortunately filters off a considerable percentage of the light. Would it, therefore, be reasonable to call the efficiency of the above flame-arc lamp 1/11-watt, as the measurements stated were made with both the inner and outer globes in place? In the printed particulars of recent forms of tungsten lamps it is said that during a period of 800 to 1000 hours the candle-power will diminish 20 per cent from the initial. Under these circumstances, since the flame-arc lamp in question gives a constant light at all times, it would seem reasonable when comparing it with the tungsten lamps to call it a 1/12-watt or 1/13-watt lamp. An editorial note on the subject agrees with the writer that it would not only be much more satisfactory but also more honest to base measurements of incandescent lamps upon the mean hemispherical candle-power as in the case of arc lamps.—London *Electrician*, Feb. 13, 1914.

Fusing Tungsten.—A note on a recent British patent (No. 10,369, 1913) of Siemens Brothers and the (German) Siemens & Halske A. G. The tungsten to be fused is contained in a crucible in an indifferent atmosphere. The crucible has a lining of compressed tungsten. The tungsten to be fused is made the positive pole of an arc furnace, the negative pole being also of tungsten. To prevent bubbles the tungsten to be fused may have about 1.7 per cent of thorium added to it.—London *Elec. Eng'ing*, Feb. 12, 1914.

Tube Lighting.—A note on two recent British patents (Nos. 1218 1913, and 8712, 1913) of the Moore-Licht A. G. To insure constancy in the light emitted, any impurities in the gas are absorbed or combined chemically by the pulverization or vaporization of auxiliary cathodes by the heat of a Geissler tube discharge. According to the second specification, the color of the light emitted is determined by exciting the tube by superposed currents of particular frequencies.—London *Elec. Eng'ing*, Feb. 12, 1914.

Generation, Transmission and Distribution

Traveling Electric Waves.—LUDWIG BINDER.—The author gives a hydraulic analogy of the formation of electric waves, their method of traveling, their reflection, and shows how to calculate the speed of propagation. He also discusses the conditions under which a straight wave-front can be obtained and shows that these conditions are not fulfilled in practice. He also gives a hydraulic analogy of the way in which waves enter a machine when a switch is handled, further how waves change when they pass from one line to a different line, and how a short-circuited line behaves.—*Elek. Zeit.*, Feb. 12, 1914.

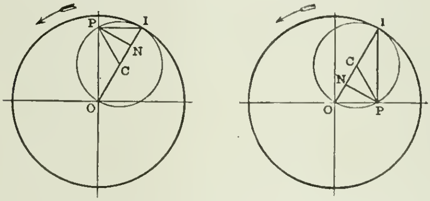
Alternating-Current Calculations.—KARL RICHTER.—A long mathematical article illustrated by diagrams. For series connections some formulas are developed from which the curves of the currents and partial voltages can be directly obtained for any variable impedance. For the special case of a pure resistance or a pure reactance the results are summed up in tables. The object of the article is to give some general rules and methods which can be applied directly in practice instead of starting the calculations from the very beginning.—*Elek. u. Masch.* (Vienna), Feb. 1 and 8, 1914.

Traction

Railway Electrification.—ROGER T. SMITH.—A long illustrated abstract of a paper read before the (British) Institution of Electrical Engineers. The author discusses the question of electrification for suburban, fast passenger and freight service. The general characteristics of electric and steam traction, together with the conditions which would be favorable for electrification, are dealt with in each of these cases.—London *Electrician*, Feb. 13, 1914.

Electrophysics and Magnetism

Representation of Power in Alternating-Current Diagrams.—F. M. DENTON.—The author thinks that students do not readily obtain a clear conception of the wave of power in an alternating-current circuit. The student sees at once that the power dissipated by an alternating current I in an ohmic resistance R is RI^2 and that, therefore, the shape of the wave of power is obtained by squaring the ordinates of the current-wave, but it strikes him as somewhat mysterious that the power wave should have the shape of a sine wave of double frequency. The ordinary vector diagram contains two vectors, one representing I and the other V, rotating with the angular velocity $2\pi n$. These serve sufficiently well to give a clear conception of the manner of variation of the current and the voltage. If in the same diagram another vector could be shown whose angular velocity would be twice that of the I and V vector, and whose projection plus a constant would be a measure of the instantaneous power, the student would be helped toward a clear conception of the nature of the power wave. The introduction of such a power vector proves to be quite simple. Let the line OI in Fig. 1 represent the current in a resistance R. Then to some scale the same line OI represents also the potential difference over R. Thus the length OP represents to one scale instantaneous current and to another scale instantaneous voltage, and $(OP)^2$ represents instantaneous power. It is obvious that the point P always lies upon the circle having OI as diameter. Now $OP^2 = PN^2 + ON^2$, the line PN having been drawn perpendicular to OI, and $PN^2 = ON \times NI$. Hence $OP^2 = ON \times NI + ON^2 = ON\ (NI + ON)$, or since $(NI + ON)$ is constant, OP^2 is proportional to ON at every instant —that is to say, the power is proportional to ON, $(OC + CN)$. Now, CN is a simple harmonically varying quantity, for it is the projection upon the diameter OI of the circle OPI of the point P moving in uniform velocity around the circumference OPI. The angular velocity of P with reference to OI is obviously twice that of I about O, for the angle PCI is always twice the angle of POC. Thus it is seen that the power at any instant is given by the projection of CP upon OI, plus the constant OC, and that the angular velocity of CP is $4\pi n$. The power vector that was required is the line CP. The case of a circuit of zero power-factor may be dealt with in a similar manner. Referring to Fig. 2, if the projection of OI upon the vertical represent instantaneous current, then to some scale the projection of OI upon the horizontal will represent instantaneous voltage, and the instantaneous power is proportional to the product of $OP \times IP$. That is to say, the power is proportional to the area of the triangle OPI, and therefore to the altitude PN of the same triangle. But PN is the projection of PC upon a diameter of the circle OPI. And, as in the previous case, P moves with uniform angular velocity $4\pi n$ with reference to OI. Hence in this case the power is a simple harmonically varying quantity of double frequency, and it is represented by the crank CP. The case of a circuit of any power-factor may be dealt with by splitting the current into two components, one in phase with the voltage and the other in quadrature.—London *Electrician*, Feb. 6, 1914.



FIGS. 1 AND 2—ALTERNATING-CURRENT DIAGRAMS

Ionization in the Unstriated Discharge and in the Arc.—C. D. CHILD.—The amount of light given by the unstriated discharge and by the arc indicates that the rate at which ions recombine in these forms of discharge varies as the first power of the current, while the equations usually assumed for discharge through gases would lead us to expect that this rate varies as the square of the current. This is explained by assuming that approximately all of the current is carried by electrons and not by ions of molecular size, and that the great majority of the electrons combine first with molecules and afterward with positive ions. The fact that the electric force in this form of discharge is a linear function of the pressure of the gas is explained by assuming that the ionization is caused by the impact of the more rapidly moving electrons on the molecules and that but few of the collisions between electrons and molecules result either in ionization or in recombination, the greater number resulting in no permanent change in either electrons or molecules. The fact that the electric force decreases slightly when the current is increased is explained by the added assumption that the potential difference through which an electron must go in order to ionize is smaller with larger currents than with small ones.—*Philos. Mag.*, February, 1914.

Luminous Discharges in a Magnetic Field.—R. F. EARHART.—An account of an experimental investigation in which quantitative measurements on the effect of a longitudinal magnetic field on a luminous discharge were made in three gases above and below their critical pressures. Measurements in a uniform magnetic field varying from 0 c.g.s. to 10,000 c.g.s. units were made. The results indicate that at pressures below the critical pressure a weak field increases the current obtained by a given potential difference while strong fields reduce it. The lower the gas pressure the greater must be the critical value of the magnetic field to secure a reduction of the current. Pressures close to the critical pressures show small effects due to magnetization, but above the critical pressure the longitudinal field reduces the current.—*Phys. Review*, February, 1914.

Secondary Gamma Radiation.—D. C. H. FLORANCE. —An investigation of the emergent and returned secondary gamma radiations using radium emanation as a source of primary gamma rays. The experiments confirm the author's earlier results that the secondary gamma radiation becomes gradually less penetrating the greater the angle it makes with the original direction of the primary beam. The penetrating power depends to a certain extent on the thickness of the radiator and on the screening of the emanation. The secondary gamma radiation is completely heterogeneous. The secondary gamma radiation for all radiators is different in type from the primary radiation, and it appears that in the process of scattering some modification has taken place. In the case of elements such as platinum, mercury and lead there is a small amount of an "extra-radiation" with an absorption coefficient of about 40 cm^{-1} in lead. This "extra-radiation" may be characteristic of the radiator. The production of secondary gamma rays plays an important part in the absorption of the primary gamma rays. Lead produces more secondary gamma rays than does an equal mass of aluminum, zinc or tin. The distribution of the secondary radiation has been examined under various conditions.—*Philos. Mag.*, February, 1914.

Electric Discharge from Liquid Points.—JOHN ZELENY.—An account of an experimental investigation in which the electrical discharge from points whose discharging surfaces consist of slightly acidulated water when placed opposite a metal plate were studied. The positive discharge was found to begin with a momentary current, which was repeated only by an increase in the potential of the point. At higher potentials the discharge current is intermittent, and this is followed by a steady current at still higher potentials. In the last case the liquid meniscus is quiescent and the luminosity covers the surface and is confined to its immediate neighborhood. With the intermittent form of positive discharge the liquid meniscus is agitated and the light starts from a small area on the surface and extends half way to the plate in the arrangement used. The negative discharge is always in the form of a brush discharge and the current is almost always intermittent and the meniscus in motion. The light in this case, however, while starting from a small area of the surface also, extends out into the gas a distance which is only about equal to the diameter of the point. The momentary discharges, which first take place from the liquid surface, produce some effects there which result in an increase in the surface tension. This arises most likely from the surface being cleansed of some material collected there. It is probable that some such effect is likewise produced when metallic surfaces are used. A hydrostatic method is given for measuring the electric intensity at the surface of liquid points both before and during discharge. The surface tension of the liquid may also be obtained with the same apparatus.—*Phys Review*, February, 1914.

Electrification at Liquid-Gas Surfaces.—H. A. MCTAGGART.—The author has worked out a rotating-cell method of examining the electric charge on small spheres of gas in a liquid. Quincke's observations on the movement to the positive pole of small spheres of air, oxygen and hydrogen in distilled water were repeated, using the rotating cell. The velocity of small spheres of gas in water was found to be proportional to the potential gradient and independent of their size (within limits). The velocity of spheres of air, oxygen and hydrogen in water was found to be about 4.10^{-4} cm. sec.$^{-1}$ volt^{-1} cm. Dissolved salts affect the charge at a gas-liquid surface, the activity of the salt depending on the charge carried by its ions in solution. An air-water surface—in the absence of polyvalent ions—is electrically neutral in a slightly acid solution. A sphere of gas in a solution can change the sign of its charge as it diminishes in size, by being absorbed in the solution. Under the conditions of these experiments the electric charge at a liquid-gas surface appears to be almost independent of the nature of the gas.—*Philos. Mag.*, February, 1914.

Anomalous Zeeman Effect in Satellites of Mercury Lines.—H. NAGAOKA AND T. TAKAMINE.—The separation of the satellites of the mercury lines 4047 and 5461 in magnetic fields is generally anomalous, and the change in wave-length is not linearly proportional to the strength of the field. In high fields some branches of the satellites vanish, and the rate of change of wave-length with corresponding increase of the field becomes equal to that for the branches of the principal line. The intensity of different branches of satellites is generally unequal.—*Philos. Mag.*, February, 1914.

Energy Required to Ionize a Molecule by Collision.—J. S. TOWNSEND.—A brief paper in which the conclusion is reached that "the energy required to produce ionization by collision in air is about $23e/300$, e being the charge on the ion."—*Philos. Mag.*, February, 1914.

Temperature and Magnetism.—N. H. WILLIAMS.—A brief article illustrated by diagrams on some anomalous temperature effects upon magnetized steel.—*Phys. Review*, February, 1914.

Electrochemistry and Batteries

Structure of the Atom.—W. PEDDIE.—The author thinks that the origin of the spectrum series could be found in the complicated structure of the atom itself, rather than in complexity of structure of configurations of electrons circulating in or around a comparatively simple atomic structure. He discusses the structure of the atom under the following headings: the centrally symmetrical atom, the atom characterized by axial rotation, the magnetic field, and the magneton.—*Philos. Mag.*, February, 1914.

Units, Measurements and Instruments

Rational Units.—G. N. LEWIS AND E. Q. ADAMS.—Some theoretical notes on the quantum theory of ultimate rational units with numerical relations between elementary charge, "Wirkungsquantum," and constant of Stefan's law.—*Phys. Review*, February, 1914.

Adjustable Condenser with Law of Squares.—W. DUDDELL.—Continuously adjustable condensers are in considerable use, especially in connection with wireless telegraphy. In using these condensers for the purpose of measurement it often happens that the quantity to be measured is proportional to the square root of the capacity of the condenser, as, for instance, in wave meters of the Donitz type. For this reason it is convenient in many cases to make the capacity of the condenser proportional to the square of the distance traversed by the moving part. Several designs of condensers are described which fulfil this requirement. The most convenient form is shown in Fig. 3, in which the outside edge of the movable plate is shaped to a suitable curve to obtain the square law. The mathematics of arriving at the law of this curve is given.—London *Electrician*, Feb. 6, 1914.

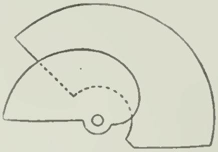


FIG. 3—ADJUSTABLE CONDENSER

Moving-Coil Galvanometer.—PAUL E. KLOPSTEG.—A brief paper in which the author gives the development of two equations for finding the proper size of wire to be used in damping rectangles in order that critical damping may be obtained in moving-coil galvanometers. The first equation is used when the number of turns in the coil cannot be ascertained, the second when this number is known.—*Phys. Review*, February, 1914.

Magnifying Electric Currents.—E. REISZ.—A nearly complete English translation of the author's recent long German article on the magnifying relay of von Lieben and Reisz for telephonic purposes. The original German article was abstracted some time ago in the *Digest*.—London *Electrician*, February, 1914.

Telegraphy, Telephony and Signals

Wireless Telegraphy Transmitters.—A. S. Blatterman.—The first part of a mathematical article in which the author deals in a general way with the electric calculations required in the design of radio-telegraph stations.—London *Electrician*, Feb. 13, 1914.

Miscellaneous

Electrical Accidents.—S. Jellinek.—The author discusses electrical accidents and deaths by lightning on the basis of a lecture of A. J. Jex-Blake. The fact is emphasized that it is a mistake to think that 100-volt circuits are always safe, since various deaths have occurred in Vienna owing to persons touching electric lamps supplied from 110-volt circuits. While Jex-Blake considered the Schaefer method of resuscitation to be the best, the present author thinks differently. He considers the Sylvester method of artificial respiration to be the only correct and effective one.—*Elek. Zeit.*, Feb. 12, 1914.

British Electrical Trades Unions.—R. W. Weekes.—An analysis of the present demands of the British electrical trades union in comparison with the rules adopted in 1912 by the British Electrical Contractors' Association. The two sets of rules are placed side by side for comparison. In the present article only wiring work is dealt with.—London *Elec. Rev.*, Feb. 6, 1914.

Book Reviews

Jahrbuch der Elektrotechnik. By Dr. Karl Strecker. Munich: R. Oldenbourgh. Illus., 224 pages. Price, 8 marks.

A carefully prepared compendium of electrotechnical literature and accomplishment for the year 1912. The well-known "Fortschritte der Elektrotechnik," that has been maintained by the Elektrotechnischer Verein from 1887 to 1911, was found to become too burdensome in its original form, and this annual volume is intended to replace it in the future. The work is divided into eighteen chapters and five sections. The latter relate respectively to general matters, electromechanics, electrochemistry, electric signaling, electric measurements and researches. Each chapter has been written by a specialist and the whole collaborated and collected into suitable uniform style by the editor. The work will form a splendid reference book as a member of a very valuable series and has a distinct place in German electrotechnical literature as a supplement to "Science Abstracts" in English.

Electricity for the Farm and Home. By Frank Koester. New York: Sturgis & Walton Company. 280 pages, 53 illus. Price, $1.

It is very generally admitted that a country in which a majority of the people own and operate the soil is likely to be socially and economically stable, whereas a country in which a majority of the people have left agriculture to seek their livelihood as industrial wage-workers is likely to be socially and economically unstable. One of the most serious problems of this age is how to make life on the farms more attractive so as to check the drain to the cities of people lured by inducements and excitements in great variety. In the book before us Mr. Koester has filled a serious gap in electrotechnical literature by explaining in simple language how electricity can most economically be used in the farm and country home so as to save muscular energy and relieve the strain on the physical system of the farmer, enabling him to use machines more and manual power less. A great field and future lie before mechanics, farmers, bankers and engineers in this direction to supply electric power to the land more cheaply than any animal can give it. The fifteen chapters of the book relate to the following topics: Benefits of agricultural electricity; central-station service; generating electric power; electric motor applications; cost of operating; electricity in the manufacture of farm by-products; electricity in the preservation of farm products; electric transportation of farm products; electric plowing; diverse applications of electricity; electric heating; electric lighting; the telephone in rural communities; electric power in irrigation; electric stimulation of vegetation. The book will commend itself to all present and prospective country dwellers, who will come more and more to appreciate the part played by electricity in making farm life attractive.

Electrical Meters. Prepared in the Extension Division of the University of Wisconsin. (Engineering Education Series.) By Cyril M. Jansky. New York: McGraw-Hill Book Company, Inc. 370 pages, illus. Price, $2.50.

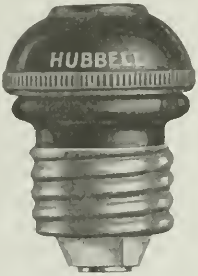
It is hardly possible to treat exhaustively of all kinds of electrical measuring instruments in a single volume; but Professor Jansky has undoubtedly succeeded in giving a simple and comprehensive description of all practical electrical meters and in presenting the essentials of the theory underlying their operation in such a manner as to be readily understood by the average reader. The matter is carefully selected and systematically arranged; the author's style is terse and clear, and the written descriptions and explanations are accompanied by excellent illustrations and diagrams. An introductory chapter deals with the fundamental principles of electricity and magnetism, and although it might be deemed superfluous, the facts are presented so simply and so concisely that the chapter seems neither out of place nor disproportionate in length. Subsequent chapters treat of the fundamental principles of alternating currents and of electro-dynamic instruments. The descriptive and explanatory matter is divided up under main headings covering ammeters and voltmeters, power-measuring instruments, power-factor and frequency meters, graphic recorders, integrating meters and demand indicators. Five chapters are devoted to instrument testing, and in the final chapter reference is made to the various sources of error in electrical measuring instruments. It is probable that the book is not written with the idea that it will be much service to the manufacturer or designer of electrical measuring instruments; but, nevertheless, it is in a book treating of this subject that one expects to find more than a mere reference to such matters as the effects of non-sinusoidal and dissimilar wave-forms on the readings of power-measuring instruments. A discussion of the meaning—or want of meaning—of the expression "phase difference" as applied to two alternating quantities of different wave-forms, together with a more complete exposition of what should be understood by the power-factor of an unbalanced polyphase circuit, might also be embodied with advantage in a second edition. The chief ground, if any exist, for adverse criticism might lie in the fact that the sinusoidal wave-form is generally assumed. This would be an unreasonable objection to make in the case of an elementary textbook on alternating currents; but, as previously mentioned, it is to a book treating exclusively of the theory, construction and operation of measuring instruments that one turns, almost instinctively, for a fairly comprehensive treatment of the effects due to wave-forms differing from the conventional sine curve.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Small Attachment Plug

An attachment plug that has been made as small as possible, although designed for maximum safety to the operator, is shown in the accompanying illustration. The push-in cap is of a convenient size, and the body is so made that it will fit a standard lamp socket. The contacts are buried in the base. This plug is being put on the market by Harvey Hubbell, Inc., Bridgeport, Conn.



ATTACHMENT PLUG

Electric Curling Iron

The electric curling iron shown herewith is manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The device is designed so that it can be used either with stored heat or continuous heat. In the former case the swivel plug is pulled out as soon as the iron becomes hot, thus breaking the circuit. With the swivel plug the iron can be freely rotated without twisting the cord when continuous heating is desired. The curling iron can be used with or without the hair clamp, which may easily be removed.

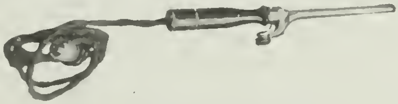


FIG. 1—CURLING IRON COMPLETE

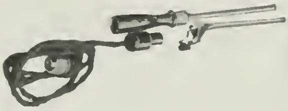
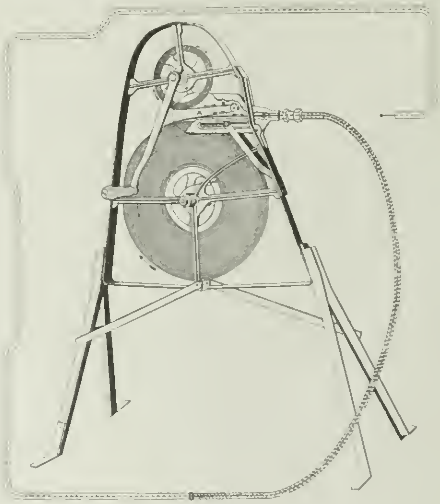


FIG. 2—CURLING IRON, PARTS DETACHED

The heating element is in the form of a rod inserted directly in the barrel. It can be removed by loosening two screws in the handle. The swivel plug, which fits in the end of the handle, is made of a molded composition, and it will not break if dropped. Strong spring contacts are carried in the plug, and they connect with the terminals of the heater. The cord is attached to the contacts within the swivel plug. None of the live parts are exposed. As the power input is only 15 watts, about 0.1 cent an hour will pay for the use of this curling iron at the average price of energy. All the metal parts are nickel-plated and highly polished. The handle is made of wood, which is black-ebony-finished.

Conduit-Wiring Machine

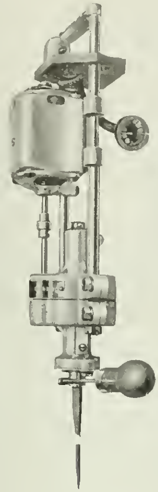
In the conduit-wiring machine illustrated in the accompanying diagram a fishing tape is conveyed from the periphery of a coil fixed on a wheel by means of a superimposed tape which is wound on a second wheel. In the illustration the heavy line *C* represents the fishing tape which is driven through the conduit. The light line *B* represents the lighter tape which by being wound on the upper wheel forces the fishing tape through the flexible-steel hose and thence through the conduit. By placing the crank on the lower wheel and turning it both tapes are re-wound and at the same time the lead wire or insulated conductor is drawn through the conduit. At ordinary speeds the fishing tape travels at 5 ft. per second around any number of bends permitted by city ordinances. The apparatus weighs 27 lb. complete. It is collapsible and can be readily carried by hand. The flexible armored steel base is 12 ft. long. This machine is manufactured by the National Conduit Wiring Machine Company, 25 Broad Street, New York.



MACHINE FOR CONDUIT WIRING

Percussion-Type Electric Drill

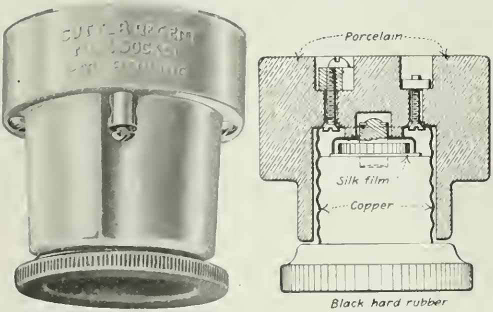
An electric drill of the percussion type for drilling concrete, brick, tiles and marble, made in two sizes, one using a 1/16-hp motor and the other a 1/8-hp motor, has been placed on the market by the Electric Tachometer Company, Philadelphia, Pa. Use is made of a universal motor for either alternating current or direct current. The weight of the smaller drill is 11 lb. and that of the larger 39 lb.



ELECTRIC DRILL

Improved Film Socket for Street Lamps

A film socket for series street-lighting circuits recently brought out by the George Cutter Company, South Bend, Ind., employs silk as the dielectric medium. As will be seen from the accompanying illustrations, all metal parts of the socket are inclosed in the porcelain base, preventing possible short-circuits and corrosion. The circular silk film is held securely in place by a copper washer and the film seat is so designed that it is impossible for an unscrupulous repairman to use cigarette papers or wooden splinters in place of the proper silk film. Films of silk, it is said, will puncture at rated voltage and where lamps of high candle-power are to be operated several layers of silk may be used without difficulty. The lamp socket screws into the receptacle and grips the lamp firmly to prevent it falling out. The device has no spring contacts to deteriorate.



FIGS. 1 AND 2—FILM SOCKET FOR STREET LAMPS

Reverse-Power Relay

A reverse-power relay designed for transformer protection in installations where transformer banks are operated in parallel has been developed by the Condit Electrical Manufacturing Company, Boston, Mass.

These relays are designed for service where it is desired to open the alternating-current circuits when the direction of energy flow or power is reversed. A circuit-breaker with shunt trip coils is required, the relay making connection to the trip coil to open the breaker, the specific purpose being to cut out instantly that particular bank of transformers wherein a fault may occur without the interruption of the remainder of the system. The relay will operate equally well on all transformer connections; that is to say, on delta-delta, star-star or delta-star, as the case may be.

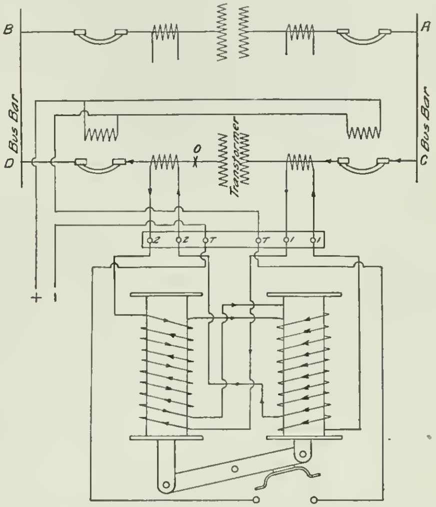


FIG. 1—WIRING DIAGRAM SHOWING RELAY CONNECTIONS

The relay consists of two powerful electromagnets which either close or maintain the tripping circuit open. Upon a reversal of power the relay is adjusted to operate and permit the tripping circuit to be closed, resulting in a simultaneous opening of the circuit-breakers on both the primary and the secondary sides of the transformer bank.

The wiring diagram in Fig. 1 illustrates the electric circuits of the relay; instead of tripping the breakers mechanically, it closes a contact which allows current to pass through the shunt trip coils of the breakers, thus permitting them to open. Its operation is independent of overloads or short-circuits, series transformer characteristics, potential or direction of energy flow, and operates only when there is a relative reversal of power in the primary and secondary circuits of the transformers.

Assuming the direction of the current to be as indicated by the arrows in Fig. 1, under normal load conditions, the current from *C* to *D* has no effect upon the relay except to keep the contacts of the shunt trip circuit open. Should a fault occur, however, at the point *O*, for instance, the tendency would be for the energy to flow in the direction *A*, *B*, *D*, *O*, causing a reversal of power in a section of the feeder *D*, *O*. This action likewise produces a reversal of power in the series transformer and causes the relay to operate and close the shunt trip coils of the circuit-breakers. Since the circuit-breakers both open simultaneously the faulty bank of transformers is completely isolated, and the continuity of the entire system is not interrupted.

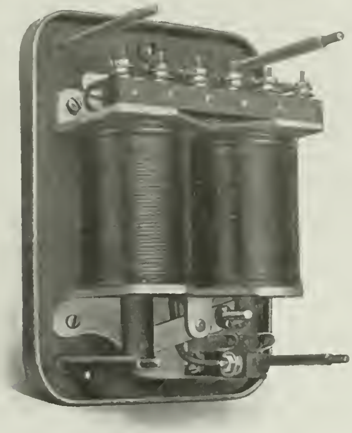


FIG. 2—RELAY WITH COVER REMOVED

Fig. 2 shows the relay with cover removed. It is designed with few moving parts and is well insulated. It is arranged to operate on a reversal of 2 amp of secondary current and requires only 20 volt-amp for its operation. The relay is inclosed in a dustproof case, having a black oxidized finish and is suitable for installation on a switchboard. The device is 6 in. wide, 8 in. long and 4 in. high.

Instrument Posts for Electrically Operated Control Outfits

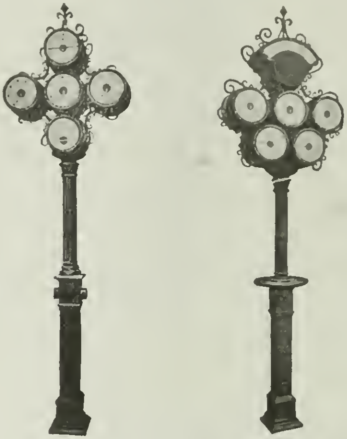
Instrument posts are often used for mounting meters in a generating station in place of an instrument switchboard. The wiring is concealed in the interior of the posts. These posts provide a very convenient and ornamental method of mounting meters, and the instruments are placed in such a position that they can be observed readily without obstructing the general view of the operator.

The usual arrangement is to have the posts support the railing of an operating gallery, each post being placed in front of its respective controlling apparatus, which is usually installed on a suitable controlling pedestal.

The posts may be secured to the floor either by bolting the shank to the side of channel-iron beams under the floor or by using a bolted flange collar, which is secured to the post and is provided with holes for holding down the bolts. With concrete floors use can be made of sockets which may be set into the floors and are designed for bolting to the flange collar.

On standard ornamental posts plates are provided where the hand railing is usually attached, but when required hand-rail bosses may be substituted. These bosses are drilled to take a standard 2-in. pipe, with an outside diameter of 2⅜ in. Posts with panel bases cannot be arranged for hand railing. These posts are finished in dead black. The posts having paneled bases are equipped with panels of slate with black marine finish.

Two styles of pedestals are made, one with an ornamental base and the other with a paneled base for the mounting of control apparatus. Each of these types is also made with a stationary top and with a swivel top, which can be turned about by means of a hand-wheel just above the base.



FIGS. 1 AND 2—STATIONARY AND SWIVEL POSTS

These instrument posts are built by the Westinghouse Electric & Manufacturing Company.

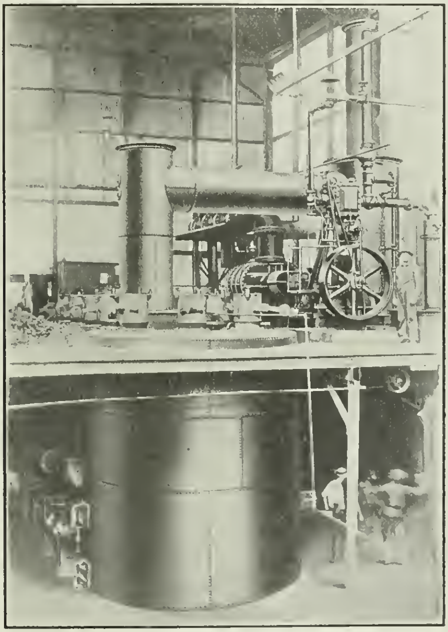
Fuel Gas Power Plant

What is declared to be the largest gas producer in the world has been built by the Smith Gas Power Company, Lexington, Ohio. This producer is of the up-draft type and is operated with bituminous coal. The complete producer plant is shown in the accompanying illustration. It has an aggregate grate area of 240 sq. ft. The gas generator, saturator and primary cooler set are installed on the lower floor and the gas exhauster and tar extractor on the charging or second floor. The gas is drawn from the top of the producer through the central vertical flue to the primary cooler. From the cooler it passes to the exhaust and is pumped through the tar extractor into the gas main. The grates are mechanically operated.

The producer is built up of a series of five transverse sections all of which are identical in construction. The shell is made of 0.375-in. open-hearth steel plate securely braced both vertically and longitudinally. Each section carries its own grate and gas outlet, and its air supply and ash-handling equipments are completely segregated from those of the other sections. Doors are placed on each side of each ash pit, and through these the operation of the grates may be observed. The fire-brick lining is 12 in. thick and is arched across the top below the head. The cross-section of the fuel bed is rectangular, although the ends of the generator are rounded for structural reasons.

The fuel magazine above the lower end of the gas outlet is divided laterally into pockets each of which has its own charging hopper. Each section, therefore, acts in a way as a small producer unit. The fuel bed is supported upon a central flat grate, with sloping grates rising at an angle of 45 deg. on either side and operated in much the same manner as inclined mechanical stokers. These stoking grates may be operated continuously or at intervals as conditions require, and the speed may be varied to suit load conditions. The flat grate is made up of rocker sections and is operated, at the will of the attendant, by means of an air cylinder. This grate cuts all ash from the center of the producer and keeps the fire clean and free.

In conjunction with the producer a tar extractor is used. It consists essentially of a gas pump or extractor which forces at high velocity the raw gas containing minute particles of tar fog through a glass-wool mat. The tar fog tends to agglomerate into larger drops after passing through the mat and falls into a trap.

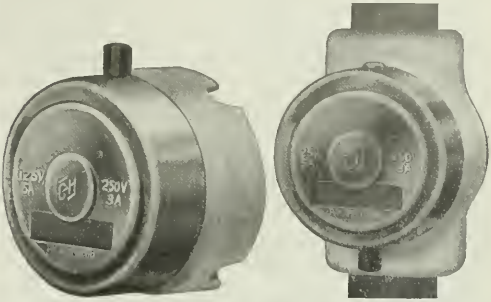


UP-DRAFT PRODUCER

Snap Switches

To its rectangular-base and round-base snap switches the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has added six new styles. These devices are used with open wiring, conduit, wooden and metal molding and concealed knobs and tubes. The accompanying illustrations show two of these switches. A "snap-locking" cap is provided, which eliminates the use of screws and saves time in installing. Two small slots which are cut in the side of the cap diametrically opposite each other and near the push-buttons engage with two nibs secured to the base.

In removing the cap the sides are pressed together and then moved upward, thus producing a bulge which causes one slot to be released from its nib. The cap is replaced by first engaging one slot, then pressing the sides so that the other slot slips over its nib and locks it in place. The usual push-button mechanism is used. Each switch has one button which indicates that the circuit is open and another indicating that it is closed. The caps are furnished either plain or with a label holder for designating the circuit or lamps controlled.



FIGS. 1 AND 2—PUSH-BUTTON SNAP SWITCHES WITH SLOTTED BASE AND WITH METAL-MOLDING BASE

Aluminum Percolator

In order to eliminate the "brassy" taste which, it is declared, utensils made of copper or brass convey to food, manufacturers of electric-cooking devices are devoting much of their attention to other metals. The percolator shown in the accompanying illustration is made of aluminum and German silver. A glass top is provided for observing the brew. The handle is made of ebonwood. The tube and jacket and the shell inclosing the heating element are of German silver, and the spout, pot, lid, base, basket and cover are of aluminum. The heating element can be easily removed. The cover is not hinged but locks with a groove-and-catch arrangement.

PERCOLATOR MADE OF ALUMINUM AND GERMAN SILVER

This percolator weighs only 1.75 lb. It is known as the El Perco and is being put on the market by the Hotpoint Electric Heating Company, Ontario, Cal.

Jobber, Dealer and Contractor

Municipal Plant Abandons Sale of Supplies

Following the plan adopted by many privately owned central-station companies, the municipal plant at Lafayette, Ga., will turn over the business of handling electrical supplies to a retail concern engaged exclusively in the sale of these supplies and will discontinue the handling of electrical goods which it has heretofore carried in stock. The Lafayette Plumbing & Electric Company is the style of the new firm, which began business Feb. 1.

Rating of Electric Flatirons

A writer in the *Edison Round Table* of Chicago reports that one of the employees of the Commonwealth Edison Company recently purchased what was supposed to be a 110-volt flatiron. The utensil failed to give satisfaction and it was sent to the repair department of the company, where it was found that the iron was built for operation on a 220-volt circuit, although the manufacturer's stamp indicated the voltage on which it was to be used as 110 volts. This may be a quite exceptional case, but it indicates one possible cause of trouble when complaints of electric flatirons are reported.

Chicago Electric Shop Doing a Good Business

According to Manager George B. Johnson, the business prospects of the Electric Shop of Chicago for the year 1914 are flattering. The month of January showed a substantial increase over the business of January, 1913, and in February the gross sales were approximately 50 per cent greater than those of February last year. Most of the patrons of this beautiful electrical shopping place are women, and the articles most numerously sold are toasters, flatirons, chafing dishes and portable lamps. It is reported, however, that a special increase in business is noted in the sale of medium-priced suction cleaners for household use. The advertising department of the Commonwealth Edison Company has provided the Electric Shop with a handsome colored souvenir post card. This represents in colors the interior of the store, and no doubt many of these cards will be mailed to friends by out-of-town visitors.

Electric-Heating "Wrinkles" for Automobiles

The Denver Gas & Electric Light Company is carrying a stock of electric-vehicle heaters made by the American Electrical Heater Company. This heater is intended to be connected to the battery of an electric automobile. It is operated by a switch and may be used by the occupant of the car at his convenience. The heater is rated to consume 100 watts an hour. The enterprising Denver company is about to add to its line of electrical appliances an electric water heater which is used to keep the water in the circulating system of a gasoline engine at a temperature high enough to prevent freezing, thus facilitating the easy starting of the engine in winter weather. This heater is placed in the water line at a point just before that at which the water enters the bottom of the radiator. It is wound for 110 volts and can be connected to any ordinary lamp socket. The installation of this heater interferes in no way with the circulating system of any gasoline engine. Its consumption of energy is 300 watts an hour, and it is adapted for use in connection with gasoline automobiles that are sheltered in unheated garages. Another appliance which is finding favor with automobile owners in Denver is an electric tire vulcanizer. This appliance is automatic and enables the owner of a car immediately to close up any cuts that may be discovered in the casing of a tire. It may also be used for closing punctures in the inner tube by the vulcanizing process. The appliance has a rated consumption of 500 watts an hour and can be attached to any lamp socket.

Co-operation Between the Electrical Contractor and Central Stations

Mr. J. F. Ramier, manager of the Memphis Consolidated Gas & Electric Company, addressed the Tennessee Electrical Contractors' Association at its recent convention in Memphis on Feb. 17 and 18 on the subject of co-operation. He said the subject head which brought out all of the points of mutual interest between the contractor and central station was synchronism, because neither the contractor nor the central station has the time to pull the other along. Both are forced to a gait which is so rapid that only a perfectly running machine or organism can possibly survive long, and while both the central station and the contractor can be synchronized and by running in parallel can occasionally stand the swings of cross-currents between them, they must keep these fluctuations off the line. From an experience of three years, Mr. Ramier said that a large part of the phenomenal growth of electricity in Memphis can be attributed to the ready response with which the contractors have received the central station's plans. There was a time when the growth of motor load was slow and the actual load carried small. An active campaign on the part of the central station resulted in an increased load of from 25 to 30 per cent yearly. This caused the contractors to take an interest, with the result that because of their efforts another and equal addition was made to the central-station motor load. Next the central station began to boost electric fans. One season was sufficient to bring it the assistance of the contractors, and an active campaign on their part showed expected results. By that time the experience of the central station was such as to warrant its refraining from selling appliances altogether and confining itself to that moral and financial support which results in making the contractor a strong part of the central-station organization.

Mr. Ramier claimed that Memphis has more homes using electricity in proportion to its inhabitants than any of its sister cities, and because of its system of rates it is more common than otherwise for a new consumer of electricity to go to the contractor and the architect. The first inkling the central station has of the business is when it is asked to connect up the service. According to Mr. Ramier, the central station in Memphis is facing problems such as energy theft and fire protection as well as the problem of keeping in closer touch with each installation, and while it is spending money asking the assistance of contractors along these lines, it is aware of the fact that sooner or later the question of still further reducing the cost of illumination by increasing the lamp efficiency will call for new methods. The company is studying hard, with a confidence born of experience that when the proposition is put fairly to the contractors it will speedily be settled in a manner that will testify to the advantages of co-operation between the central station and the contractor.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Booming the Electric Sign Business.—The Denver (Col.) Gas & Electric Company has adopted a novel plan for pushing its electric sign business. A card was issued recently giving the number of people who pass one of the busy street corners of that city on an average winter night between 6 and 12 p. m. Along with this feature of interest, an offer is made to furnish advice as to the location of signs, design sketches for the same, and to furnish also a count of the number of people passing any given point, to whom an electric sign might carry a selling talk.

New Slogan for Fuse Manufacturer.—The Economy Fuse & Manufacturing Company, of Chicago, has adopted a slogan which seems to combine business with altruism and which will be used on its business correspondence. By means of an embossing stamp two concentric rings are impressed in the paper, in the center of the inner ring the words "Safety first" being stamped and between the inner and outer rings the words "Economy next." The special points worth noting in connection with the novelty are the particular merit of the slogan itself and the cheapness of the method of application.

Glass Factory Makes Unusual Load Arrangement.—The Illinois Glass Company, operating in Alton, Ill., has recently discontinued the use of its 400-kw steam plant in favor of electric drive with energy supplied by the East St. Louis Light & Power Company. The glass company will take 400 kw continuously from the electric-service company's mains at 2300 volts pressure, and for the peaks on its own system, amounting to from 200 kw to 400 kw, will operate its own producer-gas engines. It is expected in this way to secure a low motor-service rate and at the same time utilize most of the producer gas generated.

Plans of the American Electric Car Company.—Note was made in the Jan. 31 issue of the *Electrical World* on the merging of the Argo, Broc and Borland-Grannis electric vehicle manufacturing interests in the American Electric Car Company, of Saginaw, Mich. The latter concern proposes to continue the making of all three models of the merged companies at the same factories as hitherto. The direct benefits obtained through the consolidation are increased operating economy and a strengthening of the marketing facilities of the agents of all three original companies through the completeness of the three lines as a whole.

Electric Lamp Manufacturer Doing a Good Business.—The following abstract from a letter written by R. W. Littell, of the Kentucky Electrical Company, Owensboro, Ky., contains matter of interest bearing on the recent entry of that concern into the tungsten-lamp manufacturing field. Mr. Littell says: "Early in the fall of 1913 we decided to go into the manufacture of drawn-wire tungsten lamps, and accordingly placed our order for a complete outfit of machinery for this purpose. Since then the machinery has been installed and we are now producing the lamps. Our present capacity is 1000 lamps a day, but orders are coming in so liberally and the business outlook is so good that we do not expect to be able to meet the demand for these lamps without increasing our capacity."

Turbine Manufacturer Secures Important Rights.—The mixed-pressure turbine-regulator patent rights which have recently been acquired by the Terry Steam Turbine Company, Hartford, Conn., are one step forward in the development of the Terry turbine. The company is preparing to furnish its new "return-flow" turbine in sizes from 75 hp to 1000 hp either for straight high-pressure or low-pressure service or for automatically controlled, mixed-pressure service. The mixed-pressure turbines are of advantage in connection with existing plants, where, by their operation, the energy contained in the exhaust steam may be utilized throughout the year, instead of for a period of six or seven months, as is the case at present when the exhaust is used for heating service.

Increase in Western Electric Sales During 1913.—Sales of the Western Electric Company for the year 1913 were approximately $78,000,000, an increase of about $6,000,000, or 8 per cent, over the 1912 sales of $71,727,329. In 1911 sales amounted to $66,211,957. Business in 1913 was pretty close to the estimate made at the beginning of the year. As result of business activity and unusual conditions in the Middle West due to floods, orders in the early part of the year ran at a much higher rate than that shown for the full year, but in the latter half of the period business fell off very considerably. The company added upwards of 4000 customers last year, bringing the number to approximately 36,000. The increase in business was quite general with customers of the various classes, sales being made to the Bell companies and telephone concerns outside of the Bell system, as well as many thousands of customers for electric light supplies. The increase in business applies to central stations and also contractors, despite the decrease in building during the last year, but there was a slight falling off in the business with railways. The export business of the Western Electric Company in 1913 was the largest in the history of the company, notwithstanding the conditions in Mexico.

First of the Series of Public Utility Lectures in New York.—In the Feb. 14 issue of the *Electrical World* note was made of a series of lectures on public utility matters to be given at the West Side Branch of the Young Men's Christian Association, in New York City, under the auspices of its finance forum and with the backing of leading financial interests in the field covered. The first meeting will be held at 8 p. m. on Monday, March 9, at which time T. C. Martin, secretary of the National Electric Light Association, will speak on the "Magnitude of the Electric Light, Power and Transportation Business." Other topics which it is expected to cover in the series of ten lectures, speakers for which will be announced at a later date, are "Magnitude of the Gas Business," "Financial Requirements of Public Utilities," "Future of Public Regulation of Utilities," "Result of Regulation of Public Utilities in Wisconsin," "Public Utility Franchises and Economics," "Municipal Ownership of Public Utilities," "Progress of the Science of Lighting," "Industrial Application of Electricity," "Centralization of Power Supply," "The Public, the Investor and the Holding Company," and "Treatment of Public Utilities by the Public to Secure the Best and Cheapest Service." The speakers on these topics are being invited to express their individual and impartial views, to which neither the finance forum nor the advisory committee will be committed.

Copper Statistics for 1913.—Some interesting figures on the copper situation in the United States during 1913 have been recently compiled and the following summaries and deductions may be of value to users of that metal in the electrical industry: The production of copper in this country during the above year was 612,000 tons, of which 200,000 tons is credited to Arizona and 140,000 tons to Montana. Michigan and Utah contributed more than 75,000 tons each. Domestic deliveries for the same period came to 349,000 tons and export deliveries to 395,000 tons. The last six months each year for the past five years have shown the greatest activity in consumption both foreign and domestic. The largest importers of American copper during 1913 were Germany with 145,500 tons, France with 65,800 tons, Holland with 77,100 tons and England with 55,600 tons. A total of 180,000 tons of copper was imported by the United States in 1913. Since 1860 copper prices have varied from 55.00 in 1864 to 9.00 in 1894 and the average price for the last thirty years has been 13.84½. In 1913 the average price for Lake was 15.70, for electrolytic 15.52, for casting 15.33 and for standard 15.07. Judging from the behavior of prices during past years and from the present outlook it seems likely that the average price of copper for the year 1914 will be not much over the thirty-year average given above.

The Foreign Agent in Brazil.—Continuing the subject treated in the issues of Feb. 21 and 28, the following data on Brazilian commercial customs may be of interest to firms planning to export electrical goods to that country: There is no federal license tax on commercial travelers in Brazil, but there is a system of registration which it is necessary to comply with, if the agent expects to effect any sales, in order to secure the protection of the courts in the enforcement of contracts. All Brazilian commercial houses have to be registered, and the foreign agent can sometimes secure protection by allying himself with one of these houses, through which, in that case, the goods must be handled. The various state and municipal governments have, however, license fees which are levied on foreign agents, and since these fees are widely variant and change frequently, the agent is safest in seeking early information from the American consulate in each territory visited. In some places a penalty attaches to commercial operations not covered by a local license. A power of attorney is almost universally necessary in Brazil if the agent himself is to receive payment for goods sold. Agents' samples can be imported duty free, for a maximum period of twelve months, on special application and the furnishing of a bond to secure the amount of duty in case of failure to re-export. As an alternative to furnishing a bond, the duty may be paid and a refund of 90 per cent secured on the re-exporting of the goods.

General Electric Apparatus for Industrial Plants.—A number of large industrial plants are represented in the latest report on sales of electrical apparatus by the General Electric Company. The New England Box Company, Winchester, N. H., is installing electric drive in its plant at Concord, N. H., and the equipment includes eighty-one motors ranging from 1 hp to 50 hp, three transformers, switchboard, switches and accessories. The Independent Envelope Company, Indianapolis, Ind., will install electric drive equipment consisting of a 75-kva generator with a 6-kw exciter, two 5-hp and six 10-hp motors and switchboard equipment. The Cherokee Brick Company, Raleigh, N. C., will install for electric drive in its plant seven motors ranging from 5 hp to 250 hp, transformers and switchboard apparatus. The Racine Rubber Company, Racine Junction, Wis., will place in operation in its plant 100-hp and 200-hp induction motors, a 200-kva synchronous condenser and switchboard apparatus. The Timber Butte Milling Company, Butte, Mont., will install in its mills twenty motors ranging from 7½ hp to 75 hp, a 5-kw motor-generator set and oil switches. The Riverside Portland Cement Company, Riverside, Cal., has ordered for its mill three 15-hp and one 200-hp motor. The Three Forks Portland Cement Company, Trident, Mont., has arranged to install seven motors ranging from 25 hp to 200 hp, two 30-kva transformers and a switchboard. The Endicott-Johnson Company, Lestershire, N. Y., will add to the electric drive equipment in its shoe factory two 7½-hp, two 35-hp and three 50-hp motors recently ordered. The American Cement Plaster Company, Lawrence, Kan., will equip its plant at Acme, Tex., with electric drive and has ordered twenty motors ranging from 3 hp to 25 hp, with switches. The International Portland Cement Company, Spokane, Wash., will install two 150-hp motors and starting compensators. The Crescent Portland Cement Company, Wampum, Pa., has ordered a 200-hp, 480-volt synchronous motor. The steel and iron industries are particularly large users of this company's apparatus and some of the recent large purchasers in that field are given in its latest report. The Bergen Point Iron Works, Bayonne, N. Y., have recently placed contracts for considerable electrical apparatus for mill equipment, comprising eight 110-hp to 125-hp mill-type motors with control equipments, thirty-six smaller motors ranging from 25 to 100 hp, 120 two-motor coal car equipments, sixteen transformers ranging from 50 to 425 kva, switchboards, switches and accessories. The Atlanta Steel Company, Atlanta, Ga., will add to the electrical equipment in its power house a 500-kw synchronous motor-generator set and switchboard. The Bethlehem Steel Company, South Bethlehem, Pa., will place in operation in its mills a large 3000-hp induction motor, switchboard and accessories. The Pennsylvania Steel Company, Philadelphia, Pa., will install in the power house of its plant at Steelton, Pa., a 500-kw motor-generator set. The Jeanesville Iron Works Company, Hazleton, Pa., will add to the electrical equipment of its plant a 300-hp motor recently purchased. The Alleghany Steel Company, Brackenbridge, Pa., has ordered two 12-hp and four 40-hp motors.

Electric-Vehicle Prospects Reported Bright at Chicago Meeting.—At the meeting of the Chicago Section of the Electric Vehicle Association on Feb. 24, Vice-chairman D. C. Arlington, of the Philadelphia Storage Battery Company, presided. He is the statistician of the section and stated that the sale of twenty-three electric commercial vehicles in Chicago had been reported since Jan. 1. The total number of electric commercial vehicles in service or on order in Chicago is now put at 757, and the number of pleasure cars at 2000. C. A. Street, general sales manager of the Walker Vehicle Company, gave an informal report of a recent trip to Philadelphia. The electric vehicle section in that city has had two or three meetings and, although the youngest of the geographical sections, is doing excellent work. Edwin E. Witherby, Western manager for the General Vehicle Company, gave some observations on the result of a recent Western trip. He said the outlook for the electric-vehicle business in 1914 is very good indeed. The electric-utility companies are waking up to the importance of this branch of the business and are taking hold of the subject in a most encouraging way. Fred L. Morgan, of Jackson, Mich., sales manager for the Standard Car Manufacturing Company, was asked to say a few words as a representative of the pleasure-car manufacturers. Mr. Morgan said that the company with which he is connected has safely weathered its difficulties of last year, which were legal rather than financial, and it feels highly encouraged over the outlook. He told of a plan of advertising the electric automobile by the co-operation of the electric-service company, the Standard company supplying "letter inserts" which a number of the central-station companies sent out with their monthly bills. Mr. Morgan has had much correspondence with electric-service companies in carrying out this method of advertising, and reports that almost without exception the central-station men expressed a desire to co-operate heartily with the electric-vehicle manufacturers. There was some informal discussion as to the result of the introduction of the Ford electric car in the field, and the unanimous opinion of the gentlemen present was that the result would be beneficial. The opinion was expressed that anything that brings the electric vehicle into greater prominence is good for all concerned, and therefore Mr. Ford, with his experience as a manufacturer of low-priced gas cars and his wide resources, will be welcomed as a manufacturer of electric automobiles.

NEW YORK METAL MARKET PRICES

	Feb. 24		Mar. 3	
Copper:	Bid	Asked	Bid	Asked
Standard spot*	13.75	14.37½	13.50	14.25
	Selling Prices		Selling Prices	
	£ s. d.		£ s. d.	
London, standard, spot*	64 12 6		64 2 6	
Prime Lake	14.75	to 14.87½	14.62½	to 14.87½
Electrolytic	14.50	to 14.60	14.37½	to 14.50
Casting	14.30	to 14.40	14.25	to 14.35
Copper wire base	15.75	to 15.87½	15.50	to 15.75
Lead	4.00		4.00	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.25		7.25	
Spelter, spot	5.40	to 5.50	5.32½	to 5.35
Tin, spot	38.50	to 39.00	37.90	to 38.25
Aluminum:				
Prompt delivery	18.50	to 18.75	18.50	to 18.75
Future	18.50	to 18.75	18.50	to 18.75

*OLD METALS

Heavy copper and wire	13.75	13.75
Brass, heavy	8.87½	8.87½
Brass, light	7.87½	7.87½
Lead, heavy	4.05	4.05
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to March 3 967

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*From daily transactions on the New York Metal Exchange

Corporate and Financial

Georgia Railway & Power Company Matters.—The Georgia Railway & Power Company reports for 1913 gross earnings of $5,350,995, net of $2,663,322, and a balance of $594,865, after paying interest charges of $839,230, taxes of $436,095, rental dividends of $801,168 and charges of $95,590 to sinking fund. President Arkwright states that the Tallulah Falls development will be completed by April 1. The company's title to the water-power at these falls has been settled by the Supreme Court of Georgia.

Receiver for the North Electric Company.—An involuntary petition in bankruptcy asking for a receivership for the North Electric Company was filed by five creditors of the company on Feb. 5. The Western Electric Company was the largest of the petitioning creditors. The North Electric Company has manufactured telephone apparatus for a number of years, its office being in Cleveland, Ohio, and its factory in Galion, Ohio. C. H. North was the president, Garrison Babcock the vice-president and George C. Steele secretary and treasurer. Mr. Babcock issued a circular on Feb. 7 in which he said that the company had been placed in the hands of a receiver and that a proceeding in bankruptcy was pending against it. The co-operation of creditors was asked in order to carry out a plan of reorganization.

Large Electrical Manufacturers Consolidated.—The National Carbon Company, of Cleveland, Ohio, and the American Ever Ready Company, of New York City, have been consolidated, and the latter firm will be known as the American Ever Ready Works of the National Carbon Company. Conrad Hubert, president of the Ever Ready Company and recently elected vice-president and director of the National Carbon Company, stated to an *Electrical World* representative this week that the consolidation had been effected without any important financing, and that the main advantage secured by it is the provision of extra manufacturing and storage facilities for both companies. The American Ever Ready Works have a factory on the Pacific Coast, which will be of large advantage to the National Carbon Company, and the Toronto factory of the latter concern will be of advantage to the former company. It is understood that the combination has involved no organization changes other than those affecting Mr. Hubert, and that the identity of the organization, product and sales system of each company will be preserved intact. Another advantage of the merger will be the joining of patent rights.

Annual Report of the Public Service Company of Northern Illinois.—At the annual meeting of the stockholders of the Public Service Company of Northern Illinois, held in Chicago on Feb. 24, President Samuel Insull reported for the year 1913 gross earnings of $6,066,825, and net earnings of $2,476,725, from which was paid interest on notes and bonds amounting to $1,307,399. Dividends to the amount of $455,276 were paid on preferred stock and $385,327 on common stock, and $207,694 was carried to surplus. During the year the company's outstanding bonds and notes were increased by the amount of $4,118,000. This is due to the consolidation with the Northwestern Gas Light & Coke Company, to the acquisition of the plant of the Pontiac Light & Water Company, and to the addition of a 7500-kw unit in the Blue Island generating station, a 5000-kw unit in the Waukegan station, and other plant extensions. During the year the directors increased the annual dividend rate upon the common stock from 4 per cent to 5 per cent. A service annuity system for faithful employees was put into effect on Dec. 1. It is administered by a committee consisting of President Insull, Secretary John H. Gulick, Vice-president Frank J. Baker, Vice-president Charles A. Munroe and General Superintendent George H. Lukes. The company has also established an employees' saving fund. The company's connected business, exclusive of railway power business, amounted to 1,837,630 50-kw equivalents on Dec. 31, 1913. This shows an increase of 369,024 units during the year. The company has thirteen electric generating stations operated by steam or water-power, thirty-five electric substations, nine gas-generating plants and five heat-generating stations. It has issued $17,734,500 of capital stock, has a funded debt of about $28,000,000 and its total assets amount to $48,518,630.

Financial Statement of the Electric Bond & Share Company.—The financial statement of the Electric Bond & Share Company, as of Dec. 31, 1913, contains figures of interest regarding that concern's activities. Current assets amount to $2,882,646, of which $1,217,729 represents cash on hand and in banks. The item of syndicate holdings, underwritings and advances shows assets of $4,180,703, and the investments of the company come to a total of $9,313,478. Under the head of liabilities the company has an outstanding common stock of $5,000,000 and preferred stock of $4,800,000. Its current liabilities amount to $1,348,812, syndicate and contingent liabilities to $1,939,303, reserves to $101,000, and surplus to $3,187,713.

Submarine Signal Company's Progress.—The Submarine Signal Company, Boston, Mass., reports rapid progress in its business development in the past six years. The total number of ships now equipped, or on order for equipment, is 1151, compared with 412 at the end of 1908. The number of signal stations increased from 40 in 1908 to 166 throughout the world in 1913. Several submarine boats have lately been equipped with sending apparatus, and the outlook is bright for communication between vessels in fog and storm by this means in the near future. The company has perfected an invention for "speeding up" the sending of messages by the submarine bell by the use of the Morse code. Its 1913 business was the best in its history.

New England Power Company Prospering.—President George S. Smith of the New England Power Company, Boston, Mass., states in his annual report covering the year 1913 that the gross income of the property was $778,000 as against $514,000 in 1912; that net earnings were $427,000 as against $324,000, and that the balance, after paying bond interest and sinking fund, was $167,000 on Dec. 31, compared with $150,000 a year before. A surplus remained above guaranteed dividends, note interest and other charges, despite the fact that the company's Somerset Reservoir in southwestern Vermont was not completed, that the season was the driest on record in New England for twenty years, and that many parts of the transmission system were not completed until late in November. With the Somerset Reservoir and transmission lines now available, it is expected that earnings for 1914 will be materially increased, and with the development of Plant No. 5, in the Hoosac Tunnel district of Massachusetts in the coming fall, still further gains are anticipated. During 1913 three plants were placed in operation on the Deerfield River near Shelburne Falls and have proved in every way satisfactory. They were initially operated at a disadvantage on account of the incomplete condition of the Somerset Reservoir and prior to the completion of the 110,000-volt transmission line to Millbury, Mass., in the Worcester district, and to the Berkshire section of the State. During the year a contract was made with the Narragansett Electric Lighting Company, of Providence, R. I., the second largest central-station organization in New England. Under this contract power will be supplied on reasonable terms, furnishing the energy required by large power users in the Providence district, and also a large amount of secondary power to the company itself, whose steam plant will be available under reciprocal agreement for the supply of auxiliary power in reserve. By purchase of the water rights on the Deerfield River immediately above Plant No. 5, the company will develop a head of 240 ft. at little additional construction cost. When this plant is completed the development on the Deerfield River will total about 55,000 hp, and the company owns rights on this stream permitting a still further production of hydroelectric energy. For 1914 no new construction work is planned except a gradual increase of the transmission line mileage in the territory now served and the completion of the No. 5 station. The power station building is already constructed and is now used as a transforming station for the electrical energy delivered to the Boston & Maine Railroad for the operation of trains through the Hoosac Tunnel. With the completion of the present developments, the system will be one of the largest in the country, serving a territory producing about 25 per cent of the value of all articles manufactured in the United States, and a region in which the price of coal is higher than in any other extensive manufacturing region in this country.

Business Notes

Westinghouse, Church, Kerr & Company, of 37 Wall Street, New York City, have established a laboratory for the purpose of testing concrete aggregates, water-proofing materials, paints and preservative coatings for steel and concrete.

The Rateau Steam Regenerator Company, of 410 Cedar Street, New York, has recently announced the sale by it to the Terry Steam Turbine Company, of Hartford, Conn., of a license to manufacture and sell, in connection with its product, the Rateau patented mixed-pressure turbine regulator.

The National Lamp Works of the General Electric Company have secured the services of Van Rensselaer Lansingh as manager of the recently created department devoted to the manufacture and sale of both glass and metal reflectors. Mr. Lansingh will have his office at the National Lamp Works, Nela Park, Cleveland, Ohio.

The Stone & Webster Engineering Corporation, of Boston, Mass., has appointed L. E. Palmer as advertising manager with headquarters in Boston. Mr. Palmer is a graduate of Cornell University, receiving the A. B. degree in 1905, and for the past two years has been assistant to Barrett Smith, advertising manager. Prior to his connection with Stone & Webster, Mr. Palmer was on the editorial staff of *The Survey*, New York City.

Pope's Electric Lamp Company, Ltd., of Hythe Road, Willesden, England, has recently completed extensive additions to its works which will enable it to fill orders for all sorts of carbon or "Elasta" lamps far more promptly. Besides supplying its "Elasta" wire lamps, which have been a most remarkable success owing to the strength of the filament and the economy of the lamp, this company is also in a position to quote export prices for drawn-wire lamps, and therefore will welcome inquiries for both types of lamps.

Barrett Smith has opened an office for the practice of advertising and advertising management at 20 Central Street, Boston, Mass., following five and one-half years' service at the head of the advertising department of the Stone & Webster Engineering Corporation. Prior to his connection with Stone & Webster Mr. Smith was associated with J. G. White & Company, Inc., New York, as advertising manager, and with Mackenzie & Company, Ltd., of Shanghai, China, as mechanical and constructing engineer. He was educated at Cornell University, graduating from the College of Mechanical Engineering in 1904.

New Industrial Companies

The Cresson Electric & Machine Company, of Philadelphia, Pa., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $20,000. L. A. Brownhill, of Wilmington, Del., is one of the incorporators.

The Hercules Electric Company, of Indianapolis, Ind., has been incorporated with a capital stock of $25,000 to manufacture and deal in electrical supplies. The directors are K. B. Kurtz, S. H. Kurtz, C. D. Meier, John H. Holliday and Albert Baker.

The E. A. Koeneman Electric Company, of St. Louis, Mo., has been incorporated with a capital of $12,000 by E. A. Koeneman, Charles Koeneman, Henry I. Chaplin and Harry Wibracht. The company purposes to manufacture electrical machinery, appliances, etc.

The General Vacuum Cleaner Company, of New York, N. Y., has been incorporated with a capital stock of $25,000 to manufacture and deal in vacuum-cleaning apparatus. The incorporators are L. W. Thompson and H. M. Dynan, of New York, N. Y., and K. M. Devitt, of Brooklyn, N. Y.

The Stanley Utilities Company, of New York, N. Y., has been incorporated by Charles H. Stanley, 600 West 157th Street, New York; Cynthia Stanley and Frank Hauser, of New York. The company is capitalized at $10,000 and purposes to deal in mechanical, electrical and chemical appliances.

The Dwyer Wireless Telephone Company, of New York, N. Y., and San Francisco, Cal., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $10,000,000. The company proposes to conduct a wireless telegraphy, telephony and aerophony business and to construct buildings, stations, etc., for that purpose. The incorporators are Max Oschler, Samuel H. Loveless, Sydney M. Oschler and Antonio C. Montgomery, all of New York, N. Y.; Harry P. Dwyer, George Hough Perry, William H. Schooler and Lloyd Michels, all of San Francisco.

Trade Publications

Sockets.—Lock sockets made by the Best Electric Company, Pittsburgh, Pa., are illustrated and described in a small folder recently issued by the company.

Fans.—Catalog 14-F contains illustrated descriptions of the 1914 models of fans manufactured by the Menominee Electric Manufacturing Company, Menominee, Mich.

Turbo Air Pump.—The Wheeler Condenser & Engineering Company has issued a double-page circular giving the results of recent tests on its turbo air pump. The tests showed 99.3 per cent of the theoretical vacuum at the turbine exhaust.

Oil Engines.—Types "C" and "E" of the Primm oil engine are described and fully illustrated in Bulletin No. 3, issued by the Power Manufacturing Company, Lima, Ohio. These engines are of the horizontal, single-cylinder, two-cycle cross-head construction.

Meters.—For inclusion with other loose-leaf trade literature recently sent out, the Esterline Company, Indianapolis, Ind., is mailing additional leaflets, some giving the new discounts and others containing dimensions of different classes of its apparatus.

Drawbridges.—A twelve-page bulletin, No. 143, has been issued by the Electric Storage Battery Company, Philadelphia, Pa., devoted to brief descriptions of some of the latest types of electrically operated drawbridges equipped for storage-battery operation. Some interesting examples of recent installations are illustrated.

Electrical Apparatus for Automobiles.—The Remy Electric Company, of Anderson Ind., has issued a pamphlet describing the activities and products of the reorganized Remy company. This company manufactures starting, lighting and ignition devices, and says that it is the largest concern in the world exclusively devoted to the manufacture of electrical apparatus for automobiles and locomotives.

Cranes.—A fully illustrated catalog of sixty-two pages, known as Crane Catalog No. 26, is being distributed by the Northern Engineering Works, Detroit, Mich. This is a compilation of several of the company's bulletins that more fully describe the various classes of cranes made by the Northern Engineering Works. The simple and efficient arrangement of the crane mechanism is clearly shown in the pictures.

Drilling and Boring Machines.—A pamphlet entitled "Difficult Drilling and Boring Made Easy" has been published by the Pawling & Harnischfeger Company, of Milwaukee. It describes and illustrates the use of Pawling & Harnischfeger horizontal drilling and boring machines. Many interesting examples of work done by these machines in various manufacturing establishments are given. One claim made for these equipments is the ease of handling work.

Meters.—The mercury type direct-current watt-hour meters manufactured by the Sangamo Electric Company, Springfield, Ill., are the subject of Bulletin No. 37. In this unusual thirty-two-page pamphlet the story of the meter is told in a succinct, interesting manner. From the opening paragraph, with its clear presentation of the central station as an energy-manufacturing plant, to its closing data on train ratios and disk constants for two-wire D-5 meters, this bulletin will be found most instructive. The diagrams and halftone illustrations are well chosen and form a fitting accompaniment to the text.

Personal Mention

Mr. H. M. Buck has resigned as manager of the Waukesha (Wis.) Gas & Electric Company.

Mr. George H. Holt has been elected president of the Oconto (Wis.) Electric Company as successor to Mr. W. H. Young.

Mr. E. W. Moser, who has been superintendent of the Lehighton (Pa.) Electric Light & Power Company, has resigned to engage in business for himself.

Mr. C. Rodman Stull, formerly of Bangor, Maine, has been appointed manager of the Waukesha (Wis.) Gas & Electric Company, vice Mr. H. M. Buck, resigned.

Mr. D. C. Green, of Marshfield, Ore., has been appointed general manager of the Everett (Wash.) Gas Company, which controls the electric supply in Snohomish and Monroe.

Mr. Hugh M. Wilson, first vice-president of the McGraw Publishing Company, Inc., who has been in poor health for some months, sailed on the S. S. *Minnewaska* on Feb. 28 for an extended trip in Europe.

Mr. A. H. Kublich, of Drifton, Pa., recently employed by the General Electric Company, has been appointed superintendent of the Lehighton (Pa.) Electric Light & Power Company, vice Mr. E. W. Moser, resigned.

Mr. T. I. Jones, general sales agent for the Edison Electric Illuminating Company of Brooklyn, and chairman of the Commercial Section of the N. E. L. A., sailed for Europe on Feb. 28 on the S. S. *Carmania*, to be absent three weeks.

Mr. Francis E. Donohoe, formerly of the American Electrical Works, New York City, resigned on Feb. 1 to become associated with the National Conduit & Cable Company and the National Brass & Copper Tube Company, with headquarters at 41 Park Row, New York.

Mr. Albert E. Winchester, well known as superintendent of the municipal electric plant at Norwalk, Conn., has been selected by the Public Utilities Commission of Connecticut and by the Stamford Gas & Electric Company to make an investigation into the lighting system in Stamford.

Mr. W. F. Albright has been appointed superintendent of the electrical department of the Citizens' Light, Heat & Power Company, of Johnstown, Pa., succeeding Mr. A. Weiss, who was made assistant to the general manager. Mr. Albright was formerly assistant superintendent of the company.

Mr. John H. Gulick, of Chicago, the new vice-president of the Commonwealth Edison Company, in charge of accounting, with supervision over the auditor and the auditing department, has been auditor of the company for a number of years. Mr. Gulick is considered an authority on the subject of electric-service organization and accounting. He is secretary and treasurer of the Public Service Company of Northern Illinois and a director in that company, and is also a director and a member of the executive committee of the Middle West Utilities Company.

Mr. Edward J. Doyle, the new secretary and treasurer of the Commonwealth Edison Company, Chicago, has been secretary to President Insull for several years and in that position has won the hearty good will of all who visit the president's office. Mr. Doyle is still a young man, but is rapidly rising into prominence in the Insull organizations. In the Commonwealth Edison Company he was promoted from the post of assistant secretary and assistant treasurer to his present position. He is also secretary of the Middle West Utilities Company and a member of the board of directors of that company.

Mr. Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, Mass., has returned from a six weeks' business and pleasure trip to the Pacific Coast, in company with Mrs. Edgar and Mr. and Mrs. L. L. Edgar. Mr. Edgar and his son were entertained at luncheon by Mr. John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, during their stay in San Francisco. The return trip was made via Los Angeles and New Orleans. At the former city a comprehensive inspection was made of the local plants and system of the Southern California Edison Company.

Mr. C. J. Franklin has resigned as general superintendent of railways of the Portland (Ore.) Railway, Light & Power Company to open an office in the Wilcox Building, Portland, as a consulting expert in all matters embracing operating problems, construction, valuations, rate situations, etc., in connection with public utility properties. During the last two years Mr. Franklin has given close attention to methods of operation and studies of details for new business, and his services upon special occasions have been retained by some of the principal public utility companies on the Pacific Coast. Previous to becoming connected with the Portland Railway, Light & Power Company Mr. Franklin passed five years with Stone & Webster at Tacoma as general superintendent of the Tacoma Railway & Power Company and the Puget Sound Electric Railway, operating between Tacoma and Seattle. Mr. Franklin went to the Pacific Coast after he had served thirteen years with the Virginia Passenger & Power Company, Richmond, Va.

Mr. Louis A. Ferguson, who by the retirement of Mr. Robert T. Lincoln becomes senior vice-president of the Commonwealth Edison Company of Chicago, will have charge of the contract, operating and construction departments. Mr. Ferguson is one of the best-known central-station men in the country. He was born in Dorchester, Mass., in 1867 and graduated in electrical engineering from the Massachusetts Institute of Technology in 1888. He joined the staff of the Chicago Edison Company in the same year and has been with that company, or its successor, ever since. He was first engineer of the underground department and thereafter electrical engineer and general superintendent, becoming second vice-president in 1902. Mr. Ferguson enjoys the unique distinction of having been president of three of the great technical, or semi-technical, societies of the United States. He was president of the Association of Edison Illuminating Companies for two terms, from 1901 to 1903; president of the National Electric Light Association for one term in 1902-1903, and of the American Institute of Electrical Engineers for one term in 1908-1909. Mr. Ferguson is a director in several commercial organizations and a member of a large number of clubs and societies.

LOUIS A. FERGUSON

Mr. E. C. Deal has resigned as vice-president and general manager of the Augusta-Aiken Railway & Electric Corporation of Augusta, Ga., and has become associated with the banking house of W. N. Coler & Company of New York City, which controls and operates a number of electric railway, lighting, gas and water properties. Mr. Deal gained his early experience with the Georgia Electric Light Company, which he served in various capacities from 1894 to 1898. He then entered the employ of Stone & Webster, of Boston, Mass., and left them in 1904 to go with the Gas & Electric Company of Bergen County in New Jersey as chief engineer in charge of the company's properties in more than forty municipalities in northern New Jersey. When that company was absorbed by the Public Service Corporation of New Jersey Mr. Deal became superintendent of the electric properties in central New Jersey. He severed his connection with the Public Service Corporation in 1908 to go with W. N. Coler & Company as manager and engineer of public service properties owned by them. Following the acquisition of the property of the Augusta Railway & Electric Company and the Augusta-Aiken Railway & Electric Company by a syndicate in which J. G. White & Co., Inc., of New York City were interested, Mr. Deal resigned from Coler & Company to become manager of the Augusta-Aiken Railway & Electric Corporation, the successor company in Augusta. This was in April, 1911. In April, 1913, he was elected vice-president of the company in addition to general manager. Mr. Deal is fourth vice-president of the National Electric Light Association and is a past-president of the Southeastern Section of the National Electric Light Association.

Construction

New England

BIDDEFORD, MAINE.—The Cumberland County Pwr. & Lt. Co. has acquired a right-of-way for a pole and tower transmission line from Dunstan to Biddeford, a distance of about 7 miles.

PRESQUE ISLE, MAINE.—Permission, it is reported, has been granted to the Maine & New Brunswick El. Pwr. Co., of Presque Isle, by the county officials of Woodstock County, New Brunswick, to erect a 30,000-volt transmission line through the township to Woodstock. The company proposes to furnish electricity generated at its plant at Aroostock Falls, N. B., in Woodstock, and also in towns along the route of the new transmission line. C. O. Austin, of Presque Isle, is superintendent.

McINDOE FALLS, VT.—The McIndoe Falls Electric Light Plant was recently reorganized, and it is now known as the McIndoe Falls Lt. & Pwr. Co. Don L. Judkin is president and J. M. Gibson is secretary and treasurer.

TURNERS FALLS, MASS.—The contract for the new canal (2 miles long) to Montague City, plans for which have been under way for four years, has been awarded by the Turners Falls Co. to the Holbrook, Cabot & Rollins Co., of Boston, Mass. The work involves excavation, concrete work, with cofferdam work, sewer, road and embankment building. Fred T. Ley & Co., of Springfield, were awarded the contract for power house foundations.

WESTFIELD, MASS.—The electric light commissioners have awarded the contract for new turbine and alternator to the General Electric Co., at $11,728; the Alberta Pump and Condenser Co. was awarded the contract for pump and condenser, for $4,010. Contract for steam piping and foundations will be awarded later.

STAMFORD, CONN.—The Stamford Gas & El. Co. expects to install a short section of underground distribution system. G. B. Leland is superintendent.

Middle Atlantic

ALBANY, N. Y.—Contracts have been awarded by the Board of Supervisors in connection with the new court house as follows: For time clocks and fire-alarm system to the Standard El. Time Co., of New York, at $2,470; for elevators to the Otis Elevator Co., New York, for $21,942, and for electrical work to F. W. Newman & Son, of Albany, at $18,333.

BATH, N. Y.—At the annual charter election, to be held this month, the proposal to appropriate $50,000 for the installation of a municipal electric-light plant will be submitted to the voters.

PERRY, N. Y.—Arrangements have been made by the Perry El. Lt. Co. for installation of a new street-lighting system. A contract has been placed for nitrogen incandescent lamps.

SYRACUSE, N. Y.—Bids will be received by the trustees of the New York State College of Forestry, Syracuse University, Syracuse, N. Y., until March 21 for construction, heating and ventilation, plumbing and gasfitting and electric work for the New York State College of Forestry, Syracuse University, Syracuse, N. Y. (readvertisement). Bids will be received for each division of the work separately and no combination of bids will be received. Drawings and specifications may be consulted and blank forms of proposal obtained at the office of the dean of the New York State College of Forestry at Syracuse, and at the office of Lewis F. Pilcher, Capitol, Albany, where complete sets of plans and specifications may be obtained upon deposit of $10, to be refunded upon return of same.

ALLENTOWN, PA.—Bids will be received by Cyrus J. Dilcher, county controller, Allentown, until March 19, for furnishing material and construction of an addition to the Lehigh County court house, Allentown, as follows: Item A—For construction of addition, exclusive of plumbing, heating, ventilating and electric work; alternate proposal for the entire addition, including plumbing, heating, ventilating and electric work; B—for plumbing work complete; C—for heating work complete; D—ventilating work complete; E—electric work complete. Plans and specifications are on file in the office of the county commissioners, Allentown.

CATAWISSA, PA.—At a special election to be held March 19 the proposal to sell the municipal electric-light plant at a minimum price of $12,000, or to issue bonds to the amount of $8,500 to remodel the plant to enable it furnish adequate electrical service for the borough, will be submitted to the voters.

DUBOIS, PA.—The power house at the Dubois shops of the Buffalo, Rochester & Pittsburgh Ry. Co., it is reported, will be enlarged and additional machinery installed.

HAZLETON, PA.—The Shenandoah Lt., Ht. & Pwr. Co. plans to make various improvements to its system in the spring. J. S. Wise, Jr. is general manager.

PHILADELPHIA, PA.—Mayor Blankenburg has decided to advertise for bids for lighting the streets with electricity in 1915 at once.

PHILADELPHIA, PA.—Plans have been filed by the William Steele & Sons Co., contractors, for the erection of a three-story factory building and power house for H. G. Fetterolf & Co., to be erected at Stenton Avenue and Louden Street.

PHILADELPHIA, PA.—Bids are being received by E. A. Wilson, architect, 1208 Chestnut Street, Philadelphia, on the electrical work on new apartment houses to be erected at Nineteenth Street and Erie Avenue, Philadelphia, at a cost of $260,000.

PHILADELPHIA, PA.—The contract for the construction of a three-story brick and terra-cotta school building, to be erected at Forty-seventh and Locust Streets, has been awarded to Cramp & Co., 801 Denckle Building, Philadelphia, at $159,537. Sub-contracts as yet have not been given out.

PHILADELPHIA, PA.—The contract for the new store building to be erected at Broad and Laurel Streets, Hazleton, for Gerhardt & Friedlander, has been awarded to S. Y. Fredericks & Sons, of Hazleton. A combination gas and electric-lighting system will be installed for which contract has not been awarded.

PHILADELPHIA, PA.—The contract for the erection of the new 18-story building for P. A. B. Widener, to be erected at Broad and Chestnut Streets, has been awarded to the George A. Fuller Co., Morris Building, Philadelphia. The sub-contract for a private electric system which is to be installed has not yet been let.

RIDGWAY, PA.—The Ridgway El. Lt. Co. is contemplating increasing its generating equipment. C. H. Law is general superintendent.

SHARPSVILLE, PA.—The City Council has granted the Shenango Valley El. Lt. Co., of Sharon, a contract for lighting the streets of the city for a period of five years. The company will furnish 80-cp tungsten lamps at $23 per year.

STATE COLLEGE, PA.—John W. Emery, 1524 Sansom Street, Philadelphia, is estimating on revised plans and specifications for the electrical work for the Liberal Arts Buildings, to be erected at State College, Pa.

WERNERSVILLE, PA.—The Wernersville & Heidelberg El. Lt. & Pwr. Co. expects within the next three months to erect a high-tension transmission line about 5 miles long. The material for this installation has been purchased. Robt. W. Wertz is president.

WILKES-BARRE, PA.—The City Council has passed an ordinance granting the Wilkes-Barre Lt. Co., a new company, a franchise to furnish electricity in Wilkes-Barre.

CAPE MAY COURT HOUSE, N. J.—The Vulcan El. Lt., Ht. & Pwr. Co., 915 Real Estate Building, Philadelphia, Pa., is asking for bids for the construction of a brick power station (electric) and for building 4 miles of electric railway in Cape May Court House.

ELIZABETH, N. J.—The township committee of Hillside is planning for the extension of the lighting system throughout the township, including the Lyons Farms and Saybrook sections.

FREEHOLD, N. J.—Bids will be received by the board of chosen freeholders of Monmouth County, Court House, Freehold, N. J., until March 11, for furnishing materials, lamps and electricity for lighting the bridges in the townships of Ocean, Shrewsbury and Middletown. The bridges to be lighted are: Seabright bridge, Oceanic bridge, Goose Neck bridge, Cooper's bridge, Hubbard's bridge, Locust bridge, Gibbon's bridge, Shepherd Knapp bridge, Newman Springs bridge, Oceanport bridge, O'Hagan's bridge and Mount's Corner bridge. Specifications as to the number, character and location of lamps can be obtained from John M. Corlies, freeholder, Rumson, or of John Daly, freeholder, Long Branch, N. J.

MAPLEWOOD, N. J.—The township committee has awarded a contract for street lighting to the Public Service El. Co. for a period of five years. The present system comprises about 400 incandescent lamps.

MERCHANTVILLE, N. J.—The borough council has received estimates for the installation of a municipal electric-lighting plant to cost $17,400. The plant considered would provide energy for about 400 40-cp lamps.

PRINCETON, N. J.—The lighting committee of the City Council is planning to install new street lamps in different sections of the city.

RAHWAY, N. J.—The Common Council has appointed a committee to investigate the proposition of a municipal electric lighting plant.

TRENTON, N. J.—The contract for electrical equipment in the new store building of H. M. Voorhees & Brothers at East Trenton Street, Trenton, has been awarded to J. P. Kelly, of Trenton.

MANNINGTON, W. VA.—The Consumers' El. Lt. Co. has established a day service for lamps and motors. The service began March 1.

RAVENSWOOD, W. VA.—Within the next four or five months the municipal electric-lighting plant plans to erect some new poles and lines over the town, and to purchase generators, gas engines and pumps. C. O. Nilsson is superintendent.

CLIFTON, VA.—Within the next four months the Virginia Western Pwr. Co. of Clifton expects to erect 30 miles of 44,000-volt transmission lines and several substations; also to purchase six 44,000-volt transformers, varying in size from 15 kw to 200 kw.

ST. CHARLES, VA.—The El. Trans. Co., control of which was recently purchased by the Insull interests, of Chicago, Ill., it is reported, will increase the output of its plant to 35,000 hp. The company is planning to furnish energy to the coal mines in Virginia and Kentucky.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 17 for furnishing at the various navy yards and naval stations the following supplies: Boston, Mass., Schedule 6471—re-stranding and re-insulating cables. Brooklyn, N. Y., Schedule 6471—50,000 ft. incandescent lamp cord, 1100 ⅛-in. pipe, fiber-lined, polished brass key sockets; Schedule 6489—3000 ft. rubber-insulated rat-tail wire for aerials. Camden, N. J., Schedule 6477—two 50-watt talking motor generators, two telephone-ringing dynamotors, one type C-54 telephone switchboard, miscellaneous telephones. Washington, D. C., Schedule 6473—1000 5-amp receptacle plugs, 300 double and snap switch receptacles, miscellaneous electrical supplies; Schedule 6472—miscellaneous steel wire ¼ in. and 3/16 in. in diameter).

North Central

DETROIT, MICH.—The contract for electrical work in connection with the new building for the Detroit Athletic Club has been awarded to the McCleary-Harmon Co. The cost of the building is estimated at $1,000,000.

GRAND RAPIDS, MICH.—A power plant, it is reported, will be erected in connection with the new factory for the Sterling Desk Co.

IONIA, MICH.—Steps have been taken for the installation of an ornamental street-lighting system. Robert Beard is the chairman of the committee appointed to take charge of the matter.

IRON RIVER, MICH.—Work has begun on the remodeling and enlarging of the power house of the Peninsular Pwr. Co. There has been purchased for this installation one 940-kva, 60-cycle, 6600-volt turbo-generator and other necessary equipment for the extension. D. W. Mead, Madison, Wis., is engineer in charge of the work.

AKRON, OHIO.—Bids will be received at the office of C. P. Parker, director of public service, Akron, until March 23 as follows: (1) For three 150-hp water-tube boilers: (2) one fuel economizer, smoke flue, and automatic damper regulator. Specifications and plans may be seen at the office of the director or at the office of F. A. Barbour, 1120 Tremont Building, Boston, Mass.

BELLEFONTAINE, OHIO.—The only bids for the complete installation of the addition to the municipal electric-light plant was submitted by the Laroe Construction Co., of Hamilton, at $35,000.

CINCINNATI, OHIO.—The contract for furnishing material and completing the electrical work and fireproof windows and doors in the new Bloom School, at Bank and Baymiller Streets, Cincinnati, has been awarded by the board of education to

Fischer Brothers, 1046 Madison Avenue, Covington, Ky., at $12,062. C. W. Handman is business manager of the board.

GALLIPOLIS, OHIO.—The electric plant of the Gallipolis Gas & Coke Co. has been purchased by L. B. Herrington, of Richmond, Ky., who, it is said, will remodel and make extensions to same. Mr. Herrington, it is said, has made arrangements to furnish energy to the interurban railway passing through Gallipolis, and the City Council is considering a proposal for furnishing electricity for lighting the city.

MANSFIELD, OHIO.—Complete plans for the new lighting system for the city of Mansfield will be ready early in March. Nitrogen lamps, it is said, will be included in the plans. H. Whitford Jones, of Cleveland, is consulting engineer.

NILES, OHIO.—Bids will be received by J. N. Cowdery, director of public service, until March 9 for furnishing transformers, incandescent lamps and meters for the municipal electric-light plant.

LANCASTER, KY.—Application has been made to the Council by Alexander Walker and Cleveland Rose, owners of the local electric-light plant, for a new franchise. They propose to install a new electric plant.

MORRISTOWN, KY.—The Mims-Goodson Co. contemplates installing electric elevators in a six-story mercantile building for which plans are now being prepared.

FORT WAYNE, IND.—The City Council has engaged the Indiana Engineering Co. to prepare plans and specifications and superintend the construction of the addition to the municipal electric-light plant and for the installation of the new machinery. The cost of the entire work is estimated at about $75,000 and will include the installation of a new generating unit at the plant and the erection of about 40 miles of extension to the lines.

HAVANA, ILL.—The City Council is reported to be considering the question of establishing a municipal electric-light plant in Havana.

SPRINGFIELD, ILL.—A petition has been filed by the board of local improvements for the erection of an ornamental street-lighting system on Adams Street, from Lewis Street to Tenth Street. The petition asks for five-lamp standards in the business district and for three-lamp standards in the residence section.

ANTIGO, WIS.—Permission has been granted the Antigo El. Co. by the Wisconsin Railroad Commission to issue $10,000 in capital stock for additions and improvements to its plant. The company, it is understood, will install an additional boiler and larger generators to increase the output of the plant.

BAYFIELD, WIS.—The Municipal Lt., Pwr. & Wtr. Plant expects to purchase within the next month two direct-current 2300-volt, 60-cycle, three-phase generators, also a motor-driven pump and a new switchboard.

BOSCOBEL, WIS.—The Board of Electric Light Commissioners expects to purchase this spring one 150-hp boiler. Charles A. Blair is general manager.

BUTTERNUT, WIS.—Plans are being considered by W. J. Schulz for enlarging his electric-light plant to supply electricity for lighting the entire village. H. R. Wuerffel, of Chicago, Ill., consulting engineer, has been engaged to prepare estimates of costs.

FOUNTAIN CITY, WIS.—A 9-mile extension is being planned by the Fountain City Lt. & Pwr. plant, for which the equipment will be purchased within the next three months. H. & F. Roettiger are the owners of the plant.

HARTFORD, WIS.—Within the next two months the managers of the municipal electric lighting plant expect to purchase one 450-hp Corliss engine directly connected to a 300-kw generator.

MANITOWOC, WIS.—Within the next few months it is planned by the Oslo Pwr. & Lt. Co. to build a new concrete dam to replace the one that was carried away in the spring of 1913. The dam is to be 200 ft. long and have a 10-ft. head. A. O. Anderson is president.

MAUSTON, WIS.—A new street lighting system is being planned for this city, which will be purchased either by the city of Mauston or the Mauston El. Serv. Co. J. F. Carroll is manager of the service company.

MELLEN, WIS.—Within the next four months the Mellen Wtr. & Lt. Co. expects to purchase one 75-kva to 100-kva, 2200-volt, 250 r.p.m. generator; also within the next five months a 75-hp, 250 r.p.m. engine to drive generator. A. W. Prihnow is president and general manager.

OCONTO, WIS.—The Oconto Falls Water & Lt. Plant expects to purchase within the next six months a Corliss engine and a 2200-volt alternating-current 60-cycle generator. Emmett Johnson is superintendent.

PORT WASHINGTON, WIS.—The electric light commissioners expect within the next half year to purchase a carload of 35-ft. and 40-ft. poles and also some electric irons. Fred. I. Russell is superintendent.

SHEBOYGAN FALLS, WIS.—At a special election Feb. 24 to vote on the question of issuing $40,000 in bonds for the construction of water-works and $9,000 in bonds for a lighting plant, the question of water-works was defeatetd, but the proposition to build and to purchase a lighting plant was carried. The city will probably take over the local lighting plant. Ober W. Chaplin is city clerk.

WARRENS, WIS.—The George Warren Co., owner of the electric light plant here, is planning to purchase within the next year a small 220-volt direct-current generator, some wiring supplies, and also vacuum cleaners and other household devices.

WASHBURN, WIS.—The Washburn El. Lt. & Pwr. Co. has closed a contract with the Northwestern Fuel Co. for the installation of two 200-hp, 2200-volt alternating-current motors to operate its dock equipment and one 100-hp pumping outfit for fire protection, the Washburn company furnishing the energy to operate this outfit. A 15,000-volt, three-phase line will be run to the dock and an outdoor substation erected, which will consist of three 15,000 2200-volt, 150-kw transformers. It is expected that this installation will be ready for operation not later than April 15. F. W. Downs is superintendent.

WAUSAU, WIS.—The municipal electric lighting plant, which gets its energy from the Wausau St. R. R. Co., expects to purchase within the next six months 3000 ft. steel-taped three-conductor, 6-8-10 gage cable for an underground distribution system. It is also planned to purchase twelve additional ornamental posts if the City Council passes upon the installation. H. E. Marquardt is comptroller.

ELK RIVER, MINN.—Plans are being considered by Hildreth & Waterman, owners of the water-power on Elk River, to develop the water-power, if satisfactory arrangements can be made with the village for lighting the village.

FARMINGTON, MINN.—The Farmington El. Lt. & Pwr. Co. expects to install a steam-heating plant, to furnish steam heat for about four blocks, and a 100-hp to 150-hp engine and boilers; also to erect a transmission line to two adjoining towns, a total length of 12 miles. The company also proposes to change its power equipment from 220 volts direct current to 2500 volts alternating current, three-phase, with step-up transformers to 13,200 volts for other towns. F. H. Eddy is manager.

HILLS, MINN.—An election will be held March 10 to vote on the proposal to issue $8,000 for the installation of a municipal electric-light plant.

MINNEAPOLIS, MINN.—Bids will be received until March 12 for the construction of power house of the Northern Mississippi River Pwr. Co. at Coon Rapids. Plans and specifications may be secured at the office of the Minneapolis General Electric Co., Minneapolis, for which a deposit of $10 will be required, to be refunded upon return of same.

NEW GERMANY, MINN.—Arrangements are being made by A. J. Schnobrich for the installation of an electric-light plant in connection with his garage. The Council has awarded Mr. Schnobrich a contract for lighting the streets of the village. Contracts have been awarded for the machinery, which includes a gasoline engine and dynamo.

ST. CLOUD, MINN.—The city commission will soon ask for bids for an electrically driven pump for the water-works station.

WILLMAR, MINN.—Bids will be received by the City Council until March 9 for equipment for the municipal electric-light plant as follows: One 175-hp steam engine, one 125-hp steam engine, both to be equipped with all appurtenances; one 150-kva generator, one 100-kva generator, two exciters, one 9-kw and one 12-kw, and one six-panel switchboard with accessories. Specifications and plans of switchboard may be seen at the office of the city clerk, Willmar, or at the office of Joseph W. Rosche, consulting engineer, 820 Plymouth Building, Minneapolis, Minn.

CLARINDA, IA.—The Lee El. Co., of Clarinda, contemplates the erection of an office building and storeroom, to cost about $15,000 as soon as plans can be prepared. The company does all of the house wiring in Clarinda and in all of the towns served by the company. Rufus E. Lee is manager.

LITTLE ROCK, IA.—An election will be held March 16 to submit to the voters the proposal to grant the Little Rock El. Lt Co. a franchise to operate an electric-light plant here.

SIOUX RAPIDS, IA.—The property of the Sioux Rapids Hydro El. Co., it is reported, has been purchased by K. C. Gaynor, of Sioux City, who owns the electric plants in Marcus, Ia., and Huntington, Neb. It is understood that the new owner will make improvements to the plant and service.

EUREKA, MO.—The mill and water-power owned by James Byrne, is reported to have been leased by the Missouri Pwr & Ser. Co., of St. Louis.

BALFOUR, N. D.—A franchise, it is reported, has been granted to the owners of the local flour mill to install and operate an electric-light plant in Balfour. The proposed plant is to be completed by May 1.

WILLISTON, N. D.—Within the next six months the electric light and water-works commission expects to install a complete filtering plant with water-driven pumps of 500,000-gal. capacity; also within the next three months to purchase two 50-hp motors. George A. Bissell is superintendent of water and light department.

ELKTON, S. D.—At an election held recently the proposal to issue $25,000 in bonds for the purpose of installing a municipal electric-light plant was carried. Work will begin on the construction of the plant as soon as the weather will permit

ELLENDALE, S. D.—The City Council has granted J. L. Tucker a franchise to construct and operate an electric-light plant in Ellendale for a period of 30 years. The Council has entered into an agreement for street-lighting to the amount of $1,500 per year.

SPENCER, S. D.—Steps have been taken by local business men to organize a stock company for the purpose of installing an electric-light system here. In case sufficient stock is not subscribed, a franchise will probably be granted to an outside company.

NORTH PLATTE, NEB.—The North Platte Gas & El. Co. has been reorganized under the name of the North Platte El. Co. and will be operated by the Union Co. of Omaha, Neb. The electric plant will be rebuilt and entire new equipment installed. Willis Todd, of Omaha, is engineer in charge of the work.

Southern States

MORGANTOWN, N. C.—Within a short time the electric light commissioners expect to purchase one second-hand 50-kw, three-phase, 2300-volt generator directly connected to an engine and a switchboard to control same.

ROWLAND, N. C.—Bids will be received at the office of J. McR. Braey, Mayor, Rowland, N. C., until March 10, for installing an electric-light plant, water-works and sewerage systems in the town of Rowland. Plans and specifications are on file in the office of J. B. McCrary Co., Atlanta, Ga. For further information address O. P. Chitty, clerk board of commissioners.

VANCEBORO, N. C.—The citizens have voted to establish an electric-lighting system in the town, which will be installed as soon as bids can be secured.

WILSON, N. C.—The Board of Town Commissioners, it is reported, has decided to rebuild the municipal electric-light plant. Bids were advertised to be received until Nov. 4, 1913, for equipment for the plant, but the matter was postponed indefinitely owing to the town being unable to sell the bonds. It is proposed to install a plant with an output of 800 kw in duplicate units.

DENMARK, S. C.—The Carolina Public Ser. Co., of Denmark, is installing an electric-light plant in Denmark, and will soon be ready to purchase electrical supplies. It would like to receive catalogs pertaining to same. The company does not want wire or machinery. F. M. Stansbrough is manager.

GREER, S. C.—John N. Ambler, Winston, N. C., has been employed to supervise the construction of a municipal electric-light plant, for which $67,000 in bonds have been issued. T. W. White is city clerk.

ALBANY, GA.—The Albany Pwr. & Mfg Co. expects to install within the next twelve months one 750-kw, 2300-volt, three-phase, 60-cycle turbo-alternator, complete with condensing system. E. S. Killebrew is superintendent.

BARTOW, GA.—Preparations are being made by the city of Bartow for the construction of a municipal electric-light plant. Contracts for machinery, it is said, have been awarded.

CORDELLE, GA.—The City Council is contemplating the installation of a municipal electric-light plant to supply electricity for the ornamental lighting system. It is proposed to install a generator and engine in connection with the new waterworks system. A committee, consisting of Mayor Fred Harder and J. J. Williams, has been appointed to make investigations in regard to same.

BARTOW, FLA.—Bonds to the amount of $20,000, it is reported, have been voted, the proceeds to be used for extension and improvements to the municipal electric-light systems.

MELBOURNE, FLA.—Within a few months matters will be in shape for the installation of a municipal electric-light plant, for which bonds were recently issued. J. V. E. Wiles is city clerk.

PALM BEACH, FLA.—The Atlantic Fish Co., it is reported, is contemplating the construction of an electric-light plant, ice factory and cold-storage plant. The building will be 140 ft. by 56 ft.

COLUMBIA, TENN.—Application has been made to the town of Columbia by John H. Carpenter and associates for a 20-year franchise to install and operate an electric light, power and heating system in Columbia.

DUCKTOWN, TENN.—The Tennessee Copper Co., it is reported, contemplates equipping the machinery in its mines for electrical operation.

TUSCALOOSA, ALA.—Bonds to the amount of $600,000, it is reported, have been issued by the Birmingham-Tuscaloosa Ry. & Utilities Co. The proceeds, it is said, will be used for the construction of a new central generating plant and gas holder, for extending gas distributing system, and for equipping for electrical operation and extending steam belt railway. The company is also contemplating the erection of wharves and loading docks.

HEBER SPRINGS, ARK.—The Arkansas Hydro-Electric Co., of Heber Springs, is contemplating the construction of a hydroelectric power plant on the Little River, near Heber Springs, to develop about 10,000 hp at a cost of about $2,000,000. Present plans provide for three dams—one power dam, 600 ft. long by 90 ft. high, and two reservoir dams, 1400 ft. and 800 ft. long respectively and each 90 ft. high. Four generating units, consisting of a waterwheel and generators of 25,000 hp each, will be installed. The turbines will operate under a 90-ft. head, with 70,000 cu. ft. of water per minute.

MAGAZINE, ARK.—The Magazine El. Co., it is reported, has been granted a franchise to construct and operate an electric-light plant here.

ABBEVILLE, LA.—The City Council has decided to make improvements to the municipal electric-light plant, to cost about $25,000. Harold Raymond, of New Orleans, has been engaged to prepare plans and specifications.

DUSTIN, OKLA.—The Dustin Lt. & Pwr. Co., whose plant was recently destroyed by fire, purchased new equipment immediately, including one 70-hp Rathhun gas engine and one 50-kw Fort Wayne three-phase, 220-volt generator, and has resumed operation. C. E. Kapp is owner of the plant.

LAWTON, OKLA.—At an election held recently the proposal to grant the Lawton Ltg. & Ry. Co. a franchise to construct and operate an electric railway on the streets of the city was carried.

QUINTON, OKLA.—The franchise for an electric-light plant held by S. A. Burnham has been purchased by T. M. Morrill, M. T. Crane and James Fargarton, who will begin work at once on the installation of an electric-light plant.

DALLAS, TEX.—The commissioners' court of Dallas County has granted a franchise to the Texas Pwr. & Lt. Co. for the construction of a telephone line from Dallas to Eagle Ford and Cement City, to be used in connection with the electric power supply line being installed by the company into Cement City.

DALLAS, TEX.—The contract for the general construction of the new building for the Neiman-Marcus Co., at the corner of Main and Ervay Streets, Dallas, has been awarded to the Watson Construction Co., of Dallas, at $109,995. Bids for elevators, electric wiring, heating and plumbing will be asked for within 60 days. Hubbell & Green, of Dallas, Tex., are architects.

FREEPORT, TEX.—The Freeport Sulphur Co., of Freeport, is planning to install a central electric power plant in connection with the new superheated water and power plant now being installed at its mines in Bryan Heights. Electricity generated at the plant will be used to operate the machinery in the mines, including the pumps for pumping water from the canal, and fuel oil from the tanks on the Freeport ship channel to the mines, and for lighting purposes. The plant will also furnish electricity for lamps and motors in Freeport. The equipment will be installed by Westinghouse, Church, Kerr & Co., of New York, N. Y., and it will include a 200-kw Westinghouse steam turbine directly connected to generator.

HICO, TEX.—The City Council has granted the Hico El. & Pwr. Co. a franchise to erect and maintain transmission lines in this city for a period of 40 years. The company is at present furnishing electrical service in Dublin and is now extending its transmission lines to Walnut Springs to furnish electricity there. The central station of the company is in Hico.

HOUSTON, TEX.—Bids will be received by E. B. Bonney, city secretary, Houston, until March 23, for the erection of a three-story fireproof city hall annex, the work to be let in four contracts as follows: General work, heating, plumbing and wiring. Bids are to be submitted on blanks prepared by Sanguinet, Staats & Gottlieb, architects. Plans and specifications are on file in the office of the architects, where copies may be obtained.

POST CITY, TEX.—The Post Pwr. Co. plans to purchase within the next few months wire, cross-arms, lightning arresters, insulators and meters for the electric lighting system, and also 50 street lamp hoods. H. W. Fairbanks is vice-president and general manager.

STAMFORD, TEX.—A carload of poles 25 ft. long will be purchased within the next few months by the Stamford Gas & El. Co. J. E. Johnson is president.

Pacific States

BURLINGTON, WASH.—The Burlington El. Co. has recently sold its plant to the Pacific Northwest Traction Co., Seattle, Wash.

VISALIA, CAL.—The Mount Whitney Pwr. & El. Co., of Visalia, expects to erect in the next four months additional substations, with a total output of 10,000 kw, and to purchase line material for 200 miles of transmission lines. Fred G. Hamilton is superintendent.

FAIRVIEW, UTAH.—The municipal electric-light plant expects to erect about 2 miles of transmission line and also to purchase three transformers within the next three months. Nephi Cruser is manager.

WILLARD, UTAH.—The property of the Willard Power Co. has been purchased by the Utah Pwr. & Lt. Co., Salt Lake City, Utah.

WHITE SULPHUR SPRINGS, MONT.—We are informed that the town of White Sulphur Springs does not contemplate the installation of an ornamental street-lighting system as reported in the issue of Feb. 14. George Wallwork is town clerk.

ALAMOGORDO, N. M.—The Alamogordo Wtr. Wks. Co. is preparing to erect a new power plant which will furnish energy for the operation of pumping plants for irrigation purposes in the Alamogordo valley. A new Diesel oil engine will be installed, it is reported.

Canada

CALGARY, ALTA.—Tenders will be received by the Electric Department of Calgary until March 18 for two 3000-kw, 12,000-volt transformers for the municipal electric-light system.

DUNCAN, B. C.—Preparations have been completed for the installation of a municipal electric-light plant, for which contracts were awarded Feb. 27. The equipment will consist of two 60-kw generators and two 100-hp oil engines, with switchboard complete. Transmission line will be 2200 volt, three-phase, 60-cycle. Construction work will begin immediately. P. G. Harvey is engineer in charge.

KAMLOOPS, B. C.—The contract for the erection of a pole transmission line from the municipal hydroelectric generating plant on Barriere River and the substation in Kamloops, a distance of 43 miles, has been awarded to T. R. Cornick, contracting engineer, of Vancouver. The contract calls for the use of 45-ft. wooden poles with steel-core aluminum conductors, equivalent to No. 4, B & S gage, solid copper. Spans will average 200 ft. This will be 45,000-volt line using pin-type insulators. DuCane, Dutcher & Co., of Vancouver, are consulting engineers for the city in connection with the hydroelectric system.

MONCTON, N. B.—The City Council has authorized plans to be prepared for the installation of a new system of street-lighting.

HAMILTON, ONT.—The Board of Control, it is reported, is considering the installation of a steam auxiliary power plant in connection with the water-works system, to be used in case the high-tension transmission line is out of service.

PLATTSVILLE, ONT.—A by-law has been passed authorizing the Council to close a contract with the Hydro-Electric Power Commission of Ontario to furnish electrical energy to Plattsville.

TORONTO, ONT.—Tenders will be received by the Toronto Hydro-Electric System until March 12 for transformers. Specifications and form of tender may be obtained at the office of the purchasing agent of the Toronto Hydro-Electric System.

MONTREAL, QUE.—Plans have been prepared for laying additional conduit for which tenders will be called in the early spring. A special conduit for the Montreal Tramways Co. will be built from the company's power house on William Street to McGill Street, where it will be linked with the general scheme. Preparations are also being made for drawing the wires into the conduit already laid.

SASKATOON, SASK.—The City Council has entered into an agreement to supply electricity to the Northland Milling Co., at Factoria, on the northern outskirts of the city. An overhead transmission line will be erected from the power house to Factoria. The city will bear the expense to the city limits and the company for the rest of the way.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until March 14, for furnishing copper and steel wire, track bolts, plate washers, drills, breast drills, chain blocks, tackle blocks, gaskets, creosoted switch ties, etc. Blanks and general information relating to this circular (No. 831) may be obtained at the above office or from the offices of the assistant purchasing agents at 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until March 20, for furnishing operating devices for pivoted sash, track bolts, wire, cable, chain, cable clips, grommets, belt rivets and burrs, sheet brass, marine clocks, etc. Blanks and general information relating to this circular (No. 832) may be obtained at the above office or from the offices of the assistant purchasing officers at 24 State Street, New York, N. Y.; 614 Whitney Central Building, New Orleans, La., and 1986 North Point Street, San Francisco, Cal.

PANAMA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 28 for construction of four steel towers on the Canal Zone. Separate proposals will be received for steel work and foundation. Plans and specifications may be obtained upon application to the bureau. H. R. Stanford is chief of bureau.

New Incorporations

HUNTINGTON, ARK.—The Huntington El. Lt. & Pwr. Co. has been organized with a capital stock of $8,000. The officers are: John Degen, president, and H. E. Cunningham, secretary.

DULUTH, MINN.—The Western Mesaba El. Co. has been incorporated with a capital stock of $100,000 by Frank McCormack, J. A. Hanks and M. J. McCormack.

BENSON, N. C.—The Benson El. Lt. Co. has been granted a charter with a capital stock of $50,000 for the purpose of installing an electric-light plant in Benson. The incorporators are: W. S. Murchison, A. B. Hudson and others.

MONTPELIER, VT.—The Bread Loaf Mountain Pwr. Co. has been organized with a capital stock of $5,000 for the purpose of developing power on the Middlebury River and its branches, and on the Lamoille River, to generate electricity and distributing same for lamps and motors.

Directory of Electrical Associations, Societies, Etc.

Alabama Light and Traction Association. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala. Semi-annual meeting, Mobile, Ala., May, 1914.

American Association for the Advancement of Science. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

American Electric Railway Accountants' Association. Secretary-treasurer, E. B. Burritt, 29 West 39th St., New York.

American Electric Railway Association. Secretary, E. B. Burritt, 29 West 39th St., New York.

American Electric Railway Engineering Association. Secretary, E. B. Burritt, 29 West 39th St., New York.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. General meeting, New York, April 16-18.

American Electro-Therapeutic Association. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

American Institute of Consulting Engineers. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

American Society of Refrigerating Engineers. Secretary, William H. Ross, 154 Nassau St., New York City.

American Society for Testing Materials. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, Edwin A. Scott, 29 West 39th St., New York.

American Water Works Association. Secretary, J. M. Diven, 47 State St., Troy, N. Y. Annual meeting, May.

Arkansas Association of Public Utility Operators. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, Little Rock, April 21-23, 1914.

Association of Edison Illuminating Companies. Secretary, Geo. C. Holberton, Pacific Gas & Electric Co., San Francisco, Cal.

Association of Iron and Steel Electrical Engineers. Secretary, W. T. Snyder, McKeesport, Pa.

Association of Railway Electrical Engineers. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, New Orleans, May 19-22.

California Electrical Contractors' Association. Secretary, W. S. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

Canadian Electrical Association. Affiliated with N. E. L. A. Secretary-treasurer, J. H. Larmonth, 610 Confederation Life Bldg., Toronto, Can.

Colorado Electric Club. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

Commercial Section, N. E. L. A. Secretary, J. F. Becker, 1170 Broadway, New York.

Eastern New York Section, N. E. L. A. Secretary, C. S. Van Dyck, Schenectady, N. Y.

Electric Club of Chicago. Secretary, Fred M. Rosseland, Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

Electrical Contractors' Association of Greater Boston. Secretary, R. S. Hale, 39 Boylston St., Boston.

Electrical Contractors' Association of Massachusetts. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

Electrical Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

Electrical Contractors' Association of the City of Chicago. Secretary, M. N. Blumenthal, 179 West Washington St. Meets at noon on the second and fourth Wednesday of each month at 424 South Wabash Ave.

Electrical Contractors' Association of State of Missouri. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

Electrical Contractors' Association of Wisconsin. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

Electrical Credit Association of Chicago. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

Electrical Credit Association of Philadelphia. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa.

Electrical Salesmen's Association. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

Electrical Trades Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

Electric Vehicle Association of America. Secretary, Harvey Robinson, 124 West 42d St., New York.

Electric Vehicle Association of America, New England Section. Secretary, L. L. Edgar, 39 Boylston St., Boston.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

Faraday Electrical Association. Secretary, W. J. Collins, 1129 Masonic Temple, Chicago. Meets at noon on the first and third Wednesday of each month at Planters' Hotel.

Gas, Electric and Street Railway Association of Oklahoma. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual meeting, May, 1914.

Hydroelectric Section, N. E. L. A. Secretary, S. A. Sewall, 29 West 39th St., N. Y.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

Independent Electrical Contractors' Association of Greater New York. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

Independent Telephone Association of America. Secretary, W. S. Vivian, Grand Rapids, Mich.

Indiana Electric Light Association. Secretary, Thomas Donahue, Lafayette, Ind.

Institute of Operating Engineers. Secretary, L. Houmiller, 29 West 39th St., New York.

Institute of Radio Engineers. Secretary, E. J. Simon, 81 New St., New York.

Internal-Combustion Engineers' Association. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex.

International Electrical Congress. Secretary-treasurer, Preston S. Millar, 80th St. and East End Ave., New York. San Francisco, Sept. 13-18, 1915.

International Engineering Congress. Secretary-treasurer, W. A. Cattell, Foxcroft Building, San Francisco, Cal. Congress, San Francisco, September, 1915.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 6-11, 1915.

Iowa Electrical Association. Affiliated with N. E. L. A. Annual meeting, Cedar Rapids, April 23. Secretary, H. B. Maynard, Waterloo, Ia.

Iowa Street and Interurban Railway Association. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, Cedar Rapids, April 23.

Jovian Order. Jupiter (president), W. N. Matthews, St. Louis, Mo.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

Kansas Gas, Water, Electric Light and Street Railway Association. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan.

Louisiana Electrical Contractors' Association. Secretary, J. J. Ziegler, 227 Bourbon St. Meeting every Wednesday, Audubon Building, New Orleans.

Maine Electric Association. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

Michigan Electric Association. Affiliated with N. E. L. A. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

Minnesota Electric Association. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn. Annual meeting, Minneapolis, March 18-20, 1914.

Mississippi Electric Association. Affiliated with the National Electric Light Association. Secretary-treasurer, Frank J. Duffy, Natchez, Miss.

Missouri Electric, Gas, Street Railway and Water Works Association. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis. Annual meeting, May 21-23.

National Arm, Pin and Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Association of Electrical Inspectors. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

National District-Heating Association. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention Rochester, N. Y., May 26-28.

National Electric Light Association. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, Philadelphia, June 1-5.

National Electrical Contractors' Association of the United States. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago. Annual meeting, June, 1914.

National Fire Protection Association. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass. Open meeting, New York, March, 1915.

National Independent Telephone Association. Secretary-treasurer, J. B. Earle, Waco, Texas.

Nebraska Section, N. E. L. A. Secretary-treasurer, S. J. Bell, David City, Neb.

New England Electrical Credit Association. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Street Railway Club. Secretary, H. A. Faulkner, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New Orleans Electrical Contractors' Association. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

New York Electric Railway Association. Secretary, Charles C. Dietz, 239 West 39th St., New York.

New York Electrical Credit Association. Affiliated with the National Electrical Credit Association. Secretary, Franz Neilson, 80 Wall St., New York.

New York Electrical Society. Secretary, G. H. Guy, 33 West 39th St., New York. Annual meeting, New York, June, 1914.

Northwestern Cedarmen's Association. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

Oregon Electrical Contractors' Association. Secretary, F. C. Green, 291 East Morrison St., Portland, Ore. Annual meeting, Portland, June 8-9.

Pennsylvania Electric Association (State Section N. E. L. A.). Secretary-treasurer, S. C. Pohe, Bloomburg, Pa.

Railway Signal Association. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

Society for Electrical Development, Inc General manager, J. M. Wakeman, 29 West 39th St., New York. Annual meeting, New York, May 12.

Society for the Promotion of Engineering Education. Secretary, Prof. H. H. Norris, Ithaca, N. Y. Annual meeting, Princeton, N. J., June.

Southeastern Section, N. E. L. A. Secretary-treasurer, A. A. Wilbur, Columbus, Ga. Annual meeting, Isle of Palms, Charleston, S. C., Aug. 19-21, 1914.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. Annual convention, Galveston, Tex., May 20-23.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill.

Western Society of Engineers, Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

Wisconsin Electrical Association Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 24, 1914.

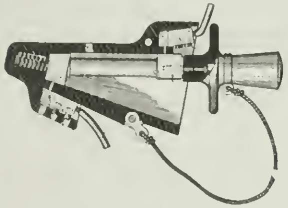
[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,087,917. Block-Signal System; E. F. Bliss, Schenectady, N. Y. App. filed Aug. 3, 1908. "Normal danger" type having few live wires.

1,087,937. Electrolytic Generator; C. Ellis, Montclair, N. J. App. filed May 29, 1913. For producing hydrogen and oxygen.

1,087,966. Automatic Control of Signals by Light; W. A. Moffett and R. P. Perkins, San Francisco, Cal. App. filed July 24, 1912. Embodies electromagnetic means combined with a selenium element.

1,087,969. Multiduct; T. E. Murray and A. V. A. McHarg, New York, N. Y. App. filed April 30, 1913. Formed from sheet metal rolled to form longitudinal crenelations.



1,087,971—Fuse Switch

1,087,971. Fuse Switch. T. E. Murray and G. W. Christians, New York, N. Y. App. filed Nov. 7, 1913. A cartridge-fuse case provided with a suitable handle forms the switch lever.

1,087,972. Motor-Control System, R. C. Newhouse, Cincinnati, Ohio. App. filed April 22, 1910. For imparting a shaking motion to the dipper of a power-driven shovel.

1,087,985. Incandescent-Lamp Suspension; H. R. Sargent, Schenectady, N. Y App. filed Nov. 23, 1912. Lamp-holding means adapted to be readily applied to or detached from installed catenary suspension wires.

1,087,997. Electro-Pneumatic Brake, W. V. Turner, Edgewood, Pa. App. filed July 18, 1911. In which pneumatic brakes may be controlled electrically at one time and automatically at another time by varying the pressure in the train pipe.

1,088,003. Resistance Grid; N. Wilkinson, Milwaukee, Wis. App. filed April 8, 1911. Made up of sheet-metal elements.

1,088,018. Means for Working Microphones in Parallel; R. Goldschmidt, Berlin, Germany. App. filed Oct. 1, 1912. So that when influenced by a common sound wave the energy required for transmitting the sound is increased accordingly.

1,088,101. Grounding Device; H. E. Schimmel, Providence, R. I. App. filed Dec. 1, 1911. Grounds the wire without using the bushing heretofore required to be soldered to the end of the conduit.

1,088,114. Unit or Grid; E. C. Van Glahn, New York, N. Y. App. filed Sept 19, 1913. For use in electric ranges.

1,088,120. Portable Self-Contained Electric Lamp; F. T Baird, Blue Island, Ill. App. filed June 11, 1913. For railroad use in place of the customary hand lantern.

1,088,157. Manufacture of Electrical Resistances, A. W. Maley, West Bromwich, England. App. filed Oct. 8, 1910. Uses grid of steel or iron containing high percentage of carbon.

1,088,165. Electric-Lamp Fixture; T. Nelson, Chicago, Ill. App. filed Aug. 18, 1913. Wall-bracket structure.

1,088,197. Device on Transformers for Preventing the Decomposition of Oil by the Oxygen Contained in Air; A. Aichele, Baden, Switzerland. App. filed Dec. 15, 1911. Does not require the transformer box to be sealed hermetically.

1,088,210. Storage-Battery Insulation; J. N. Davis, Denver, Col. App. filed May 27, 1912. To prevent short-circuiting of the shells between the positive and negative plates.

1,088,246. Railway Signaling System; J. B. Struble, Wilkinsburg, Pa. App. filed July 24, 1909. Block signal system particularly adapted to alternating current.

1,088,268. Electric-Circuit Breaker and the Like; E. A. Fagerlund, Stockholm, Sweden. App. filed April 22, 1912. Automatically operating time switch.

1,088,270. Telephone System; W. A. Fricke, Chicago, Ill. App. filed March 26, 1912. Common-battery multiple-switchboard system.

1,088,276. Arc Lamp: J. Härden, Schenectady, N. Y. App. filed May 4, 1905. Special feeding mechanism and circuit arrangement.

1,088,278. Rain Guard for Insulators; M. K. Holmes, Muncie, Ind. App. filed April 16, 1913. Centrally perforated guard plate having spring fingers to embrace the body of an insulator.

1,088,283. Telephone; P. L. Jensen and E. S Pridham, Napa, Cal. App. filed March 19, 1912. Loud-speaking sensitive telephone receiver.

1,088,296. Electrode; J. W. Richards, South Bethlehem, Pa. App. filed May 12, 1913. Has heat-retarding gaps containing a compound of aluminum.

1,088,327. Accounting System; W. J. Crumpton, Evanston, Ill. App. filed May 17, 1909. Workman's time recorder.

1,088,343. Process for Making Filaments and Filamentous Plates for Storage-Battery Electrodes; H. C. Hubbell, Newark, N. J. App. filed June 26, 1911. Aggregates alternate layers of different metals, unites by welding, subjects to pressure and cuts resulting sheet into strips or bars.

1,088,363. Electric-Railway Signal System; A. Pillich, Lackawanna, N. Y. App. filed March 28, 1910. Signals received on the train.

1,088,374. Electric Battery and Accumulator; F. Sablon, Faches-Thumesnil, France. App. filed Aug. 15, 1913. Packing composed of baked mixture of double silicate of magnesia and lime and trisilicate of magnesia.

1,088,402. Electric Insulating Fitting; J. F. Burns, Philadelphia, Pa. App. filed March 22, 1911. Adapted to be fitted in the end cap of a conduit and in openings in the terminal boxes.

1,088,448. Timed Detonator for Explosives; M. W. Quiggle and G E. Bailey, Los Angeles, Cal. App. filed May 6, 1911. Transmission of fire from ignition means to detonating material is regulated to consume greater or less time.

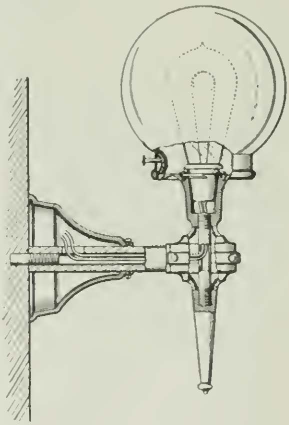
1,088,454. Switch Indicator; C. M. Roe, Jersey City, N. J App. filed Nov. 25, 1911. Indicates to engineer in entering the yard just what track is open to him.

1,088,489. Self-Regulating Dynamo-Electric Machine; C A Vandervell and A H Midgley, Acton Vale, England App. filed July 8, 1913. For car-lighting systems.

1,088,499. Electro-Mechanical Player for Musical Instruments; J. F. White, Pittsburgh, Pa. App. filed Nov. 13, 1908. Attachment for ordinary pianos.

1,088,503. Electrical Steering Gear; J. D. Williams, Jr., Philadelphia, Pa. App. filed Feb. 16, 1910. Includes hand switch for starting the motor and automatic means operated by the motor for returning the switch to its off position.

1,088,517. Means for Regulating the Speed of Asynchronous or Induction Motors; J. Bethenod, Paris, France. App. filed July 18, 1911. Prevents loss of power in the motor.



1,088,165—Electric-Lamp Fixture

1,088,527. Combined Electric-Light System; J. H. Burcham, Danville, Ill. App. filed June 9, 1913. For use on locomotives so arranged that arc-light and incandescent lamps may be synchronously maintained lighted.

1,088,531. Portable Storage-Battery Case; J. C. Callier, Roslyn, Wash. App. filed July 9, 1913. For miners, fuse being located in the case to prevent possibility of explosion.

1,088,541. Automatic Exchange System for the Transmission of Intelligence; F. S. Coulter, Livonia, Ind. App. filed April 9, 1913. Avoids need of manually operated exchange system.

1,088,607. Electric-Lamp Stand; W. A. McKay and M. Claussen, San Francisco, Cal. App. filed April 3, 1912. A means for clamping it to a support and a concealed reel for winding extra cord.

1,088,611. Device for Signalizing the Presence of Explosive Gas Mixtures in Fire-Damp Mines; H. Neubauer, Gotha, Germany. App. filed Feb. 25, 1913. Has inclosed explosion chamber which signalizes presence of the gas to a distant point.

1,088,648. Circuit-Controlling Lock; T. N Birch, Kansas City, Mo. App. filed Sept. 30, 1912. For automobile ignition service.

1,088,657. Reversing and Controlling Gear; J. P. Hall, Oldham, England. App. filed May 15, 1913. For automatically controlling an electric motor in a predetermined cycle.

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Magnitude of the Electrical Utilities

Much valuable information concerning the magnitude of the central-station industry in the United States and its growth during the past decade is presented elsewhere in this issue. Exclusive of $36,500,000 obtained from the sale of energy for railways, the central stations of the country obtained a total income of $302,000,000 from energy utilized in lighting, heating and industrial service during 1912, an increase of 250 per cent over the income during 1902. The chief items contributing to the enormous growth of the electrical energy supply business in the decade indicated are outlined on page 586 and will be discussed more fully in a later issue.

Resuming Our Onward March

It will perhaps be remembered that the value of electrical exports in November, 1913, showed a decline as compared with the same month in 1912, it being the first time in a long period that anything of the kind had happened. The expansion and development of such foreign trade had been persistently steady, and the incidental retrogression came with a shock that would have been more intensely felt had it not been realized that conditions generally were so bad it was hardly reasonable to expect an exception in any quarter subject to normal and international influences. It was, in fact, a period of low ebb in industrial and financial activity, of depression in banking circles and of anxiety among business men as to what might be coming along to hit them next. The scene changed certainly and suddenly about that time, with brighter hues and more cheerful outlook, and while business is still none too good it is going the right way. The electrical exports of December, 1913, are a slight indication in their way of the general trend, for it may be noted that they resume the interrupted onward march. They amounted to $2,233,999 as compared with $2,186,264. The gain over the corresponding month was slight, but it was a gain. There has been practically a universal feeling that 1913 was an off year and that better times could not arrive until the date changed. But, on the whole, electrical exports were good, and the total figures for the year maintained the increase of 1912 over 1911. The figures are, for 1911, $19,355,536; for 1912, $23,212,813, and for 1913, $28,197,363. Here is an advance full of real encouragement, for it will be conceded that trade in 1913, especially toward the end of the year, had few cheering aspects. How much better, then, we ought to do in 1914, with peace restored in Europe, the tariff settled and currency problems worked out to a satisfactory finish!

Saving Commissions on Utility Issues

Of more than passing interest is the offer by the Third Avenue Railway, New York, of $4,000,000 of 4 per cent bonds directly to private investors. One reason for this move is stated to be the popular aversion to banking commissions paid in connection with public utility financing. The plan is not new but is sufficiently rare to be worth consideration in connection with the sale of securities under average conditions of utility credit and the capacity of local investment markets to absorb public service corporation issues. If local investors will buy the securities of their public service corporations directly, so much the better. No company that can sell stocks or bonds in this way will object to saving bankers' commission or discount from par, or to giving at least a part of these bankers' profits to customers and the general public. It would be foolish to suppose that under all circumstances the assistance of bankers could be dispensed with in marketing securities There is, on the other hand, no reason why, under favorable circumstances as to corporate credit and the security market, a utility should not cut out the banker middleman and sell its securities over its own counter. Instead of assuming that recourse must be had to the bankers in every case, it may be well to consider whether or not a direct sale of securities could not be made. A few successful experiments along this line might do much to change for the better existing customs in utility financing.

Teaching the Public About Utilities

Aside from the interest which attaches to the subject matter of the lectures themselves, the public utility lecture course recently inaugurated by the Finance Forum of the Y. M. C. A. in New York, referred to in this issue, has considerable significance as a sign of the times. A strictly practical organization like the Y. M. C. A., the principal object of whose existence is to secure and hold the attention, sympathy and interest of young men and to offer them some clean and profitable way of spending their leisure time for the good of their minds, bodies and morals, may be assumed to know something of the ways and means best calculated to achieve these results. The Finance Forum selected the subject of public utilities for the lecture course simply for the reason that the young men wanted to learn something about utilities. Since these young men are drawn indiscriminately from the public and may fairly be taken as types of the educated American, it would seem that the general public in 1914 is beginning to realize the desirability of understanding a little more of the technique and economics of public service. The electrical interests should be truly grateful that the public is exhibiting this tendency. The regulation of utilities by commissions is no longer a theory but an accomplished fact, the total effect of which on the electrical industry can safely be characterized as good, although in certain notorious instances its effect has been bad. A repetition of such instances can be avoided only by breaking down prejudice and ignorance and by appointing regulating commissioners who are mentally capable of serving the public best by taking into consideration the interests of the utilities which they are to regulate. If this result cannot be secured, the next five years may be lean for the electrical industry and equally bad for the public. For the welfare of the whole country it is to be hoped that the public will be instructed diligently concerning some of the fundamentals of our mighty, but sensitive, public service utilities, and will learn to select the right men for the regulating commissions.

Transmission-Line Problems

Among the papers presented at the recent convention of the American Institute of Electrical Engineers was one by Mr. P. W. Sothman on the problems of high-tension transmission lines. This is mainly directed to structural elements of the modern tower line, and it contains many useful suggestions based on experience. Tower-line construction is ordinarily accompanied by suspension insulators, and these give a certain mechanical flexibility to the suspended conductors, very different from the tight grip of the pin insulators. In some respects this flexibility is an advantage. In other respects it is a source of danger, and special precautions have to be taken to limit the flexibility.

One of the electrical subjects discussed is the benefit obtainable from an over-all ground wire as a lightning protector. It is pointed out that the consensus of experience is in favor of such benefit being secured. It is interesting to note, however, how much difference of opinion exists among engineers and central-station managers as to the degree of protection which over-all ground wires can secure. It seems likely that this difference of opinion is largely due to the variability of lightning. An overhead line is run across country and suffers accidents from lightning. In order to reduce the damage, an over-all ground wire is installed. A comparison is then attempted to be made between the lightning troubles encountered before and after the addition. If the lightning disturbances were systematic, regular and occurred on schedule time, this procedure would naturally be reliable; but, the opposite qualities being notorious in lightning disturbances, judgment is apt to be baffled and accurate comparison rendered futile.

There seems to be a general agreement that modern high-tension lines, operating at, say, 60 kv and over, are less subject to lightning disturbances than lower-tension lines used to be. We may well suppose that this result is attributable to the better and more thoroughly insured insulation obtained with the modern disk insulator string. It may be fair to say that the well-constructed tower line of the future will be practically free from induced disturbances due to lightning strokes in the vicinity. Occasionally, however, lightning strokes from cloud to ground may be expected to connect directly with the line, or include the conductors in its path, even in spite of the shelter of over-all ground wires. In such cases the discharges are apt to be so powerful that break-downs must occur. In other words, we can expect improvements in aerial line construction and insulation to be proof only against indirect strokes. We can hardly aspire to making them proof against direct strokes. Fortunately the direct strokes are only a small percentage of the indirect strokes.

The Justifiable Holding Company

Some of the last testimony before a committee of Congress on trust legislation has borne directly upon the holding company for electric utilities. Mr. Flexner, representing the Middle West Utilities Company, an abstract of whose testimony is given in this issue, spoke on this point. It is well that the views of Congress should be clear on the subject. The holding company cannot be legislated out of existence without destruction to existing legitimate industry. It is true that the holding company for public utilities represents an aggregation of plants. But in the collection of these plants the object is not to effect a monopoly of the kind against which public opinion is aroused. It is to bring together under a single executive and financial management plants that are usually widely separated in territory and without the chance for competition. To this aggregation of plants economies in financing and operation are applied. The monopoly in such companies is the monopoly rendered usually by a single utility company in each community. That is the sort of monopoly which economists favor. It is the kind which commissions promote in practice and commend in theory. They not only promote such monopoly but they discourage competition against such monopoly. The reason why they do so is plain and justifiable. Competition in such cases means duplication of plant. The logical end of such duplication is consolidation. That means that the public is called upon to pay rates providing a return on both plants. To prevent this duplication of facilities and investment, to prevent two like plants from growing where one grew before, is the practice of the commissions. Investigation by Congress will prove the economic soundness of these principles. The holding company in public utilities is merely a device for bringing these monopolies together. It is true that evils develop in such companies, but they do not arise from the inherent monopolistic character of the operating underlying companies. They arise from other conditions which are just as likely to develop in small individual companies as in groups of these companies.

Direct-Current 2400-Volt Railway

The account of the electrification work of the Butte, Anaconda & Pacific Railway elsewhere in our columns is of particular interest as dealing with the first case in which a railroad has substituted for its steam-locomotive system a high-voltage direct-current system of considerable magnitude. The total trackage of the section equipped, including sidings and yards, rises to the respectable figure of 95 miles, although the road is not a long one. It is chiefly devoted to hauling copper ore from the mines at Butte to the smelters at Anaconda, only four passenger trains being operated daily in each direction. The total freight traffic amounts to something like 5,000,000 tons a year, handled in trains weighing from 1400 tons to 4000 tons according to the section of the system on which they are operated. For freight-train operation two articulated double-truck locomotives are coupled together while for switching and passenger service a single unit suffices. The locomotives weigh about 80 tons each and can give about 1000 hp continuous output.

The system, which has been in operation as a whole for about six months, has given a good account of itself. Energy for its operation is derived from the Great Falls plant over a line 130 miles long worked at 102,000 volts. A pair of 1000-kw motor generators are installed in each of the substations at Butte and Anaconda respectively, the 26-mile railway line being practically fed with energy from each end. In the motor-generator sets a single synchronous motor drives a pair of 500-kw, 1200-volt generators connected in series. The motors on the locomotives are insulated for 2400 volts but wound for only 1200 volts, two being connected permanently in series. Altogether the system is a very interesting application of high-voltage direct current in locomotive units of considerable output doing a large amount of regular heavy work. Their operation will be watched very keenly as affording much information concerning the desirability of applying the same solution to much larger problems.

The Half-Watt-per-Candle Lamp

The recent development of an incandescent lamp consuming only about half a watt per mean horizontal candle, with a correspondingly high working temperature, has brought renewed interest to studies of high-temperature radiation. Some investigations in this direction have recently been published in the *Zeitschrift für Beleuctungswesen Heizungs und Lüftungstechnik*, as mentioned in our Digest. Two types of the new lamp are discussed and reported upon. The working temperature of the filament is computed from observations of the spectrum and of the specific consumption. The results indicate that the working temperature is very nearly in direct proportion to the watts consumption, and that it reached about 2850 deg. absolute in one of the lamps tested. In the new lamps the working temperature is carried to a new stage of elevation, above which it seems at present undesirable to carry the incandescing filament. Nevertheless, the ratio of the luminous to total emitted radiation is still so low that there is great room for further improvement. Whether the improvement can be expected from recourse to yet higher temperatures is an open question. No improvement in incandescent-lamp efficiency has yet been made without a rise in working temperature, but in lamps employing luminous vapor, such as the mercury-vapor lamp, no such direct dependence on temperature has been found necessary.

Constant-Current Transmission

The account by Dr. Louis Bell in this issue of the practical working of the Thury plant between St. Maurice and Lausanne, Switzerland, furnishes evidence enough that the high-voltage direct-current transmission system is far from being a failure. This particular plant has been in operation for more than ten years, and although the apparatus would be very much simplified were the plant being built at the present time, it has made a good record throughout its long period of operation in a way that speaks volumes for the character of the construction. From the viewpoint of cost, the greatest fundamental difference between such a system and the ordinary alternating-current plant is the total absence in the former of the enormously expensive and forbidding switchboard apparatus to which the engineer is driven, or thinks he is driven, in the latter. The direct-current generating system is obviously considerably more expensive than an equivalent equipment in ordinary three-phase generators, but when one considers the cost of the transformers and of the switchboard control the case takes on a somewhat different aspect, still further modified when one includes the cost of the structure required to contain the accessories.

A very striking difference between constant-current and constant-potential operating is the facility with which the former may be worked with the ground as the return conductor. There seems to be no trouble at all in running these unidirectional constant-current systems with ground return whenever necessary in an emergency, or as a regular practice. It is found that a properly made ground circuit has less resistance than the transmission line itself so that there is a positive gain in efficiency as well as in convenience. A ground return with limited current is different from a ground return on a constant-potential system, and it certainly is a matter of no small importance to have a transmission circuit either wire of which when grounded can carry the full load indefinitely and without loss of efficiency. We believe that the uniform experience with these constant-current plants has been very gratifying from the standpoint of operation. While for ordinary cases nobody claims that they are equivalent to the three-phase plant in convenience and cheapness of distribution, they have certainly made a good record and have some unique advantages in operative qualities.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Long Acre Suit Dismissed

Supreme Court Justice Greenbaum threw out of court on March 6 the foreclosure suit of the Metropolitan Trust Company against the Long Acre Electric Light & Power Company, of New York City. It was brought by the trust company as trustee of the bond issue made by the Long Acre company in 1906 for $500,000, and it was alleged that the latter had defaulted in an interest payment of $96,000. Justice Greenbaum said that the Long Acre company had always been solvent and characterized the action as a scheme of the New York Edison Company to injure its rival.

Bill to Abolish Limited-Area Franchises

House bill No. 285, recently introduced in the Kentucky State Legislature, seeks to prohibit the granting of any franchise for a limited area covering the supply of gas, water or electricity. The bill is understood to be aimed at "block plants" operated in Louisville, Ky., Mayor Buschemeyer of that city having declared in this connection:

"The company which must supply service to everybody is forced to a certain extent to meet the competition of the block plant in the block where the latter operates. The cost of this competition is borne by patrons who do not live in territory supplied by block plants, because it postpones indefinitely the time when, by economical regulation and operation, rates all over the city can be reduced. It takes from the many to enrich the few, which makes the matter one of special privilege. To no company or individual should a franchise be given to use the public streets and alleys unless the service is to be furnished over the entire city."

Status of Water-Power Legislation in New York

In his message to the Legislature on March 5 on conservation of the resources of the State of New York Governor Glynn indorsed the hydroelectric bills prepared by the State Conservation Commission and now pending in the Legislature, providing for state development of water-powers. The Governor asserted that the 1,000,000 electric hp now being generated by the waters of the State has been handed over to private corporations without provision for adequate compensation to the State. He called for State development of the remaining, as he estimated, 1,500,000 hp of undeveloped water-powers and said that this would mean a saving in fuel bills of $50,000,000 a year.

A bill providing broadly for the development of New York State's water-powers by means of reservoirs and dams constructed by the State, with the operating rights leased to private corporations, was introduced in the Assembly on March 6 by Assemblyman Jones, of Watertown. The bill adds a new article to the conservation law ostensibly to control the flow of rivers. It provides for the establishment of river regulation districts along watersheds, and that any integral part of such a watershed may be made such a district on the application of three taxpayers to the Conservation Commission. The "river regulation districts" are made public corporations with perpetual powers. When a district is formed the Governor must appoint a board of three members with powers of eminent domain and to condemn property, except what belongs to a city. The State under the bill would hold title to all property so taken.

Industrial Disease a Personal Injury Under Compensation Act

The Supreme Court of Massachusetts has handed down a decision in the case of Hurle vs. American Mutual Liability Insurance Company to the effect that disease caused by industrial conditions may be treated as a personal injury under the Massachusetts workingmen's compensation act. In the case at bar the plaintiff, an employee in the power house of the Plymouth (Mass.) Cordage Company, became totally incapacitated for work by optic neuritis induced by poisonous gases inhaled about seventy times a day at the peepholes of a gas-producer installation. The court holds that a broad interpretation of the workingmen's compensation act justifies the Industrial Accident Board's finding in favor of the victim, and that while the preponderance in recent years of actions grounded upon some physical violence has tended to emphasize the aspect of injury which depends upon visual contact or direct lesion, this is by no means the exclusive meaning of the term "injury," and that it would not be accurate but lax to treat the act as if it referred merely to accidents.

Concrete Poles Withstand the Storm

The strength of the reinforced-concrete telegraph pole has been demonstrated upon more than one occasion during violent storms to which poles of the wooden type readily succumb. One of the most severe tests ever inflicted upon them occurred during the recent blizzard in the North Atlantic States, from which they emerged intact. Perhaps the most striking example of their extreme durability as exemplified in this storm was in the case of the telegraph line of the Pennsylvania Railroad Company, where a large number of reinforced-concrete telegraph poles were exposed to the storm which swept over the Hackensack meadows in the vicinity of the west entrance of the Pennsylvania tunnels leading into New York City. The company had erected many of these poles in recognition of their durable and storm-proof properties. The storm center was in and about New York City. The wind reached a velocity of from 70 to 80 miles an hour, and the accumulation of snow and ice was so great that New York was practically isolated for a time, at least so far as aboveground telegraphic communication with Philadelphia was concerned. The company's telegraph line was out of commission for a long time and many of the wooden poles were broken down by the wind and their burden of snow and ice. In no case, however, did a reinforced-concrete pole collapse. So severe was the stress that the wooden cross-arms upon some of these poles were broken, but the poles themselves remained intact.

Low-Head Water-Power Development

In a paper recently read before the Illinois Electric Railways Association Mr. C. W. Humphrey, Chicago, consulting engineer, described the hydroelectric development of the McKinley System on the Illinois River at Marseilles, Ill. Mr. Humphrey remarked that it is only a few years since attention began to be attracted to low-head hydroelectric developments. Now the tendency toward such development is quite marked, and old abandoned mill sites in large number are being considered for hydroelectric development. Up to the present time, however, very few low-head developments have been made primarily as auxiliaries to steam plants. The general belief has been that the hydroelectric plant should be large enough to generate the entire requirement, except, possibly, during a low-water period, when a steam auxiliary might make up the difference. But, according to Mr. Humphrey, the fact is beginning to be recognized now that many low-head developments can be constructed at a cost so low that electricity can be generated for less than the fuel costs of a steam plant, even when the quantity is sufficient to supply only a small portion of the owner's requirements. The writer pointed out that any low-head water-power plant, even of very moderate size, can produce energy very cheaply if the plant can be operated continuously at its maximum rating whenever water is available.

In concluding his paper Mr. Humphrey said that the government reports for 1912 showed that the amount of water-power developed in the United States was 4,016,127 hp, while the total of the possibilities of water-power development amounted to 51,398,000 hp, or about thirteen times the amount developed or under construction. In 1912 the State of Illinois had 51,211 hp developed out of a possible 345,000 hp. Practically all of the possible developments in the State of Illinois fall in the low-head class.

Winter Advice to Electric-Truck Users

To electric-truck users in New York City the New York Edison Company has just issued a timely set of suggestions intended to secure the best operation of battery-driven wagons through the heavy snow drifts which have recently encumbered the streets of the metropolis. The instructions are printed on a heavy card, the reverse side of which bears a list of the Edison company's substations at which emergency charging service may be obtained. For such charging no cash is necessary, the firm's name on the truck being taken as sufficient guarantee of payment. The following advice is reproduced from the card, and is entitled "Truck Don'ts for Winter":

"Don't try to accomplish as much in the snow as you have on clear asphalt.

"Don't start out in the morning until you are satisfied that your battery has been fully charged.

"Don't try to push a drift ahead of you. Leave it for the snow contractor.

"Don't sit still while the wheels go 'round in the slush. Have a box of sand and a kitchen coal shovel handy. Use sand liberally. It is cheaper than electricity.

"Don't throw your power on full. Work it up gradually, not forgetting the sand box.

"Don't forget an anti-skid device. An improvised one may be made by looping three or four turns of a rope around your tires.

"Don't forget that time may be gained by leaving your wagon at the corner and making side-street deliveries on foot.

"Don't let your truck stay out all night for want of a boost. The New York Edison Company has twenty-four emergency charging stations in New York where your firm's credit is good."

Institute of Radio Engineers

At the March 4 meeting of the Institute of Radio Engineers, New York City, President L. W. Austin read a paper on "The Effect of a Parallel Condenser in the Receiving Antenna," and Mr. Louis Cohen, of the Bureau of Standards, Washington, D. C., described in his paper "A Method for Determining Logarithmic Decrement."

In his paper Dr. Austin commented on the practice of using a variable condenser in parallel with inductance in the receiving antenna to receive longer waves as being convenient and doing away with the necessity of small inductance steps. It also reduces the total amount of inductance required, but is usually found to be less efficient than purely inductive tuning. Tables showing the effects of different values of parallel capacity for two sizes of artificial antenna were shown. As the capacity was increased and the inductance decreased the galvanometer deflection decreased. Replacing one-half the inductance by capacity decreased the deflection about one-third. Practically the same results were obtained with the real antenna.

Mr. Cohen discussed the Bjerknes formula, stating briefly that as commonly used its results may be incorrect. He pointed out the desirability of developing another method for use in checking. Mr. Cohen proposed that, instead of detuning the wave-meter circuit until $LI^2 \div 2$ is obtained as in the common method based on the Bjerknes formula, the resistance of the wave-meter circuit be increased until $LI^2 \div 2$ is obtained; then with the inductance, frequency, resistance and added resistance of the wave meter known the desired decrement can be readily obtained.

Forthcoming Meetings of the A. I. E. E.

At Pittsburgh, Pa., April 9 and 10, the American Institute of Electrical Engineers will hold a meeting under the auspices of its committee on the use of electricity in mines, when the following papers will be presented: "Mine-Duty Controllers," by Mr. H. C. Reed; "Self-Contained Portable Electric Lamps," by Mr. S. W. Swoboda; "Mine Substations," Part I, "The Construction and Operation of Mine Substations," by Mr. H. Booker; Part II, "Motor-Generator Sets Versus Synchronous Converters as Applied to Mine Work," by Mr. W. M. Hoen, and "The Development of the Electric Mine Locomotive," by Mr. G. M. Eaton. There will also be a general discussion on rules for electrical installations in mines.

At Washington, D. C., April 24 and 25, there will be a joint meeting of the A. I. E. E. and the American Physical Society under the auspices of the Institute's electrophysics committee and its Washington Section. Five papers will be presented on behalf of the A. I. E. E., as follows: "A Theory of Corona," by Mr.

Bergen Davis; "Some Investigations of Lightning Protection for Buildings," by Mr. T. M. De Blois; "A Milliampere Current Transformer," by Mr. Edward Bennett; "Some Simple Examples of Transmission-Line Surges," by Mr. W. S. Franklin, and "Solenoids," by Mr. C. R. Underhill.

The annual business meeting of the Institute will be held at New York May 19. Following the business session there will be a technical program under the auspices of the committee upon electricity in marine work.

Another meeting of the A. I. E. E. will be held at Pittsfield, Mass., May 29, with headquarters at the Maplewood Hotel. The principal subject before this conference will be "The Relative Advantages of 'Y' and Delta Connections," and all of the papers presented will have some bearing on this general topic. The following papers have been promised for this meeting: "Grounding of Transmission Lines," Dr. C. P. Steinmetz; "Experience with Line Transformers," Mr. D. W. Roper; "A Study of Some Three-Phase Systems," Mr. C. L. Fortescue; "Relative Merits of 'Y' and Delta Connections for Generators," Mr. T. S. Eden; "Conditions Under Which Harmonics Are Produced," Mr. Clinker, and "Stresses in Three-Phase Operation," Mr. L. F. Blume.

The thirty-first annual convention of the American Institute of Electrical Engineers will be held in Detroit, Mich., June 22 to 26, 1914. Convention headquarters will be at the Hotel Cadillac.

Magnitude of Public Utilities

The first of a series of ten lectures on public utility questions arranged by the Finance Forum of the Young Men's Christian Association in New York, with the aid of the leading public utility interests of that city, was given at the West Side Branch of that organization on the evening of March 9. Mr. Henry L. Doherty opened the meeting by indicating the scope of the lectures and their significance at the present time. He said that in the strict interpretation of the term public utilities are included only electric lighting and motor service, gas and street railway enterprises, and that the series of lectures will aim to cover both the financial and the economic sides of the field. The bigness of public utility matters was brought out forcibly by a few figures on the growth of the urban population in this country and of the public utilities themselves. Mr. Doherty showed how the per capita use of their service increases with the increase in population of the cities.

Mr. T. Commerford Martin, executive secretary of the National Electric Light Association, was introduced as the speaker of the evening, on the subject "Magnitude of the Electric Light, Power and Transportation Business." Mr. Martin's many years of activity in connection with the government electrical census work enabled him to present, in concrete statistics, evidence of the remarkable growth of public utilities in this country during the past forty years. In 1877, according to Mr. Martin, the total investment in the electrical industry in this country amounted to about $50,000,000, practically all of which was in the telegraph, which was the only real commercial application of electricity at that time. To-day, Mr. Martin stated, the capitalization and investment—which he believes to be synonymous—in the various branches of the electrical industry are approximately $10,000,000,000, with an earning power of $2,000,000,000 a year. The growth was shown to have been a steady one, regardless of the financial crises in other lines of industry, at various periods since the above date, the average rate of growth for the past twenty years in the electrical industry having been 25 per cent per annum.

The manufacturing branch of the industry, on which all the other branches are dependent and which was at first the most important one, has now yielded first place to the operating branches, in which the largest amounts of capital are invested at the present time. The traction systems throughout the country have contributed largely to the development of its trade, and the energy-distributing systems have helped toward the establishment of many industries which could not have been carried on in any other way. All of the aluminum and nearly all of the copper produced in this country are refined or abstracted electrolytically. The large water-power resources of the South have furnished energy for the operation of cotton mills, which have come to the position of formidable competitors of the New England textile industry. Practically no progress is being made in the telegraph business at the present time, according to Mr. Martin, owing to the tremendous growth of the telephone systems throughout the country.

Cleveland Electrical Exposition

Cleveland, Ohio, is planning to hold an electrical exposition at the Coliseum May 20 to 30, under the auspices of the Electric League of Cleveland. This is to be the first exposition of its kind ever held in that city, but owing to the abundance of electrical industries in the vicinity it is anticipated that as much importance will be attached to the event as was given to the industrial exposition held a short time ago. The main purposes of the electrical exposition are: To educate the community as to the advantages of electricity for illumination, industrial power and household use; to display time and labor-saving devices operated by electricity; to encourage people to use more electrical appliances and to foster a general interest in the electrical industries of Cleveland and vicinity. Electrical processes as well as products will be shown. An elaborate decorating and lighting scheme will be employed in order to make the Coliseum attractive by both night and day.

An executive committee of fifteen and an exposition committee of 150 will have charge of affairs, with Mr. William G. Rose acting as manager. A publicity campaign will scatter broadcast facts and figures concerning the event to arouse interest. The executive offices are located in the Illuminating Building, Public Square, Cleveland.

Annual Dinner of Engineers at Boston

The fifth annual dinner of the Boston Section of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the Boston Society of Civil Engineers was held at the Boston City Club on March 4, nearly 250 being present. The speakers were Mr. Guy E. Tripp, chairman of the board of directors Westinghouse Electric & Manufacturing Company; President C. O. Mailloux of the A. I. E. E., President James Hartness of the A. S. M. E., Dr. A. E. Kennelly of Harvard University, and Dr. Milton W. Franklin, Sprague Electric Works, Bloomfield, N. J. Prof. Harry E. Clifford, of Harvard University, was toastmaster, and Mr. N. J. Neall, Boston, was chairman of the committee on arrangements.

Mr. Tripp delivered a powerful address upon the anti-trust legislation now under consideration at Washington, expanding somewhat upon the ideas expressed by him at the recent annual meeting of the Chamber of Commerce of the United States at Washington. An abstract of Mr. Tripp's Boston address appeared in these columns March 7. The speaker reviewed the salient features of the so-called "Five Brothers" bills and urged their careful consideration by all engineers and other persons interested in the commercial prosperity of the country.

Dr. Kennelly emphasized the importance of the engineer interesting himself in public affairs and outlined the purposes of the International Electrotechnical Commission, paying eloquent tribute to the linguistic work of President Mailloux in the deliberations of that body. He expressed the hope that international specifications would be forthcoming which would enable engineers to standardize machinery ratings on the basis of the commission's definition. President Mailloux expressed warm appreciation of the work of Dr. Kennelly on the commission, commented upon the growing spirit of fraternity among engineers, and in concurrence with President Hartness and Dr. Franklin emphasized the increasing usefulness of the engineer in modern civilization.

Anti-Trust Legislation

Two of the committees of Congress working on the administration anti-trust legislation came to a full stop during last week. The sub-committee of the House committee on commerce, which has charge of drafting a new bill to deal with the proposed interstate trade commission, found that there are almost insurmountable objections to the proposed publicity features of the measure. The Senate committee on interstate commerce, on the other hand, which has been holding hearings on Senator Newland's bill for the regulation of trade relations, has developed strong objection on the part of influential Senators and Representatives to adding anything to the statutes that will serve to change the Sherman law. The House committee on the judiciary, the other committee of Congress considering trust legislation, however, continued its hearings.

In last week's issue was published information of interest to the electrical industry brought out at the hearings before the House committee on the judiciary. This had to do chiefly with the fixing of resale prices on electrical appliances. The viewpoint of a representative of a large holding company is given in what follows.

Mr. Bernard Flexner, Representing Middle West Utilities Company

Mr. Bernard Flexner, representing the Middle West Utilities Company, Chicago, Ill., stated that a holding company owning the securities of gas and electric light utilities should be excluded from the operation of a statute affecting holding companies. The Middle West Utilities Company holds the securities of electric light properties in widely separated localities. All of these properties are operated by domestic corporations of the states containing the localities. Most of the states have public service commissions and the very thing that it would be desired to accomplish is being done by the states themselves. Companies which hold the securities of various operating companies make it possible to develop in the communities in which operations are conducted a character of service that otherwise would have been absolutely impossible. In Illinois, for instance, the operating Illinois corporation has taken over and is operating about 100 utilities in 100 different municipalities. Before these properties were brought together most of the communities were getting electric light only at night. Now they have twenty-four-hour service. The tendency in prices everywhere has been to lower.

The question of business of an interstate nature was brought up, and Mr. Flexner said that electricity was transmitted from one state to another. It would interfere very considerably with legitimate development of business to reach holding companies of this character where they do not present the elements of competition and cannot present such elements. Congress has recognized utilities as monopolies to be regulated and every state has recognized them as monopolies. The purpose of public service commission laws is to create a condition of regulated monopoly with reference to this character of business.

With regard to the interlocking directorate bill, Mr. Flexner said that an exception ought to be made in favor of a corporation and its lawful subsidiaries.

Buffalo Electric Show

The Buffalo Electric Show was opened at Elmwood Music Hall, Buffalo, N. Y., on the evening of March 9, to continue throughout the week. It represents the concerted action of the electrical contractors, jobbers, manufacturers and the central-station interests, and if the attendance on the opening night is duplicated only in part the show will be a pronounced success. On the front wall of the auditorium is the largest electric sign ever built in Buffalo. It is 42 ft. wide and 20 ft. high and has script letters 15 ft. high reading "Electric Show." These are studded with clear-globe tungsten lamps and the blaze of light is visible a great distance away. The booths within the hall are tastefully arranged and are grouped around a great fountain in the center, within which the spraying water is tinted with all the hues of the rainbow by hidden lamps. The general color scheme of the show is white. The hall girders overhead are hidden behind a billowy canopy of yellow and white bunting radiant in the brightness of numerous electric lamps, most of which are invisible. From the ceiling are suspended baskets containing large tungsten lamps, and in spite of the large volume of light everything is arranged so that there is no glare.

The Buffalo General Electric Company has a "house electric" near the entrance, in which the convenience, cleanliness and desirability of electricity in the home are demonstrated. The usual array of household cooking devices and conveniences is shown. The Cataract Power & Conduit Company, which distributes the energy sent from Niagara Falls, has an educational exhibit to impress upon the public the overwhelming importance of electricity as an aid to commerce, and a miniature substation occupies two booths. The electrical contractors and supply houses show various wiring devices, appliances and lighting fixtures. In fact, the entire show is pre-eminently one to impress the householder and small manufacturer with the advantages of electricity. One of the finest exhibits of electrical apparatus of all sorts is that of the Robertson-Cataract Company, which occupies the entire west end of the hall. The exhibit is divided into three main divisions, one for displaying lighting fixtures, another for the display of electric household and cooking appliances and the center space being occupied by a large exhibit of electrical apparatus and supplies, including almost everything needed for electrical installations, from the outdoor pole-line material to the finished job in the home or factory. Among the large electrical contracting and supply house exhibits are those of McCarthy Brothers & Ford, the Western Electric Company, the Electric Shop, the W. C. Jaynes Electrical Company, the J. C. Sterns Electrical Company, the Holtzer-Cabot Company, the Johnson-Wahle Electric Company, the Tower Electric Sales Company, the Buffalo Electric Contracting Company, the Thordarson Electric Manufacturing Company, the Sterns Electric Equipment Company, J. H. Vail, H. J. Wood & Company, H. I. Sackett Electric Company and J. N. Adam & Company.

Effectiveness in Central-Station Organization

Prof. John Price Jackson, formerly dean of the Engineering School of Pennsylvania State College and now Commissioner of the Department of Labor and Industry for the State of Pennsylvania, addressed the Philadelphia Section of the National Electric Light Association recently on the topic "Co-operation and Effectiveness in Industrial Organizations." The speaker declared that such effectiveness depends on, first, the right attitude of the employee toward the company and, second, a due appreciation on the part of the company of the service of its employees. The latter should not indulge in criticism of the company among themselves and much less to outsiders. Employers, on the other hand, must remember that their men are human and that improvements in working conditions, comfort, safety, etc., can do more toward bringing about effective organization than caustic criticism or arrogant methods can ever accomplish.

Last month the engineering department branch of the Philadelphia Section was addressed by Mr. Albert R. Granger, manager of the Beacon Light Company, Chester, Pa., and Mr. John E. Melloy, electrical superintendent of the same company. At the Feb. 6 meeting of the meter-department branch, Mr. A. R. Cordner read a paper on "Economic Factors in Central-Station Development."

Power and Machinery Contracts Signed for Large Reversing Steel Mill at Massillon, Ohio

The Massillon (Ohio) Rolling Mill Company, now operating a sheet mill, is formulating plans which contemplate the installation of six open-hearth furnaces, a 26-in. blooming mill and a 34-in. bar mill, in addition to a stamping and enameling plant and other fabricating mills. The total output of the plant will be 150,000 tons of steel annually, 60,000 tons of which will go to the sheet mill, while the remainder will be made into high-grade nickel and vanadium alloy steels. Contracts for the electrical apparatus have been signed with the Westinghouse Electric & Manufacturing Company, while the contract for electrical energy, to be supplied from the mains of the Massillon Electric & Gas Company, was closed by Mr. R. E. Burger, manager of the Henry L. Doherty property at Elyria, Ohio. Energy will be taken from the electric-service company's mains at 2300 volts and will drive a directly connected induction-motor-generator set delivering direct current for the large mill motor. This set will be equipped with a 100-ton laminated flywheel, having a peripheral speed of about 4 miles a minute. The blooming mill will be driven by a direct-current reversing motor, reversing being accomplished through control apparatus connected in the generator-field winding. The bar mill will be driven by a 2000-hp induction motor. It has been estimated that the connected load of the mill will be 7000 hp and that the maximum demand will be in the neighborhood of 2400 kw.

Telephones of the United States

Preliminary figures of the forthcoming quinquennial report on telephones of the United States have been given out by the Bureau of the Census. The statistics relate to the years ended Dec. 31, 1902, 1907 and 1912, and include the total wire mileage and the total number of telephones reported for all systems in the United States that were in operation all or any part of those years. They do not include private telephone lines used exclusively for communication between departments of the same establishment unless connected with lines elsewhere through a private branch or exchange. The number of telephones includes those furnishing service through private branch exchanges, local pay and outlying toll stations.

During the year 1912 the length of wire used on the telephone lines of the United States amounted to 20,248,326 miles, an increase of 313.2 per cent during the decade. There were in use 8,729,592 telephones, an increase of 268.2 per cent during the ten years. Of these, the Bell system increased by 137.8 per cent during the period from 1902 to 1907 and by 62.4 per cent from 1907 to 1912. During the same periods the number of telephones reported by all other companies and systems increased 183.4 per cent and 22 per cent respectively. In 1902 the Bell system controlled 69.1 per cent of the wire and 55.6 per cent of the telephones in use, and in 1912 this system controlled 74.7 per cent of the wire and 58.3 per cent of the telephones. The proportion of the total wire mileage and total number of telephones owned by the Bell system has increased during the decade, while that owned by the independent companies has decreased.

TELEPHONE STATISTICS OF THE UNITED STATES FOR 1912

	Year	Miles of Wire	Number of Telephones	Estimated Number of Messages or Talks*
United States	1912	20,248,326	8,729,592	13,735,658,245†
	1907	12,999,364	6,118,578	10,400,433,958†
	1902	4,900,451	2,371,044	5,070,554,553
Bell Telephone System	1912	15,133,186	5,087,027	9,133,226,836
	1907	8,947,266	3,132,063	6,401,044,799
	1902	3,387,924	1,317,178	3,074,530,060
All other companies and systems	1912	5,115,140	3,642,565	4,602,431,409
	1907	4,052,098	2,986,515	3,999,389,159
	1902	1,512,527	1,053,866	1,996,024,493

*The number of messages reported by the Bell Telephone System includes only completed calls, while the figures for all other companies may include some original calls not necessarily completed, such as calls that the operator reports as "Line busy" or "Does not answer."

†Exclusive of companies with an annual income of less than $5,000.

While accurate statistics cannot be compiled on the number of messages transmitted, it is estimated that there were 13,735,658,245 messages sent over the telephone lines of companies which had an income of at least $5,000 during 1912. It is impossible to obtain even an estimate of the number of conversations over private branch wires and the party lines which do not require interconnection at the public or central exchanges. No estimates were required concerning the number of messages for the 1,402,844 telephones on the lines of small companies which had an income of less than $5,000 during 1912. Messages for the smaller systems were included to some extent at the census of 1902; therefore, the statistics of messages reported for the three periods are not strictly comparable and they should not be considered as representing the total amount of business transacted by telephone systems of the United States during the year 1912. The figures in detail are shown in the accompanying table.

Public Service Commission News

Maryland Commission

That the order of the Maryland Public Service Commission directing the Curtis Bay Electric Light & Water Company to extend its service into the town of Brooklyn, Anne Arundel County, was unlawful and unreasonable is the gist of an opinion handed down by the Court of Appeals. The opinion affirms the decree of the Circuit Court for Baltimore City. The commission passed its order upon petition of the Brooklyn Improvement Association. It reached the conclusion that the company could well undertake the extension on the prospect of obtaining new customers.

New Jersey Commission

The Board of Public Utility Commissioners of New Jersey has declined to hear the application of the township of South Orange that the Public Service Electric Company incorporate a clause in its street-lighting contract permitting the acquisition of its equipment by any other company if in the future such other company should obtain a lighting contract.

The Supreme Court has handed down a decision affirming the authority of the Board of Public Utility Commissioners to refuse to approve of franchises granted by municipalities if it deems that such utility is not essential for public benefit and convenience. The court, therefore, refuses the mandamus writs applied for by the Eastern Telephone & Telegraph Company, to which a franchise was recently granted by the Cape May Board of Freeholders, the franchise being later denied by the utility board.

California Commission

The Consolidated Utilities Company, Compton, and the Glendora Light & Power Company have filed applications with the Railroad Commission of California asking authority to transfer their properties to the Pacific Light & Power Corporation.

The Western States Gas & Electric Company has filed an application with the Railroad Commission of California for authority to issue $219,000 first mortgage refunding 5 per cent gold bonds which the applicant wishes to sell at 82½.

Massachusetts Commission

Chairman F. E. Barker of the Gas and Electric Light Commission advocated extending the commission's powers at a recent hearing by the legislative committee on public lighting on the bill giving the commission final jurisdiction over the issue of securities by utilities under its supervision. The commission's bill is designed to avoid the recurrence of such a reversal of the board's decisions as was brought about in the recent Fall River Gas Works Company case, where the Supreme Court of the State required the board to authorize a stock issue which the commission had refused to approve on the ground that it was inconsistent with the public interest (Fall River Gas Works vs. Gas and Electric Light Commissioners, 214 Mass., 529). Under its provisions no securities could be issued save with the approval of the board as a court of last resort, no court appeal being allowed in case of an adverse decision. The bill is designed to prevent the accumulation of unduly large surpluses and the issue of new securities in the face of what are virtually stock dividends, in the commission's opinion. The bill was opposed by Mr. A. A. Ballantine, for the Stone & Webster Management Association, and Mr. E. W. Burdett, for the Massachusetts Electric Lighting Association, who contended that the practical control of surplus accumulation is sufficiently lodged in the board's rate-making powers, which can easily be invoked upon petition by aggrieved parties.

Current News Notes

Municipal Lighting Activity in Pasadena.—The municipal electric-lighting plant in Pasadena, Cal., has now about 6000 meter connections, and Mr. C. W. Koiner, the general manager, is said to have recommended that the minimum monthly charge be reduced to 50 cents.

* * *

Louisville & Nashville-Western Union Suit.—The Louisville & Nashville Railroad Company has filed a bill of exceptions to the recent decision of Judge Walter Evans, of the federal court at Louisville, Ky., granting the Western Union Telegraph Company a new trial after a jury had awarded the railroad company $500,000 for the use of its right-of-way by the Western Union.

* * *

Better Industrial Relations Exhibit.—A "Better Industrial Relations Exhibit" is to be held April 18 to 25 at 2 West Sixty-fourth Street, New York City, at which will be shown devices in modern business which tend to make more harmonious the relations between employer and employee and to better the conditions of employment. The "Business Men's Group" of the Society for Ethical Culture, New York, will have charge of the exhibit.

* * *

What One Central-Station Company Did for Electric Vehicles.—When the Union Electric Light & Power Company started to push the electric-vehicle business in St. Louis seven years ago there were but eleven "electrics" operating on the streets of the city. To-day there are 600 pleasure cars and 150 trucks. A census taken when the company decided to discontinue its electric-vehicle business showed that one-fourth of all pleasure cars operating in the city had been sold by the central-station company.

* * *

Transformers in Chicago.—In a recent paper Mr. W. G. Kelley, of the distribution division of the engineering department of the Commonwealth Edison Company of Chicago, said that during the period from 1902 to 1913 the number of transformers connected with the system increased from 1750 to 14,500 and their rating increased from 12,700 kw to 127,500 kw, the average size increasing from 6 kw in 1902 to 8.5 kw in 1913. This shows an increase in the density of the load as well as the extension of the system.

* * *

Testimonial Dinner to Dr. Samuel Sheldon.—A testimonial dinner will be tendered to Dr. Samuel Sheldon at the Hotel Astor on March 21 to celebrate a quarter of a century of service as professor at the Polytechnic Institute of Brooklyn. Undergraduates, alumni, friends and professional associates are expected to come from various parts of the country to join in the celebration. Mr. T. C. Martin will preside as toastmaster and the speakers will include Messrs. S. O. Edmonds, Ralph W. Pope, Dr. L. W. Atkinson and W. L. Bliss.

* * *

Grids for Spot Resistance Lamp.—In the article "Resistance Grid for Spot Lamp" appearing on page 273 in the Jan. 31 issue an error was made in stating the size and length of the resistance wire to be used. Instead of employing 13 ft. of No. 18 Iala resistance wire as recommended, 90 ft. of No. 10 wire of the same material should be used. The temperature finally attained by this wire would be about 700 deg. Fahr. under the conditions imposed. If a lower temperature rise of say 500 deg. Fahr. is desired, about 215 ft. of No. 6 wire may be employed.

San Francisco Exposition Buildings Ready July 1.—The main exhibit palaces of the Panama-Pacific International Exposition, to be held at San Francisco in 1915, will contain approximately 60,000 exhibits from all parts of the world. Allotment of space will shortly be taken up and the installation of exhibits in the buildings will begin about July 1, thus giving exhibitors nearly nine months to get ready. More than 7000 applications for concessions have been received. Already 212 national and international congresses have signified their intention to meet in San Francisco during 1915, and it is probable that the number of organized bodies which will assemble during the exposition will reach 500.

* * *

Dollars-and-Cents Value of Generating-Station Efficiency.—In answer to a question at a recent meeting of the Commonwealth Edison Company Section of the National Electric Light Association, Mr. G. E. McKana, of the statistical department of the company, said that it is probable that the present coal consumption of the company would be double what it is if the generating units of to-day were no more efficient than the reciprocating-engine units of the Harrison Street station twenty years ago. Under such conditions the annual coal consumption would be 2,500,000 tons a year. If the extra coal burned is worth no more than a dollar a ton, the annual saving is $1,250,000, which, capitalized at 5 per cent, represents $25,000,000.

* * *

SOCIETY MEETINGS

Philadelphia Section, I. E. S.—The next meeting of the Philadelphia Section of the Illuminating Engineering Society will be held March 20 at the Engineers' Club, 1317 Spruce Street, Philadelphia. The usual dinner will precede the meeting. At the session Mr. F. D Bartlett will present a paper on "Lighting and Signaling Systems of Subways," and Prof. James Barnes will speak on "The Sun—the Master Lamp."

* * *

Kentucky Jovians to Rejuvenate.—The first rejuvenation of the Jovian Order in Kentucky will be held at the Seelbach Hotel, Louisville, March 17. The rejuvenation will be a joint affair, Louisville, Lexington, Ky., and Evansville, Ind., participating. Jupiter W. N. Matthews, St. Louis, will officiate, and Messrs. James Clark, Jr., statesman for the Louisville district, and C. J. Eaton, Lexington, who is statesman in that territory, are in charge of the arrangements. It is expected to initiate 100 candidates at the rejuvenation. The banquet which will follow will be attended by 125 Jovians.

* * *

Electrical Association of Wilmington, N. C.—At the March 5 meeting of the Electrical Association of Wilmington, N. C., Mr. W. C. Andrews, Orange, N. J., gave a talk on the construction and operation of the Edison alkaline nickel-iron storage battery. The Wilmington association is now in its second season, with a membership of sixty. Meetings are held monthly. At the April meeting energy-consuming appliances will be discussed in a paper by Mr. R. H. Bouligny, Richmond, Va. The president of the association is Mr. Raymond Hunt, superintendent of the Tide Water Power Company, and its vice-president is Mr. Charles R. Sugg, of the Atlantic Coast Line.

* * *

The 3750-Kw Direct-Current Turbo-Generators at Cleveland.—At the Feb. 23 meeting of the Cleveland Section of the American Institute of Electrical Engineers, which was held in the new office building of the Cleveland Electric Illuminating Company, Mr. H. L. Wallau, electrical engineer for the company, presented a paper describing the performance of the two 3750-kw, 13,650-amp, 275-volt direct-current turbo-generators installed at Cleveland about a year ago. The generators are driven through McAlpin reduction gears, giving an armature peripheral speed of 8500 ft. per minute and a commutator speed of 4250 ft. per minute. Each turbine weighs 153,000 lb., the gearing 40,000 lb., and the generator 163,000 lb.

* * *

Society for Electrical Development to Decide on Plans.—The executive committee of the Society for Electrical Development, Inc., met in New York on March 11 and discussed several important questions in connection with future activities of the society. The following committee was appointed to meet at the society's offices on March 17 to reach a final decision on plans and put them into effect: Mr. Henry L. Doherty, of New York; Mr. N. H. Boynton, of Cleveland; Mr. George Williams, of New York; Mr. J. Robert Crouse, of Cleveland; Mr. W. E. Robertson, of Buffalo; Mr. F. H. Gale, of Schenectady; Mr. J. R. Strong, of New York; Mr. E. W. Lloyd, of Chicago; Mr. J. C. McQuiston, of Pittsburgh; Mr. J. M. Wakeman, of New York, and Mr. S. L. Coles, secretary of the society.

* * *

Western Society of Engineers and Utilities.—An extra meeting of the Western Society of Engineers will be held Monday, March 16, at 8 p. m., in the rooms of the society at Chicago. At the annual meeting of this society in January Mr. M. E. Cooley, dean of the College of Engineering of the University of Michigan, delivered an address on "Factors Determining a Reasonable Charge for Public Utility Service." The meeting on Monday night will be practically a discussion of the subject brought up by Dean Cooley. A paper on "Public Utility Regulation from the Investors' Standpoint" will be presented by Mr. Andrew Cooke. Mr. Samuel O. Dunn, editor of the *Railway Age Gazette*, will discuss "Public Utility Valuation from the Railroad Point of View." "Rate Determination of Public Utilities from the Standpoint of the Student of Public Relations" is the subject of a paper to be presented by Mr. Harold Almert, formerly associated with H. M. Byllesby & Company, of Chicago.

* * *

Meeting of Chicago Jovians.—A very successful rejuvenation and joviation of the Jovian Order was held in the Hotel Sherman, Chicago, on the night of March 5. The rejuvenation was attended by about 230 men, including fifty-eight candidates, who were initiated into the order. At the preliminary dinner Mr. T. C. Ringgold presided as toastmaster. Mr. F. W. Harvey, Jr., alternate statesman for Illinois, presented an ingenious plan by which contributions poured in for the local work of the Jovians until $297 had been received. The finances of the Chicago Jovian League are now in a satisfactory condition. Mr. Ell C. Bennett, of St. Louis, the Mercury of the order and in charge of the central office, was present and made a short speech, emphasizing particularly the work of the commercial division. Mr. Sam A. Hobson, Past-Jupiter Three, made a speech in which he said that in his judgment Chicago ought to elect the next Jupiter, and a movement to that end should be started at once. At the conclusion of Mr. Hobson's speech Mr. A. A. Gray, statesman-at-large, arose and, on behalf of the Jovians of Chicago, suggested as the next Jupiter of the Jovian Order Mr. Homer E. Niesz. After the dinner the initiation was conducted in an impressive manner, and this was followed by an excellent wrestling bout staged by professionals for the entertainment of the Jovians.

Transmission Plant Without a Switchboard

Comparison of the constant-current Thury system with the alternating-current three-phase system for transmission purposes. By Dr. Louis Bell

THE writer had long wished to see in operation a transmission plant on the direct-current constant-current system and to judge something of its actual conditions of working in everyday use. Not long ago the opportunity came.

In the United States electrical engineers instinctively call to mind when constant-current working is mentioned the old arc-light plants, with generators in small units only too apt to produce pin-wheel effects at the commutator, and operating now and then a few small and scattered motors in defiance of all decent regard for standard practice, not to say human safety. A system with a considerable motor load lingered on in San Francisco, if memory serves aright, long after its appointed time, and used to be sought out as a sort of electrical curio.

Any one who goes to Switzerland with preconceived notions of such sort is likely to get a sudden shock when he is brought to the realization that as developed by the masterly skill of M. Thury the constant - current system is not a system of distribution but of transmission, is wonderfully simple instead of exasperatingly complex, and looks forward to long underground cables instead of backward to the rickety lines of tattered underwriters' wire that rise before the mind's eye at the mention of constant current.

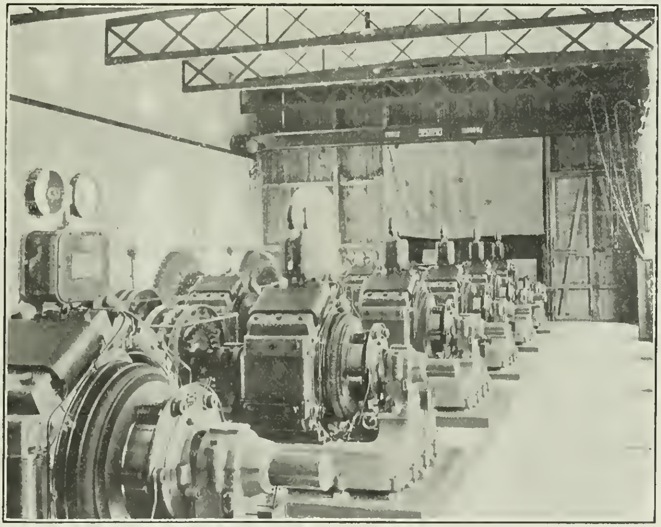


FIG. 1—INTERIOR OF ST. MAURICE-LAUSANNE POWER STATION, SHOWING SIX GENERATING SETS

In fact, after looking into the matter rather carefully if the writer were asked to name the most fundamental characteristic feature of the Thury sytem he would say that it is simplicity in practical operation. It is perfectly true that the generating units must be in series if high voltage is to be employed—likewise the receiving motors; but this seems to be the end of the matter, and the stations as a whole are vastly simpler than the ordinary three-phase station, and in the writer's judgment a good deal less likely to go wrong. By this is not meant that such condition is necessary, but merely that it exists in stations as they are. In fact, the auxiliary and switchboard equipment of the ordinary transmission station is in large measure needless, is outrageously expensive and is a prolific source of operative troubles. But it is a fact that quite regularly confronts one with the result that it is rather a serious task to learn the connections and devices in a new station so as to work it with facility—relative facility—for there is always a capital chance for mistakes in an emergency.

On the other hand, any intelligent station man ought to be able to get the knack of handling a constant-current station inside of the twenty-four hours needed to see it under its normal cycle of load conditions and thereafter to operate it with comfortable facility. In fact, the absence of all the switchboard and transformer complications not only simplifies running but quite recoups one for the necessarily greater expense of the generators and motors. To explain what is meant one of the older and less simple plants on the constant-current system, which the writer had the pleasure of visiting in company with M. Thury himself, is described in the following account.

The purpose was to visit one of the recent plants of the great Moutier-Lyons transmissions, but owing to complicated railway connections it proved so inaccessible that at the suggestion of M. Thury the day was spent looking over the St. Maurice-Lausanne plant, which for a decade has been doing excellent and remarkably reliable work in bringing the power of the upper Rhône to the service of the municipality of Lausanne. It is a plant not now remarkable for size or voltage—about 4000 kw at full load and voltage about 25,000. The distance of transmission is 56 km (about 35 miles), so that the plant is typical of the ordinary run of medium-sized systems commonly found in this country working at from 20,000 volts to 25,000 volts, three-phase.

St. Maurice lies southeast of the Lake of Geneva in the narrow reach of the Rhône valley that leads up toward the Simplon, and is reached by train along the bank of the lake from Geneva in a couple of hours. The power station is a mile or so down the valley from the village—a valley contracted to a scant mile in width with towering cliffs, bristling with rather well-concealed fortifications, on each side.

The headworks are about 500 m from the station and present no remarkable features. Two big penstocks, about 3 m in diameter, lead the water down to the power station—a long concrete structure half hidden in a hollow with a commodious house at one end and merely sheathed in at the other to permit of a future extension to double its capacity. As shown, it is laid out quite after the usual American plan, with generating sets arranged crosswise and wheel discharge under the building. The six draft tubes of the present installation are shown passing at an angle into the tailrace. The wheels themselves are ordinary turbines built by Escher, Wyss & Company, and the head at which they work is moderate, in the neighborhood of 30 m. The penstocks are protected by standpipes.

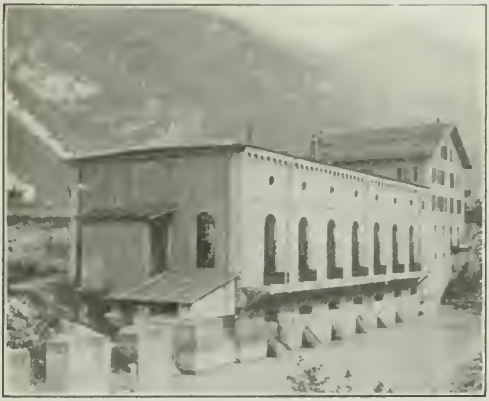


FIG. 2—ST. MAURICE-LAUSANNE POWER STATION

The interior of the power house contains six generating sets each composed of a turbine directly connected to a pair of Thury generators. Each of these machines gives a constant current of 150 amp at a maximum pressure of 2200 volts. Each thus gives 330 kw and each generating unit 660 kw. Each pair is connected by a big insulating flexible coupling, and a similar coupling unites the pair to the wheel. The nature of this coupling is well shown between the second pair of machines in the foreground of Fig. 1. It consists of two large opposed plates carrying alternately disposed pins incased in heavy rubber cylinders.

All six sets are governed for constant current by a single governor set to control the wheel speeds and working by pressure cylinders somewhat after the manner of the familiar Lombard governor. In addition, each generator set has its own little servo-motor to work the gates in stopping and starting. Each pair of generators has mounted upon it an ammeter and voltmeter and is equipped with an automatic short-circuiting switch, shown as a little box below the end bearing, to prevent the machines getting away from control as motors in case of accident. A pillar near the waterwheel end of each pair carries a very simple short-circuiting switch for putting the unit into action.

Control of Main Units

And this is all. The main switchboard of the station, if one may by courtesy call it so, is shown in Fig. 5. It is a glass-doored cabinet fastened to the wall and containing an ammeter, a voltmeter graduated to thousands of volts, and as regards the main plant nothing else. The rest of the meager contents merely supply and control the little motor that works the governor and connect the governor itself. There are in the front corner of the power house next the tailrace two little 80-kw, three-phase machines for a local circuit into St. Maurice, and this pair has more of incidental equipment and switchboard than all the rest of the plant together.

Literally the main transmission plant has no switchboard at all and is handled with a facility that is little short of amusing. If, for instance, the load is coming on and one wants to throw in another unit, he steps to a waterwheel (see Fig. 3) and gives a twist to the little hand-wheel of its servo-motor, which device is mostly hidden behind the switch post in the figure. As the short-circuited machine starts up he reaches out and opens the switch at the post as the ammeter on the machine comes approximately to 150, and the governor does the rest.

In throwing off a set the servo-motor valve is closed and the short-circuiting switch thrown in when the voltmeter indicates a couple of hundred volts, and that is all there is to it. The writer saw the performance several times, both to illustrate the method and also the working in ordinary service, and he can readily believe the operator's statement that full load could actually be shifted from one set to another in ten seconds. Ordinarily three or four of the sets are in use, the others being thrown in as the peak load comes on. The voltmeter in Fig. 5 shows about 12,000, and that was on a Sunday afternoon. At the peak all machines go in and this pressure is doubled. Were this same plant being built to-day it would be much simpler than here shown. There would be only three sets instead of six, and each of these would be merely a double armature machine with three bearings, coupled directly to the waterwheel with a single insulating clutch.

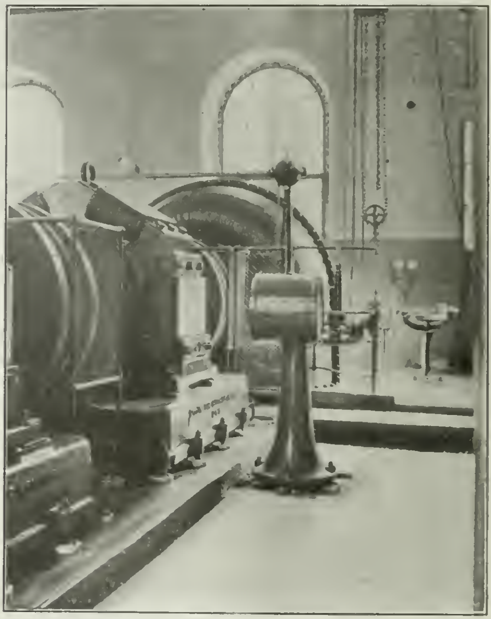


FIG. 3—METHOD OF SUPPORTING MACHINES ON PORCELAIN BLOCKS

Of course, in any such plant the machines must be carefully insulated from earth, and Fig. 3 shows very well the method by which it is done by porcelain blocks on which the generator rests. In later plants the machine foundations themselves are insulated instead, and the floor is also pretty effectively insulated, so that, as is the case with the plant inspected, one can work about the generators quite in safety.

Terminal Station

The receiving plant for a system of this kind is similar to the generating plant, but with the constant-current motor directly coupled to three-phase generators wound for the distributing voltage of the final system. In this case a constant-speed governor is used which regulates the motors by brush shifting. It is found in practice that such regulation can be made very sensitive and exact so that the motors on the distributing lines are held at speed if anything rather better than in the case of transmission directly from three-phase generators taking operation year in and year out. For with a constant current the speed of the driven machinery does not depend on that of the prime mover, and fluctuations in head are no longer a cause of worry except in so far as they may operate to limit the ultimate output.

Of course, there is greater loss in these motor-generators than there would be in transformers, but one must really compare with two transformations instead of one, and when supplying railway load, for example, the difference becomes very small.

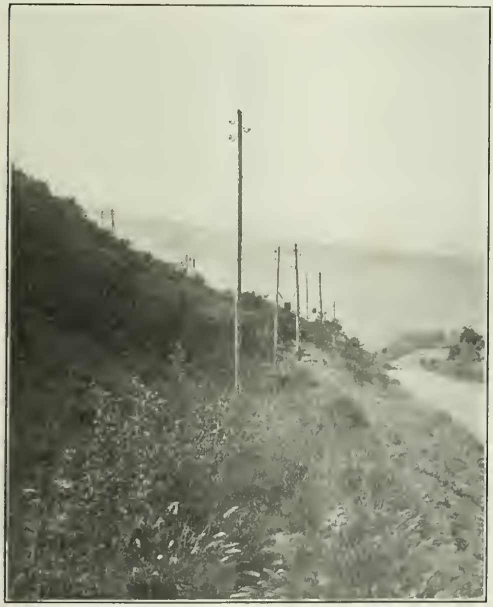


FIG. 4—TRANSMISSION LINE FROM ST. MAURICE TO LAUSANNE

Transmission Line

The transmission-line problem is an interesting one. One must face squarely the realization that the line loss, whatever it may be, is a constant quantity quite irrespective of load. On the other hand, the top voltage which determines the factor of safety in the insulation only hits the constant-current system at the peak and there is no out-of-phase component for which one has to make allowance in the line. Taking the power-factor into consideration, together with the losses it indirectly occasions, the average line losses in the two cases are nearer together than first thought would indicate.

The line from St. Maurice to Lausanne, shown in Fig. 4, is a very simple one on the ordinary Swiss wooden-pole construction with rather small porcelain insulators. In the illustration the little three-phase circuit supplying St. Maurice is seen on the left and the main circuit appears crossing the river and running up toward St. Maurice on its own poles. It will be noticed that there is only a single two-wire circuit. For all practical purposes, however, it is a duplicate circuit, for either of the wires can be used earthed to transmit full load without loss of efficiency. In fact, this plant has actually been so operated for long periods, and the use of a return metallic circuit is quite needless save as giving duplication and as a concession to popular prejudice. Earthing 150-amp constant current is quite a different proposition from earthing an alternating-current constant-potential circuit.

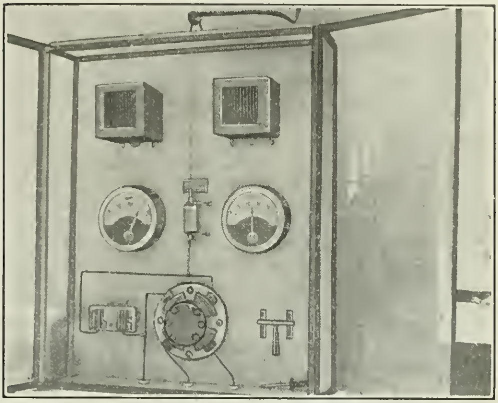


FIG. 5—INSTRUMENT BOARD

This possibility gives assurance of reliable service and such it has proved to afford. Protection against lightning is exceptionally easy since heavy inductance can be put in the line without any unpleasant results. Likewise, the whole brood of troubles connected with resonance drop out of sight, so that as regards the line the operator can rest comfortably. All in all, despite the number of units and the twelve high-voltage commutators the system seems extraordinarily easy to operate. The commutators also show no trace of sparking and have that nice glossy look that bespeaks smooth operation.

In all this the writer is not presenting a brief for the constant-current system, but must confess that it impresses one very strongly as being for appropriate cases most useful, and beautifully simple from the hard practical standpoint of the man who has to run it. A station without a switchboard certainly appeals to anyone familiar with the dozens of switches piled up in the ordinary alternating-current plant and each one looking for trouble. Decidedly, anyone who thinks that standard three-phase generators, transformers and switchboard panels make up the whole thing in modern electrical transmission would do well to take off his blinders and look about a bit. A visit to Switzerland would, one may safely predict, not fail of its effect on the most obstinate of skeptics.

Central-Station Statistics of the United States

Preliminary figures of the Census Bureau on the electric-lighting stations of the country for 1912, with comparisons for 1907 and 1902—Statistics for individual states and geographical sections

ADVANCE figures of the forthcoming quinquennial report on the central stations of the continental United States (exclusive of Alaska, Hawaii, the Philippine Islands and Porto Rico) have just been given out by the Bureau of the Census.

The statistics relate to the years ended Dec. 31 for 1912 and 1907 and June 30 for 1902, and cover both commercial and municipal electric plants. They do not include electric plants operated by factories, hotels, etc., which consume the energy generated, those operated by the federal government and state institutions, or plants that were idle or in course of construction at the time the census was taken.

The figures as given for the continental United States show general gains for the decade 1902-1912. The number of commercial stations or plants increased from 2805 in 1902 to 3659 in 1912, or 30 per cent. The number of municipal plants increased from 815 in 1902 to 1562 in 1912, or 92 per cent. The total income for 1912 amounted to $302,115,599, as compared with $85,700,605 in 1902, or an increase of 252 per cent. The total expenses, including salaries and wages, in 1912, amounted to $234,419,478, as compared with $68,081,375 in 1902, or an increase of 244 per cent. The total number of persons employed in 1912 was 79,335, as compared with 30,326 in 1902, or an increase of 162 per cent. The total horse-power of the steam engines and steam turbines was 4,946,532 in 1912, as compared with 1,394,395 in 1902, or an increase of 255 per cent. The horse-power of the waterwheels was 2,471,081 in 1912 as compared with 438,472 in 1902, or an increase of 464 per cent. The output of stations amounted to 11,502,963,006 kw-hr. in 1912, as compared with 2,507,051,115 in 1902, or an increase of 359 per cent. The estimated number of arc lamps wired for service in 1912 was 505,395, as compared with 385,698 in 1902, or an increase of 31 per cent. Incandescent and other varieties of lamps wired for service, however, numbered 76,507,142 in 1912, as compared with 18,194,044 in 1902, or an increase of 320 per cent. The horse-power rating of the stationary motors served with electricity amounted to 4,130,619 in 1912, as compared with 438,005 in 1902, or an increase of 843 per cent. The figures are shown in detail in Table I.

It should be pointed out that the government is careful to specify that the term "station" as used by the Census Bureau may represent a single electric station or a number of stations operated under the same ownership, hence the difference in the number of stations reported by the government and those contained in the McGraw Electrical Directory, which showed 5823 in October, 1912.

The reports for electric railways made by the Census Bureau contain statistics for 169 companies which report central-station work. These are counted as a part of the electric-railway systems and are not included in the total number of 5221 establishments shown in the central-station report. Reports of important isolated stations have also been excluded unless a considerable quantity of electrical energy is sold for commercial purposes.

Reports by Geographical Sections

For convenience the country has been divided into six sections and the statistics for these six sections compiled separately from the reports as sent out by the Census Bureau. These geographical sections are not those followed by the Census Bureau, and it will be noted that there is some disparity between the figures given by the Census Bureau in Table I and those carefully compiled from the census reports by individual states in the office of the *Electrical World*. The differences, which are considerable in some cases, are doubtless due to typographical errors in the preliminary reports as sent out by the Census Bureau.

TABLE I—CENTRAL-STATION STATISTICS OF THE CONTINENTAL UNITED STATES

	1912	1907	1902	Per Cent of Increase: 1902-1912
Number of stations*	5,221	4,714	3,620	44.2
Commercial	3,659	3,462	2,805	30.4
Municipal	1,562	1,252	815	91.7
Total income†	$302,115,599	$175,642,338	$85,700,605	252.5
Light, heat, and power, including free service	$286,980,858	$169,614,691	$84,186,605	240.9
All other sources	$15,134,741	$6,027,647	$1,514,000	899.7
Total expenses, including salaries and wages‡	$234,419,478	$134,196,911	$68,081,375	244.3
Total number persons employed	79,335	47,632	30,326	161.6
Total horse-power	7,528,648	4,098,188	1,845,018	308.0
Steam engines and steam turbines:¶				
Number	7,844	8,054	6,295	24.6
Horse-power	4,946,532	2,693,273	1,394,395	254.6
Waterwheels:				
Number	2,933	2,481	1,390	111.0
Horse-power	2,471,081	1,349,087	438,472	463.6
Gas and oil engines:				
Number	1,116	463	165	576.4
Horse-power	111,035	55,828	12,181	811.5
Kw rating of generators	5,134,689	2,709,225	1,212,235	323.6
Output of stations, kw-hr.	11,502,963,006	5,862,276,737	2,507,051,115	358.8
Estimated number of lamps wired for service:				
Arc	505,395	§562,795	385,698	31.0
Incandescent and other varieties	76,507,142	§41,876,332	18,194,044	320.5
Stationary motors served:				
Number	435,473	167,181	101,064	330.9
Horse-power	4,130,619	1,649,026	438,005	843.1

*The term "station" as here used may represent a single electric station or a number of stations operated under the same ownership.

†Exclusive of $36,500,030 in 1912, $20,093,302 in 1907, and $7,703,574 in 1902, reported by street and electric railway companies as income from sale of electric energy for light or motor service or from sale of energy to other public service corporations.

‡In addition to salaries and wages, includes the cost of supplies and materials used for ordinary repairs and replacement, advertising, fuel, mechanical power, electrical energy purchased, taxes, charges for depreciation, and all other expenses incident to operation and maintenance.

¶Includes auxiliary engines.

§Includes, for purposes of comparison, 7082 arc and 267,997 incandescent lamps reported by the electric companies to light their own properties. Lamps used for such service were included in the total number reported in 1912.

The six divisions used comprise the New England States; the North Central States, including those north of the Mason and Dixon line and east of the Mississippi River; the Southeastern States, including those south of the Mason and Dixon line and east of the Mississippi River; the Middle Western States, which include the double row of states west of the Mississippi River stretching from Texas and Louisiana to the Canadian border; the Rocky Mountain States, which include those states between the Middle Western group and the three states on the Pacific Coast, and the Pacific Coast States.

New England States

The census figures for the New England States as a group and also by individual states were published in the *Electrical World* of Jan. 10, page 74, together with comments on the showing made.

North Central States

This division includes New York, New Jersey, Pennsylvania, Delaware, District of Columbia, Maryland, West Virginia, Ohio, Indiana, Michigan, Illinois and Wisconsin. In the reports by individual states Wisconsin is separated from its proper group because of the exigencies of typographical make-up. The great manufacturing centers are located in this group of states.

Over one-half of the total income from electricity in the United States and over one-third of the total output is reported from the North Central States. Over one-half of the horse-power of motors of the country also belongs to that section, the greater part of the arc lamps and almost 60 per cent of the incandescent lamps of the country. New York is the largest state in the country throughout, being first in population, in number of stations and total rating of generating equipment, in horse-power of steam engines and of waterwheels, in total output and in aggregate income. Its output is almost four times that of Pennsylvania and almost twice that of Illinois.

TABLE II—CENTRAL-STATION STATISTICS OF THE CONTINENTAL UNITED STATES FOR 1912

State	Population in 1910	Number of Stations	Total Rating in Kw	Steam, Hp	Water, Hp	Total Output in Kw-hr.	Aggregate Income
Alabama	2,138,093	69	24,477	24,593	9,880	48,602,553	$1,210,156
Arizona	204,354	16	14,756	12,775	9,300	32,960,084	1,172,232
Arkansas	1,574,449	74	16,335	22,820	3,040	17,786,660	967,529
California	2,377,549	112	588,281	416,186	432,062	1,747,459,041	27,685,573
Colorado	799,024	73	71,668	56,999	77,005	165,196,068	4,771,074
Connecticut	1,114,756	44	77,655	90,257	19,434	130,672,201	5,345,640
*Delaware	202,322	*	*	*	*	*	*
*District of Columbia	331,069	*	*	*	*	*	*
Florida	752,619	50	23,619	28,136	5,700	25,895,751	1,323,899
Georgia	2,609,121	126	56,232	35,994	51,957	87,571,815	1,763,977
Idaho	325,594	38	35,656	4,525	51,850	115,812,292	1,587,407
Illinois	5,638,591	269	449,917	608,269	37,362	1,150,900,306	29,016,652
Indiana	2,700,876	201	135,801	161,588	23,915	236,944,000	7,711,223
Iowa	2,224,771	223	53,237	70,102	7,029	67,166,647	4,344,786
Kansas	1,690,949	176	69,205	89,508	8,820	133,252,988	2,922,935
Kentucky	2,289,905	89	54,062	81,767	....	75,593,179	2,754,115
Louisiana	1,656,388	50	19,169	27,165	....	18,328,080	2,246,129
Maine	742,371	79	58,757	19,745	69,938	117,092,565	2,044,280
*Maryland	1,294,450	*56	*87,137	*109,029	*4,049	*37,994,885	*5,189,469
Massachusetts	3,366,416	117	252,732	326,300	24,480	386,254,294	16,111,496
Michigan	2,810,173	235	247,789	252,103	125,079	525,615,508	11,518,256
Minnesota	2,075,708	195	93,502	67,939	80,172	186,045,055	6,937,841
Mississippi	1,797,114	82	21,863	30,497	....	27,924,183	1,122,890
Missouri	3,293,335	190	122,786	180,193	1,902	232,828,763	9,746,600
Montana	376,053	29	74,398	12,825	102,885	379,212,617	3,883,410
Nebraska	1,192,214	174	34,586	46,284	5,884	56,299,682	2,802,614
Nevada	81,875	8	10,513	2,880	12,540	44,969,772	618,942
New Hampshire	430,572	59	57,768	27,291	56,937	126,593,970	2,326,998
New Jersey	2,537,167	64	179,477	237,945	1,569	383,891,504	10,901,484
New Mexico	327,396	21	7,981	10,198	817	9,027,824	495,658
New York	9,113,614	321	772,030	645,403	512,406	2,175,048,634	57,218,973
North Carolina	2,206,287	94	43,099	15,032	49,951	70,552,737	1,342,302
North Dakota	577,056	42	10,824	16,169	....	12,298,553	860,536
Ohio	4,767,121	304	244,182	328,412	8,860	399,101,309	11,905,111
Oklahoma	1,657,155	130	28,301	51,787	2,135	48,824,097	2,239,709
Oregon	672,765	66	32,416	16,213	29,802	58,789,342	1,406,144
Pennsylvania	7,665,111	284	427,304	481,991	132,293	589,665,167	24,387,863
Rhode Ilsand	542,674	8	38,509	48,059	2,440	62,106,528	2,305,176
South Carolina	1,515,400	61	132,408	39,941	178,555	356,771,757	4,449,583
South Dakota	583,888	77	20,032	20,835	6,913	24,703,754	1,134,217
Tennessee	2,184,789	90	49,640	41,244	27,750	75,544,893	2,448,218
Texas	3,896,542	253	84,564	123,113	3,503	200,457,319	6,783,972
Utah	373,351	45	37,935	1,000	59,588	86,634,658	1,516,410
Vermont	355,956	61	29,468	15,091	35,272	56,552,977	1,173,851
Virginia	2,061,612	67	40,512	15,305	44,280	28,724,684	760,688
Washington	1,141,990	70	57,283	18,293	77,591	71,414,473	3,087,721
West Virginia	1,221,119	58	29,772	37,149	6,036	42,344,796	1,110,462
Wisconsin	2,333,860	251	98,839	76,645	68,766	215,402,974	6,274,589
Wyoming	145,965	20	8,212	10,262	1,334	11,580,567	605,462
Total	91,971,529	5,221	5,124,689	5,055,857	2,471,081	11,154,411,507	$299,534,252

*Delaware, District of Columbia and Maryland have been combined under Maryland, no separate figures being available.

Southeastern States

This group includes Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama,, Mississippi, Tennessee and Kentucky.

The growth in the number of waterwheels and in horse-power of motors connected in that section during the last decade has been phenomenal. South Carolina especially showed great increases in water-power development and in output. The use of electricity in South Carolina is greater than in any other of the Southeastern States. It is the tenth state of the Union so far as output of kilowatt-hours is concerned, and from the aggregate income it is evident that the energy is sold very cheaply. As a section, the Southeastern is the smallest of the six divisions, the total output of the six states being only 797,000,000 kw-hr., almost half of which was generated in South Carolina.

Middle Western States

This group of states takes in the great agricultural section of the United States stretching from the Gulf of Mexico to Canada.

The eleven states in this section showed an output during 1912 more than 10 per cent greater than the output of the six New England States. The increases during the last five years compared very favorably with the increases in other sections of the country. There is less water-power in the Middle West section than in any other section of the country, yet the percentage increase in output during the last five years and during the last decade was greater than that for similar periods in the North Central States. The output for Illinois, however, was greater than the output of the whole Middle West. The income per unit generated, on the other hand, was larger in the Middle West division than that of any other section of the country. Missouri, as was to be expected, made the best showing, with Texas second.

Rocky Mountain States

The figures of the central electric light and power stations of the Rocky Mountain States include those of Idaho, Montana, Wyoming, Nevada, Utah, Colorado, Arizona and New Mexico. The kilowatt output in the district shows phenomenal increases, notably in Idaho and Montana. As in other sections of the country, there is a sharp decline shown in the use of arc lamps within the five-year period. Utah shows a decrease of 77 per cent in the number of arcs wired for service during the decade and an increase of 63.2 per cent in all other varieties. Colorado shows an increase in the number of incandescent and other lamps of 249.4 per cent during the decade. The development of water-power in the section is reflected in the increase of 440 per cent during the decade, whereas steam and gas engines increased only 163 per cent during the same decade. The growth in the use of electric motors, which showed an increase of 1025 per cent during the decade, is remarkable.

TABLE III—CENTRAL-STATION STATISTICS OF THE MANUFACTURING OR NORTH CENTRAL STATES

	1912	1907	1902	Per Cent Increase	
				1907-12	1902-12
Number of establishments	2,043	2,098	1,794	2.6	13.9
Commercial	1,448	1,527	1,368	—5.1	5.8
Municipal	595	571	426	4.2	39.6
Income	$165,234,082	$96,797,890	$48,992,104	71.3	237.0
Light, heat and power	$155,774,016	$93,509,483	$48,289,437	66.6	221.0
All other sources	$9,460,066	$3,288,407	$702,667	188.0	1205.0
Total expenses, including salaries and wages	$130,188,800	$73,301,160	$40,072,381	78.2	225.0
Total number persons employed	44,871	25,587	17,268	74.5	159.5
Total horse-power	3,858,869	2,063,847	993,813	87.3	288.3
Steam and gas engines (including turbines):					
Number	4,059	3,883	3,325	4.3	22.4
Horse-power	2,938,534	1,553,163	812,427	89.0	262.0
Waterwheels:					
Number	1,242	1,105	582	12.4	113.6
Horse-power	920,335	480,726	173,361	91.7	432.0
Kw rating of generators	2,672,248	1,402,582	658,953	90.5	308.0
Output of stations, kw-hr	4,756,909,083	3,188,521,028	1,548,057,312	49.2	207.0
Lamps wired for service:					
Arc	330,236	356,463	243,847	—7.3	36.7
All other varieties	42,736,177	23,494,752	10,889,180	82.4	292.0
Stationary motors served:					
Number	253,817	90,316	54,760	180.5	363.5
Horse-power	2,112,554	888,866	235,597	137.0	800.0

Pacific Coast States

The three states on the Pacific seaboard show remarkable increases, although the census figures for Washington call for some explanation.

The decreases shown in 1912 as compared with 1907 are due to the fact that the report for electric railways in 1912 includes a number of the important companies that in 1907 were reported as central electric stations. By combining the totals for several of the items of physical equipment for the central electric stations and the electric railways, a more correct idea may be had of the electrical industry in Washington, which increased since 1907 as follows: Primary power, from 109,661 hp in 1907 to 341,701 hp in 1912; the kilowatt rating of the dynamos, from 94,987 in 1907 to 209,913 in 1912, and the output of stations, from 283,302,190 kw-hr. in 1907 to 510,822,535 kw-hr. in 1912.

California is the second state in the Union in kilowatt rating of stations, in water-power and in kilowatt-hour output. She is the third state in the Union in aggregate income and the twelfth state in the Union as regards population.

TABLE IV—CENTRAL-STATION STATISTICS OF MIDDLE WEST OR AGRICULTURAL STATES

	1912	1907	1902	Per Cent Increase	
				1907-12	1902-12
Number of establishments	1,584	1,195	818	33	94
Commercial	1,063	864	601	23	76
Municipal	521	331	214	57	144
Income	$40,986,868	$23,315,027	$11,207,726	76	266
Light, heat and power	$39,229,192	$22,461,370	$10,984,721	75	257
All other sources	$1,757,676	$853,657	$223,005	106	688
Total expenses, including salaries and wages	$32,105,834	$19,423,441	$8,569,274	65	274
Total number persons employed	13,703	7,481	4,417	83	211
Total horse-power	835,313	513,417	215,717	63	287
Steam and gas engines (including turbines):					
Number	2,675	1,818	1,189	47	125
Horse-power	715,915	411,537	198,405	74	261
Waterwheels:					
Number	259	453	102	—43	154
Horse-power	109,502	94,473	14,569	16	652
Kw rating of generators	552,541	334,162	142,877	65	287
Output of stations, kw-hr	997,991,598	524,936,290	250,118,674	90	300
Lamps wired for service:					
Arc	60,505	72,597	47,014	—17	29
All other varieties	11,614,358	6,173,143	2,343,394	88	395
Stationary motors served:					
Number	62,877	26,247	20,400	139	208
Horse-power	419,878	180,534	44,355	132	846

The census figures reveal the fact that electricity is cheaper on the Pacific Coast than anywhere else in the country. The three states on the Coast turned out more electricity than the twenty states in the Middle West and Southeastern sections combined. There was an increase in the horse-power of motors for the decade of over 1000 per cent.

TABLE V—CENTRAL-STATION STATISTICS OF SOUTHEASTERN STATES

	1912	1907	1902	Per Cent Increase	
				1907-12	1902-12
Number of establishments	728	576	348	21	120
Commercial	415	328	236	26	70
Municipal	313	218	112	26	180
Income	$17,175,828	$8,260,275	$4,044,875	110	320
Light, heat and power	$16,613,376	$8,035,526	$3,955,950	110	320
All other sources	$562,452	$226,848	$88,925	105	535
Total expenses, including salaries and wages	$13,029,782	$6,217,520	$2,974,686	110	335
Total number persons employed	5,055	2,968	1,827	70	175
Total horse-power	680,582	301,131	107,656	125	530
Steam and gas engines (including turbines):					
Number	1,024	776	499	32	105
Horse-power	312,509	158,590	86,648	97	261
Waterwheels.					
Number	298	194	50	54	496
Horse-power	368,073	139,525	20,326	164	1710
Kw rating of generators	445,912	194,686	73,004	129	510
Output of stations, kw-hr	797,181,552	281,785,628	125,385,552	183	536
Lamps wired for service:					
Arc	29,139	28,364	17,708	3	65
All other varieties	4,002,486	1,873,954	713,614	114	447
Stationary motors served:					
Number	18,758	5,124	4,886	266	284
Horse-power	323,640	79,741	17,841	306	1710

Remarkable as the showing made by the Pacific Coast States is, it must be remembered that coal is very expensive there and cheap oil is available only in certain sections. As is well known, abundant water-power prevails near the Pacific seaboard, and the greatest electric transmission systems of the world are situated there.

TABLE VI—CENTRAL-STATION STATISTICS OF ROCKY MOUNTAIN STATES

	1912	1907	1902	PER CENT INCREASE	
				1907-1912	1902-1912
Number of establishments	250	219	152	14.0	64.0
Commercial	211	199	147	6.0	44.0
Municipal	39	20	5	95.0	680.0
Income	$14,650,595	$8,816,227	$4,217,173	66.0	248.0
Light, heat and power	$13,763,088	$8,504,933	$4,127,455	62.0	233.0
All other sources	$887,507	$311,294	$89,718	185.0	889.0
Total expenses, including salaries and wages	$11,400,235	$6,361,801	$3,441,299	79.0	231.0
Total number persons employed	3,841	2,028	1,320	90.0	191.0
Total horse-power	426,783	225,287	105,338	90.0	305.0
Steam and gas engines (including turbines):					
Number	288	272	228	6.0	26.0
Horse-power	115,989	86,558	44,159	34.0	163.0
Waterwheels:					
Number	294	216	141	36.0	109.0
Horse-power	315,319	137,018	60,679	130.0	420.0
Kw rating of generators	261,119	151,032	65,952	73.0	296.0
Output of stations, kw-hr	845,393,882	381,032,187	145,780,112	122.0	480.0
Lamps wired for service:					
Arc	9,926	11,850	9,348	—16.0	6.0
All other varieties	2,239,337	1,321,876	612,258	69.0	266.0
Stationary motors served:					
Number	11,864	6,091	2,394	95.0	396.0
Horse-power	235,506	94,960	20,953	148.0	1025.

TABLE VII—CENTRAL-STATION STATISTICS OF THE PACIFIC COAST STATES

	1912	1907	1902	PER CENT INCREASE	
				1907-12	1902-12
Number of establishments	248	261	194	—5	28
Commercial	211	230	171	—8	23
Municipal	37	31	23	19	60
Income	$32,179,438	$19,792,316	$6,541,650	63	390
Light, heat and power	$30,801,677	$18,981,997	$6,324,404	62	390
All other sources	$1,377,761	$810,319	$217,246	70	490
Total expenses, including salaries and wages	$26,279,396	$16,253,125	$5,070,102	62	420
Total number persons employed	7,348	4,480	1,821	64	320
Total horse-power	990,147	578,712	175,480	171	460
Steam and gas engines (including turbines):					
Number	301	286	231	5	23
Horse-power	450,692	184,907	56,979	144	657
Waterwheels:					
Number	329	292	220	13	50
Horse-power	539,455	366 614	107,366	47	402
Kw rating of generators	677,980	337,375	108,660	101	524
Output of stations, kw-hr	1,877,662,856	1,012,199,537	189,981,964	86	889
Lamps wired for service:					
Arc	30,904	30,389	20,764	2	49
All other varieties	7,956,640	4,065,923	1,216,363	96	557
Stationary motors served:					
Number	32,865	15,565	5,888	111	459
Horse-power	647,733	250,205	57,096	159	1035

TABLE VIII—CENSUS RETURNS OF NORTH CENTRAL OR MANUFACTURING STATES BY INDIVIDUAL STATES

	NEW YORK			NEW JERSEY			DELAWARE, DISTRICT OF COLUMBIA AND MARYLAND		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of establishments	321	314	256	64	04	64	56	50	42
Commercial	272	267	228	56	57	60	43	36	31
Municipal	49	47	28	8	7	4	13	14	11
Income	$57,218,973	$34,859,170	$16,854,839	$10,901,481	$5,952,378	$3,421,304	$5,189,469	$3,347,728	$1,712,048
Light, heat and power	$53,189,000	$34,067,383	$16,742,239	$10,544,630	$5,910,745	$3,356,599	$5,105,399	$3,298,747	$1,693,396
All other sources	$4,029,973	$791,787	$112,600	$356,854	$41,633	$64,705	$84,070	$48,981	$18,652
Total expenses, including salaries and wages	$44,297,869	$25,961,930	$14,706,366	$9,348,864	$4,599,586	$3,413,914	$4,056,055	$3,819,147	$1,446,850
Total number of persons employed	13,733	7,716	5,421	2,989	1,759	1,074	1,249	1,024	549
Total horse-power	1,157,809	722,653	323,413	239,514	93,602	68,761	113,078	85,346	29,863
Steam and gas engines (including turbines):									
Number	619	541	501	272	205	177	117	130	120
Horse-power	645,403	413,322	192,291	237,945	90,273	66,916	109,029	82,346	29,588
Waterwheels:									
Number	405	362	241	18	22	14	33	18	6
Horse-power	512,406	305,950	128,785	1,569	1,794	1,005	4,049	1,632	275
Kilowatt rating of dynamos	772,030	482,031	187,252	179,477	70,566	46,120	87,137	62,956	21,639
Output of stations, kilowatt-hours	2,175 048,634	1,452,222,471	701,769,716	383,891,504	140,527,522	78,739,456	37,994,885	78,412,197	39,999,997
Estimated number of lamps wired for service:									
Arc	94,324	97,529	59,130	22,585	21,973	15,685	8,144	13,765	8,905
All other varieties	12,884,911	7,017,061	3,705,525	2,961,343	1,675,024	646,762	1,727,106	1,055,779	282,758
Stationary motors served:									
Number	82,525	18,051	13,581	12,772	5,994	2,213	13,718	6,523	1,429
Horse-power	795,256	393,955	109,277	85,011	27,604	9,246	76,527	32,856	5,919

TABLE VIII—(CONTINUED)

	PENNSYLVANIA			WEST VIRGINIA			OHIO		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of establishments	284	327	279	58	48	41	304	272	233
Commercial	239	282	243	52	43	35	186	167	145
Municipal	45	45	36	6	5	6	118	105	88
Income	$24,387,863	$16,015,392	$9,486,867	$1,110,462	$724,253	$322,015	$11,905,111	$7,643,997	$4,431,038
Light, heat and power	$23,482,208	$15,400,800	$9,311,416	$1,090,968	$689,919	$320,443	$11,514,628	$7,474,980	$4,347,506
All other sources	$905,655	$614,592	$175,451	$19,494	$34,334	$1,572	$390,483	$169,017	$83,532
Total expenses, including salaries and wages	$18,174,684	$12,155,341	$7,547,967	$807,843	$534,365	$229,558	$8,722,293	$6,027,780	$3,286,336
Total number of persons employed	7,328	4,502	3,180	439	262	178	3,131	2,157	1,766
Total horse-power	614,284	302,537	175,510	43,185	21,428	10,820	337,272	179,111	103,745
Steam and gas engines (including turbines):									
Number	696	771	689	112	79	66	599	533	450
Horse-power	481,991	265,632	167,083	37,149	17,416	10,720	328,412	175,879	101,279
Waterwheels:									
Number	136	119	50	14	11	1	33	21	14
Horse-power	132,293	30,863	6,988	6,036	3,627	100	8,860	2,037	1,676
Kilowatt rating of dynamos	427,304	212,543	121,388	29,772	14,726	6,985	244,182	126,533	69,811
Output of stations, kilowatt-hours	589,665,167	416,554,167	241,094,328	42,344,796	24,871,317	11,355,905	399,101,309	217,311,924	127,437,383
Estimated number of lamps wired for service:									
Arc	64,673	66,777	47,722	2,468	2,885	1,898	36,318	43,849	31,839
All other varieties	6,257,665	3,897,662	1,783,683	305,312	160,279	78,066	3,454,515	2,267,958	934,213
Stationary motors served:									
Number	29,119	10,063	14,144	1,279	340	136	29,022	13,083	5,704
Horse-power	333,414	122,461	30,560	22,925	4,432	291	145,331	64,941	21,956

TABLE VIII—(CONTINUED)

	INDIANA			MICHIGAN			ILLINOIS		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of establishments	201	200	180	235	231	201	269	383	346
Commercial	130	132	118	127	130	120	170	271	264
Municipal	71	68	62	108	101	81	99	112	82
Income	$7,711,223	$4,438,332	$2,105,146	$11,518,256	$6,072,010	$2,613,812	$20,010,652	$15,465,993	$6,757,015
Light, heat and power	$7,417,484	$4,222,610	$2,038,121	$11,127,031	$5,750,447	$2,516,800	$26,317,474	$14,566,772	$6,692,248
All other sources	$293,739	$215,722	$67,025	$391,225	$321,563	$97,012	$2,669,178	$899,221	$64,767
Total expenses, including salaries and wages	$6,028,909	$3,627,336	$1,573,908	$9,784,138	$4,611,070	$1,948,516	$23,557,887	$10,055,463	$1,961,915
Total number of persons employed	2,169	1,618	941	3,876	1,780	1,255	8,036	3,902	2,339
Total horse-power	185,503	116,828	54,237	377,182	184,207	64,883	645,631	299,246	126,866
Steam and gas engines (including turbines)									
Number	369	364	280	346	308	268	611	700	571
Horse-power	161,588	95,467	53,002	252,103	97,711	47,591	608,269	287,828	116,969
Waterwheels:									
Number	90	83	12	245	249	114	92	80	52
Horse-power	23,915	19,606	1,105	125,079	85,738	16,085	37,362	10,478	9,505
Kilowatt rating of dynamos	135,801	81,576	38,144	247,789	101,714	44,176	449,917	209,226	100,320
Output of stations, kilowatt-hours	236,941,000	130,263,693	75,585,493	525,615,508	208,154,199	80,564,630	1,150,900,306	467,657,328	161,543,646
Estimated number of lamps wired for service									
Arc	17,328	22,165	15,325	20,516	23,514	17,712	53,486	55,309	38,215
All other varieties	2,375,448	1,330,660	656,451	3,602,606	1,717,339	805,127	7,375,539	3,591,309	1,567,665
Stationary motors served									
Number	14,005	5,132	2,631	18,400	7,080	2,271	46,278	21,675	11,838
Horse-power	91,897	33,716	5,653	174,009	53,245	11,337	315,659	137,661	35,928

TABLE IX—CENSUS RETURNS OF MIDDLE WEST OR AGRICULTURAL STATES BY INDIVIDUAL STATES

	WISCONSIN*			MINNESOTA			IOWA		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of establishments	251	206	152	195	171	138	223	192	169
Commercial	173	142	124	91	79	68	159	141	131
Municipal	78	64	28	104	92	70	64	51	38
Income	$6,274,589	$2,278,637	$1,288,020	$6,937,841	$3,478,009	$1,858,789	$4,344,786	$2,479,969	$1,545,663
Light, heat and power	$5,955,194	$2,127,080	$1,270,669	$6,647,199	$3,333,469	$1,838,806	$4,017,588	$2,317,880	$1,477,348
All other sources	$319,395	$151,557	$17,351	$290,642	$144,540	$19,983	$327,198	$162,089	$68,315
Total expenses, including salaries and wages	$5,320,258	$1,969,142	$957,021	$5,580,525	$2,986,277	$1,459,874	$3,328,740	$1,083,613	$1,223,682
Total number of persons employed	1,921	867	565	1,568	1,062	649	1,329	855	732
Total horse-power	145,411	58,889	35,715	148,111	121,825	34,823	77,131	46,739	39,504
Steam and gas engines (including turbines):									
Number	318	252	194	301	250	197	360	279	242
Horse-power	76,645	30,262	26,988	67,939	49,523	28,562	70,102	42,470	36,990
Waterwheels:									
Number	176	140	78	76	71	27	58	44	31
Horse-power	68,766	19,001	7,837	80,172	71,656	6,010	7,029	3,833	2,399
Kilowatt rating of dynamos	98,839	40,711	23,118	93,502	78,516	20,999	53,237	32,056	24,886
Output of stations, kilowatt-hours	215,402,974	52,546,210	29,966,758	186,015,055	87,579,431	40,258,632	67,166,647	37,729,072	36,506,425
Estimated number of lamps wired for service:									
Arc	10,394	8,697	7,416	9,201	13,398	8,543	4,679	7,352	5,929
All other varieties	1,791,732	781,681	428,930	1,858,306	903,023	384,705	1,512,568	809,386	420,847
Stationary motors served:									
Number	6,699	2,306	813	12,203	3,711	1,855	8,773	2,613	1,054
Horse-power	72,525	17,995	5,430	75,973	41,095	9,481	43,820	14,547	4,193

TABLE IX—(CONTINUED)

	NORTH DAKOTA			SOUTH DAKOTA			NEBRASKA		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of establishments	42	29	21	77	37	28	174	98	54
Commercial	33	21	13	64	29	22	112	73	43
Municipal	9	8	8	13	8	6	62	25	11
Income	$860,536	$533,383	$197,689	$1,134,217	$513,682	$207,868	$2,802,614	$1,562,669	$601,777
Light, heat and power	$822,929	$480,042	$197,375	$1,067,617	$492,767	$204,292	$2,589,960	$1,474,426	$597,304
All other sources	$37,607	$53,341	$314	$66,600	$20,915	$3,576	$124,374	$88,243	$4,473
Total expenses, including salaries and wages	$714,294	$413,506	$157,275	$965,763	$433,841	$157,971	$2,230,512	$1,158,060	$131,342
Total number of persons employed	232	150	75	338	169	85	882	401	237
Total horse-power	16,169	10,277	3,930	27,748	12,984	5,057	52,168	30,020	12,308
Steam and gas engines (including turbines):									
Number	82	57	30	136	55	34	247	132	67
Horse-power	16,160	10,025	3,830	20,835	10,580	4,062	46,284	26,091	10,488
Waterwheels:									
Number	......	1	1	15	12	7	44	19	9
Horse-power	...	100	100	6,913	2,205	845	5,884	2,054	1,820
Kilowatt rating of dynamos	10,824	5,819	2,042	20,032	10,046	2,910	31,586	20,041	8,412
Output of stations, kilowatt-hours	12,298,553	8,229,765	5,850,115	24,703,754	13,615,015	4,256,007	56,299,682	31,958,739	12,315,775
Estimated number of lamps wired for service:									
Arc	866	1,163	502	1,134	1,278	798	3,682	4,262	2,608
All other varieties	219,452	110,233	41,016	278,221	129,643	63,248	1,034,661	490,101	151,162
Stationary motors served:									
Number	1,145	327	81	1,394	279	43	3,575	1,719	604
Horse-power	6,128	1,816	703	13,619	3,649	239	26,325	10,776	2,278

*Wisconsin is placed here merely for convenience of make-up. It is included in group of North Central States

TABLE IX—(CONTINUED)

	MISSOURI			KANSAS			ARKANSAS		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of establishments	190	162	123	176	111	61	74	63	42
Commercial	125	104	80	94	79	50	56	50	34
Municipal	65	58	43	82	32	11	18	13	8
Income	$9,746,600	$5,805,828	$2,392,149	$2,922,935	$1,514,867	$650,833	$967,529	$675,718	$425,317
Light, heat and power	$9,299,495	$5,683,795	$2,360,150	$2,811,793	$1,419,091	$611,966	$930,430	$664,916	$413,775
All other sources	$447,105	$122,033	$31,999	$111,142	$95,776	$38,867	$37,099	$10,802	$11,542
Total expenses, including salaries and wages	$7,484,853	$5,341,126	$2,042,422	$2,626,270	$1,201,101	$480,482	$749,029	$491,871	$278,817
Total number of persons employed	2,434	1,800	997	1,109	567	292	360	244	149
Total horse-power	182,095	111,416	45,318	98,328	48,374	13,283	25,860	13,953	8,433
Steam and gas engines (including turbines):									
Number	323	249	189	295	167	83	120	92	63
Horse-power	180,193	103,007	43,309	89,508	38,767	12,224	22,820	13,328	8,206
Waterwheels:									
Number	5	5	2	26	36	11	10	1	2
Horse-power	1,902	2,002	1,000	8,820	8,661	1,034	3,010	300	227
Kilowatt rating of dynamos	122,786	68,467	32,100	69,205	30,307	8,596	16,335	9,678	6,024
Output of stations, kilowatt-hours	232,828,763	147,328,446	57,450,731	133,252,988	59,740,179	13,326,518	17,786,660	11,519,316	9,965,997
Estimated number of lamps wired for service:									
Arc	13,394	17,576	13,144	7,904	5,685	3,498	1,102	1,669	1,654
All other varieties	2,526,515	1,705,396	593,798	898,201	472,751	128,857	243,728	142,525	82,234
Stationary motors served:									
Number	15,429	8,923	4,646	5,021	1,425	1,484	994	198	838
Horse-power	116,971	54,111	14,552	33,277	12,033	1,885	5,283	1,177	722

TABLE IX—(CONTINUED)

	OKLAHOMA			LOUISIANA			TEXAS		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of establishments	130	72	20	50	42	25	253	218	137
Commercial	67	58	18	27	21	15	235	209	130
Municipal	63	14	2	23	21	10	18	9	7
Income	$2,239,709	$1,106,316	$281,452	$2,246,129	$1,852,383	$971,631	$6,783,972	$3,792,203	$2,074,558
Light, heat and power	$2,169,088	$1,097,134	$267,453	$2,218,477	$1,829,128	$967,027	$6,654,616	$3,668,722	$2,049,225
All other sources	$70,621	$9,182	$13,999	$27,652	$23,255	$4,604	$129,356	$123,481	$25,333
Total expenses, including salaries and wages	$1,888,706	$1,025,702	$176,539	$1,604,019	$1,291,908	$682,939	$4,924,093	$3,096,436	$1,477,931
Total number of persons employed	785	414	92	489	541	336	2,021	1,275	773
Total horse-power	53,922	22,623	4,407	27,165	23,292	13,767	126,616	71,914	34,887
Steam and gas engines (including turbines):									
Number	232	112	28	95	74	48	484	351	208
Horse-power	51,787	22,549	4,407	27,165	22,787	13,567	123,113	67,410	32,768
Waterwheels:									
Number	7		....	....	....	....	18	23	12
Horse-power	2,135	...	....	....	....	....	3,503	2,762	1,104
Kilowatt rating of dynamos	28,301	15,499	3,019	19,169	15,175	7,781	84,564	48,558	26,108
Output of stations, kilowatt-hours	48,824,097	24,985,903	3,825,763	18,328,080	26,421,316	17,474,261	200,457,319	75,829,108	48,888,450
Estimated number of lamps wired for service:									
Arc	3,659	3,451	914	7,267	8,587	4,278	7,617	8,176	5,146
All other varieties	592,315	219,537	37,443	584,015	377,225	135,593	1,866,373	804,323	303,591
Stationary motors served:									
Number	3,470	1,086	430	2,428	1,713	1,129	8,445	4,223	8,236
Horse-power	23,056	6,586	347	24,557	16,110	5,128	50,869	18,634	4,827

TABLE X—CENSUS RETURNS OF PACIFIC COAST STATES BY INDIVIDUAL STATES

	WASHINGTON			OREGON			CALIFORNIA		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of establishments	70	71	40	66	61	39	112	129	115
Commercial	60	65	33	54	50	33	97	115	105
Municipal	10	6	7	12	11	6	15	14	10
Income	$3,087,721	$3,410,542	$783,651	$1,406,141	$1,965,245	$691,582	$27,685,573	$14,416,529	$5,066,417
Light, heat and power	$2,976,297	$3,219,814	$739,743	$1,364,226	$1,840,155	$638,571	$26,461,154	$13,922,028	$4,946,090
All other sources	$111,424	$190,728	$43,908	$41,918	$125,090	$53,011	$1,224,419	$494,501	$120,327
Total expenses, including salaries and wages	$2,270,132	$2,388,628	$651,495	$1,205,738	$1,283,560	$499,632	$22,803,526	$12,580,937	$3,918,975
Total number of persons employed	1,078	885	274	532	467	187	5,738	3,128	1,360
Total horse-power	95,884	67,224	22,894	46,015	126,815	17,798	848,248	384,673	134,788
Steam and gas engines (including turbines):									
Number	58	54	38	63	65	37	180	167	156
Horse-power	18,293	10,764	5,553	16,213	24,259	6,583	416,186	149,884	54,843
Waterwheels:									
Number	64	48	41	60	72	46	205	172	133
Horse-power	77,591	56,118	17,238	29,802	102,052	11,195	432,062	208,441	78,933
Kilowatt rating of dynamos	57,283	66,308	13,679	32,416	32,587	11,165	588,281	238,480	83,816
Output of stations, kilowatt-hours	71,414,473	257,785,236	19,722,262	58,789,312	92,807,992	17,531,660	1,747,459,041	661,606,309	152,728,042
Estimated number of lamps wired for service:									
Arc	4,729	6,771	2,977	1,285	3,927	2,023	24,890	19,691	15,764
All other varieties	781,244	624,865	108,443	382,196	372,844	95,045	6,793,200	3,068,214	1,006,875
Stationary motors served:									
Number	2,279	1,933	295	1,527	2,072	403	29,059	11,560	5,190
Horse-power	28,148	29,686	2,780	15,843	20,452	4,020	603,742	200,067	50,296

TABLE XI—CENSUS RETURNS OF SOUTHEASTERN STATES BY INDIVIDUAL STATES

	VIRGINIA			NORTH CAROLINA			SOUTH CAROLINA		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of establishments	67	51	37	94	71	38	61	40	24
Commercial	53	37	27	46	35	22	30	23	16
Municipal	14	14	10	48	36	16	22	17	8
Income	$760,688	$390,628	$210,632	$1,342,302	$543,322	$250,133	$4,449,583	$901,537	$387,010
Light, heat and power	$750,524	$380,770	$210,176	$1,287,683	$527,672	$241,903	$4,215,766	$865,708	$356,066
All other sources	$10,164	$9,849	$156	$54,610	$15,650	$8,230	$233,817	$35,829	$30,944
Total expenses, including salaries and wages	$567,459	$261,795	$171,185	$1,046,217	$437,215	$192,775	$2,850,661	$634,375	$272,729
Total number of persons employed	341	178	170	453	248	141	683	261	160
Total horse-power	59,585	14,619	5,443	64,983	20,683	6,566	218,496	84,115	21,205
Steam and gas engines (including turbines):									
Number	69	39	40	92	73	42	71	49	36
Horse-power	15,305	4,028	4,177	15,032	10,241	4,630	39,941	8,625	10,690
Waterwheels:									
Number	63	44	10	52	32	10	88	52	9
Horse-power	44,280	9,551	1,221	49,951	9,962	1,920	178,555	75,430	10,415
Kilowatt rating of dynamos	40,512	9,195	3,827	43,099	13,911	4,141	132,408	51,271	13,390
Output of stations, kilowatt-hours	28,724,684	10,208,360	6,879,243	70,552,737	13,171,681	8,351,346	356,771,757	68,696,424	18,426,763
Estimated number of lamps wired for service:									
Arc	2,589	1,415	1,278	1,928	1,936	1,178	2,345	2,521	1,366
All other varieties	237,079	93,635	37,645	571,384	144,256	45,181	268,721	150,018	46,068
Stationary motors served:									
Number	753	268	450	1,876	249	161	5,452	969	160
Horse-power	8,570	3,690	257	32,830	4,345	950	155,385	37,388	6,546

TABLE XI—(CONTINUED)

	GEORGIA			FLORIDA			ALABAMA		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of establishments	126	93	43	50	37	26	69	55	25
Commercial	42	34	24	33	24	21	34	27	16
Municipal	84	59	19	17	13	5	35	28	9
Income	$1,763,077	$1,110,510	$357,565	$1,323,899	$654,251	$324,770	$1,210,156	$1,012,743	$385,263
Light, heat and power	$1,677,363	$1,086,601	$348,753	$1,301,479	$630,632	$323,414	$1,186,976	$997,506	$374,138
All other sources	$86,614	$23,909	$8,812	$22,420	$23,619	$1,356	$23,180	$15,237	$11,125
Total expenses, including salaries and wages	$1,655,420	$844,557	$254,838	$1,052,696	$480,726	$224,637	$980,169	$872,302	$284,537
Total number of persons employed									
Total horse-power	697	384	203	455	265	136	456	343	162
Steam and gas engines (including turbines):	87,951	54,704	12,630	33,836	14,370	6,114	34,473	26,401	7,620
Number									
Horse-power	160	104	46	96	69	47	96	81	38
Waterwheels:	35,994	18,269	6,409	28,136	14,244	6,106	24,593	19,247	7,620
Number									
Horse-power	45	37	12	3	.. . .		15	15	.
Kilowatt rating of dynamos	51,957	36,335	6,121	5,700	... .	.	9,880	7,007	
Output of stations, kilowatt-hours	56,232	35,446	7,620	23,619	7,804	4,699	24,477	17,121	1,473
Estimated number of lamps wired for service:	87,571,815	59,311,202	9,911,243	25,895,751	11,765,994	8,066,078	48,602,553	30,846,764	11,616,707
Arc	2,651	3,173	1,452	1,264	1,408	1,106	3,920	4,926	2,034
All other varieties	410,068	180,337	60,139	367,772	141,284	61,144	347,871	232,646	61,373
Stationary motors served:									
Number	1,964	410	47	1,121	189	133	1,065	541	750
Horse-power	50,633	11,078	2,123	14,141	1,584	455	11,148	5,650	747

TABLE XI—(CONTINUED)

	MISSISSIPPI			TENNESSEE			KENTUCKY		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of establishments	82	68	43	90	78	54	89	83	58
Commercial	35	29	25	60	50	35	73	69	50
Municipal	47	39	18	30	28	19	16	14	8
Income	$1,122,890	$686,700	$366,934	$2,448,218	$1,299,983	$912,482	$2,754,115	$1,660,700	$850,08
Light, heat and power	$1,101,686	$667,543	$341,546	$2,408,762	$1,266,610	$911,555	$2,683,137	$1,610,475	$848,399
All other sources	$21,204	$19,157	$25,388	$39,456	$33,373	$927	$70,978	$50,225	$1,687
Total expenses, including salaries and wages	$878,379	$519,860	$277,719	$1,753,875	$882,763	$587,032	$2,244,906	$1,283,918	$709,23
Total number of persons employed	407	288	182	656	416	306	907	585	367
Total horse-power	30,497	15,522	7,660	68,994	28,730	19,003	81,767	41,984	21,41
Steam and gas engines (including turbines):									
Number	129	97	60	134	116	87	177	148	103
Horse-power	30,497	14,847	7,660	41,244	26,510	17,971	81,767	41,679	21,385
Waterwheels:									
Number		.		32	14	8			1
Horse-power	..	.	......	27,750	1,240	619			40
Kilowatt rating of dynamos	21,863	9,881	5,106	49,640	20,911	14,736	54,062	29,110	15,012
Output of stations, kilowatt-hours	27,924,183	15,701,624	9,825,926	75,544,893	34,847,956	24,472,632	75,593,179	37,232,623	27,835,614
Estimated number of lamps wired for service:									
Arc	1,823	1,694	1,035	4,808	4,407	3,662	7,814	6,884	4,598
All other varieties	279,220	141,079	85,111	671,150	306,903	174,291	849,220	183,796	142,662
Stationary motors served:									
Number	701	181	1,182	1,720	1,193	1,218	4,106	1,124	785
Horse-power	7,955	1,520	256	20,357	4,524	3,335	22,621	9,962	3,172

TABLE XII—CENSUS RETURNS OF ROCKY MOUNTAIN STATES BY INDIVIDUAL STATES

	IDAHO			MONTANA			WYOMING		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of establishments	38	42	19	29	33	27	20	18	13
Commercial	35	40	18	27	31	26	18	18	13
Municipal	3	2	1	2	2	1	2	....	....
Income	$1,587,407	$719,395	$192,206	$3,883,410	$2,469,131	$1,025,971	$605,462	$317,580	$159,216
Light, heat and power	$1,551,519	$692,489	$191,126	$3,292,385	$2,376,472	$1,017,805	$593,832	$303,683	$159,016
All other sources	$35,858	$26,906	$1,080	$591,025	$92,659	$8,166	$11,630	$13,897	$200
Total expenses, including salaries and wages	$1,537,260	$472,493	$141,160	$2,411,668	$1,469,808	$660,476	$445,789	$235,846	$111,682
Total number of persons employed	324	188	88	514	319	202	163	96	63
Total horse-power	56,375	13,694	6,454	115,710	68,817	31,887	11,596	5,125	3,229
Steam and gas engines (including turbines):									
Number	14	19	15	39	31	26	46	30	27
Horse-power	4,525	2,202	1,530	12,825	11,830	7,787	10,262	4,310	3,154
Waterwheels:									
Number	63	37	23	64	62	44	11	6	1
Horse-power	51,850	11,492	3,924	102,885	56,987	24,000	1,334	765	75
Kilowatt rating of dynamos	35,656	7,082	2,774	74,398	39,602	22,055	8,212	3,208	1,831
Output of stations, kilowatt-hours	115,812,292	9,577,588	6,018,149	379,212,617	137,379,261	36,435,766	11,580,567	6,499,084	3,883,285
Estimated number of lamps wired for service:									
Arc	1,349	966	657	2,193	3,123	1,648	492	517	259
All other varieties	261,096	122,491	33,262	388,718	231,201	101,868	112,228	69,674	22,082
Stationary motors served:									
Number	1,723	406	163	1,962	971	151	672	131	1
Horse-power	27,142	4,054	205	75,184	33,240	1,401	6,224	685	1

TABLE XII—(CONTINUED)

	NEVADA			UTAH			COLORADO		
	1912	1907	1902	1912	1907	1902	1912	1907	1902
Number of establishments	8	9	5	45	31	16	73	56	48
Commercial	7	9	5	28	22	15	62	49	46
Municipal	1	....	....	17	9	1	11	7	2
Income	$618,942	$372,108	$44,549	$1,516,410	$665,241	$714,353	$4,771,074	$3,410,240	$1,652,505
Light, heat and power	$607,597	$352,959	$44,549	$1,497,205	$627,332	$664,240	$4,606,427	$3,317,844	$1,628,953
All other sources	$11,345	$19,149	....	$19,205	$37,909	$50,113	$164,647	$92,396	$23,552
Total expenses, including salaries and wages	$428,255	$245,291	$39,687	$1,206,729	$461,675	$607,769	$3,997,760	$2,785,401	$1,537,471
Total number of persons employed	147	78	18	401	198	240	1,917	918	588
Total horse-power	15,420	6,980	1,720	60,588	35,950	20,460	134,004	82,427	38,268
Steam and gas engines (including turbines):									
Number	14	9	4	6	10	9	95	114	99
Horse-power	2,880	695	250	1,000	1,279	2,050	56,999	55,301	25,118
Waterwheels:									
Number	13	9	4	63	45	26	67	47	42
Horse-power	12,540	6,260	1,470	59,588	34,671	18,410	77,005	25,580	12,750
Kilowatt rating of dynamos	10,513	5,690	764	37,935	33,592	13,923	71,668	53,130	21,808
Output of stations, kilowatt-hours	44,969,772	29,621,730	1,508,910	86,634,658	61,672,661	32,457,063	165,196,068	123,275,212	60,177,084
Estimated number of lamps wired for service:									
Arc	321	327	78	333	440	1,469	4,175	5,391	4,770
All other varieties	45,443	63,939	8,213	150,380	67,670	92,165	1,032,865	649,494	295,605
Stationary motors served									
Number	303	411	13	1,014	406	295	4,780	3,232	1,264
Horse-power	12,384	6,850	180	37,490	5,519	5,868	60,451	41,161	12,484

TABLE XII—(CONTINUED)

	ARIZONA			NEW MEXICO		
	1912	1907	1902	1912	1907	1902
Number of establishments	16	15	13	21	15	11
Commercial	16	15	13	18	15	11
Municipal	....	...	....	3	...	....
Income	$1,172,232	$569,850	$293,066	$495,658	$292,682	$135,307
Light, heat and power	$1,127,908	$544,192	$288,019	$486,185	$289,962	$133,747
All other sources	$44,321	$25,658	$5,047	$9,473	$2,720	$1,560
Total expenses, including salaries and wages	$923,258	$464,350	$240,953	$449,516	$226,937	$102,201
Total number of persons employed	217	148	86	158	83	45
Total horse-power	22,075	7,716	2,540	11,015	4,548	1,780
Steam and gas engines (including turbines):						
Number	33	33	27	41	26	21
Horse-power	12,775	6,906	2,540	10,198	4,035	1,730
Waterwheels:						
Number	4	4		9	6	1
Horse-power	9,300	750		817	513	50
Kilowatt rating of dynamos	14,756	4,939	1,811	7,981	3,789	986
Output of stations, kilowatt-hours	32,960,084	9,392,302	3,662,045	9,027,824	1,614,349	2,637,810
Estimated uumber of lamps wired for service:						
Arc	686	754	295	377	332	272
All other varieties	136,400	72,028	36,556	112,207	55,379	22,507
Stationary motors served:						
Number	741	339	132	639	195	75
Horse-power	12,547	2,220	714	4,084	1,231	100

Electrical Distribution Engineering in Chicago—II

Substation and battery equipment of the Commonwealth Edison Company—Care of cables and pole lines, methods of preventing electrolysis, and organization of substation department

IN the *Electrical World* of March 7 the operating methods of the Commonwealth Edison Company in reference to the organization of the staff, methods of new construction and the use of underground cable were described. A description of other features of operation follows.

Inspection and Repair of Cables and Pole Lines

No routine tests are made on the high-tension cables, as experience has shown that they cause more interference with service than they save. A force of men is constantly at work in manholes, cleaning them and testing the low-tension junction boxes and testing for open mains in the Edison-tube system. These men report the condition of cables as they incidentally observe them and so perform a function as inspectors. One regular inspector is employed, who devotes his attention principally to new work. There is so little trouble with high-tension cables that this very simple system gives excellent results.

The overhead lines are regularly patrolled, an inspector being assigned to each district for this purpose. The repair gangs at once correct defects reported by the inspectors. Trouble-men are always in readiness to be sent out on emergency calls in connection with overhead-line failures. When a circuit-breaker connected to a sixty-cycle line opens once a trouble man is sent out. This practice has been made a rule since the company decided to set protective relays for operation at a minimum of about 50 per cent overload, or for about double load for two seconds. These settings correspond to 240 amp and 340 amp respectively for a No. 0 cable. Thus the opening of a circuit-breaker indicates line trouble.

The substation switch equipment is also regularly inspected to prevent interruption to service by a force of repair men who are employed in cleaning and repairing insulators and switch gear. These men report to the substation department. Their work, however, has a vital relation to line maintenance.

In repairing high-tension lines every precaution is taken to insure the safety of linemen. This is especially necessary when there are so many substations interconnected with a network of cables and pole line. A special code of safety rules has been inaugurated and is strictly enforced. When work is to be done which will interfere with customers' service, or when changes in line connections are to be made, the overhead department makes requisition for a load dispatcher's permit which gives permission to do specified work between stated times of starting and completion. This is approved by the starting engineer and the load dispatcher. Copies of the permit go to the construction or cable foreman and to the station operator. The former re-

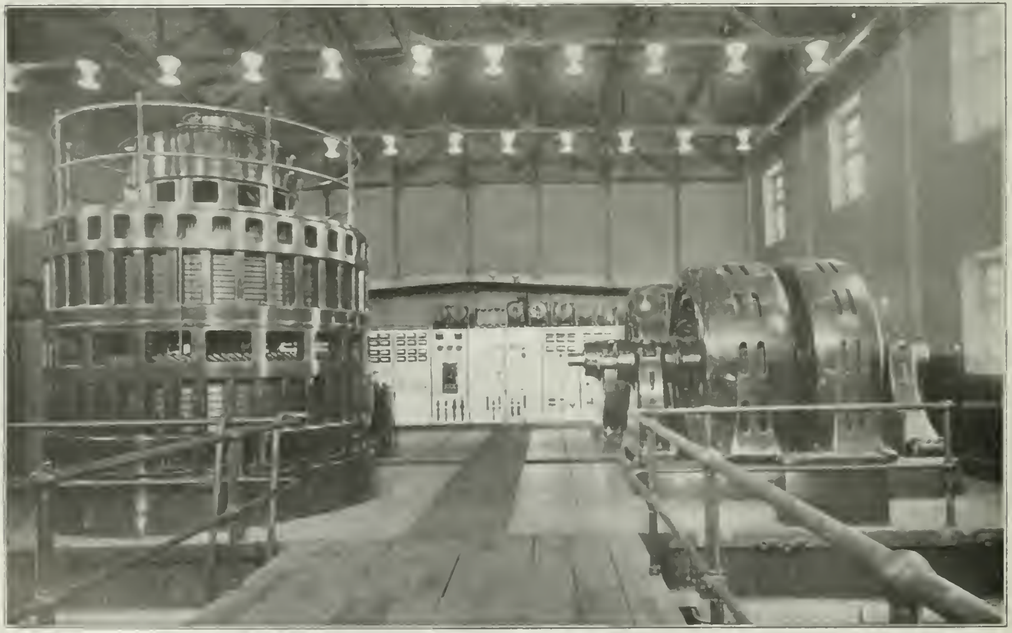


FIG. 10—FREQUENCY-CHANGER SETS IN HYDE PARK SUBSTATION

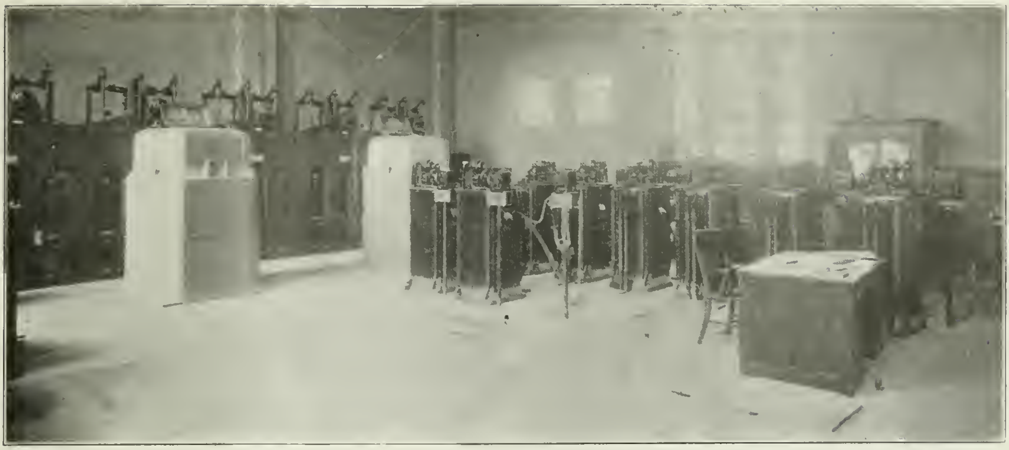


FIG. 11—AUTOMATIC REGULATORS AND OIL SWITCHES IN EDGEWATER SUBSTATION

ports to the operator in person and presents his permit, which is verified by consultation over the telephone with the load dispatcher. The operator has two days' notice of repairs so that he is prepared to spare the line. The load dispatcher then orders the line out of service and has it and the high-tension apparatus grounded in accordance with definite grounding rules. The load dispatcher orders the line put back into service after the necessary tests have been made.

Prevention of Electrolysis

With such a vast network of high-tension and low-tension underground circuits the prevention of electrolytic corrosion requires constant watchfulness. A force of men is therefore kept constantly at work. The whole system is covered monthly in routine inspection of polarity and potential of cable coverings. If dangerous differences of potential, 1 volt or more, are found between the sheath and surrounding conductors, remedial measures are taken. The latter are usually in the direction of "drainage" rather than in breaking up neighboring pipes into insulated sections.

The first steps in bonding were taken in 1895 and 1896, when the trolley lines began to extend into the downtown district and to make trouble for the lighting company. Bonding of cable sheaths to each other and to neighboring conductors was begun near the power plants and was extended out radially therefrom. At first bonds were put in about a quarter of a mile apart and at branching points. As substations were installed they introduced new danger centers and drainage cables connecting with negative busbars were added. Occasionally it has been necessary to parallel the cables with special drainage cables and the cables are sometimes bonded direct to the rails. Each problem is treated from the standpoint of economy. Practically all of the overhead structure of the elevated railways and the surface tracks are bonded together, greatly improving the return circuit. As new construction goes on in manholes the opportunity is taken to bond all cables together, so that the whole system is being rapidly bonded. The copper bonding wire has capacity as great as or greater than the lead coverings in order that it may not burn off in case of trouble. Incidentally it should be noted that this bonding minimizes the destructive effect of cable burn-outs by localizing the current flowing in the lead sheaths.

The result of all of this care is a reduction in expense chargeable to electrolysis to about one-third what it was a few years ago. Electrical repairs at the present time cost less than 1 per cent of the total investment.

Organization of Substation Department

The substation department of the company is organized in three divisions—the departments of inspection, operation, and reserve steam plants and repairs.

The head of the inspection division makes a general inspection of all substations approximately every two weeks. The detailed inspections made by the operators are uniform and are carried out in accordance with an inspection schedule which is posted in all substations. The schedule calls for the inspection of each particular piece of apparatus by a particular man at a particular time. The inspection is very thorough. Defects are promptly reported and measures are taken to remove them. They are thus usually corrected before damage results. This is especially necessary in such a large system where the responsible head cannot be familiar with the condition in detail of each piece of apparatus. An independent inspection is also made by the relief men, who take regular eight-hour shifts in the substations for the purpose of giving the regular men a shift off at intervals.

In the development of the system of substations the latter's first function was to transform the twenty-five-cycle current received from the power plants to direct current for lighting and power circuits. Later, frequency-changing substations became a feature as the demand for sixty-cycle current increased. The Edison system in Chicago was, of course, a purely direct-current network at first. It soon, however, reached the limit of the economical radius of distribution directly from the generating stations with low-tension direct current, and the range had to be increased by means of alternating-current transmission. As much direct-current generating equipment was already installed the first step was to use inverted rotaries in the generating stations, and this was done at Harrison Street and at Washington Street. Units of 250-kw capacity were used for this purpose, and these supplied 100-kw units in two substations. This temporary expedient was later rendered unnecessary by the installation of alternators in the Harrison Street plant. A 2500-kw double-current generator, which is now performing rotary-converter duty, was also installed in this plant. As alternating current demonstrated its suitability for lighting, a demand for sixty-cycle current arose. This was met by the installation at first of small high-frequency generators and later by the introduction of frequency changers installed at outlying points. The sixty-cycle load grew until at present a total of 25,000 kw in frequency-changing sets is in use. The largest of these, a 5000-kw machine, is in the Quarry Street station. Recently several very large sixty-cycle generators have been installed in the newer power plants, and the frequency changers serve a useful purpose as reserve capacity and in tying together the twenty-five-cycle and sixty-cycle systems. They are used principally during the annual peak periods. The new 20,000-kw horizontal turbo-generator now being placed in the Fisk Street station is a sixty-cycle machine, while the frequency of the new 25,000-kw generator output is twenty-five cycles.

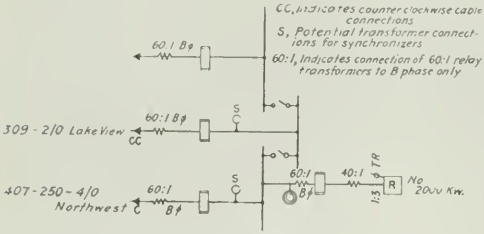

CC, Indicates counter clockwise cable connections
S, Potential transformer connections for synchronizers
60:1, Indicates connection of 60:1 relay transformers to B phase only
60.1 Bϕ
309 - 2/0 Lake View
CC
60:1 Bϕ
S
407 - 250 - 4/0 Northwest
C
60:1
Bϕ
S
60:1
Bϕ
40:1
1:3
TR
R
No 2000 Kw.

FIG. 12—DIAGRAM FOR ELEVATED RAILWAY SUBSTATION WITH TRANSFER BUS

On May 1, 1913, the substation equipment comprised about 184,000 kw of substation apparatus of all kinds. There were rotaries of 81,000-kw rating, 22,500 kw of motor-generators, 46,400 kw of 12,000-volt, sixty-cycle transformers, 22,200 kw of storage batteries rated on a one-hour discharge, and 12,000 kw of railway-company equipment operated by the Edison company.

Substation Operating Methods

The company in some instances supplies all requirements in a given territory from one substation. By combining the various kinds of service the load-factor is very materially improved and duplication of investment is avoided. Arrangements recently made with the railway companies are such as to render it possible to shut down most of the railway power plants except during the annual peak period.

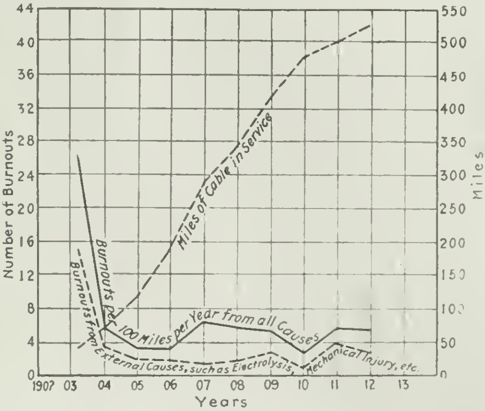


FIG. 13—RECORD OF BREAK-DOWNS OF 9000-VOLT TRANSMISSION LINES

The superintendent of substations, Mr. E. F. Smith, is responsible for everything connected with the conversion of electrical energy in the Edison substations. In addition to its forty-eight substations, the substation department maintains and operates during annual peaks two steam reserve plants. Of these the Harrison Street plant, once the show power station of the world, has a generating capacity of 14,000 kw, provided by twenty-four boilers and nine generating units. Two 2000-kw rotaries supply direct current for local distribution. A 2500-kw double-current generator, which is still occasionally used to accommodate the downtown load, is also in service as a rotary converter. There are also several smaller rotaries in the plant. At Fifty-sixth Street is a combined reserve steam and frequency-changing plant containing, in addition to the motor-generator sets, stationary transformers for use in the 4000/2300-volt, four-wire, three-phase distribution system. The lower voltage from the neutral to the main wires is used for lighting, and the higher voltage between main wires for power purposes.

Training Substation Operators

In view of the great importance of insuring absolute reliability on the part of substation operators, whose most important duties are performed in emergency, the company has devoted special attention to the training of these men. This work is under the general charge of Mr. A. E. Evans, general operator in charge of the operating division of the substation department.

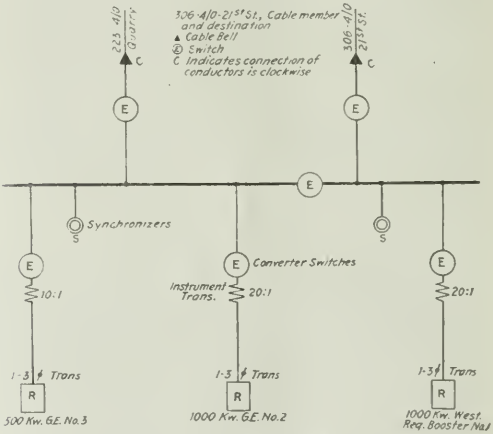


FIG. 14—TYPICAL DIAGRAM FOR SMALL SUBSTATION

To insure accurate and quick work in emergencies constant vigilance on the part of the operators is needed. Nervous men cannot stand this. All applicants for positions are required to pass a thorough physical and mental examination, which includes tests of eyesight, ability to distinguish color, predisposition to nervousness, etc. New operators serve a term as apprentices and as such receive a thorough training, averaging four months in duration. The chief operators are responsible for the instruction, and they submit weekly reports of progress. On the average one hour per day is devoted to instruction and one hour to the study of the rules, making wiring diagrams, etc. The rest of the time is given to routine operation, cleaning machines and general "janitor" work. Apprentices work ten hours per day, operators eight.

The apprentices gain experience with all forms of equipment and are expected to make steady progress. Promotions are made on the basis of efficiency and seniority. Examinations are conducted by a small examining board consisting of members of the substation staff and the chief operator. Quarterly examinations are held for all classes of operators. A merit or efficiency system is the basis of the ratings, and attendance, punctuality and performance of duty are all considered in the quarterly grading. Reports and ratings are forwarded through a committee to the head of the substation department, who fixes the final rating of the department for each individual.

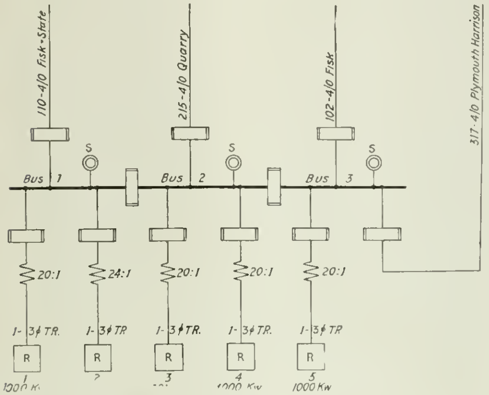


FIG. 15—TYPICAL LARGE SUBSTATION WITH TIE-LINE CONNECTION

By averaging data of all certified operators it is possible to draw a picture of a composite operator, of whom the following may be said: He entered the service at twenty-four and one-half years of age and served an apprenticeship of five and one-tenth months, receiving during this period 21 cents per hour. He has been in service four and one-fifth years and is now, therefore, twenty-eight and seven-tenths years old. He works 232 hours per month in eight-hour shifts. He operates 563 kw of motor-generators, 2250 kw of rotary converters, 600 kw of storage battery and 1100 kw of 12,000-volt, sixty-cycle transformers.

Of the operating force 47 per cent are married and 68 per cent are members of the Commonwealth Edison section of the National Electric Light Association. Ninety per cent of those eligible are subscribers to the employees' saving fund. The men hail from nineteen states and Canada, and all have a grammar-school education, 54 per cent having attended high school. Eleven per cent are college graduates, while 21 per cent attended college but did not graduate. Fifty-eight per cent have studied correspondence-school courses, and of these 17 per cent completed them, a percentage considerably higher than the average of all students of correspondence schools. Each operator performs an average of six "serious" operations per day, or 2300 per year. Errors made by the entire operating force are at the average rate of one every ten days, or one for each operator in three and one-third years. There has never been a fatal accident in the substation department.

TABLE III—STORAGE BATTERIES, COMMONWEALTH EDISON COMPANY, CHICAGO

Substation	Plates	Date Installed	Ratings			
			One Hour		One and One-Half Hours	
			Amp-hr.	Kw-hr.	Amp-hr.	Kw-hr.
Adams Street, No. 1	87H	May '98	11,400	1425	12,996	1624
Adams Street, No. 2	81H	Oct., '99	11,400	1425	12,996	1624
Adams Street, No. 3	81H	Oct., '01	11,400	1425	12,996	1624
Sedgwick Street	49G	Nov., '01	3,120	390	3,557	445
Fourteenth Street	33G	Oct., '01	2,080	260	2,371	295
Division Street	49G	Oct., '02	3,120	390	3,557	446
Harrison Street	61H	Nov., '02	8,550	1069	9,747	1218
Lydia Street	81H	Nov., '02	11,400	1425	12,996	1624
State Street	33G	Oct., '02	2,080	260	2,371	295
Haddock Place, No. 1	61H	Sept., '03	8,550	1069	9,747	1218
Haddock Place, No. 2	61H	Nov., '03	8,550	1069	9,747	1218
Morgan Street	33H	Oct., '03	4,560	570	5,198	650
Ohio Street	49H	May, '04	6,840	855	7,797	975
Market Street, No. 1	73H	June, '04	10,260	1283	11,696	1462
Wabash Avenue, No. 1	61H	Oct., '05	8,550	1069	9,747	1218
Wabash Avenue, No. 2	61H	Nov., '05	8,550	1069	9,747	1218
Plymouth Place, No. 1	61H	Nov., '05	8,550	1069	9,747	1218
Plymouth Place, No. 2	61H	Oct., '06	8,550	1069	9,747	1218
West Twenty-second Street	33H49	Nov., '05	4,560	570	5,198	650
Market Street, No. 2	115H	Dec., '09	19,000	2375	21,509	2687
Indiana Street	33H	Dec., '09	5,320	665	6,064	758
Twenty-seventh Street	37H51	Oct., '11	6,000	750	6,840	855
State Street, No. 2	33H67	Nov., '12	5,320	665	6,064	758

TABLE IV—SAMPLE DAILY STORAGE-BATTERY RECORD

DAILY REPORT OF BATTERY FLOATING—BATTERY NO. 1

To. D. Macrae. Substation, State Street. Chief Operator, Critchfield Date, July 2, 1913

Time	Bus Voltage	Cells in Circuit	Voltage per Cell	Amp-hour meter in ampere-hr		For floating at an average of 2.12 volts per cell	
				Charge	Discharge	Voltage	Cells in Circuit
1:00 P.M.	245	116	2112	....	...	236 to 238	112
4:10 P.M.	247	117	2111	....	....	238 to 240	113
5:00 P.M.	245	116	2112	....	....	240 to 242	114
5:30 P.M.	243	115	2113	....	...	242 to 244	115
5:40 P.M.	241	114	2114	....	...	244 to 246	116
6:15 P.M.	243	116	2113	....	....	246 to 248	117
8:00 P.M.	245	116	2112	....	....	248 to 250	118
8:40 P.M.	243	115	2113	....	..	260 to 252	119
11:00 P.M.	241	114	2114	....	....	252 to 254	120
1:00 A.M.	238	112	2125	....	...	....	.....
7:00 A.M.	241	114	2114	....	....	....	.....
7:45 A.M.	243	115	2113	....	....	....	.....
8:50 A.M.	245	116	2112	....	.	.....	.....
10:40 A.M.	249	118	2110	....	....	.....	....
12:05 P.M.	247	117	2111	. .	....	. .	.....

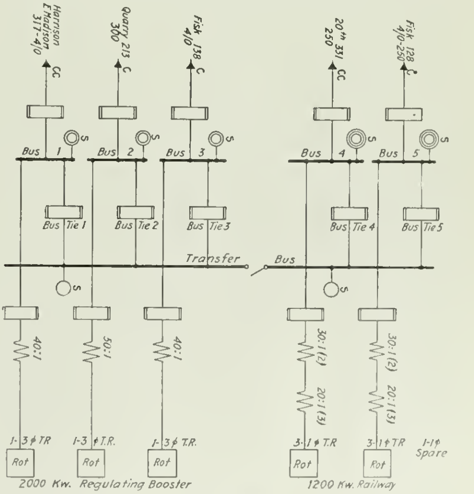


FIG. 16—DIAGRAM OF LARGE SUBSTATION WITH TRANSFER BUS

All operating errors are thoroughly investigated and the blame placed. Extra good service also receives official recognition. The essential details of troubles resulting from operating errors are distributed through bulletins, and instructions for avoiding repetitions thereof are given. The results of such work have been a constant improvement in the efficiency of the operating force. To indicate this it may be said, in addition to the data given earlier, that in 1910 out of 238,000 serious operations fifty-one errors were made, an average of 0.49 per man. In the 284,000 operations made in 1913 up to the time when these data were compiled, there were but thirty-three errors, or 0.20 per man.

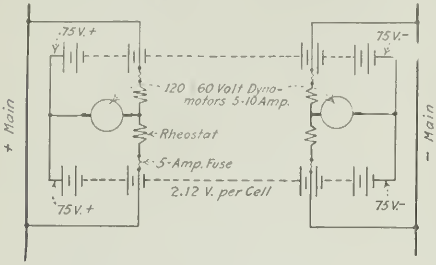


FIG. 17—ARRANGEMENT FOR CHARGING STORAGE-BATTERY END CELLS

Storage Batteries

So much depends upon absolute reliability of lighting service in a large city that the storage battery is practically a necessity in the business section. Unexpected darkness in a large department-store basement, for example, would result in possible panic and almost certain loss through theft. The Edison company, therefore, has a large number of batteries so distributed that failure of direct-current supply is practically impossible. The dates of installation, types of plates and capacities of these are given in the accompanying table and the locations are shown on the map. These batteries are always kept fully charged for emergency use. The cost of their upkeep should be charged, therefore, to service insurance.

The same principle is applied in the power plants and substations where smaller batteries are installed for reserve oil-switch operation and alternator excitation. For the former purpose sixty-cell batteries having a capacity of 80 amp each for one hour are employed. These serve also to supply energy for auxiliary emergency lighting. Exciter batteries are operated in parallel with the exciter busbars and in most cases contain seventy cells each. They are rated at from 680 amp to 1100 amp. Three such are installed at Fisk Street, two at Quarry Street and two at the Northwest station.

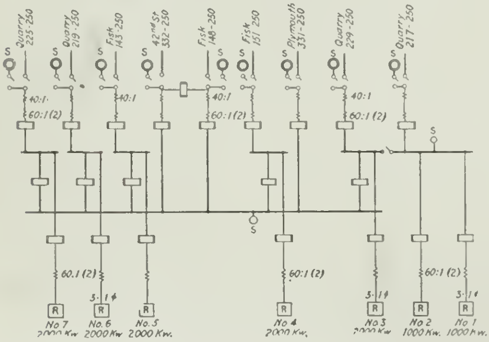
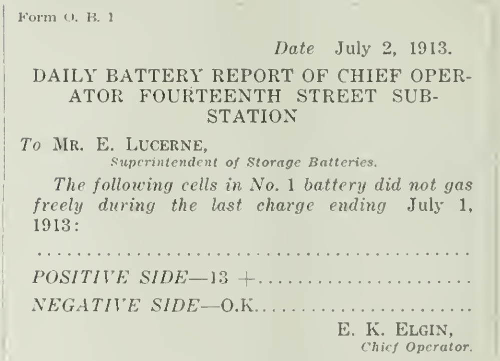


FIG. 18—LARGE SUBSTATION WITH ELABORATE LAY-OUT

At present the batteries are being renewed by means of "Exide" plates, which have higher capacity at high rates of discharge than the Manchester plates and also occupy less floor space for equal ratings. The Manchester plates increase in rating as the lead supports are turned into active material until they actually drop apart. In spite of their durability, however, the advantages mentioned for the "Exide" plates have brought about the change to the latter type.

In all substations the batteries are floated on the bus at 2.12 volts per cell. This provides for a slight charge and makes up for the slow discharge due to local action. At the normal temperature of 70 deg. Fahr. a cell of 61H Manchester plates, 2.5 amp is required to hold the cell voltage at 2.12 volts. All batteries are given fifteen-minute freshening charges at one-fourth of the one-hour rate. If this produces gassing, the cells are considered in good condition, otherwise they are reported as defective on a form like that shown herewith. Every two weeks the batteries receive an overcharge for two hours to make up for any losses which may have occurred.

An interesting and effective plan for charging the end cells is in operation in the Wabash Avenue substation. The scheme is illustrated in Fig. 17. There are two batteries operated in parallel, the positive and negative mains being connected at the points required to give 2.12 volts per cell. Between these points and the respective ends of the battery are connected dynamotors of from 5-amp to 10-amp capacity. In each branch of the dynamotor-battery circuit are an adjusting rheostat and a 5-amp fuse. The end cells are thus continually charged like those in the sections connected across the mains.



Form O. B. 1

Date July 2, 1913.

DAILY BATTERY REPORT OF CHIEF OPERATOR FOURTEENTH STREET SUBSTATION

To MR. E. LUCERNE,
Superintendent of Storage Batteries.

The following cells in No. 1 battery did not gas freely during the last charge ending July 1, 1913:

. . . .

POSITIVE SIDE—13 +. . . . .

NEGATIVE SIDE—O.K. . . . .

E. K. ELGIN,
Chief Operator.

FIG. 19—SAMPLE DAILY STORAGE-BATTERY REPORT

Once each week the specific gravity of each cell is measured and recorded on a special form, and the forms are assembled in a book for ease of comparison and study. A record of charges and discharges by months is also made. When plates are reported as defective, the first indication of defect being failure to gas under overcharge, they are sometimes replaced by used plates. New and old plates are never assembled in the same cell. After repair the cell is given a four-hour charge by means of a booster. In addition to the reports mentioned daily reports of the operating condition of each battery as a whole are filed. Each operator has instructions to adjust the number of cells in service to correspond to changes in busbar voltage and to record the time and battery data whenever such adjustment is made. A sample record is given in Table IV.

High-Voltage Direct-Current Electrification

Use of electric energy for railway operation purely for economical reasons—Special equipment necessary because of high pressure of 2400 volts direct current

THE electrification of the Butte, Anaconda & Pacific Railway is distinctive for two reasons, first because the high pressure of 2400 volts direct current is used and secondly because it is one of the first cases in which steam operation has been displaced by electricity purely for reasons of economy. The electrified lines of this system extend from the Butte Hill railway yards, near which copper is being mined, to the smelter at East Anaconda. The total mileage on a single-track basis, including sidings, tracks in yards and smelter tracks, is about 95 miles. Although the main object of the road is to haul ore, there is considerable local traffic, both freight and passenger, between Butte and Anaconda, the former city having a population of about 65,000 and the latter of about 10,000.

The freight traffic consists largely of copper ore and amounts to more than 5,000,000 tons per year. This material is hauled in steel ore cars each weighing about 18 tons and having a capacity of 50 tons. Trains of thirty loaded cars weighing 2000 tons are made up at the Butte Hill yards and are hauled by two-unit locomotives down the mountain to the Rocker yards, a few miles west of Butte, where 4000-ton trains are made up for the main line. At the East Anaconda yards the trains are again broken up and 1400-ton trains are sent up Smelter Hill to the ore bins. All of the shifting and "spotting" of cars at the smelters and in the sorting yards is done by single locomotive units.

The first electric locomotives were put in service May 28, 1913, and were used to haul ore cars between the East Anaconda yards and the smelter. During the first seven months of service they made approximately 201,000 miles and hauled about 2,365,000 tons of ore.

Eight passenger trains per day are operated between Butte and Anaconda, four in each direction. The main-line trains were first hauled by electric locomotives on Oct. 1, 1913, and promptly demonstrated their ability to make better time than was possible with steam engines. Single locomotives are used, hauling trains of from three to five passenger and baggage cars.

Energy for the operation of electric trains is purchased from the Great Falls Power Company. The gen-

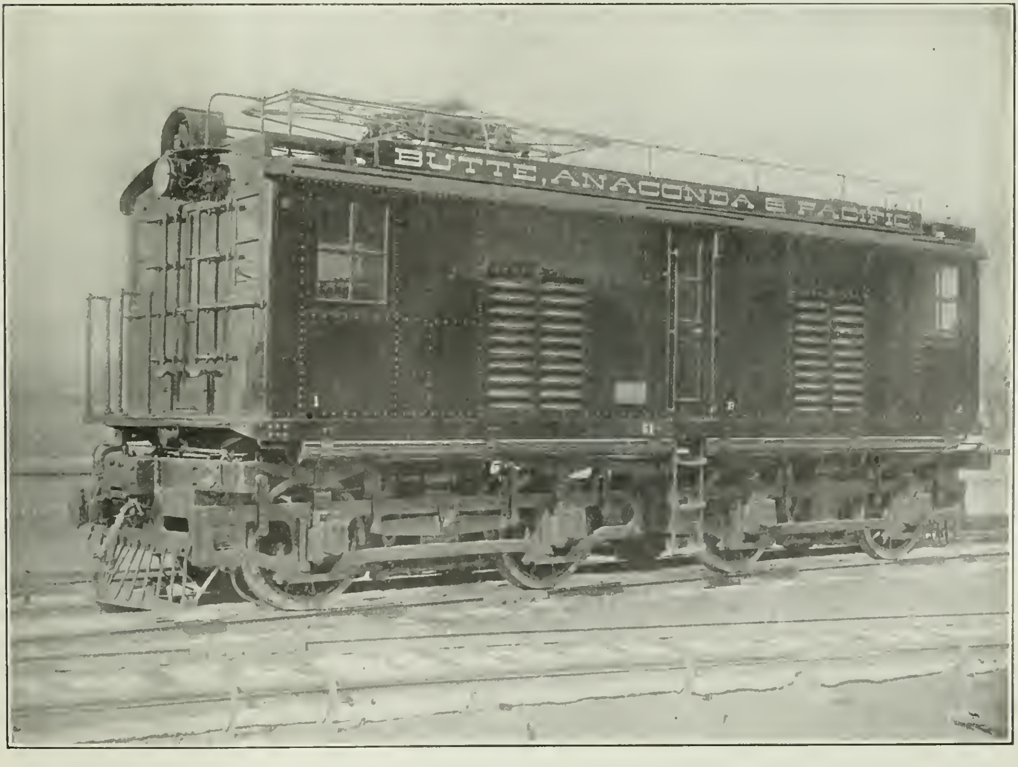


FIG. 1—2400-VOLT DIRECT-CURRENT LOCOMOTIVE, BUTTE, ANACONDA & PACIFIC RAILROAD

erating plant is situated at Great Falls, Mont., on the Missouri River, and has for some time been supplying electric energy for the operation of the mines and smelters at Butte and Anaconda. Six hydroelectric units are installed, having a nominal rating of 21,000 kw. The machines are of the horizontal type, generating 6600 volts, three-phase, at a frequency of sixty cycles.

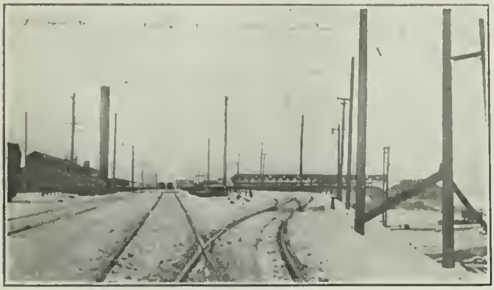


FIG. 2—OVERHEAD CONSTRUCTION

The emf is stepped up to 102,000 volts for transmission to the transformer substation at Butte, a distance of 130 miles, over two separate parallel lines constructed on the same right-of-way. An extension of the system transmits energy at 60,000 volts to a second transformer station at Anaconda, 26 miles farther on.

The two existing substations at Butte and Anaconda were used to house the 2400-volt motor-generator sets required for operating the electric trains, so that no additional buildings were constructed for this purpose. Energy is obtained from two 1000-kw, three-unit motor-generator sets in each substation, which take energy from the 2400-volt alternating-current buses. These units operate continuously twenty-four hours per day and seven days of the week to supply the necessary energy for train operation. Each set consists of a three-phase, sixty-cycle, 1450-kva synchronous motor operating at a speed of 720 r.p.m., which is directly connected to two 500-kw, 1200-volt generators, insulated to operate in series for 2400 volts.

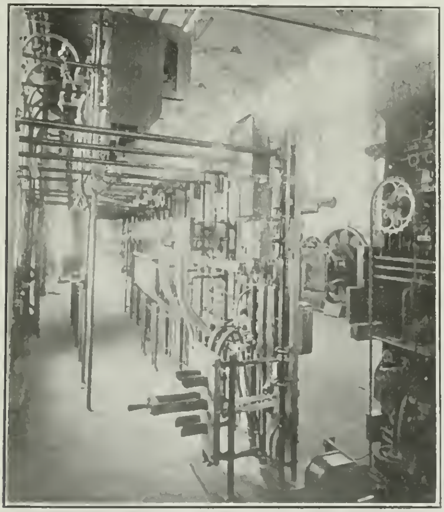


FIG. 3—2400-VOLT SWITCHBOARD, BUTTE SUBSTATION

The 2400-volt switchboards for controlling these sets are said to be the first direct-current boards to be constructed for such a high voltage. In general, they are similar to the standard 600-volt types excepting that they have increased insulation and special provision for interrupting the 2400-volt current. The circuit-breakers and switches are also arranged for remote control, and all apparatus on the panels is provided with ample insulation to insure safety to operators.

The 2400-volt circuit-breakers and switches are installed on separate panels above and back of the main panels and are operated by connecting rods from handles mounted on the front of the main switchboard. These handles are similar in appearance, and to avoid confusion the circuit-breaker handles are inverted. The breakers are equipped with special magnetic blowouts and arc chutes, and provision is also made for automatically inserting a high resistance in the generator-field circuit at the same instant the main circuit-breakers open, thus reducing the generator voltage.

The alternating-current switchboard contains two panels for remotely controlling the synchronous motors, solenoid-operated oil switches, two panels for the motor-field circuits and a panel for the automatic voltage regulator. These panels also contain other necessary instruments, including frequency and synchronism indicators, ammeters, wattmeters and relays.

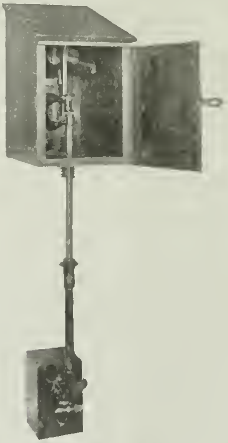


FIG. 4—SECTION SWITCH AND OPERATING LEVER

The overhead construction for this system was especially designed to give the flexibility necessary for satisfactory operation of the pantograph trolleys used on the locomotives. The 4-0 grooved copper trolley used over all tracks is supported by an eleven-point catenary suspension from a stranded-steel messenger cable. Both side-bracket and cross-span construction is used as required by the local conditions.

The section breakers were designed for the 2400-volt service, and at six points insulated crossings are necessary at the intersection of the 2400-volt trolley with the 600-volt trolley of the city system. On the main line use is made of a very simple section insulator, the two trolley wires from the ends of each section being paralleled at a suitable distance for insulation, so that the pantograph bridges the two circuits for a short distance, thus avoiding interruption of the supply of energy to the locomotive. The construction in the yards and sidings is simplified by paralleling the trolley from the side tracks for a short distance along the main line. This arrangement avoids the use of switch plates or similar devices. At some of these junction points the pantograph engages as many as six trolley wires.

The 4-0 trolley is reinforced between the substations with two 500,000-circ. mil bare copper cables tapped to the trolley at intervals of 1000 ft. A 4-0 negative return wire is also installed between Rocker and East Anaconda. This wire is carried on the trolley poles and is connected to the cross bonds at intervals of 1000 ft. The rails are connected by 4-0 bonds at every joint. The substations are normally connected together by these feeders, allowing an interchange of energy. In emergency either station can supply energy to the entire system.

The locomotive equipment consists of seventeen 80-ton units, fifteen for freight and two for passenger service. The freight locomotives are geared for low speed and are operated in pairs for the main-line service. The maximum free-running speed is 35 miles per hour. The two passenger locomotives are of the same construction as the freight units, but are geared for a maximum free-running speed of 55 miles per hour. A speed of 45 miles per hour is made with three passenger coaches on straight level track. The continuous tractive effort of a single 80-ton freight locomotive is 25,000 lb. at 15 miles per hour. The maximum tractive effort for a period of five minutes is 48,000 lb. based on a tractive coefficient of 30 per cent.

The locomotives are of the articulated double-truck type with all the weight on drivers. The central channels forming a part of the underframe are inclosed and are utilized as a distributing air duct for the forced ventilation of the motors. The air is conducted through the center pins, which are hollow, into the truck transoms and thence to the motors.

The motors are of the GE-229-A commutating-pole type and coil wound for 1200 volts and insulated for 2400 volts. The motor is designed for locomotive service and is provided with forced ventilation. In the ventilation of these motors the volume of air circulated is increased by the use of an auxiliary blower mounted on an extension of the dynamotor shaft. The gear reduction on the freight locomotive is 4.84 and on the passenger locomotive 3.2. The double-unit, 160-ton locomotive is capable of giving a continuous sustained output of 2100 hp. The motors are connected to the driving wheels by twin gears.

FIGS. 5 AND 6—SECTION SWITCH AND STEEL TRANSMISSION TOWER

The control equipment is Sprague-General Electric multiple-unit type, operating the four motors in series and in series-parallel. Two 1200-volt motors are permanently connected in series. The controller provides ten steps in series and nine in series-parallel. The transition between series and series-parallel is effected without opening the motor circuit, and there is no appreciable reduction in tractive effort during the change. The transfer of circuits at this point is made by a special change-over switch, which is operated electro-pneumatically.

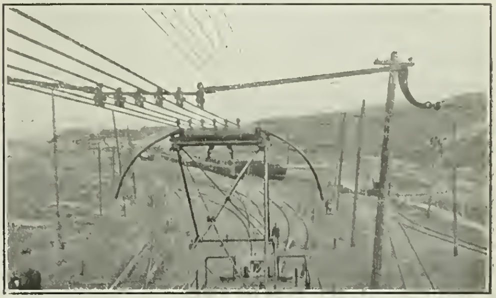


FIG. 7—OVERHEAD CONSTRUCTION IN YARDS, PANTOGRAPH ENGAGING SIX WIRES

The 2400-volt contactors are operated from the 600-volt control circuit and are specially constructed to separate the 2400-volt parts from the coils and interlocks which carry the 600-volt current. The necessary insulation is obtained by large clearances and by the use of porcelain and mica insulation. The armature is connected to the contact lever by a wooden rod. The contacts, magnetic blowout and arc chutes are also especially designed to rupture the 2400-volt arc.

Energy is collected by overhead roller pantographs, which are pneumatically operated and are controlled from either of the engineer's compartments by an air valve. A 2400-volt insulated bus line runs along the center of the cab roof. These bus lines are connected together by couplers between the two freight units, so that energy may be obtained from either one or two collectors.

For operating the control equipment and air compressor and for lighting the locomotive and cars 600-volt energy is supplied from a 2400-to-600-volt dynamotor installed on each locomotive.

All of the passenger and baggage cars now used between Butte and Anaconda will be heated as well as lighted by electricity as soon as the equipment can be installed. The cars will be heated from a single heating unit placed underneath the car floor and supplied with energy from a 2400-volt bus connected directly to the 2400-volt bus on the locomotive. This unit will have a maximum capacity of 25 kw and will be used to heat the air which is distributed to different parts of the car by means of a small motor-driven blower. Cool air will be drawn into the insulated case inclosing the heating units from some point on the roof of the car. After passing over the heating coils the air will be carried through ducts under the floor of the car to radiators placed between alternate seats. The blower has a capacity of from 500 cu. ft. to 1000 cu. ft. of air per minute, and the motor is connected in series with the heating units.

Standard 600-volt lighting fixtures will be used on the cars, and each passenger and baggage coach will be wired for five groups of five lamps in series. The lights in each car will be controlled by a suitable master switch and fuse with snap switches in the individual circuits. Thirty-six-watt tungsten lamps will be used.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

New Book of Rate Schedules in Chicago

The Commonwealth Edison Company of Chicago has issued a new book of rate schedules. This is a loose-leaf book laid out on the lines suggested by the rate research committee of the National Electric Light Association. The first sheet gives the table of contents; the second, a preliminary statement of general information; the third, Rate A, or the general service rate, and so on, the entire book consisting of twenty-five sheets. A large portion of the book is devoted to the standard contract riders, and the publication contains complete information about all the rates of the company, simply and clearly expressed. It may be noted that there are five general classifications of rates as follows: Rate A, general service; Rate B, regular power service; Rate C, large light and power service; Rate D, sign-lighting service (meter basis); Rate E, flat-rate lighting service. The number of standard contract riders which may modify the rates is thirty-two.

The "Electric Corner" at Cambridge, Ohio

Taking one of the darkest corners in the business section of Cambridge, Ohio, the New Midland Power & Traction Company recently equipped the cornice of its two-story office building with the row of lamps shown in the accompanying illustration, with the result that this section is now one of the most popular and attractive in the city. The benefits of moving the company's headquarters from an out-of-the-way location to the present site opposite the court house have also been reflected in the increased sale of electric appliances as well as in the greater number of tickets purchased for the company's interurban railway line. The business office itself is brilliantly lighted, as revealed in the photograph, and the new "electric corner" is now one of the bright spots of Cambridge, contributing its share to the increasing local standard of illumination. Mr. W. S. Hays is superintendent of the New Midland Power & Traction Company.

CENTRAL-STATION OFFICE AT CAMBRIDGE, OHIO

Energy Consumption of Electrically Operated Gristmills

Among the off-peak motor loads of the Illinois Northern Utilities Company, which operates in the vicinity of Dixon and Sterling, Ill., are some fifteen gristmills, each containing from 50 hp to 60 hp in motors. By the terms of a special form of contract granted gristmill operators energy is obtained at a net rate of 3.5 cents per kw-hr. provided that the mill load is kept off the lines from 4:30 p. m. to 10 p. m. during the entire year. For the months of June, July, August and September, when little milling is done, the company waives collection of the 50-cent minimum monthly charge per hp connected.

ELECTRICALLY OPERATED GRISTMILL AT DIXON, ILL.

In serving these gristmill customers the company is automatically protected in the observance of its off-peak clause, because the farmers who come to town to have grinding done invariably start home by 4:30 p. m. to get their evening milking finished. This insures, of course, that the mills will be shut down in ample time to avoid the evening lighting peak.

The average annual income from gristmill customers is now about $1,800, although there are three or four months in the year when little grinding is done.

One of the most efficient of the company's gristmill installations, according to Mr. C. B. Yonts, general contract agent, is the Sprout-Waldron attrition mill of the Dixon Cereal Company. On an actual test of grinding 15 tons of corn and cobs and corn and oats, the energy consumption of this mill was but 110 kw-hr. At the 3.5-cent off-peak rate, this is equivalent to 26.4 cents per ton. The average rate for grinding is 10 cents per

100 lb. The mill in question employs two 20-hp motors direct-connected to disks running in opposite directions. The output of this equipment is almost 50 per cent greater than that of other attrition mills in use in the Dixon territory, which are belt-connected to a single 50-hp motor. The cost of grinding with such a belted outfit averages about 60 cents per ton, based on figures covering a three-month period during which both old and new corn was ground.

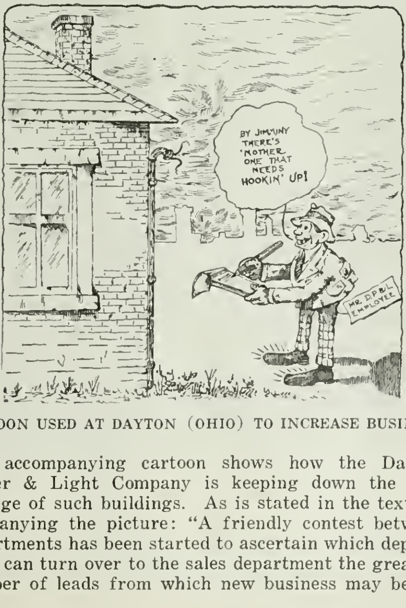
One old-type 50-hp belt-connected mill in the vicinity charges 6 cents per bag for grinding, although the cost is but 3.1 cents. Another old-type mill belt-driven by a 75-hp motor charges 5 cents per bag, while the cost is only 2.25 cents per bag. In the case of still another 50-hp belt-driven installation the cost is but 3.05 cents per bag, but the charge made is 6 cents per bag.

One gristmill in the Illinois Northern district was recently converted into a combination grist and merchant mill. In the past it had been operated only during the winter months, but when the son of the former owner took over the business the significance of load-factor was explained to him, with the result that he put on two eight-hour shifts and took advantage of the company's maximum-demand rate. This mill is now operating twenty-four hours a day and has a load-factor of about 85 per cent. Whereas the company's income from the former mill averaged about $50 per month, the present mill is returning $350 per month, and the operator is well satisfied.

In addition to the milling business described, the company also serves a number of canning plants in the vicinity. Nearly all of this canning is done during the four summer months, when the gristmills are closed down, thus enabling the same transformers to be used for both purposes and giving the company a good annual load-factor between the two seasonal demands.

"Hooking Up" Dayton's Wired Houses

It nets the electric-service company no return to have wired houses and stores in its territory unless they are connected to its lines and are using electrical energy.



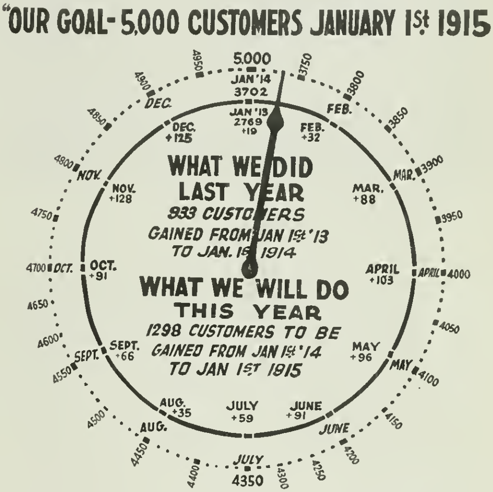
CARTOON USED AT DAYTON (OHIO) TO INCREASE BUSINESS

The accompanying cartoon shows how the Dayton Power & Light Company is keeping down the percentage of such buildings. As is stated in the text accompanying the picture: "A friendly contest between departments has been started to ascertain which department can turn over to the sales department the greatest number of leads from which new business may be secured. Every employee is asked to co-operate and turn over to the head of his department the street address of any house or store that he knows is wired and where electric light is not being used." The twin slogans of the contest are "Watch for services not connected" and "Mark it down!"

Cartoons such as the one shown herewith have been posted on the company's bulletin boards and in other conspicuous places, reliance being placed upon the picture of the man "marking it down" to attract the attention of his fellow employees and to tell them the story almost without the aid of the text. Mr. Thomas F. Kelly, sales manager for the Dayton company, believes the cartoon idea will be a business getter.

Setting the Pace at New Britain, Conn.

During the year 1913 the New Britain division of the United Electric Light & Water Company of Connecticut achieved a record for the new business added to its lines. A net gain of 933 customers, or 33.5 per cent, was made, bringing the total number of customers connected on Jan. 1, 1914, to 3702. Feeling that this record was one in which to take just pride, the organization has now set out to make an even better showing for 1914. To keep up the enthusiasm of the employees and to hold them in closer touch with the sales department's work, the large clock dial shown herewith was prepared and mounted on beaver board, 44 in. by 44 in. On the inner circle the monthly gain of customers for the year 1913 is shown, while on the outer circle the months for the year 1914 are laid off, and every employee is urged not to let any 1913 month's record stand. The first of each month the hand is moved up to show the actual number of customers on the lines at that time, and if the record of the year before is broken, a fresh start is made on the next month. The campaign was launched with the slogan "Our goal—5000 customers Jan. 1, 1915," and all employees have pledged their untiring support to make good this prediction. To attain the goal, a gain of 1298 customers for the year 1914, or 35 per cent, must be made, which means extra effort on the part of every employee—meter readers, installers, linemen, salesmen, superintendent.



CLOCK DIAL TO SHOW INCREASE IN CUSTOMERS

The dial is placed in the main office at New Britain in full view of the public and employees, and much interest is shown in the progress of the hand. On pay day especially the linemen and other employees who come into the office only once a week evince added interest in the growth of the company's business, and all want to take an active part in the development. During the first month the record of January, 1913, was broken and a gain of 53 consumers was added against 19 the year before, or an increase of 279 per cent.

Different schemes will be used to stimulate interest in the campaign, and small prizes will be offered to the employees handing in the most "leads" that result in new business. Monthly talks to all the employees, thanking them for their efforts for the past month and advancing for the next month a new idea of some nature which will bring about general co-operation and enthusiasm, have also proved successful.

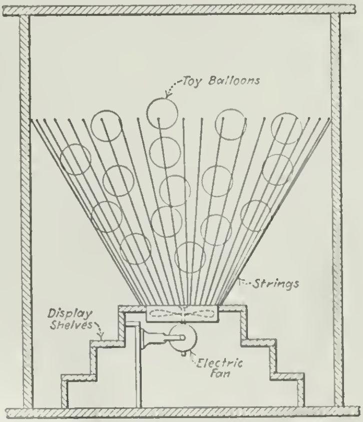
Mr. F. S. Troup is the contract agent for the New Britain division of the United Electric Company.

Displacing Gas-Heated Irons in St. Louis

Mr. C. E. Michel, manager of the appliance department of the Union Electric Light & Power Company, St. Louis, Mo., recently announced that the company would allow its customers $1 on the purchase price of any electric iron if they brought with them their old self-heated gas irons when they called to make their electrical purchases. At the end of the sale the company plans to load the old returned irons onto one of its electric trucks and, after treating them to a ride through the city, properly placarded, will dump the entire lot from the Eads Bridge into the Mississippi River.

A Fan-Driven Window Display

During the winter season a drugstore in Milwaukee, Wis., installed a rather novel electrical display to make its window more attractive. The drawing herewith shows the idea used. An electric fan was hidden beneath the pyramided shelves and sent its blast of air toward the ceiling. Varicolored toy balloons were retained within the fan's zone of action by a basket of strings arranged in the shape of a frustum of a cone. The balloons were driven about with attractive irregularity that compelled attention.



BALLOONS SHOWN IN WINDOW KEPT IN MOTION BY FAN

Illumination and Wiring

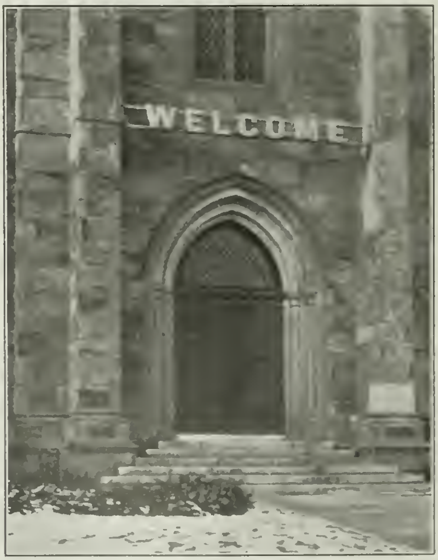
Shooting a Transmission Line Clear of Ice-Laden Branches

A severe sleet storm swept over west central Ohio early in February, putting many telephone and electric power lines out of commission. The 33,000-volt transmission line of the Greenville Electric Light & Power Company traversed the stricken district, and while no damage was done to the circuit itself, the line had to suspend operation owing to the great amount of ice on the insulators and cross-arms and to the falling of trees across the wires.

According to Mr. D. L. Gaskill, president of the Greenville company, a very novel method was finally resorted to in order to clear the line of the ice-laden limbs which dropped into contact with the wires at points between poles. These limbs were ordinarily out of the way of the wires except when bent down under the load of sleet, and their position on the trees was such that it was practically impossible to get at them to cut them off. Some one finally suggested trying a shotgun, and it at once proved entirely successful in clearing the line of these ice-coated limbs. About 300 shells were used altogether in clearing up 26 miles of line. In no case were more than two shots needed to sever the limb and bring it to the ground, and in some instances one shot so dislodged the ice as to allow the limb to return to its normal position.

Church Sign on Central-Station Service

"Welcome" signs of the electrically lighted type are often used by churches making an appeal to the passing stranger, but in many cases the signs are inharmonious with respect to church architecture and do not show to best advantage on account of their location. The accompanying halftone illustrates an electric sign which is in constant use by the First Baptist Church



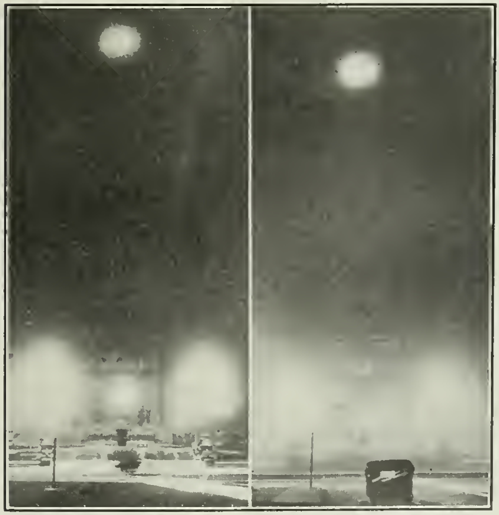
ELECTRIC SIGN FOR CHURCH

of Watertown, Mass., whose edifice is one of the most architecturally beautiful church structures in New England. In this case special care was taken to make the sign conform to the courses of stone blocks forming the tower, a straight horizontal design without superfluous ornamentation being adopted. Placed across the main entrance and directly above the arch, the sign does not detract from the appearance of the building, but conveys the sense of hospitality intended even when viewed from a considerable distance. The sign is 12.5 ft. long and 15 in. high and carries sixty-seven 4-cp lamps supplied from the 110-volt lines of the Boston Edison company. The sign is about 18 ft. above the top of the steps. The letters are painted white and are carried on a light angle-iron with the wiring run in inconspicuous pipe conduit.

Replacing Arc Lamps with Nitrogen-Filled Tungsten Units in Plaza Lighting

The Merchants' Heat & Light Company, Indianapolis, Ind., has just completed an installation of forty-eight 750-watt nitrogen-filled tungsten lamps on the circular plaza surrounding the beautiful Soldiers and Sailors' Monument which stands at the center of the Hoosier capital. The lamps used are the Westinghouse 750-watt multiple type, delivering approximately 1100 cp. The contract with the State of Indiana for the monument lighting called for 5-amp multiple-type arc lamps, and the change to the new high-efficiency tungsten lamps was made voluntarily by the Merchants' company for the purpose of determining the utility of the new illuminants.

The photograph from which Fig. 1 was made was taken while the old installation of arc lamps was still in service. The picture reproduced in Fig. 2, showing the tungsten units, was taken from the same spot as the first and had the same length of exposure. It will be noticed that the intensity of illumination on the plaza is much greater with the new lamps. Fig. 3 shows the west side of the monument where the standards each carry eight lamps. The larger standards on the north side, seen in Fig. 1, have sixteen lamps each. An adequate idea of the superior illumination obtained with the new installation can hardly be gained from the photographs on account of the greater proportion of visual to actinic rays present in the nitrogen lamps compared with the arc units.



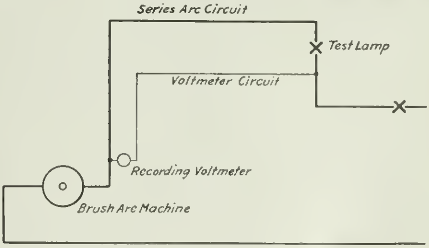
FIGS. 1 AND 2—INDIANAPOLIS MONUMENT LIGHTED BY ARC LAMPS AND BY NITROGEN-FILLED LAMPS

FIG. 3—WEST SIDE STANDARDS EACH EQUIPPED WITH EIGHT 750-WATT NITROGEN-FILLED LAMPS

The fixtures for use with the new incandescent lamps were constructed of old arc-lamp casings. The diffusing globes are of the flaming-arc type and provide for free passage of air around the lamp bulb.

Testing Arc Lamps in Service at Mattoon, Ill.

After a lamp has been taken down from its position in the local lighting series circuit and repaired in the workshop of the municipal electric-light plant at Mattoon, Ill., it is hung on a street corner near the power station to undergo an operating test under actual service conditions. Connections arranged as in the accompanying circuit diagram enable the recording voltmeter in the station to trace a voltage chart showing



VOLTMETER CONNECTIONS FOR TESTING ARC LAMPS IN SERVICE the characteristics of the lamp's operation. This scheme according to Mr. W. S. Bury, city electrician, not only shows up the weak points of the lamp when operating out of doors, but also provides a chart of the system's operation if one is needed for future reference.

Recent Telephone Patents

A telephone-supporting bracket, patented by Mr. Farnham Fox, New York, is arranged to swing in a vertical plane, the base of the telephone set being maintained horizontally for all positions of the bracket. The relation of the parts is similar to that of a pantograph. Two of the arms are, however, hollow troughs, the edges of which are bent to lock together with a sliding contact and form together a rectangular bar. A counterbalance spring runs alongside of the bar, one end being secured to each part. Sufficient friction is maintained at the groove contact by short spiral springs, which tend to push apart the two portions of the bar.

Messrs. C. T. Porter and R. J. Osborne, of San Francisco, Cal., are the joint patentees of an antiseptic device. Sheet-metal clamps are placed between the mouthpiece and the face of the transmitter. The mounting consists of a strip of metal which extends forward above the mouthpiece to a point near the latter's lip. The strip is then carried upward a distance slightly greater than the diameter of the mouthpiece; it is next bent forward a short distance and then downward, this downward part being expanded into a disk slightly larger than the opening of the mouthpiece. A metal-incased pad of antiseptic material is mounted upon a horizontal pin which extends from the lower edge of the disk to the mounting. This pad may be swung down over the mouthpiece or up behind the disk. In this latter position a spring forces it tightly against the rear face of the disk.

Letters to the Editors

Meters on Unbalanced Circuits

To the Editors of the Electrical World:

Sirs: The two articles on polyphase metering in your issue of Jan. 17 deal with a subject that until very recently has not received the attention which it deserves, especially when it is considered that very often the bulk of a central station's income depends on the energy measured by polyphase meters. In both articles it is assumed that the meter elements and the instrument transformers are connected to their proper circuits and that the error in the connections consists only of a reversal in one of the circuits. In a great number of cases that have come to my attention the mistake in the connection was not simply a reversal but generally consisted of one or more incorrect connections of the meter elements or the instrument transformers to their proper source.

The two methods are to some extent based on the assumption that the load is balanced. Such a condition may exist approximately in a great many cases where the meter measures the energy consumed by a loaded three-phase motor. However, very abnormal and peculiar conditions of unbalancing may sometimes exist when a motor is running light. By no means is it permissible to make the assumption of balance on circuits carrying a complex load, as, for example, a load consisting of single-phase and polyphase motors and lamps. Both methods, however, appear to have a wide range of application for unbalanced condition at low power-factor, provided it is definitely certain which of the two elements is the so-called "slow element." In unbalanced conditions the element which on balanced condition would be the low reading one may actually be the high reading element. In the second method, with an unbalanced high power-factor condition and reversal of current phase in the low reading element, the conditions may be such that a forward indication would result when the common potential wire is opened. According to the rule given, a forward indication shows the connection to be correct, which, of course, in this particular case would not be true. Another condition that must be kept in mind is that with an unbalanced condition at high power-factor the difference in speed of the two elements may be mistaken for a condition of low power-factor.

It is not my intention to belittle in any way the effort made by the writers to formulate methods and rules for clearing up what is probably the most troublesome work a meterman is called upon to unravel. Both methods are sure to find useful application by metermen, but they must be used with caution and should not be left to be applied by a person who has no knowledge of meters, as it is claimed may be done with one of the methods. Such rules and methods are like keen-edged tools which work with ease in the hands of the artisan but which may slip when someone else manipulates them, and when this happens an injustice will be done to somebody which may be difficult to rectify or explain.

Albany, N. Y. J. P. Gebelein.

Sheet-Steel Economy in Magnetic Circuits

To the Editors of the Electrical World:

Sirs:—When a manufacturer of steel sheets places a new and highly improved product upon the market theory would lead one to suppose that engineers and designers would rush in and devour the new product. Sheet steel for magnetic structures can be so satisfactorily tested in the course of two weeks that no possible doubt of its character need trouble the most conservative. The fact is, however, that engineers and designers, the exponents of conservation and economy, do no such thing, and it isn't because of the cost of the new article.

Maybe the new material thoroughly justifies a premium price of even a few dollars per ton, which might reflect upon the cost of the average motor as much as the one-one-hundredth of 1 per cent. The keen commercial side of the designer greets the new offer with the argument as follows:

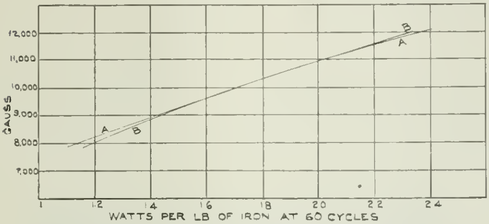
"To get full value from the new material I must change my designs; that means expensive new dies, costly alterations of patterns and new routine. No, I must not do that now, for having done it I am at the mercy of your product—at the mercy of one producer whose caprices may run up the price to me, curtail my supply or hamper my freedom in other ways."

Then there are engineers who are up to the minute sufficiently to regard the high-class steel makers with more confidence. It certainly is consistent for the buyer to return the confidence of the maker who spends his time and money to better the art in which he is so interested. These more generous people keep the new product from starving to death.

To show that it is not necessary to change dies materially or expend money upon pattern changes in order to take advantage of new high-grade materials when offered is the purpose of the following argument:

I present in the accompanying illustration a set of two curves for consideration. Curve A is plotted from the data contained in the literature of a prominent sheet-steel maker and is for 26-gage (0.01875 in.). It represents, I believe, his guaranty. Curve B has been obtained from data of another maker and represents his guaranty. It is for 29 U. S. standard gage (0.01406 in.).

The accompanying table gives data for the various gages concerning the percentage of iron in a given volume of laminated material for 0.001 in., 0.002 in. and 0.003 in. allowed per lamina for insulation, etc. The table also gives the number of laminas occupying 1 in. of built-up structure.



LOSS AT VARYING MAGNETIC DENSITY

Most engineers regard the Epstein test as a proper criterion for the behavior of the steel in the machine. While the iron losses of the apparatus are usually higher than shown by the standard Epstein test, designers have a fair understanding of the reasons therefor, particularly as they apply to their own machines. The curves shown herewith have been based on data obtained by the Epstein method.

Consider a given magnetic circuit to be operated at 10,000 gauses (lines per sq. cm) at sixty cycles. Suppose the structure in question to contain solid steel weighing 100 lb. If now the 29-gage steel of curve A be substituted, the weight will be decreased, but the gross volume will remain constant. If 0.002 in. be allowed for each lamina insulation, the weight, instead of being 100 lb., will be reduced to 87.6 lb., as shown by the accompanying table. Since the net iron is now only 87.6 per cent and the same total induction traverses it as in the case of the solid metal, the net magnetic density is increased from 10,000 gauses to 11,400 gausses. Curve A shows that at this density the 29-gage material has a core loss of 2.10 watts per lb. at sixty cycles. The structure will then have a total loss of 184 watts.

DATA ON IRON IN LAMINATED MATERIAL

Gage, U. S. Std.	Thickness, in Inches	Per cent metal for insulation per lamina of various thicknesses, in inches			Number of sheets per inch for insulation per lamina of various thicknesses, in inches		
		0.001	0.002	0.003	0.001	0.002	0.003
32	0.0102	91.0	83.7	77.2	90.0	82.5	76.0
30	0.0125	92.6	86.1	80.5	74.0	68.9	64.4
29	0.0141	93.4	87.6	82.5	66.4	62.3	58.7
28	0.0156	94.0	88.6	83.7	60.3	56.8	53.7
27	0.0172	94.5	89.6	85.0	55.0	52.2	49.5
26	0.0188	94.9	90.5	86.2	50.6	48.3	46.1
25	0.0219	95.6	91.8	88.0	43.7	42.0	40.3
24	0.0250	96.2	92.6	89.3	38.4	37.0	35.8

In view of the fact that the 26-gage material of curve B is slightly better than even the 29-gage of curve A, let us see what effect the substitution of it would have. A reference to the table will show that the 26-gage material with the 0.002-in. insulation allowance will net 90.5 lb. of metal in the chosen gross volume, or 90.5 per cent iron. Under this condition the net magnetic density will be 11,050 gausses, and curve B shows the loss to be 2.03 watts per lb. Thus the total for the 26-gage structure is 184 watts.

The losses being the same, the two cases may be compared for magnetic reluctances. It is giving the 26-gage material the worst of it to consider, for simplicity's sake, that the 26-gage and 29-gage materials are alike in their permeability characteristics. The chosen volume of the 26-gage material weighs 90.5 lb., while the 29-gage volume weighs only 87.6 lb., or 97 per cent of the net iron section of the former. Where the magnetic densities are high—say in the neighborhood of 20,000 gauses—the extra 3 per cent of metal may mean a reduction of 10 per cent or more in the magnetomotive force required to magnetize the volume.

Reference to the table will show that for the 0.002-in. insulation 62.3 punchings of 29-gage are required per inch of built-up volume, while only 48.3 are required of the 26-gage. Using the heavier gage, then, should easily increase the production of the punching shop (reckoning punchings by weight) by 25 per cent. Each 0.05 cent saved per pound of steel consumed represents a saving of $1 per ton.

The established difference in price between the 29-gage and the 26-gage materials is $3 per ton in favor of the heavier material. It is seen, therefore, that without changing the designs, by using the better material of curve B we increase the production of the punching shop by 25 per cent, reduce the varnish used for insulation, and, even though we do use 3 per cent more metal than before, we still save between $2 and $3 per ton on the raw material.

The fact of the situation is, however, that the average buyer would rather not change gages and make these savings. Of the two or three real dollars per ton saved he is not willing to give the steel maker one for his efforts, expensive research and backed-up guarantees. Even considering the punching-shop increase of capacity, he is not willing to change gages.

Follansbee, W. Va. JOHN G. HOMAN.

Co-operative Electrical Farming

To the Editors of the Electrical World:

SIRS:—I have noted with interest the article "Co-operative Electric Threshing by Iowa Farmers" in your issue of Jan. 24.

This is a most promising development and one especially gratifying to me, since I have so long advocated electric farming in the technical and general press, having been the pioneer in this country in the cause of electrified agriculture, besides pointing out in detail in my recent book, "Electricity for the Farm and Home," the benefits of co-operation in electric farming.

The group of Iowa farmers mentioned should, however, carry their co-operative operations very much further in order to realize the full benefits of various applications of electricity on the farm. One of the most notable advantages of such co-operative farming is electric plowing. The ownership of an electric plow involves entirely too large an investment for the average individual farmer, but its purchase by a group enables its benefits to be reaped by all.

Central-station companies would find it to their advantage to promote co-operative electric farming, since they will thereby establish better load-factors. Co-operative electric farming promises to be the mainstay of a large number of central stations in the next decade.

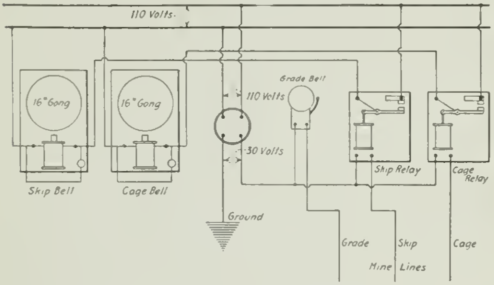
New York. FRANK KOESTER.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Alternating-Current Signal System for Mines

The alternating-current signal system illustrated herewith can be used satisfactorily in mines where direct-current systems have given trouble due to electrolysis. The bells are of the alternating-current solenoid type and are operated by means of a relay from a 110-volt circuit. A small 110/30-volt transformer supplies low-potential energy for the operating circuit, one side of which is common and grounded while the other passes through the respective relays. The ungrounded side of the circuit consists of No. 4 bare copper wire supported on insulators. By grounding any wire its respective bell will ring. This system is used in the Penn Iron Mines in Michigan.



SIGNAL SYSTEM FOR MINES

Remote-Controlled Valves for High-Pressure Fire-Protection System

In New York City, south of Houston Street and east of the Bowery, are two interlacing but independent high-pressure fire-protection systems which are now being connected at three points by remote-controlled motor-operated valves to permit more flexible and reliable operation. The valve-control apparatus is installed in the pumping stations so that if a break occurs in a water main, as indicated by the Venturi charts or pressure gages, the crippled section can be isolated in about one minute. One of the valves is an accessory to the duplex system and the other two are provided for the purpose of separating or uniting the two pumping districts. These valves also permit of supplying both systems from one pumping station when the other becomes inoperative. Each valve is operated by a 5-hp motor placed in a vault beneath the street, where an emergency control board is also installed. The pumping stations, of which there are two, are both motor-operated, energy being supplied by the New York Edison Company.

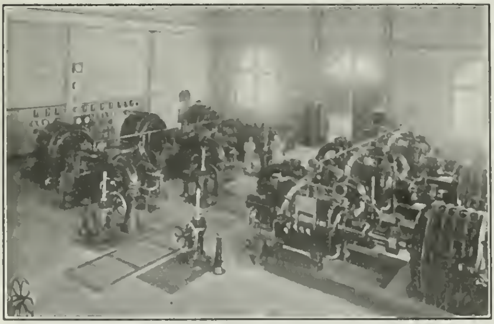


FIG. 1—ONE OF NEW YORK'S MOTOR-DRIVEN PUMPING STATIONS

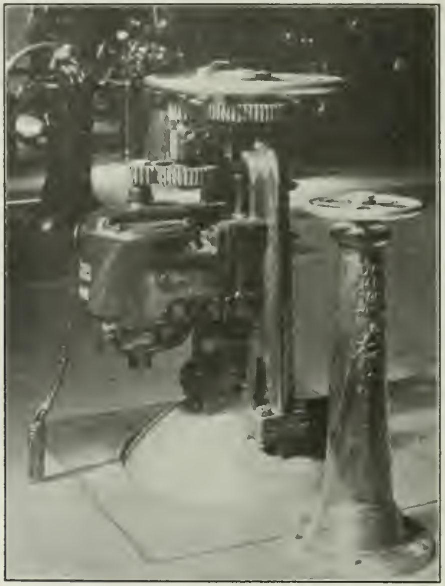


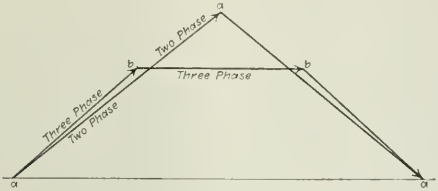
FIG. 2—MOTOR-OPERATED GATE VALVE IN HIGH-PRESSURE FIRE SYSTEM

Converting an Operating Frequency Changer from Two-Phase to Three-Phase

When the Kansas City (Mo.) Electric Light Company began changing over its system from two-phase to three-phase operation the problem of rewinding frequency changers without purchasing additional units became a pressing one. Owing to load conditions on the sixty-cycle system which these machines were supplying it was impossible for the largest of them to be out of service a sufficient period of time to make the change in its coils. There were, however, times each day when the large machine was not on the lines.

A way out of the difficulty was suggested by Mr. R.

K. McMaster, electrical engineer for the company, and, acting upon his suggestion, a portion of the machine was changed each day until the conversion was complete. By the scheme adopted a single pair of poles was changed at a time, and as the three-phase coils were set in place end connections and jumpers were installed so that the new coils might form a part of the two-phase winding delivering two-phase energy to the external circuit. From the vectors in the accompanying diagram showing the phase position of the generated emfs it will be seen that each pair of poles delivered approximately the same amount of energy as when the two-phase winding was in place.

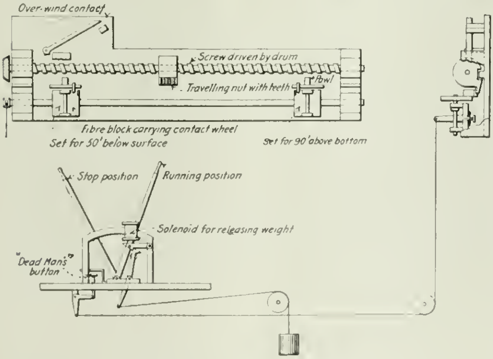


VECTORS FOR ONE PAIR OF POLES

Eight poles of the twenty-pole unit were changed during the first day and eight the second day. On the third day of the work the remaining four poles were changed and the jumper wires were removed, completing the job. During the intervening peak loads the machine was operated in parallel with the other frequency changers of the system, carrying its share of the two-phase load. When the change was complete the re-wound machine was thrown on the three-phase bus and it has since been operating without trouble.

Automatic Control of Hoist Motor

Illustrated herewith is a device which can be adapted to use on mine hoisting apparatus to limit the travel of the cage and to prevent too high acceleration or the overwinding of the hoisting cable. The mechanism consists of an endless screw along which travels a nut actuating three contactors (shown in the drawing) which in turn operate the drum brake and open the clutch. A flyball governor for limiting the rate of acceleration is attached to the intermediate shaft connecting the mechanism with the hoisting drum.


Over-wind contact
Screw driven by drum
Pawl
Travelling nut with teeth
Fibre block carrying contact wheel
Set for 50' below surface
Set for 90' above bottom
Stop position
Running position
Solenoid for releasing weight
"Dead Man's" button

SAFETY DEVICE ON HOISTS

Two of the contactors limit the travel of the hoisting cage while the third prevents overwinding of the cable. The travel-limit contactors may be rendered inoperative by turning the common shaft on which they are mounted through a small angle by pressing on a "dead-man's" floor push, located near the clutch and brake levers. Attached to the lever quadrant is a solenoid trip which when operated by the contactors causes a weight to throw both levers into the "stop" position. This last operation is entirely practicable, as these levers are only master controllers of the oil-operated brake and clutch apparatus.

This scheme of automatic control is being employed with satisfaction at the Penn Iron Mines, Vulcan, Mich.

Cost of Electric Riveting

Will you give me some information on the cost of riveting, using electricity to heat the rivets? J. S. K.

Below are printed data on the cost of riveting with Eveland electric riveters in which alternating-current energy is used only to heat the rivets, the heads being formed by a single manual operation. The figures are based on actual tests with rivets of ordinary length and represent only the cost of energy at 10 cents per kw-hr.

Rivet Diameter, In.	Energy Cost per 1000
0.25	$0.04 to $0.05
0.3125	0.08 to 0.10
0.375	0.12 to 0.14
0.5 to 0.625	0.20 to 0.25

Larger sizes can be riveted at a cost practically proportional to their volume. The labor cost is low with the electric riveter, as one man with a helper can do more work than two men and a forge attendant using pneumatic or other power apparatus.

Pole Fires Caused by Soot on Insulators

We are having an unusual amount of trouble on a section of 30,000-volt transmission line from poles and cross-arms burning. The line passes near a tin-plate factory which emits large quantities of dense smoke and acid fumes. A deposit has been collecting on the insulators for several years. Can the burn-outs be attributed to the smoke? E. E. L.

The deposit which you have noticed on the insulators is probably soot in the form of finely divided carbon. This coating furnishes a path to ground or between conductors, and the resulting leakage currents may be the cause of firing your poles. If the soot deposit is slow in forming, it ought to be possible to prevent repetition of the trouble by periodically cleaning the insulators with a portable compressed-air blower or by hand when the line is de-energized. In case the deposit forms rapidly, it may be necessary to protect the insulators with some sort of covering. On the Pacific Coast one company experienced considerable trouble from insulator break-downs due to the salt sea fog. The insulators were finally inclosed in fog boxes and no further trouble was had. It may be possible that the acid fumes which you mention are absorbed by the cross-arms when they are wet and the tendency to burn-outs increased. Some even more peculiar phenomena than this took place in the East recently where insulated conductors spanning a marsh were continually being eaten away and disintegrated. The trouble was finally traced to acid fumes arising from the stagnant water of the marsh. As glass is more hygroscopic than porcelain, there is more tendency for dust and soot to collect on the former. According to tests recently reported in these columns, dry insulators coated with dirt and soot withstood 75 per cent of their normal break-down voltage for half an hour before failing, whereas the same sooty insulators in a damp atmosphere broke down in a much shorter time because of moisture collected on the surface deposit.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Lifting Magnets.—Karl Metzler.—A mathematical paper on the design of bell-shaped lifting magnets with respect to rise of temperature and minimum cost of material. The cost of material of lifting magnets becomes a minimum if the price of the iron shell equals the price of the winding. The relation $T = 630\ L \div O$ (where T is the rise of temperature of the winding, L the power required for excitation measured in watts, and O the total surface of the coil in square centimeters) permits determining the iron cross-section in such a way that the weight of the winding becomes a maximum. The total ampere-turns obtained from this maximum weight of winding are then separated into iron ampere-turns and air ampere-turns on the supposition of different inductions in the iron. For the final design those values for which the tractive force becomes a maximum are selected from the table. This method is especially suitable for comparative calculations for different winding constructions.—*Elek. u. Masch.* (Vienna), Feb. 22, 1914.

Brush Holders.—J. O. Girdlestone.—An illustrated article giving some details of a new brush-holder construction.—London *Elec. Review*, Jan. 9, 1914.

Lamps and Lighting

Half-Watt Tungsten Lamp.—H. Lux.—An account of a long and elaborate series of tests of a 1000-cp "nitra lamp" for 110 volts and a 1000-cp "half-watt osram lamp" for 115 volts. The photometric curves of the two lamps are given. For the nitra lamp the mean spherical candle-power equals 0.857 time the horizontal candle-power and the mean lower hemispherical candle-power equals 0.912 time the horizontal candle-power. For the half-watt osram lamp the mean spherical candle-power equals 0.832 time the horizontal candle-power and the mean lower hemispherical candle-power equals 0.904 time the horizontal candle-power. Various tables are given of the specific consumption of the lamps and of the ratio of light radiation to power supplied. Some of the principal figures are collected in the table reprinted. Fig. 1 gives the curves of the temperatures of the nitra lamp and the half-watt osram lamp as a function of the watt consumption. Fig. 2 gives the spectral composition of the light of the nitra lamp and of ordinary tungsten lamps. The highest curve is the curve of the nitra lamp and the five lower curves relate to ordinary tungsten lamps at 110, 90, 70, 50 and 40 volts respectively. The abscissas are wave-lengths. The diagram shows clearly how much stronger the nitra lamp is in

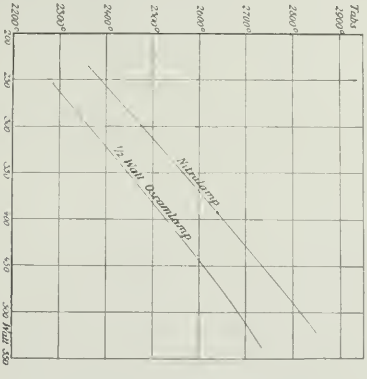


FIG. 1—TEMPERATURE-ENERGY CURVES OF NITRA AND ORDINARY TUNGSTEN LAMPS

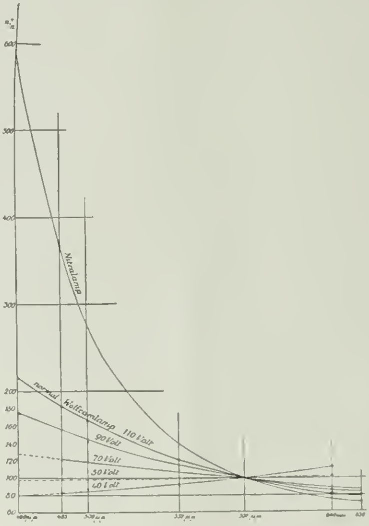


FIG. 2—SPECTRAL COMPOSITION OF LIGHT FROM NITRA AND ORDINARY TUNGSTEN LAMPS

SPECIFIC CONSUMPTION OF LAMPS AND RATIO OF LIGHT RADIATION

	Watts per Mean Spherical Hefner Cp					Watts per Mean Lower Hemispherical Hefner Cp					Ratio of Light Radiation to Power Supply in Per Cent				
Volts	70	90	100	110	115	70	90	100	110	115	70	90	100	110	115
Nitra........	1.486	0.836	0.666	0.567	....	1.396	0.785	0.626	0.533	....	2.06	3.11	4.09	4.82	....
Osram........	2.268	1.206	0.919	0.770	0.686	2.084	1.111	0.846	0.709	0.632	1.39	2.18	2.86	3.61	3.84

blue rays than are ordinary tungsten lamps. For this reason the nitra lamp gives a much whiter light than the ordinary tungsten lamp. But it is still reddish compared with sunlight. By inclosing the lamp in a blue-green globe a light is obtained which is as nearly equal to diffused daylight as may be desired for all purposes where exact color distinction is necessary.—*Zeit. f. Beleucht.*, Jan. 20 and 30, 1914.

Ductile-Filament Tungsten Lamps.—An illustrated description of the "ferrowatt" lamp, the characteristic feature of which is its relatively small size due to the use of a tungsten filament in the form of a spiral, the filament being arranged chiefly in a horizontal position. The maximum candle-power is obtained vertically downward in the direction of the lamp's axis. The 220-volt, 25-cp lamp has a largest diameter of 64 mm (2½ in.) and a height (without the socket) of 64 mm.—*Elek. Zeit.*, Feb. 19, 1914.

Electric Incandescent Lighting Versus Gas.—M. Scholz.—The author discusses to what extent the new "half-watt" tungsten lamp is likely to hurt the gas-lighting industry. He concludes that even with the new lamp and with the relatively low tariff charged in Berlin for public electric lighting the lighting of streets by electricity is more expensive than the use of gas. The same result is claimed for the lighting of store windows, etc. The final conclusion is that even the new half-watt lamp has not yet overcome the economical handicap enjoyed by gas.—*Zeit. f. Beleucht.*, Feb. 10, 1914.

Carbon-Cobalt Filament.—A note on a recent British patent (No. 16,481, 1913) of C. Kanazawa. A raw filament is prepared from a cellulose solution containing cobalt oxide and manganese sulphate in a solution of zinc chloride. This filament is subjected to a white heat in a crucible with graphite under vacuum for more than twenty hours. It is said that the filament is strong, efficient, has a long life and is not affected by vibration.—London *Elec. Eng'ing*, Feb. 19, 1914.

Generation, Transmission and Distribution

Traveling Waves.—Ludwig Binder.—The conclusion of his article, illustrated by diagrams, in which the author gives a hydrodynamic analogy of electric waves traveling along a line. The following special cases are discussed in the present instalment: Reflection of a traveling wave from the end of a line; reflection at a switch; reflection of a discharge wave; reaction of a switching operation upon a machine; entrance of a discharge wave into a machine; transition of a traveling wave from one line into another line of different characteristics, and effect of a short-circuit. While the principal part of the article deals with direct current, a few notes on alternating current are added.—*Elek. Zeit.*, Feb. 19, 1914.

Mechanical Refrigeration.—J. Macintire.—A second article of his illustrated serial on the physico-chemical principles of mechanical refrigeration. In the present instalment the author discusses the compression refrigeration cycle.—*Metall. and Chem. Eng'ing*, March, 1914.

Traction

Electric Locomotives.—Hans Engel.—A description of a new type of locomotive constructed for the electric line from St. Moritz to Schuls, with a branch to Samaden-Pontresina, and known as the Rhaetian railway. It employs seventeen-cycle, single-phase energy at a pressure of 10,000 volts to 11,000 volts. The locomotive must be capable of drawing a train having a total maximum weight of 200 tons, and it was particularly specified that a train having a total weight of 180 tons must be able to start on the gradient of 1 in 40 and attain a speed of 17.5 miles per hour in fifty-two seconds. Further, these trains must travel backward and forward over the entire line from St. Moritz to Schuls four times consecutively—i. e., a total distance of 285 miles—without the electrical equipment becoming excessively heated. The maximum speed is 27.5 miles per hour. The brake specified was of the Hardy vacuum type. The drive is accomplished by two motors, each having an hourly rating of 350 hp. Both motors are connected according to the method known as the double-feed system. On starting the rotor is short-circuited.—*A. E. G. Journal;* abstracted in London *Electrician*, Feb. 20, 1914.

Mountain Railway.—The conclusion of the long, detailed and profusely illustrated description of the Lötschberg railway. In the present instalment the power station and line equipment are dealt with.—London *Electrician*, Feb. 20, 1914.

Installations, Systems and Appliances

British Statistical Tables.—A table of 332 colonial electricity supply stations (in Canada, South Africa, Australia, etc.), giving names of companies, officials, details of equipment, etc. A second table gives a list of 190 supply stations in other countries than Great Britain, a third list gives data of forty colonial electric tramways and a fourth presents data of forty-seven tramway systems in other countries than Great Britain. —Supplement to London *Electrician*, Feb. 20, 1914.

Electrical Industry in France.—M. Soubrier.—An article on the lessons of the exhibition in Ghent, 1913. The author refers to the poor showing of France among other countries in the development of electrical export trade and finds a remedy in a complete reorganization of the professional technical training system.—*La Lumière Elec.*, Feb. 7, 1914.

Wires, Wiring and Conduits

Spacing Distances.—Gino Rebore.—An article on the safe distances which should be maintained between conductors and earth and between conductors and walls in wiring installations.—*Atti dell' Assoc. Elettrot. Italiana*, No. 3, 1913; *La Lumière Elec.*, Jan. 31, 1914.

Cables.—J. B. Sparks.—An article giving comparative tables which permit a rapid comparison of the cost of paper-insulated aluminum cables with copper cables for different prices of aluminum and copper within white limits.—London *Elec. Review*, Jan. 9, 1914; *La Lumière Elec.*, Feb. 14, 1914.

Electrophysics and Magnetism

Electric Resistivity of Brass.—E. F. Northrup.—An article illustrated by diagrams giving the results of an experimental determination of the resistivity of brass from 20 deg. C. to 1100 deg. C. The ratio of the electric resistivity in the liquid condition at the melting point to the electric resistivity in solid condition at the same temperature is 2.37.—*Metall. and Chem. Eng'ing*, March, 1914.

Suppression of the Photoelectric Effect.—K. Fredenhagen and Hans Küstner.—An account of an experimental investigation which thus far has been restricted to zinc, the investigation of other metallic surfaces being still in progress. The results obtained may be summarized as follows: (1) No measurable photoelectric effect can be obtained with pure zinc surfaces when all traces of reactive gases have been removed. That is, the photoelectric effect is less than one-thousandth part of the value found under ordinary experimental conditions. (2) The "fatigue" which occurs in the presence of reactive gases can be accounted for by the reaction with absorbed gases. The "recovery" is explained by the diffusion of reactive gases toward the zinc, whereby the velocity of the reaction, and consequently the strength of the photoelectric current, are conditioned by the concentration of the reactive gases at the zinc surface. The time variation of the photoelectric current can be changed multifariously by suitable combinations of the two processes constituting fatigue and recovery. (3) So long as ionization by collision does not enter as a factor, the pressure of neutral gases has no influence on the magnitude of the photoelectric effect.—*Physik. Zeit.*, No. 2, February, 1914; abstracted in the *Amer. Jour. Science*, March, 1914.

Electrochemistry and Batteries

Electrometallurgy of Iron and Steel.—WOOLSEY MCA. JOHNSON.—After some remarks on iron ore reduction in the electric furnace the author takes up the electrometallurgy of steel for the following three purposes—special steel or alloy steel making, steel castings in foundry work, and electric refining of molten steel for tonnage products. Some other smaller applications of the electric furnace in the metallurgy of steel are also discussed.—*Metall. and Chem. Eng'ng*, March, 1914.

Electric Laboratory Furnace.—ZAY JEFFRIES.—An illustrated article on the "gran-annular" electric furnace. The name implies "granular" because the electric resistor is in the form of grains and "annular" because the grains occupy a space in the furnace of the shape of a hollow cylinder. A description of this furnace is given and the results obtained with kryptol, granular carbon and granular graphite as resistor material are given. A comparison is made with a platinum-wire furnace and notes are added on operation, control of temperature and various uses.—*Metall. and Chem. Eng'ing*, March, 1914.

Ductile Tungsten.—R. W. MOORE.—A paper describing the different steps in reducing tungsten from its ore and in changing metallic tungsten from the brittle to the ductile state.—*Metall. and Chem. Eng'ing*, March, 1914.

Units, Measurements and Instruments

Series Dicharge Tubes.—H. GREINACHER.—If a horn lightning arrester is connected to the poles of a high-tension transformer, an arc is obtained which travels upward between the two horns, is then extinguished. a new arc is formed at the bottom, it in turn travels upward, etc. By taking a photograph of the phenomenon it is seen that the arc consists of series of discharges traveling upward. This fact can be made visible directly to the eye by producing the discharge in a vacuum. In this case no real arc is obtained, but only a so-called brush discharge. Each partial discharge of the transformer produces blue brush discharge streak (negative) and on the opposite wire a point of red light (the so-called anode light). Fig. 4 shows the discharge obtained with a tube for making such experiments, as shown in Fig. 3, which can be evacuated at will. For a certain degree of vacuum the phenomenon is most effective. These tubes may also be fitted with different gases like nitrogen, carbon dioxide, helium, etc. These tubes can be used for the following purposes: First, the character of the current can be determined, as the phenomenon is quite different for alternating current, continuous current and intermittent direct current. Any distortion of an alternating current, for instance, by electrolytic valves, can be seen by means of the discharge tube. Secondly, the tubes show the way in which direct-current interrupters operate. Third, short-time intervals can be easily determined by means of such tubes. The time interval between two brush streaks for alternating current of fifty periods is 0.01 second. If, for instance, the period of exposition of a camera shutter is to be determined, the picture of the series discharges on the plate is counted; if there are five streaks during the operation of the shutter, the exposure is 0.05 second.—*Elek. Zeit.*, Feb. 19, 1914.

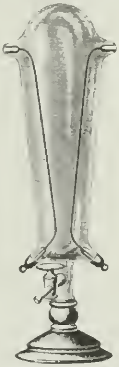


FIG. 3—SERIES DISCHARGE TUBES

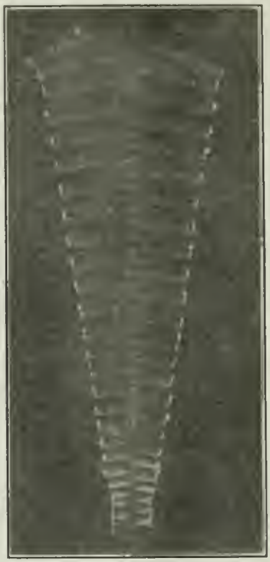


FIG. 4—HIGH-TENSION DISCHARGE BETWEEN HORNS IN A VACUUM

Magnetic Tests of Cast Steel and Cast Iron.—H. SCHÜBBE.—An illustrated article in which the author first describes the ring method and discusses the calibration of the mirror galvanometer and the determination of the mean magnetization curve. He then takes up the yoke method, which is far more convenient, and shows how to apply the correction for the air which is inclosed between the rod and the secondary winding, also the correction for the magnetization of the yoke and the correction for the air inclosed in the contact surface.—*Elek. u. Masch.* (Vienna), Feb. 22, 1914.

Induction Meters.—MANNE SIEGBAHN.—An article illustrated by diagrams in which the author gives a theory of three-phase induction meters (Ferraris meters) on the basis of Maxwell's fundamental equations. For this purpose these equations are written in the form of polar co-ordinates and are essentially simplified for the special conditions of the problem.—*Elek. Zeit.*, Feb. 19, 1914.

Telegraphy, Telephony and Signals

Wheatstone Automatic Telegraph System.—Ricardo Lopez.—An illustrated description of a new method which the author has invented for perforating the paper strips used for the automatic transmission of telegraph signals by the Wheatstone transmitter. The work of perforation is thereby much simplified and can be effected without any other change in the electrical connections or any further training on the part of the operators.—London *Electrician*, Feb. 20, 1914.

Wireless Transmitter.—A. S. Blatterman.—The conclusion of his mathematical paper, in which the author describes in a general way how to calculate the design of a wireless telegraph station. In the present instalment the design of a 5-kw station is given as an example.—London *Electrician*, Feb. 20, 1914.

Wireless Telegraphy.—P. Brenot.—A review of the present status of receiving stations for wireless telegraphy. The author gives details of the receiving antenna, the connections at the receiving stations, constructions of receivers and different types of detectors. —*La Lumière Elec.*, Feb. 14, 1914.

Book Reviews

Taschenbuch für Monteure Elektrischer Beleuchtungsanlagen. By Gottlob Lux and Dr. C. Michalke; revised by Freiherr von Gaisberg. 284 pages, 210 illus. Munich: R. Oldenbourg.

A very practical pocket-book intended for the use of electric-light workers. It contains information as to the nature, construction, mode of operation and maintenance of electric machinery, apparatus and plant, to enable the operator to carry on his duties the more intelligently. The subjects treated of may be judged from the following list of main sections: General preliminaries; machinery; generators; motors; motor-generators and transformers; installation and maintenance; tests for defects; storage batteries; instruments; grounding; arc lamps; vapor lamps; incandescent lamps; conductors, and rules and precautions. The book is written in clear and simple language with plenty of illustrations and diagrams, some of which are rather rough in appearance. There are few tables and fewer formulas. The volume will interest electric-lighting engineers who wish to know what is published in Germany for the use of central-station assistants.

A Reader of Scientific and Technical Spanish. With vocabulary and notes. By Cornelius De Witt Willcox. New York: Sturgis & Walton. 590 pages. Price, $1.75 net.

An excellent textbook of contemporaneous Spanish scientific and technical language intended for the use of English-speaking students already familiar with elementary Spanish and desirous of becoming acquainted with scientific and technological Spanish. The book is divided into nineteen chapters relating to the following topics: Physics, chemistry, the conservation of modern explosives, the utilization of hydraulic power, steam, applications of compressed air, steam turbines, electric energy transmission, mines, bridges, railways, surveying, topography, geography, automobiles, aeronautics, submarines, and the battle of Santiago de Cuba. A good vocabulary index completes the book. The particular series of subjects dealt with is essentially that in which the student of military and naval sciences is most interested. Nevertheless, the treatment is sufficiently broad to invite the interest of students of engineering generally. The volume will be useful to technological colleges and to students intending to take up technical work in Spanish-speaking countries.

Chronique Illustrée du Concours International de Télégraphie Practique; Turin, 1911. Rome, Italy: Ministero delle Poste e dei Telegrafi. Edited by Ferdinando Geronimi. 186 pages, with appendixes of 150 pages, illus.

A handsomely bound and finely illustrated souvenir volume commemorating the International Congress of Practical Telegraphy at Turin in 1911 in conjunction with the Turin exhibition of that year. The volume has been printed mainly in French, although the congress was on Italian soil, in order thereby to be more generally acceptable and readable. Along with the numerous social events described and photographed were a number of Morse and Baudot practical message tests with medals and prizes for speed and accuracy in transmission as awarded by an international jury. The book well commemorates the event which it signalizes.

Deutscher Kalender für Elektrotechniker. 1914. Founded by F. Uppenborn; new edition amplified by G. Dettmar. In two parts. Part I, 648 pages, 229 illus.; Part II, 348 pages, 154 illus.

A carefully worked-out pocket-book for the electrical engineer in two small volumes. The first is in a leatheroid cover for the pocket and the second is in unprotected paper for the bookshelf. Volume I is divided into fourteen sections, relating to the following subjects: Conversion tables; units; magnetism; electricity; measurements; electric machines; transformers; apparatus; generating and distributing stations; electric lighting; motors; miscellaneous public utilities; rules; precautions. A calendar, for notes and engagements, brings up the rear. Volume II is likewise divided into fourteen sections as follows: Electric railways; electric vehicles; telephony; telegraphy; fire annunciators; signal telegraphs; railway block signaling; electric mine firing; electric blocks; lightning protectors; electrochemistry; physics; mathematics; technical tables. The two little volumes contain jointly a very large amount of electrical engineering data and information that will recommend them to those acquainted with the German language and who are interested in European technical practice.

Freileitungsbau-Ortsnetzbau. Ein Leitfaden für Montage- und Projektierungs- Ingenieure Betriebsleiter und Verwaltungsamte. By A. Kapper. 351 illus., 2 tables. Munich and Berlin: R. Oldenbourg. Price, 13 marks.

A very practical engineering textbook and reference book on the construction of poles, masts and other structures for the support of overhead conductors. The book is clearly written and well illustrated. Numerous numerical examples are introduced to indicate the applications of the formulas. The twenty-seven chapters of the book relate to the following topics: Introduction; conducting materials; sag and tension; calculation of supports; stability of poles; bedplate stresses; anchoring; concrete foundations; constructing work; insulators; insulator supports; wire supports; joints; arrangement of conductors; grounding; crossovers; pole erecting; wire erecting; overhead transmission; instruments used in line construction; design; economic spans; economics of overhead construction; distributing conductors; contracts; tools; regulations. From the standpoint of engineering construction for overhead lines of all kinds, the book is one of the most thorough and complete that we have seen. It will recommend itself to all constructing engineers and students of line construction acquainted with the German language.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Chandelier Pull Switch

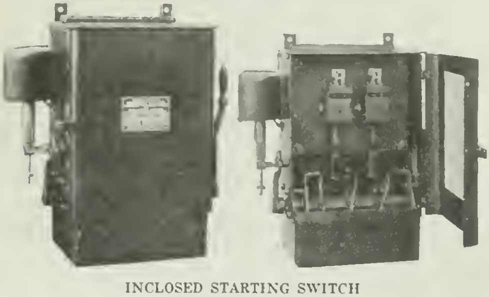
A pull switch which can be attached to the bottom of a chandelier for controlling the lamps installed thereon is being manufactured by the Bryant Electric Company, Bridgeport, Conn. The device is made in two sizes, one known as the standard "New Wrinkle" switch and the other as the electrolier or "Wrinklet" switch. Both types are provided with a 0.125-in. cap and 10 ft. of black linen cord. This cord can be cut off to the desired length, depending upon the height of the ceiling and of the chandelier. A beaded chain takes the wear through the nipple on the bottom of the switch.

PULL SWITCH

Starting Switch for Alternating-Current Motors

The switch shown herewith was designed for throwing directly upon the line squirrel-cage induction motors rated at 7.5 hp or less. The shaft carrying the switch contacts extends through both sides of the inclosing case, the lever for its operation being attached to the right end, while a locking arm is attached to the left end.

The operating lever is held in the "off" position by strong springs. The mechanism is so designed that the lever cannot be moved to the running position until it has first been thrown to the starting position. The switch contacts are oil-immersed, thus utilizing the oil break to minimize sparking and insure long life. The oil tank can be easily removed for inspection or repair of the switch.



INCLOSED STARTING SWITCH

The switch is provided with a low-voltage release coil which shuts the motor down in case of failure of voltage. The magnet coil being de-energized, its core drops and strikes the lever which engages the locking arm and holds the switch closed in the running position, thus tripping the switch and permitting the starting lever to return instantly to the "off" position. This low-voltage release coil is totally inclosed.

Overload relays, which are designed to permit a wide range of adjustment, protect the motor from overloads and prevent it from running single-phase. These relays are mounted inside the inclosing case. If it is desired to stop the motor from remote points, push-button stations may be wired into the low-voltage-release circuit so that when the button is pressed this circuit is opened and the switch tripped in the same manner as when the voltage fails.

This motor-starting switch above described is manufactured by the General Electric Company, Schenectady, N. Y.

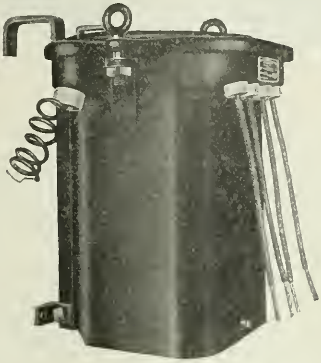
Pressed-Steel Transformer Case

A transformer case for distributing transformers recently developed is of pressed steel, the material used being blue-annealed planished steel plate. The principal advance in design claimed for the new case is that it is much lighter and stronger than the ordinary cast-iron cases that have been in use for the past twenty-five years.

The reduction in weight of transformers is important to the central station, because the cost of handling transformers is a definite, appreciable item of expense to which little attention seems to have been paid heretofore. Transformers are really a tonnage material when considering the handling expense, the lightest and smallest size weighing at least 100 lb. and the medium and larger sizes weighing up to 3000 lb. each for the pole-type sizes. The handling of distributing transformers is necessarily done by the line-crew with "hand-power" and "man-power," which is higher in cost than "horse-power." An average saving in the total transformer weight of 30 per cent claimed by the manufacturers of the new pressed-steel case transformer means practically an average saving of 30 per cent in freight, and since transformers run into considerable weight, the cost for freight is an item of expense which the buyer of distributing transformers must pay directly or indirectly. While it is difficult to get accurate central-station costs for the handling of such heavy material as transformers, fairly close estimates are made, and such estimates show that on 10,000 lb. of transformers shipped 500 miles the freight, cartage, loading, unloading, warehousing, installing, etc., costs about $110. Thus a 30 per cent decrease in weight saves $33.

The percentage of weight reduction (30 per cent) is substantial enough to result in other practical benefits to the central station in permitting larger transformers to be mounted on poles with the same pole-strain safety factor, or permits the use of smaller poles for given transformer sizes.

Reduction in weight with the additional advantage of strength is, of course, very desirable. It is claimed that the new pressed-steel case is not only lighter in weight but much stronger than cast iron, so that the new case will stand up even better to the every-day wear and tear, rough handling in transit, accidental bumps and jars, such as sometimes happen when a transformer is dropped from a pole or wagon. It is said that in tests made recently thirteen blows with a sledge failed to show any injury, except slight indentation of the pressed steel, whereas the ordinary cast-iron case was cracked with the first blow and shattered completely with the second blow. The common cast-iron case will let oil leak through, owing to seepage through the porous material, unless it is carefully japanned, and where the cast iron is imperfect or thin hot transformer oil will seep through the metal and drip. Pressed steel, because of its density and non-porous structure, eliminates the possibility of oil seepage. It is said that tests of the pressed-steel case which has been under development for several years have been thoroughly carried out by its originator, the Pittsburgh Transformer Company, Pittsburgh.

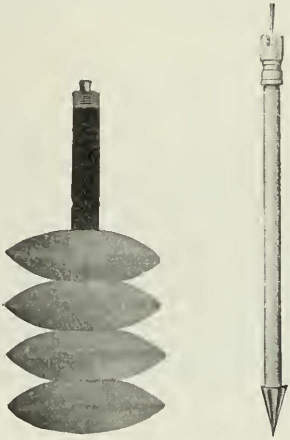

TRANSFORMER WITH PRESSED-STEEL CASE

Grounding Device

The Lord Manufacturing Company, Brooklyn, N. Y., has developed a device for grounding which is made of porous material having an affinity with moisture. Two kinds of these "hydrogrounds" are made, one being of the disk type shown in Fig. 1 and the other of the driving type shown in Fig. 2. In the former four parts of the element in the form of ovoids are mounted in series on a central metallic conducting medium. A large surface contact is thus provided. The diameter of each ovoid is 6 in. An insulated metal stem extends above the top ovoid. The end of the stem is threaded and may be supplied with a coupling into which can be secured an extension. This type is furnished in two lengths, one being 13.5 in. long with a stem extending 6.125 in. above the ovoids and the other 6 ft. 2.125 in. long with a stem 5 ft. 7.625 in. above the ovoids. A lug is provided at the tip of the stem into which copper may be soldered.

In the drive type the element is inclosed in a perforated iron sheath one end of which is fitted with an iron cone and the opposite end with a reducing bushing and a driving cap. A No. 4 B. & S. copper wire is sealed into the center of the element for the entire length of the sheath and extends beyond the driving cap. Metallic contact is made between this conductor and the sheath. The cap is slotted so that the conductor may be protected from damage during driving. To this wire an extension wire may be joined if the pipe extension is not employed.

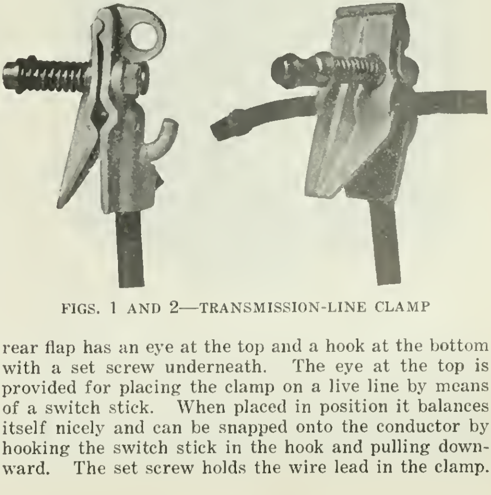
These grounding devices should be set deep in the earth, the depth depending on the character of the soil and the general contour of the earth. It is advisable also to soak the earth surrounding the device with a strong brine.


FIGS. 1 AND 2—DISK TYPE AND DRIVE TYPE

Transmission-Line Clamp

A clamp for grounding transmission and pole lines of any description has been developed and is being placed on the market by Messrs. Hickey & Schneider, 227 Fulton Street, New York. The clamp may also be used for connecting two lines together when one or both of the lines are alive, for connecting transformers of a bank to their respective buses, as a substitute for pole-disconnecting switches and as a jumper between conductors of tower lines of two or more conductors.

The clamp, which is shown herewith, is made of two brass castings, the front flap and the rear flap. The rear flap has an eye at the top and a hook at the bottom with a set screw underneath. The eye at the top is provided for placing the clamp on a live line by means of a switch stick. When placed in position it balances itself nicely and can be snapped onto the conductor by hooking the switch stick in the hook and pulling downward. The set screw holds the wire lead in the clamp.


FIGS. 1 AND 2—TRANSMISSION-LINE CLAMP

The bolts and springs of the clamp are made entirely of brass, thus eliminating all possibility of rust from exposure to the weather. The clamp may be removed from the line by placing the switch stick in the eye and pushing upward. In a test made on one of these clamps it was found that the device carried over 200 amp for two hours with a rise in temperature of only 5 deg.

Graphic Meters

Continuous-writing curve-drawing instruments for measuring electrical quantities such as volts, amperes, watts, etc., are being placed on the market by the Esterline Company, Indianapolis, Ind. Electric speed recorders, service recorders, pyrometers and graphic counters are also included among these devices.

These meters are available as switchboard rear-connected, wall or front-connected, and portable instruments. Their general construction is the same with the exception of the style of the case and the method of making connections.

The direct-writing type method is employed, the pen being in contact with the paper at all times. The pressure of the pen on the paper is regulated by a counterweight adjusted to hold the stylus on the paper with minimum friction.

An eight-day jewel-bearing balance-wheel clock is used. It is provided with two driving springs and a third spring which operates the re-rolling device for winding up the finished chart. On some types the reroll is omitted and the finished record is allowed to be fed out through a slot in the bottom of the case. Different combinations of gears are supplied so that five chart feeds, 0.75 in., 1.5 in., 3 in., 6 in. and 12 in. per hour, may be obtained on any clock by putting on the proper gears. For furnishing rapid chart feeds a special attachment permits the chart feed to be changed instantly from a given number of inches per hour to the same number of inches per minute.

The meter elements are assembled as a unit and may be removed from the instrument without dismantling.

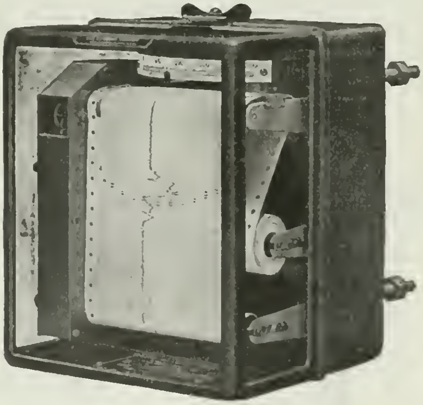


FIG. 1—PORTABLE METER WITH ALUMINUM CASE

For direct-current ammeters and voltmeters a powerful D'Arsonval permanent-magnet-type movement is used. For direct-current and alternating-current wattmeters, alternating-current voltmeters and ammeters, dynamometer construction is employed. No iron is used in the magnetic fields of the dynamometer movements. The armature shaft of the meter element has a bracket which carries pivots in which the pointer carrying the pen rests.

Tape record charts 6 in. wide with a ruled portion 4.5 in. wide are used. The time divisions are in the form of arcs ruled across the paper 0.75 in. apart. Range numbers are provided across the chart to facilitate the interpretation of the curves. The record charts are of sufficient length to last two weeks each at 3 in. per hour.

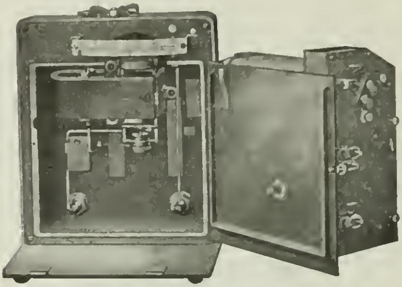


FIG. 2—METER WITH CLOCK DOOR OPEN

The alternating-current instruments have adjustable damping devices consisting of rotating vanes immersed in small cups containing oil or other viscous liquid. The amount of damping is varied by adjusting the height of the cup, the quantity of oil or the quality of the liquid.

The energy consumption of the instruments themselves is so low that they may be operated from shunts or transformers already installed. Voltmeters and wattmeters require from 4 watts to 5 watts for each voltage element subject to a pressure of 110 volts. Direct-current ammeters consisting of millivoltmeters and shunts require only about 0.3 amp. Owing to the direct-writing construction, no extra control circuits are made use of.

Fig. 1 shows a portable meter with an aluminum case. Fig. 2 shows a portable meter with the clock door open.

Electric Passenger Cars at Boston Automobile Show

The twelfth annual automobile show at Boston, Mass., was opened in the Mechanics' Building March 7, to extend through March 14, pleasure cars only being exhibited. Commercial cars will be displayed at another show from March 17 to 21, inclusive. Fifty thousand persons visited the show on the opening night, breaking all records of attendance. The decorations were unusually elaborate. Some of the new products shown at Boston, which were not exhibited at either the New York or Chicago salons, are described in the following paragraphs:

S. R. Bailey & Company, Inc., Boston, Mass., featured an electric roadster seating four passengers, and also a new cabriolet or convertible roadster seating two persons. Its wheelbase is 132 in. and its length over all is 167 in. Sixty cells of Edison A-6 battery are carried in the spaces under the front hood and beneath the floor. The weight of the car is 3100 lb. with standard battery. A feature of the cabriolet lies in the design of the top to facilitate housing the passenger during winter and converting the machine into an open car in summer.

The Waverley Company, Indianapolis, Ind., exhibited a new front-and-rear drive brougham with copyrighted body design and a seating capacity for four. The overall length of the car is 139 in. and its width 66 in. The wheelbase is 106 in. and the inside length, glass to glass, is 67 in. The body design includes a curved drop sill bringing the floor within easy reach of the ground. Separate steering and controller levers and a separate set of brake levers are provided at the rear seat. By the use of a sliding and folding chair construction increased floor space is made available when not more than three passengers are to be carried.

Other exhibitors were the Century Electric Car Company, Detroit, Mich.; W. L. Russell Company, Boston, "Buffalo" electrics; D. C. Tiffany Company, Boston, "Ohio" electrics; Anderson Electric Car Company, Detroit, Mich., "Detroit" electrics; Peerless Motor Car Company, Rauch & Lang electrics; Standard Electric Car Company; W. H. Stevens, Boston; American Storage Battery Company, Boston; Burn-Boston Battery Company, Boston; Holtzer-Cabot Electric Company, Brookline, Mass.; Philadelphia Storage Battery Company, Philadelphia, Pa.; Van Dorn Electric Tool Company, Boston; Columbus Buggy Company, Columbus, Ohio; Herbert S. Potter, Boston; Edison Storage Battery Company, Orange, N. J., and H. W. Johns-Manville Company, Boston.

1500-Volt Direct-Current Locomotives

The Piedmont & Northern Lines, Charlotte, N. C., are placing in service six new 1500-volt direct-current electric locomotives on the Greenville, Spartanburg & Anderson division of their system for heavy freight traffic. Each of these locomotives weighs 65.5 tons, all the weight being on the drivers. The cabs are of the box type, extending nearly the entire length of the underframe.

Each locomotive has four box-frame, commutating-pole motors, which at their normal rating, operating at 1500 volts, two in series, will develop a tractive effort of 17,500 lb. and a speed of 21 m.p.h. One of these locomotives will handle a train of from 800 to 1000 tons gross weight. Each motor is geared to one of the axles, thus making all axles driving axles. A forged pinion is mounted on each armature shaft and meshes into a corresponding solid-steel gear mounted on the axle. The gear ratio is sixty-five to eighteen teeth, making 3.61 gear reduction. The continuous capacity of each motor is 200 amp under forced ventilation and 269 amp at the one-hour rating. For the complete equipment of four motors on a locomotive this is equivalent to a continuously sustained tractive effort of 11,200 lb. at the rail head.

The motor is inclosed and is designed especially for locomotive service. Through the method of forced ventilation employed air is circulated over the armature and field coils, over and through the commutator, through longitudinal holes in the armature core and thence exhausted through openings in the bearing head. A large volume of cool air is thus distributed effectively throughout the motor.

The rheostats are formed of cast-iron grids assembled in frames and insulated with mica. At each end of the rheostat compartment and suspended from the roof of the cab in laterally inclosed steel frames, accessible through lift doors at the sides, are grouped the contactors and the reverser. All mechanism and circuits carrying 1500 volts are thoroughly insulated and protected from accidental contact.

Sprague-General Electric multiple-unit control is employed. The pairs of motors with their respective resistances are all connected in series on the first point of the controller. The resistance is varied through six points and finally short-circuited on the seventh or running point. The pairs of motors are then operated similarly in series-parallel and all resistance is cut out on the twelfth point, which is the full-speed running point. This provides control connections with seven steps in series and five steps in series-parallel. The transition between series and series parallel is effected without opening the motor circuit, and there is no appreciable reduction in tractive effort during the change.

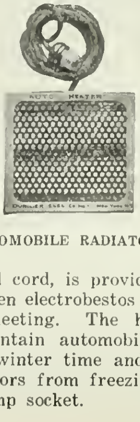
ELECTRIC LOCOMOTIVE

Energy is collected from the trolley wire by an overhead pantograph trolley, which is pneumatically controlled and can be put into service from either engineer's station by a manually operated valve. Some of the local lines are operated at 600 volts and in some cases as low as 500 volts, direct current. A change-over switch is provided for cutting out the dynamotor while the locomotive is operating on low-voltage circuits, so that in such cases energy for the auxiliary control and supply circuits is obtained directly from the trolley circuit. This change-over switch is protected by an automatic relay which makes it impossible to connect 1500-volt trolley energy to the auxiliary circuits of the locomotive.

The locomotives above described were designed and built by the General Electric Company, Schenectady, N. Y.

Automobile Radiator Heater

The Dubilier Electric Company, 63 Fifth Avenue, New York, has placed on the market a small automobile radiator heater, 6 in. by 7 in. by 0.5 in. in size, weighing 2 lb. The apparatus, shown herewith, complete with plug and cord, is provided with a heating unit mounted between electrobestos strips protected by perforated-metal sheeting. The heater is designed particularly to maintain automobile radiators warm over night in the winter time and thus prevent the water in the radiators from freezing. The plug will fit any standard lamp socket.



SMALL AUTOMOBILE RADIATOR HEATER

Jobber, Dealer and Contractor

Electrical Credit Men of Indiana

Members of the Indiana division of the Electrical Credit Association of Chicago recently held a meeting at the Severin Hotel, Indianapolis, and discussed the book-credit systems now in use by the larger electrical companies. The credit standing of various firms was also touched upon. Mr. A. O. Kuehmsted, of Chicago, vice-president of the organization, was present at the meeting. The Electrical Credit Association has branches in various cities, from Cleveland to Denver and from Detroit to Dallas. Much interest in the prospects for the new Indiana organization was evinced by electrical men from all parts of the State.

The Stuff of Which Some Contractors Are Made

An electrical contracting and supply house in Brigham City, Utah, commenting on the caliber of some of the electrical contractors in that territory, writes that some of the boys once engaged by it as helpers are wiring houses away below standard with cheap material. Being in possession of a typewriter and printed letterheads, they are able to purchase 1907 code material from some Eastern supply dealers and thus easily beat the prices of reputable contractors, since there is no inspector in Brigham City and the municipality owns the lighting plant. Besides this, the boys do farmwork and haul coal between times. As there is no inspection of electrical work, the city electrician being elected by one of the political parties, a great many farmers and mechanics also do their own wiring work. The electrical trade, therefore, is progressing slowly in Brigham City and an electrician does not command a very high wage.

Conference on National Electrical Code

The regular meeting of the Electrical Conference was held in the rooms of the meter department of the Philadelphia (Pa.) Electric Company on Feb. 26. Mr. Washington Devereux, of the Philadelphia Fire Underwriters' Association, presided and explained in detail various sections of the National Electrical Code. The meeting was well attended, there being about 250 present, made up of electrical contractors, jobbers and central-station men. Mr. Louis J. Grossman, chairman of the committee on organization, submitted his report, and Mr. M. E. Arnold made a short address on co-operation. Mr. W. K. Kerford, vice-chairman of the conference, spoke of the willingness of the Philadelphia Electric Company to assist the electrical contractor in every way, especially at the time of starting two-phase motors and similar devices. The greater part of the evening was given over to discussions on the rules relative to switchboards and on motor control. These monthly meetings, which have as their object the education of the mechanic or practical man making electrical installations in the best methods and practices, have met with clearly marked success. The inspectors of the Philadelphia Fire Underwriters' Association, the Philadelphia Electric Company's inspectors and municipal inspectors also attended. The discussion is most informal, and any one, no matter what kind of situation he may hold, is free to rise and ask for information. The following officers will serve during the ensuing year. Chairman, Mr. Washington Devereux; vice-chairman, Mr. William Kerford; treasurer, Mr. Herman Eckstein, and secretary, Mr. Richard H. Silbert.

Humor and Pathos of Electrical Contracting

At the recent convention of the Tennessee Electrical Contractors' Association in Memphis Mr. J. A. Fowler, of the Fowler Electric Company of Memphis, dwelt on the pathetic and the humorous sides of the electrical contracting business. He told of a general contractor who had occasion to let a contract for electrical work costing $8,000. The general contractor used an estimate of $10,000 from a local electrical contractor, and after the former had secured the job he proceeded to peddle the electrical work instead of letting it to the electrical contractor whose bid he had used. Working two electrical contractors against each other, he finally secured one who undertook the work for $7,400, or $600 below cost.

The habit of doing work below cost is one of the most pathetic conditions in the electrical contracting business. Its origin is due to the fact that the contractor either does not possess the experience needed to estimate his costs properly or fools himself by not keeping a record of work while it is in progress and thereby has no means for gaging future costs. Unfortunately, this type of contractor who keeps no records is always confident that he is making money. In time, however, he is ruined and injures the creditors. The customer, however, profits, so that there is an element of humor along with an element of pathos. Some contractors make a practice of taking work below cost, expecting to obtain all future business of the customer or with an eye to the extras which may arise on the job. The contractor who pursues these methods is, according to Mr. Fowler, a dangerous element in the business, because in his efforts to protect his losses he violates the terms of his contract and cheats his customer by installing inferior work, besides exposing him and others to the attending dangers. If he does not resort to the foregoing method, he plans to rob his customer or his tenants on the extras he expects to get. One value of an organization such as the National Electrical Contractors' Association, it was pointed out, was shown in the efforts made to rid the business of this very undesirable type of contractor.

A curious intermingling of humor and pathos is found when a building is declared dangerous because of defective electrical work and the owner contracts to have the defects corrected by a contractor who does not know how or one who is dishonest and tries every means to have his work pass inspection, with the result in either case that the remodeled work is as bad as, if not worse than, that condemned, and the customer has spent his money for naught. It is a pathetic travesty on the claims for "safety first" when no effort is made to eliminate dangerous wiring conditions in hotels, rooming houses and workshops where the existence of these conditions is almost as dangerous as the presence of a store of dynamite. The dynamite in any case would be well guarded, but who can guard defective electrical work? The latter may cause trouble in a thousand places and at any time. Mr. Fowler said that the contractor should not let the taunt of self-interest deter him from making public a knowledge of defects. The practice of playing hide-and-seek with the electrical inspector and the owner is fast passing, owing to the co-operative efforts of honest electrical contractors, and while time was when the electrical inspector was forever warring such a condition is now exceptional. As a rule, the contractor meets the inspector more than half way in their mutual effort to turn out work that will stand the test of time and be a monument to the honesty and integrity of the contractor.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Factory of Altorfer Brothers Burned.—Altorfer Brothers Company, which has been manufacturing the "Alco" electric washing machine, and other washing machines, at Roanoke, Ill., has had the misfortune to suffer the complete loss of its factory by fire. Nothing daunted, however, the company has arranged for a temporary factory at Morton, Ill., and is now operating at that point.

Arkansas Hydroelectric Development Projected.—The Arkansas Hydroelectric Company has been incorporated to finance the development of a 10,000-hp water-power site on the Little River, near Heber, Ark. Three dams are to be built and about 100 miles of high-tension transmission line erected. Four 2500-hp generating units are to be installed in the plant, and the estimated cost of the work is $2,000,000.

Babcock & Wilcox Boiler Sales Satisfactory.—Among the larger recent purchasers of Babcock & Wilcox boilers and superheaters are the Bethlehem Steel Company, of South Bethlehem, Pa., which took 6702 hp, with superheaters; the Singer Manufacturing Company, of South Bend, Ind., which took 3120 hp, with superheaters; the Richmond Light & Railway Company, Staten Island, N. Y., which took 2416 hp, with superheaters, and the Middle West Utilities Company, of Kincaid, Ill., taking 1016 hp, with superheaters and chain grates. Other recent purchasers of this company's product in large quantities are the Crucible Steel Company of America, Pittsburgh, Pa., with 1206 hp; C. A. Smith Lumber & Manufacturing Company, of Marshalfield, Ore., with 1206 hp, and the Western Ohio Railroad Company, of St. Mary's Ohio, with 1304 hp, installed.

St. Louis League of Electrical Interests Going After South American Trade.—In an endeavor to increase its export trade in South America the Business Men's League of St. Louis has organized a foreign-trade excursion. The party will leave on April 1 for a visit to Bahia, Rio de Janeiro, San Paulo and Santos in Brazil, Montevideo in Uruguay, Buenos Aires in Argentina, Santiago and Valparaiso in Chile, Lima in Peru and other cities. In this expedition the St. Louis League of Electrical Interests, Jovian Chapter, will be represented by Charles E. Sharp. Mr. Sharp, who is addressed at the Security Building, St. Louis, has been identified with the export trade to Mexico for several years and has had considerable experience with the electrical requirements of that country. He is familiar with the customs of Latin-American people. The business men of St. Louis feel that, with the comparatively recent completion of the Transandine Railroad between Argentina and Chile, and the opening of the Panama Canal which is in prospect, they should be getting in closer touch with the business men in the centers of commerce in South America, so that they may secure a fair share of trade of South American countries.

Battery Manufacturer Planning New Equipment.—The William Roche Electrical Company, of 487 to 489 Greenwich Street, New York, is planning to extend its production facilities by the installation of two metal-frame tamping machines for the manufacture of its dry batteries. It is also planning to establish agencies in some of the larger Eastern cities. William Roche, the president of the concern, has been in the battery manufacturing business for a number of years and his product was used in some of the early signaling work. The United Booking Offices of America, a theatrical booking agency at 1564 Broadway, New York, has a unique installation of this company's batteries, which has made a good record under heavy service. The set operates a time stamp for recording the receipt dates on correspondence and other similar matter entering the office. The stamp functions once every minute for eight or ten hours a day, and the battery set for this service has been in operation for over a year without any renewals. The Roche Company was incorporated some months ago, with William Roche as president, A. I. Hoe as treasurer, and E. L. Ostendorf as secretary and general manager.

General Industrial Bearing of Pending Legislation.—At a dinner of the Westinghouse companies at Pittsburgh, Pa., March 7, Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, gave a talk on the tendencies of the present administration and their bearing on the industrial future of the country in general, and of the Westinghouse companies in particular. His remarks were prefaced with the assertion that he believes with President Wilson that "private monopoly is indefensible and intolerable," and that its prohibition "will bring new men, new energies, and a new spirit of initiative, new blood, into the management of our great business enterprises," "will immensely hearten the young men coming on and will greatly enrich the business activities of the country." Mr. Tripp then took up the five pending administrative measures, which are being drawn up for the purpose of regulating monopolistic tendencies, and told wherein he thought them defective. The Interstate Trade Commission bill he thinks too drastic in its present form, but he believes that it could be modified to include both the Sherman law definitions bill and the trade relations bill, while excluding the portion which he considers objectionable. Mr. Tripp thinks also that the interlocking directorates bill and the anti-holding company bill should be materially changed so as not seriously to interfere with present business methods. If legislation should be framed along these safe and conservative lines, he believes that its effect will not be detrimental to the Westinghouse Electric & Manufacturing Company, since that has always been competitive.

Figures on Tin for 1913.—Statistics on this metal for the year 1913 contain figures of interest to the electrical industry. The total production of the world during that year was 119,000 long tons, of which over 52 per cent was shipped from the Straits Settlements, and nearly 21 per cent from Bolivia. About 4.9 per cent was produced in the Welsh mines in Cornwall. The world's consumption of tin during 1913 was approximately 116,000 long tons, of which over 39 per cent was taken by the United States. For the last ten years the American consumption has generally been higher in the first half of the year than in the second, and in 1913 this was particularly true. The deliveries in this country during March last year came to 5900 tons, the highest figure for a single month within the decade. The lowest figures on American monthly tin deliveries for the past ten years were reached in December, 1907, when only 1200 tons were delivered. The average monthly tin delivery in the United States for the past ten years has been 3400 tons, and the average for the last year was 3660 tons. Average tin prices experienced considerable variation from month to month last year, the high figure of 50.45 being reached in January, and the month of December showing the low average price of 37.64. While the largest ratio between maximum and minimum figures of monthly consumption during 1913 was 2.1, and the largest ratio between maximum and minimum monthly average prices was only 1.3, the largest ratio between the maximum and the minimum products of monthly average consumption and monthly average price was nearly 2.4, indicating that the actual conditions in the tin market during that year were rather more unsettled than the figures on either prices or consumption would seem to show.

Status of Commercial Travelers in Paraguay and Uruguay.—In Paraguay foreign commercial representatives and firms are divided into classes, according to their importance and the volume of business transacted, and the taxes levied are graded from about $500 a year down. That figure represents the tax on the first-class concerns in the prinicipal cities, and the taxes on less important companies and in smaller communities are considerably lower. In many cases the commercial traveler is not required to pay the tax. Samples may be imported, duty free, on deposit of the amount of this duty, which is refunded on the re-exportation of the samples from the port of entry within the period allowed. The Uruguayan government places a license tax on all lines of business, and this applies to the representatives of foreign business houses. In the department of Montevideo this tax amounts to about $200 per year, and it is $100 a year elsewhere in the country. Application for a license is made to the police authorities on a special blank, and the license is valid from the date of issue until Dec. 31. The records show that few travelers pay this tax, as they find it preferable to associate themselves with local licensed firms in most cases. The privilege of free importation of samples has been allowed for years, and the furnishing of satisfactory security for the re-exporting of the goods, within the allowed period, is required. Samples are not allowed this privilege until the traveler has presented his license or proof of his connection with a local licensed firm. Goods are admitted free under bond, temporarily, in order to allow time for securing the license or effecting business connections.

Statement of the Copper Producers' Association for February

Every item in the February report of the Copper Producers' Association showed a decrease from the corresponding figures for January. A very simliar condition was observed during June, 1913, at the time of a marked slump in copper prices of much the same character as the present slump. The decrease in all items seems to be a pretty certain result of general stagnation in the industry. The shortness of the month affects the figures to some extent, and the exports, at a rate of practically 3,000,000 lb. a day, reached record figures. General industry, particularly along the electrical lines, shows increasing activity, and the domestic consumption in March will probably show a fair increase. Foreign deliveries have been above normal for some weeks, and will probably show a decline during March. Production during the present month will probably not suffice to prevent a further reduction of stocks. The complete figures for February are:

	February, pounds		January, pounds	
Stocks on hand in the United States on first of month		87,296,685		91,438,867
Production		122,561,007		131,770,274
		209,857,692		223,209,141
Domestic deliveries.	47,586,657		47,956,955	
Foreign deliveries..	83,899,183		87,955,501	
		131,485,840		135,912,456
Stocks on hand at at end of month..		78,371,852		87,296,685

NEW YORK METAL MARKET PRICES

	Mar. 3		Mar. 10	
Copper:	Bid	Asked	Bid	Asked
Standard spot*	13.50	14.25	13.37½	14.00
	Selling Prices £ s. d.		Selling Prices £ s. d.	
London, standard, spot*. ..	64 2 6		63 18 9	
Prime Lake	14.62½	to 14.87½	....	....
Electrolytic	14.37½	to 14.50	14.25	to 14.35
Casting	14.25	to 14.35	14.10	to 14.20
Copper wire base.........	15.50	to 15.75	15.50	....
Lead	4.00		4.00	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter.....	7.25		7.25	
Spelter, spot	5.32½	to 5.35	5.35	....
Tin, spot	37.90	to 38.25	37.62½	to 37.87½
Aluminum:				
Prompt delivery	18.50	to 18.75	18.37½	to 18.62½
Future	18.50	to 18.75	18.37½	to 18.62½

*OLD METALS

Heavy copper and wire.....................	13.75	13.62½
Brass, heavy	8.87½	8.62½
Brass, light	7.87½	7.62½
Lead, heavy	4.05	4.00
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to March 10...... 13,712

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*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Cities Service Company Status.—The earnings statement of the Cities Service Company, recently issued, covering the year ended Dec. 31, 1913, shows a gross income of $2,172,411 and net earnings of $2,087,063. After deduction of interest and dividends on preferred and common stock, a surplus of $588,797 was realized for the year, making a total accumulated surplus of $2,146,080. These figures cover ten months' operation of the company alone and two months subsequent to its absorption of the Consolidated Cities Light, Power & Traction Company and the Utilities Improvement Company.

Proposed Telephone Merger in Chicago.—The project of the sale of the telephone property of the Chicago Tunnel Company to the American Telephone & Telegraph Company, for the Chicago Telephone Company, is again before the committee on gas, oil and electric light of the Chicago City Council. The price agreed upon by the prospective buyer and seller is $6,300,000, but the consent of the city is needed under the terms of the franchise by which the Chicago Tunnel Company conducts its telephone business. At a meeting of the Council committee on March 5 a resolution was adopted, after a warm debate, setting forth "That it be the sense of this committee that the committee is opposed to a dual system of telephones, provided this action shall not bind the committee to anything relative to the facts and figures of the proposed sale."

Baltimore Utility Planning Stock Issue.—The Consolidated Gas, Electric Light & Power Company filed with the Maryland Public Service Commission on March 6 application for permission to issue $1,106,800 worth of consolidated mortgage debenture stock bearing interest at 5 per cent, with the privilege of conversion at the option of the holder into common stock on the basis of $25 debenture stock for $100 par value common stock. The debenture stock is to be issued under and secured by an indenture of a deed of trust to the Fidelity Trust Company, dated May 1, 1913. The company also applied for permission to issue, when and as needed, for the conversion of the debenture stock, $909,800 of common stock. The company has already issued $3,893,200 debenture stock, convertible into full-paid common stock at the option of the holder at any time prior to July 1, 1916, and the new issue will bring the total amount outstanding up to $5,000,000.

Activities of Virginia-Western Power Company.—W. G. Mathews, president of the Virginia-Western Power Company, gives information of some interest in a letter published by the Central Trust Company of Ilinois as a part of a bond circular. The Virginia-Western Power Company was organized less than a year ago, and took over the physical properties of four electric-service companies operating in the western part of Virginia. The company serves the cities of Clifton Forge and Buena Vista, and the towns of Covington, Lexington and Iron Gate. It has recently purchased electric-service properties in Ronceverte, Lewisburg and Alderson, W. Va., these cities being directly west of the territory already served. At Clifton Forge the company owns a modern steam-turbine plant of two units with total rating of 1725 kw. A 14-mile transmission line extends from Clifton Forge to Covington and Iron Gate. On the North River, near Buena Vista, the company operates two small hydroelectric plants having a rating of 675 kw. There is a small steam plant at Ronceverte with a transmission line of 6 miles to Lewisburg. Energy is furnished for the operation of the Lewisburg & Ronceverte electric railway. At Alderson the company purchases steam power from a milling company, but the transmission of electricity from Ronceverte, 9 miles distant, is contemplated. In Clifton Forge the company sells all of the electrical energy used in the shops of the Chesapeake & Ohio Railroad. Lexington, one of the towns served, is the seat of the Virginia Military Institute, which has a high reputation for the character of its engineering instruction and has furnished a number of electrical engineers well known in the industry. The company has outstanding $300,000 in common stock and $126,000 in 6 per cent preferred stock. It has issued first mortgage 6 per cent bonds of a par value of $325,000.

Annual Summaries of Stone & Webster Properties.—The combined reports of the public utility properties under the control of the Stone & Webster Management Association for the year ended Dec. 31, 1913, show a total capitalization of $186,515,400, of which $86,512,100 represents outstanding securities, $38,092,100 preferred stock outstanding, and the remainder outstanding common stock. Gross earnings total $26,688,521, net earnings of $11,104,764 being realized. Interest charges amounted to $4,432,104 for the year, and during the same period dividends of $4,184,476 were paid. The associated companies own and operate about 1299 miles of single-track electric railway, carrying for the year 341,255,000 passengers. Their total connected lighting load at the end of the year was about 120,700 kw, and their combined commercial motor load was approximately 179,800 hp.

Annual Report of the Mackay Companies.—The financial report of the Mackay Companies for the year ended Feb. 1 showed total assets of $92,469,709, of which $91,997,714 represented investments in other companies, and the rest cash. There was $50,000,000 outstanding in preferred stock and $41,380,400 in common stock, while the surplus came to $1,089,309. The concern is the holding or controlling company for the Postal Telegraph Company and the Commercial Cable Company, and its receipts for the year, including income from investments in these companies, amounted to $4,202,413. Disbursements included a 4 per cent dividend on the preferred and a 5 per cent dividend on the common stock, an operating expense of $30,587, and a balance of $102,805. Clarence H. Mackay, president of the company, in his report to the shareholders stated that it has the largest combined land and ocean telegraph system in the world, although there are larger separate systems of both kinds. He expressed gratification at the outcome of the recent government action concerning the mutual relations of the American Telephone & Telegraph Company and the Western Union Telegraph Company, deprecated the policy of government ownership of telephone and telegraph facilities, and stated that in spite of the commercial expansion of wireless service the extension of both land and water telegraph lines has been progressing. Mr. Mackay said that the concern has no debts and that its preferred stock has not been increased for the past seven years, nor its common stock for the past nine years.

Monarch Electric Company, of Kansas City, Goes Into Bankruptcy.—On Feb. 9 Joseph M. Jones was appointed receiver for the Monarch Electric Company, of Kansas City. The receiver was appointed on the petition of creditors. The Monarch Electric Company was a dealer in electrical and telephone supplies at 1113 Wyandotte Street, Kansas City, Mo. Its officers were: President, F. L. Funsten; treasurer, S. C. Forbes; secretary, R. V. Hughes. The receiver's statement shows liabilities amounting to $82,305.70 and assets $90,422.09. It appears that R. E. Funsten, reported to be the father of the president of the company, advanced the corporation $10,000 in cash, for which he holds $7,138.37 worth of merchandise delivered to him by the corporation. R. E. Funsten also appears as indorser on $14,000 owing to the bank, and to protect himself on this indorsement he holds bills receivable due the corporation to an approximate amount of $10,212.88, which amount is included in the assets as stated. The National Reserve Bank holds a demand note for $750, to which is attached as collateral an assigned contract on which there is a balance due of approximately $2,060.12. The latter sum is also included in bills receivable mentioned in the assets. The contract is practically completed. It appears further that the Commercial Credit & Investment Company has heretofore advanced $7,566.96 to the Monarch Electric Company and has taken as collateral security the assignment of certain accounts and bills receivable in the sum of $9,014.45, which sum is included in the figures representing accounts and bills receivable. In the assets one item of $21,009.92 is given. This represents, according to the receiver, the overdrafts of various and former officers of the corporation, as well as funds of the corporation heretofore disbursed on dividend account, and it is doubtful, in the judgment of the receiver, whether any considerable amount can be realized from this sum.

Business Notes

The Cooper Hewitt Electric Company has appointed E. H. Waddington as district manager for the five states adjacent to Missouri, with headquarters at 1403 Central National Bank Building, St. Louis, Mo.

The Allen Bradley Company, of Milwaukee, Wis., has moved its Chicago office, in charge of F. L. Gohl, to 307 Webster Building, 327 La Salle Street, Chicago, Ill. The change was made necessary by a decided increase in business.

F. E. Gilbert, sales agent for the Bristol Company and the Weston Electrical Instrument Company in the Philadelphia territory, has announced the removal of his office to 303, 304 Hale Building, 1326 Chestnut Street, Philadelphia, Pa.

The Day and Night Sign System, Inc., has moved its office and factory from 424 West Sixth Street to 212 West Eleventh Street, Los Angeles, Cal. J. H. La Pearl is general manager of this company and Alexander Ots is sales manager.

The Eastern Electric Lamp Company, of Hartford, Conn., has opened an office and stock room at 45 Clinton Street, Newark, N. J., under the direction of P. M. Dreyfuss, who will retain his position in charge of the New York office at 47 West Street. The new quarters have been taken because of increased business.

The Terry Steam Turbine Company, of Hartford, Conn., has concluded arrangements with the firm of Fraser & Chalmers, Ltd., 3 London Wall Buildings, London, England, for handling the Terry turbines in England and its colonies, with the exception of Canada. This arrangement does not include marine forced-draft sets, which are to be handled by Yarrow & Company, Ltd., of Scotstoun, Glasgow, Scotland, as heretofore.

The Corbett & De Coursey Company, of Pittsburgh, Pa., has secured the services of J. A. Wahlgren as sales manager. Mr. Wahlgren was formerly assistant sales manager for the Western Electric Company in Buffalo, N. Y. The first-mentioned company is representing the Flexlume Sign Company, of Buffalo, and other concerns in the territory which includes western Pennsylvania, western New York, West Virginia, Ohio, and Indiana, and is in a position to take on some other good lines.

The H. W. Johns-Manville Company, of New York, has moved both its Indianapolis (Ind.) and its Louisville (Ky.) branches in order to secure larger quarters. The new address of the former branch is 408, 410 North Capital Avenue, Indianapolis, Ind., and the latter branch has been moved to 659, 661 South Fourth Avenue, Louisville, Ky. Both branches will have ample storage capacity and showrooms and a service department for the convenience of the company's customers in automobile accessories.

The Central Foundry Company, of 90 West Street, New York City, has taken over the business of the E. P. Morris Iron Works, 136 Liberty Street, but the sales end of the latter concern's operation will continue to be handled under the same name and at the same address as hitherto. Both companies have been active in the manufacture of cast-iron products, and the latter has supplied to the trade an extensive line of ornamental poles, brackets, and standards for street-lighting and combination trolley service.

New Industrial Companies

The Coles Company, of Akron, Ohio, has been incorporated with a capital stock of $1,000 by E. E. Otis and C. F. Berry. The company purposes to manufacture electrical appliances.

The E. E. Electric Sign Company, of Chicago, Ill., has been incorporated with a capital stock of $10,000 to manufacture and deal in electric signs. The incorporators are C. P. Barnett, J. C. Morgan, J. C. and G. C. Eubank and C. B. Boles.

Rogers & Hilton, of Syracuse, N. Y., have been incorporated by F. S. Rogers, J. S. Hilton and T. H. Hilton, of Syracuse. The company is capitalized at $25,000 and purposes to do a general electrical and mechanical engineering and contracting business.

The Acme Register Company, of Portland, Maine, has filed articles of incorporation under the laws of the State of Maine with a capital stock of $500,000. The company purposes to manufacture and deal in electrical devices or machines for registering, signaling, etc. The officers are R. A. Worth, president, and E. C. Keith, treasurer, both of Portland.

The Battery Equipment & Engineering Company, of Chicago, Ill., has been granted a charter with a capital stock of $1,000 to manufacture and deal in batteries, supplies, machinery, etc. The incorporators are David H. Jackson, Wilson K. Kline and R. M. Carroll.

Trade Publications

Oil-Filtering Systems.—S. F. Bowser & Company, Inc., Fort Wayne, Ind., are sending out a four-page circular telling the story in words and pictures of how a Bowser oil filter will save money. This company manufactures filters with capacities of from 5 gal. to 7000 gal. or more per day, built upon the dry system of filtration. Illustrations are shown of installations of the Bowser oil-filtering system in many industries.

Lifting Magnets.—The Electric Controller & Manufacturing Company, of Cleveland, Ohio, has recently issued, as an addition to its bulletin catalog, a reprint of an article by H. F. Stratton in *The Foundry* and the *Iron Trade Review* on the "Application of Electric Power in the Foundry." The paper touches on various motor-operated foundry tools, but is largely devoted to a general discussion of the uses of lifting magnets in the foundry.

Door Safety Switches.—An eight-page pamphlet on door safety switches for use with electric elevators has just been published by the Cutler-Hammer Manufacturing Company, of Milwaukee. Accidents on all types of elevators are often the result of setting the elevator machine in motion before the doors are closed and locked and the passengers clear. With the ever-increasing number of elevator passengers the safety feature is of utmost importance.

Signal Systems.—The application of electricity in the operation of hospital signal systems is the subject of the latest publication of the Holtzer Cabot Electric Company, of Brookline, Mass. Among the different pieces of apparatus illustrated and described for this service are extension push buttons, elapsed time recorders, buzzers, signal lamps and auxiliary equipment. Several complete systems are shown and described with plan views of the methods of installation.

Automatic Cut-off Valves.—The latest bulletin issued by the Lagonda Manufacturing Company, of Springfield, Ohio, on automatic cut-off valves, is an excellent example of the present-day type of engineering catalog, which is looked upon by engineers and plant managers as a text of concise information. This book takes up the causes and effects of water hammer in boilers, the effect of cutting in boilers below or above the pressure of the steam header, the specifications of boiler insurance companies, and the methods of government tests.

Brackets and Pole-Line Hardware.—The Hubbard Reference Book for 1914, recently issued by Hubbard & Company, of Pittsburgh, Pa., is an interesting and exhaustive catalog on the pole-line hardware put out by that company, including also the Pierce brackets, pins, poles, anchors and other transmission-line supplies. The book contains numerous photographs of actual installations of the above apparatus and gives also complete information as to the dimensions and prices of the same. Two special features of the book are a tabulation of the transmission-line construction details for 131 different high-tension systems and elevations of a number of different standard polyphase pole-line constructions.

Personal Mention

Mr. Percy W. Winters has been appointed manager of the Harrison (Ark.) Electric Light & Ice Company.

Mr. O. C. Small has succeeded Mr. L. C. Davis as editor of the *Union Electric Bulletin* of the Union Electric Light & Power Company of St. Louis.

Mr. James Ray Thomas resigned March 1 as superintendent of the Crawfordsville (Ind.) Electric Light & Power Company, a municipal plant.

Mr. John Gordon has been appointed foreman electrical engineer of the car department of the Grand Trunk Pacific Railway at Transcona, Man.

Mr. William J. Norton, of Norton & Bird, consulting engineers, Chicago, has been appointed one of the statesmen-at-large for the Jovian Order.

Mr. S. B. Clark has been appointed superintendent of construction of the Northwestern Electric Company of Portland, vice Mr. F. J. Walsh, resigned.

Mr. Charles A. Edwards, of Huntington, Ind., assumed his duties as a member of the Indiana Public Service Commission March 1, taking the place of Mr. Frank E. Payne, of Jeffersonville.

Mr. Richard C. Smith has resigned as sales agent of the Safety Insulated Wire & Cable Company to represent the Bishop Gutta-Percha Company of New York as traveling sales representative.

Mr. C. A. Learned, manager of the Meriden (Conn.) Gas & Electric Light Company, was elected president of the New England Association of Gas Engineers at its recent convention at Boston.

Mr. R. E. Flower, formerly contract agent for the Mobile Electric Company, Mobile, Ala., has been appointed assistant commercial manager of the Louisville Gas & Electric Company, Louisville, Ky.

Mr. J. E. Noeggerath, consulting engineer, New York, has returned from a seven months' trip to Belgium, Germany and Switzerland, where he made a special study of oil engines and centrifugal pumps.

Mr. Frederick L. Thornton has resigned as assistant auditor of the Kansas City (Mo.) Electric Light Company to become a member of the staff of Arthur Young & Company, certified accountants of that city.

Mr. John Kilgour, for many years president of the Cincinnati & Suburban Bell Telephone Company, has retired from active connection with the affairs of the company. His son, Mr. Bayard L. Kilgour, has succeeded him.

Mr. R. S. Hale, superintendent of the research department of the Edison Electric Illuminating Company of Boston, has returned from his honeymoon tour abroad, during the course of which he visited England, France, Germany, Switzerland and Italy.

Mr. F. J. Walsh, superintendent of construction for the Northwestern Electric Company of Portland, Ore., was tendered a banquet at the Multnomah Hotel, Portland, on severing his connection with the company to become chief engineer of the port of Astoria, Ore.

Mr. R. Vance Pearson, who has been connected with the electric line and service department of the Utah Light & Railway Company for the past ten years in Salt Lake City and Ogden, Utah, has been appointed to represent the company in the commercial field at Ogden.

Mr. Britton I. Budd, president of the Metropolitan West Side Elevated Railway Company and the other elevated railway companies of Chicago, was elected president of the Illinois Electric Railways Association at the annual convention of the association in Springfield, Ill., on March 6.

Mr. J. H. Trimmingham, who was assistant to the chief engineer of the Electrical Commission of the city of Montreal, Que., has been appointed superintendent of power for the Sherbrooke Railway & Power Company, Sherbrooke, Que., succeeding Mr. J. B. Woodyatt, who is now engaged with the Southern Canada Power Company.

Mr. Eugene H. Beil has been appointed manager of the Youngstown (Ohio) Consolidated Gas & Electric Company. Mr. Beil was in the employ of the Youngstown Consolidated Gas & Electric Company for fifteen years and severed his connection with the company three years ago to accept the position of electrical engineer with the firm of Day & Zimmerman, of Philadelphia, which position he now relinquishes to return to the Youngstown company.

Mr. L. N. Whitney, until recently general manager for the Central Union Telephone Company in Indiana, with headquarters in Indianapolis, is now general commercial superintendent of the New England Telephone & Telegraph Company, with headquarters in Boston. Mr. Whitney is a graduate of the Massachusetts Institute of Technology, class of 1896, and he has been a Bell telephone man during all of his business life. He was popular in Indianapolis.

Mr. Bert H. Peck has been appointed city telephone supervisor of Chicago. Mr. Peck will have charge of the telephone complaint bureau of the city, established by the terms of the telephone rate ordinance, under the supervision of Mr. Ray Palmer, commissioner of gas and electricity. Mr. Peck is a graduate of the University of Wisconsin in electrical engineering (class of 1906) and is a member of the American Institute of Electrical Engineers. He was until recently connected with the Chicago office of D. C. & Wm. B. Jackson, engineers.

Mr. Francis Edward Gobey, superintendent of rolling stock of the Lancashire & Yorkshire Railway, Manchester, England, is visiting the United States in company with Messrs. David Halliwell and S. C. Povey, of the same company, to make a study of American high-tension electrified railway lines. Particular attention will be paid to third-rail practice in view of the further electrification of the Lancashire & Yorkshire Railway. The party arrived on the *Lusitania* March 6 and plans to remain in the United States about one month.

Mr. Emil Huber-Stockar, engineer in charge for the Swiss government of the electrification of the Gothard tunnel, is visiting this country for the purpose of studying the operation of heavy electric railway systems, especially the New York terminal installations of the New York Central, Pennsylvania and New Haven railroads. Mr. Huber was formerly technical and managing director of the Oerlikon Company, near Zurich, Switzerland, and is president of the Swiss National Committee of the International Electrotechnical Commission. He will deliver an address on heavy electric traction before the New York Railroad Club on March 20.

Mr. F. N. Jewett, sales manager of the Wagner Electric Manufacturing Company, St. Louis, Mo., has had to relinquish the duties and responsibilities of his position temporarily because of a recent nervous collapse. He will, however, retain his connection with the Wagner company in the capacity of assistant to the executive officers. For the present he will devote his energies primarily to the restoration of his health, and will undertake only such duties as the state of his health will permit. Mr. Jewett's many friends are gratified to learn that his condition is showing very satisfactory, though somewhat slow, improvement, with the assurance of complete recovery in time. Mr. Jewett is a graduate of Cornell University, class of 1893. After graduation he entered the experimental department of the Payne Engine Company, Elmira, N. Y., where he remained until 1895. In 1895 he entered the New York sales office of this same company. He remained there until 1896, when the company went out of business. From 1896 to 1899 Mr. Jewett was with Evans, Almirall & Company, of New York, as salesman, and from 1900 to 1906 he was Western manager of the company, with headquarters in Chicago. In 1906 Mr. Jewett resigned and accepted a position with the Wagner Electric Manufacturing Company as manager of the Chicago district. Three years later he was made sales manager. Mr. Jewett is a member of the American Society of Mechanical Engineers, a member of the Society of Heating and Ventilating Engineers and an associate of the American Institute of Electrical Engineers.

F. N. JEWETT

Mr. Lynn C. Davis, for a number of years connected with the Union Electric Light & Power Company, of St. Louis, and its predecessors, resigned recently to accept a position on the editorial staff of the St. Louis *Post-Dispatch*. Mr. Davis was publicity agent of the company and editor of the *Union Electric Bulletin*. For several years he has been doing daily newspaper work "on the side," and he recently decided to give all his time to this work. Mr. Davis is a fluent writer of both prose and verse. He conducts a department in the *Post-Dispatch* known as "Sport Salad."

Prof. Allan B. Field, of the department of mechanical engineering of the Victoria University, Manchester, England, who has been on a short visit to this country, sailed for Liverpool on the S. S. *Lusitania* on March 10. He is well known in this country, having been for many years connected with the Bullock and Allis-Chalmers companies in charge of their alternating-current departments at Cincinnati and Milwaukee. During the last four years spent in America he was in charge of the steam-generator work of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Obituary

Burt Crouch, assistant sales manager of the St. Louis office of the Western Electric Company, is believed to have lost his life in the disastrous fire which destroyed the Missouri Athletic Club, St. Louis, March 9, causing the death of more than thirty persons. Mr. Crouch lived at the club and has been missing since the early morning disaster. He was about thirty-four years of age and unmarried. Before joining the forces of the Western Electric Company Mr. Crouch was employed by the Union Electric Light & Power Company. He was popular among the electrical men of St. Louis.

Frederick J. Newman, president of the Chicago Electric Motor Car Company, died at his home in Chicago on March 8, aged thirty-six years, after a long illness. Mr. Newman was well known in electrical and automobile circles in Chicago. For a number of years he was connected with the Woods Motor Vehicle Company of Chicago, being chief engineer and second vice-president at the time of his retirement to organize the Chicago Electric Motor Car Company, which he did about two years ago. Mr. Newman was born in Milwaukee and was a graduate of the University of Wisconsin. He leaves a wife and two children.

John Gott, chief electrician of the Commercial Cable Company, died of pneumonia and pleurisy at Brighton, England, March 8, at the age of seventy-four years. Always eminent as a submarine-telegraph engineer, Mr. Gott attracted the widest attention within the last year by the successful operation of his invention by which Morse characters can be sent through ocean cables and received in the same way as ordinary signals on land lines. As described in the *Electrical World* of March 29, 1913, page 659, each impulse of each letter is of reverse polarity, so that each impulse has the effect of neutralizing the preceding one, thus making for the greatest definition. With the Gott system a single circuit has been effectively operated from San Francisco to London. Born in 1840, young Gott entered the service of the Electric International Telegraph Company at the age of twelve. In 1861 he was stationed at Naples with the Italian telegraph system, and in 1863 was transferred to Alexandria in Egypt, meanwhile assisting in laying cables in the Mediterranean Sea. In 1865 he was one of the crew of the *Great Eastern* during its attempts to lay a transatlantic cable. Besides the reverse-impulse method of cable transmission above mentioned, Mr. Gott devised an improved fault-finder for locating cable leaks, a quadruplex system for land lines and an improved method of working submarine cables.

Construction

New England

WEYBRIDGE, VT.—Thompson, Shaw & Co., owners of the local electric-light plant, contemplate installing a larger generator within the next 18 months, but have not yet decided upon the time of installation.

ASHBY, MASS.—At a town meeting held March 2 a committee, consisting of John A. Pipe, chairman, Curtis Huckins and William Foresman, was appointed to investigate the question of obtaining a 24-hour electric service and report at a meeting to be held March 30. W. O. Loveland is owner of the local electric-light plant.

CAMBRIDGE, MASS.—The Cambridge El. Lt. Co. expects to purchase some electrolytic lightning arresters. Welles E. Holmes is treasurer and general manager.

HOLYOKE, MASS.—Within the next three months the electric light commissioners expect to erect an addition to municipal power house. Contracts have already been placed for one 4000-kw Westinghouse turbine, one switchboard panel and condenser. A. W. Derby is superintendent.

SPRINGFIELD, MASS.—The Crocker-Wheeler Co., of Ampere, N. J., has submitted a proposal to the city property committee offering to install a generator and other equipment in the municipal heating plant to furnish electricity for lighting the municipal group, the Central High and High School of Commerce buildings at the rate of from 4 cents to 5 cents per kw-hr. At the end of five years the company agrees to turn the equipment over to the city without further cost.

Middle Atlantic

ARGYLE, N. Y.—The Board of Supervisors of Washington County has authorized the committee to advertise for bids for the installation of an electric-lighting system in the county almshouse in Argyle, the cost not to exceed $3,000.

BATH, N. Y.—At an election held March 3 the proposal to issue $50,000 in bonds for the construction of a municipal lighting plant was carried. J. W. Taggent is village clerk.

FULTON, N. Y.—The Board of Public Works is considering plans and specifications for the proposed street-lighting contract. The agreement calls for not less than 400 6.6-amp tungsten lamps for a period of ten years. The city is to have an option on the purchase of the lighting system, exclusive of power house, until Dec. 31, 1917, at the physical value of the lighting system at the time of purchase.

HANNAWA FALLS, N. Y.—The Hannawa Falls Wtr. Pwr. Co. will build a new dam at Hannawa Falls to replace the old dam, which was badly damaged on Feb. 28.

ONEIDA, N. Y.—We are advised that the distributing system to be installed by the Kenwood El. Lt. Co. in certain parts of Oneida and Vernon for the purpose of furnishing electricity to the two villages is practically completed. The company is waiting for permission to be granted by the Public Service Commission to operate the system. An item stating that the company had made application to the Public Service Commission for permission to construct and operate transmission lines in the above towns was published in the issue of Feb. 21. H. V. Noyes is proprietor of the Kenwood El. Lt. Co. and the Oneida Community, Ltd.

BELLEVUE, PA.—The City Council has awarded a contract to the Duquesne Lt. Co., of Pittsburgh, for the installation of 32 arc lamps, to be placed at once on the principal business blocks. Bids are now being asked for the installation of a police signal system.

HOMER CITY, PA.—The City Council has appointed a committee to make investigations relative to the installation of a municipal electric-light plant. S. C. Steele is chairman of the committee.

PHILADELPHIA, PA.—The Philadelphia El. Co. is negotiating with William H. Steigerwalt for a lease of the property at 1004 Chestnut Street, on which it proposes to erect an addition to its present power house at Tenth and Chestnut Streets. Plans for the proposed extension will be prepared by John T. Windrim, architect, Commonwealth Building, Philadelphia.

PITTSBURGH, PA.—Bids will be received at the United States Engineer Office, Pittsburgh, Pa., until April 1, for furnishing and delivering steel maneuver boat hulls, engines, steamboat and hand capstans, electric-light plants, derricks, kevels, spuds, etc., for dams Nos. 1, 7, 9 and 28 on the Ohio River. Further information may be obtained upon application to Lt.-Col. Francis R. Shunk.

BEACH HAVEN, N. J.—The Borough Council is reported to have granted the Holmes El. Lt. & Pwr. Co., of Baltimore, Md., an electric-light franchise in Beach Haven.

ELMER, N. J.—We are informed that the borough of Elmer does not contemplate the installation of an electric-lighting system, as reported in the issue of Jan. 24. Hiram Van Meter is borough clerk.

MERCHANTVILLE, N. J.—We are informed that no definite action has yet been taken by the Borough Council relative to the installation of a municipal electric-light plant. W. F. McAllister is clerk. Reported in the issue of Feb. 28 to have received estimate for an electric-lighting plant.

NEWARK, N. J.—Bids will be received by the public building committee of the Board of Chosen Freeholders of the County of Essex, County Court House, Newark, N. J., until March 18, for furnishing material and for construction of a tuberculosis hospital at Overbrook, in the town of Cedar Grove, in accordance with plans and specifications prepared by Herman Kreitler, John F. Capen and Joseph B. Allen, architects. Separate bids will be received as follows: (1) masonry, carpentry, plumbing and painting work; (2) heating and ventilation work; (3) electric-lighting and power work. Copies of plans and specifications may be obtained upon application at the office of John F. Capen, 207 Market Street, Newark, architect, upon deposit of $25. Walter A. Evans is director of committee on public buildings.

CUMBERLAND, MD.—The Edison El. Illg. Co., of Cumberland, expects to erect a power house during the coming year; as yet nothing definite has been decided upon. W. M. Roberts, Jr., is general manager.

WOODSBORO, MD.—The Council is considering the question of submitting to the voters the proposal to issue $10,000 in bonds for the installation of an electric-lighting system and water-works.

MORGANTOWN, W. VA.—Plans have been prepared by W. S. Barstow & Co., 50 Pine Street, New York, N. Y., for extensive improvements to the system of the West Virginia Lt. & Trac. Co., of Morgantown, including the erection of a brick, steel and reinforced concrete power house (100 ft. by 150 ft., one story high), the installation of water-tube boilers, turbo-generators, water heaters, pumps, high-pressure piping, transmission equipment, etc. The cost of the work is estimated at $200,000.

BASIC CITY, VA.—The managers of municipal electric-light plant are erecting distributing lines and extending the street-lighting system. R. K. Stoutamyer is superintendent of lights.

SCOTTSVILLE, VA.—The installation of an electric-light plant and water-works system in Scottsville is under consideration. A committee has been appointed to look into the matter.

WASHINGTON, D. C.—Bids will be received at the engineer depot, United States Army, Washington Barracks, D. C., until March 17 for furnishing armored duplex, rubber-insulated, lead-sheathed cable as follows: (1) 19,500 ft. 81 circ. mils; (2) 4500 ft. 26,300 circ. mils; (3) 3020 ft. 106,000 circ. mils; unarmored duplex, rubber-insulated, lead-sheathed cable; (4) 5200 ft. 81 circ. mils. For further information address Lt.-Col. Joseph E. Kuhn.

WASHINGTON, D. C.—Following the installation of the new lighting system on Pennsylvania Avenue between the Peace Monument and the Treasury Building, plans are being made for improvements of other business sections of the city. Arc lamps (of the same type as those in Pennsylvania Avenue) will be installed on every thoroughfare between Seventh and Fifteenth Streets and Pennsylvania Avenue and G Street. In other sections of the business district 100-watt incandescent lamps will be installed, similar to those on Massachusetts Avenue and Union Station Plaza. Plans for these improvements have been practically completed and work will begin as soon as they are approved by the District Commissioners. The cost of the installation is estimated at $50,000 and will be borne by the Potomac El. Pwr. Co.

WASHINGTON, D. C.—Bids will be received at the engineer depot, United States Army, Washington Barracks, D. C., until March 17 for furnishing water-tight electric fixtures and accessories, including 110 water-tight service boxes without outlet couplings, 24 water-tight service boxes without cut-out or fuses, 38 water-tight service boxes with cut-out and six 75-amp fuses, 41 water-tight boxes without cut-out or fuses, 815 type X outlet couplings, 160 type Y outlet couplings and junction boxes with covers and gaskets as follows: 76 two-way, 93 three-way and 28 four-way. Bids will also be received at the same time and place for furnishing the following cable hangers, complete, with screws and expansion bolts: 5570 type O, 485 type 4, 25 type 6 and 1000 type 8. For further information address Lt.-Col. Joseph E. Kuhn, U. S. A.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 31, for furnishing at the various navy yards and naval stations the following supplies: Brooklyn, N. Y., Schedule 6512—eight tube cleaners, 130 low-pressure composition unions, eight 8½-in. dial engine-room clocks; Schedule 6511—25,000 lb. naval bar brass. Boston, Mass., Schedule 6512—42 crucibles for melting composition, miscellaneous composition pipe fittings, 372 low-pressure composition unions; Schedule 6511—2060 lb. sheet brass, 2320 lb. sheet copper. Philadelphia, Pa., Schedule 6501—200 storage batteries for gun firing, etc.; Schedule 6512—300 ft. ¾-in. flexible-copper hose. Annapolis, Md., Schedule 6507—two blinker and speed light controllers, miscellaneous telegraph, rudder indicators, etc., two blinker and truck lamps, miscellaneous contact makers, etc., two telephones (type A, B, C, P and CN); Schedule 6500—18 portable desk lamps. Brooklyn, N. Y., Schedule 6506—one fire-control system. Washington, D. C., Schedule 6495—one motor-driven radial drill. Bids will also be received until April 14 as follows: Schedule 6514—annual supply of cotton and rubber insulating tapes for all naval stations and navy yards. Applications for schedule should designate the schedule desired by number. T. J. Cowie is paymaster general, U. S. N.

North Central

ANN ARBOR, MICH.—The Ann Arbor Merchants' Credit Association and the Business Men's Club are considering the question of installing a new street-lighting system in Ann Arbor.

AU SABLE, MICH.—The Au Sable El. Co., a subsidiary of the Commonwealth Pwr., Ry. & Lt. Co., has issued a mortgage to secure $1,500,000 in bonds, the proceeds of which will be used for improvements and extensions to its system.

BLISSFIELD, MICH.—Within the next two months the electric-light committee expects to install a single-cylinder (16-in. by 20-in.) Ball engine; also to purchase within the next four months several transformers. R. H. Ellis is superintendent.

BRIGHTON, MICH.—The Brighton Lt. & Pwr. Co., recently incorporated with a capital stock of $16,000, will take over the property of the Brighton El. Lt. & Pwr. Co. The Eastern Michigan Edison Co., of Detroit, it is said, will erect a transmission line from South Lyon and eventually take over the Brighton plant. C. C. Conrad will continue as manager.

COPEMISH, MICH.—A proposal has been submitted to the City Council by Col. E. Zimmerman, of Marquette, owner of the Betsey River dam, to furnish electricity for lamps and motors in Copemish.

KENTON, MICH.—The local electric-light plant, owned by the Sparrow-Kroll Lumber Co., is reported to have been destroyed by fire recently. The town is at present without electrical service.

NEWBERRY, MICH.—Bids will be received by E. H. Campbell, secretary board of trustees of Newberry State Hospital, Newberry, until March 16, for the erection of power house. Charlton & Kuenzi, of Marquette, are architects.

DAYTON, OHIO.—Plans are being considered for the installation of an ornamental street-lighting system on Wayne Avenue between Fifth Street and Xenia Avenue.

FREMONT, OHIO.—The Lake Shore El. Ry. Co., of Cleveland, is reported to have decided to increase the output of its steam power plant in Fremont by 500 hp or 600 hp. The work will include the installation of three large boilers and the erection of a brick smokestack 225 ft. high.

MASON, OHIO.—The proposal to issue bonds (about $10,000) for the installation of a municipal electric-light plant will soon be submitted to the voters. M. A. Castoe & Co., of Cincinnati, are consulting engineers. R. W. Gutermuch is clerk. Reported in the issue of Feb. 28 to have engaged Seidl & Hausmsn, of Cleveland, to prepare plans for electric-lighting system.

OAK HARBOR, OHIO.—The Council has accepted the proposal of the Northwestern Ohio Ry. & Pwr. Co., of Port Clinton, to furnish electricity in the village of Oak Harbor for a period of 10 years. The village will purchase the local plant and distributing system of the George Mylander estate. Bonds have already been voted to establish a municipal lighting system.

OSBORN, OHIO.—The Dayton Pwr. & Lt. Co., of Dayton, it is reported, has submitted a proposal to the Village Council offering to take over the municipal electric-light plant and to furnish electricity for the local system from its plant in Dayton. Work will begin on the erection of the transmission line as soon as the contract is signed.

URBANA, OHIO.—The Urbana Lt. Co. is contemplating extending its transmission lines to Cable and Kennard in addition to the line now being erected to the Catawba gravel pit.

VAN WERT, OHIO.—We are informed that the city of Van Wert does not contemplate the installation of a new lighting system, as reported in the issue of Feb. 28. Only a few slight changes and improvements will be made to the present system. Pierce Carr is city auditor.

BOWLING GREEN, KY.—We are informed that a power plant will not be installed at the State Normal School in Bowling Green in the very near future. Reported in the issue of Feb. 28 that Howard & Merriam, of Columbus, Ohio, were preparing plans for the erection of a power house.

CARLISLE, KY.—Within the next three months the Carlisle El. Lt. & Pwr. Co. expects to erect about 4000 ft. of transmission line to the water-works pumping station. No. 8 weather-proof copper wire will be used. The company also expects to purchase 50 poles (25-ft. to 30-ft., with 7-in. top). Boon Ingles is manager.

EDMONDTON, KY.—The Edmondton Lt. & Pwr. Co., recently incorporated with a capital stock of $1,250, is contemplating the installation of a small electric-light plant. For further information address George Greenup.

LOUISVILLE, KY.—The Louisville Pillow Co. expects to purchase an electrically operated freight elevator. M. P. Kelly is president.

LOUISVILLE, KY.—Plans are being prepared by Joseph & Joseph, of Louisville, architects, for a new factory building for the Bouvier Specialty Co., 801 West Main Street, Louisville. Electric motors will be needed to operate pumps, bottling and washing machinery.

SMITH MILLS, KY.—The municipality of Smith Mills is contemplating the installation of a municipal electric-light plant. The city, it is understood, will purchase a generator and engine.

BOURBON, IND.—The Union Wtr., Lt. & Pwr. Co., of Bourbon, has recently installed 12 standards for five-lamp clusters, 20 200-cp and 15 100-cp tungsten series street lamps. Elmer Kessler is superintendent.

CLINTON, IND.—The Clinton El. Lt. & Pwr. Co. expects to purchase 500-kw, 2300-volt, three-phase, 60-cycle generating unit (directly connected), with condensing outfit. C. M. Poor is superintendent and purchasing agent.

COLUMBIA CITY, IND.—The City Council is considering the question of installing a heating system. F. T. Schultz is superintendent.

FORT BRANCH, IND.—The Fort Branch El. Lt. & Pwr. Co. has been reorganized under the name of the El. Lt. Co. of Fort Branch. The local power plant is being dismantled and will be converted into a substation. Electricity for operating the local system will be purchased from the Evansville Pub. Ser. Co., of Evansville. When improvements are completed a 24-hour service will be established in Fort Branch, single-phase for lighting and three-phase for heavy motors. Homer T. Genung.

FORT WAYNE, IND.—Bids will be received by the Board of Public Works, Fort Wayne, until March 24 for furnishing and erecting turbo-generator set, exciter, condenser and switchboard, for municipal electric-light plant. Plans and specifications may be obtained from the Board of Public Works upon deposit of $10, which will be refunded upon return of same. For details see proposal columns. The Indiana Engineering & Construction Co. is consulting engineer.

GAS CITY, IND.—Within the next five months the electric light commissioners expect to rebuild about 2 miles of overhead transmission lines and to purchase one carload of poles and quite a quantity of weatherproof wire; also within the next six months to purchase some irons, fans and probably some washing machines. A contract has just been placed with the Westinghouse El. & Mfg. Co. for switchboard instruments, including meters, wattmeters, transformers, etc. T. S. McKee is superintendent.

KNIGHTSTOWN, IND.—The electric-light commissioners expect to erect within the next two months 40 five-lamp standards, using 3000 ft. of Okonite steel cable. N. Hiatt is superintendent.

KNOX, IND.—Thomas A. Christ, owner of the local electric-light plant, is contemplating purchasing energy or enlarging his plant. If it is decided to purchase energy, the system will be changed to alternating current.

PERU, IND.—The city of Peru is contemplating the purchase of a new street-lighting system. Arthur Herren is manager of the electric-light and water-works plant.

WALKERTON, IND.—Contracts have just been placed by the town of Walkerton for one panel for switchboard, three 30-kva, 13,200-volt transformers and necessary lightning protection. Within the next few months a small stock of electrical appliances and supplies will be purchased for use in connection with day service which will go into effect on or before April 1. A. L. Freyer is superintendent.

JOLIET, ILL.—The equipment of the proposed electric plant of the Joliet Mfg. Co. will consist of a 14-in. by 14-in. single-valve Ames engine directly connected to a Crocker-Wheeler 100-kva, three-phase, 60-cycle, 240-volt generator and switchboard equipment manufactured by the States El. Co. W. J. Steckel is superintendent of the company.

METROPOLIS, ILL.—The city of Metropolis expects to erect a retaining wall around the power house as a protection from the floods of the Ohio River. P. M. Richards is superintendent.

NEWTON, ILL.—The city of Newton would like to purchase a good second-hand 150-hp tubular boiler for the municipal electric-light plant; it also expects to purchase within the next 30 days a supply of electrical supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc. John W. Matheny is city clerk.

AMERY, WIS.—The Amery River Milling Co., recently organized with a capital stock of $40,000, proposes to generate and sell electricity. The incorporators are E. J. Schneider, E. M. Fay and others.

ELLSWORTH, WIS.—The State Railroad Commission has granted the Chippewa Valley Ry., Lt. & Pwr. Co., of Eau Claire, permission to purchase the property of the Ellsworth Ht., Lt. & Pwr. Co.; also authority to issue $42,000 in stock and bonds to apply on purchase of same.

JUNEAU, WIS.—The citizens have voted to issue $9,000 in bonds, the proceeds to be used for the erection of an electric transmission line and the installation of a distribution system for lighting the city. Electricity for operating the system will be purchased from the company in Horicon.

READSTOWN, WIS.—The installation of an electric-light plant in Readstown is under consideration.

UNION GROVE, WIS.—Application has been made to the Council by William Hary for a franchise to install an electric-light plant in Union Grove.

WAUKESHA, WIS.—The Waukesha Gas & El. Co. has just completed the installation of a 1250-kva Westinghouse turbine with Le Blanc condenser and two Murphy automatic smokeless furnaces. C. Rodman Stull is manager.

BLUE EARTH, MINN.—The town of Blue Earth expects to install a heating system, covering about four blocks, for which bids will be called within the next 60 days. Don Fitch is superintendent of the electric-light plant and water-works system.

FOREST LAKE, MINN.—The installation of an electric-light plant in Forest Lake is under consideration. C. E. Stewart is reported interested in the project.

HIBBING, MINN.—The extension of the ornamental street-lighting system in Hibbing is under consideration. It is proposed to erect five-lamp clusters (the same as are now in use) the entire length of Second Avenue and on the cross streets between Second and Third Avenue. On streets running east from Third Avenue three-lamp clusters will be placed; three-lamp clusters will also be used on Fourth Avenue.

ISANTI, MINN.—Messrs. Allen & Lovic, of Pine City, it is reported, have submitted a proposal to the Council offering to extend the transmission line from Grandy to Isanti, to furnish electrical service here.

ROUND LAKE, MINN.—The installation of a municipal electric-light plant in Round Lake is reported to be under consideration. R. D. Hart is village recorder.

WACONIA, MINN.—A proposal has been submitted to the Commercial Club of Waconia by General Luce, of the Luce El. Co., offering to extend a transmission line from St. Bonifacius to Waconia.

WILMOT, MINN.—Plans of the water and light commission to replace the present electric equipment with more modern machinery and increase the output of the plant, it is reported, have been approved by the City Council. The cost of the improvements is estimated at about $14,000.

WINNEBAGO, MINN.—The Commercial Club is promoting a movement for the installation of ornamental street lamps in the business district of the city.

ATLANTIC, IA.—Within the next 30 days the electric-light commissioners expect to purchase from 100 to 200 meters T. E. Nichols is manager.

CEDAR FALLS, IA.—The municipal electric-light plant, now under construction, will be placed in operation in about six weeks. C. H. Streeter is superintendent.

GARNER, IA.—The Enterprise El. Lt., Ht. & Pwr. Co., of Garner, expects to purchase within the next six months electrical appliances, including washing machines, vacuum cleaners, heating and cooking apparatus and supplies. H. F. Kellogg is superintendent.

GLENWOOD, IA.—The Glenwood El. Lt. & Pwr. Co. has recently extended its system and is now furnishing electrical service in Carson, Silver City, Mineola, Henderson, Emerson and Hastings, as well as Glenwood. The company, it is reported, is contemplating installing a new boiler and generator.

GLIDDEN, IA.—The electric light commission has decided to erect a transmission line from the municipal electric-light plant to furnish electricity to farmers residing more than 6 miles from town.

MASON CITY, IA.—An election will be held on March 26 to vote on the proposition to issue bonds for the installation of a municipal electric-light plant. W. A. Judd is water commissioner.

RIVERTON, IA.—At the annual election to be held March 30 the proposal to grant a franchise for the installation of an electric-light plant will be submitted to the voters. A local company, headed by Joseph Samuels, of the Nishna Valley Bank, has been organized to install the system.

SAC CITY, IA.—Within the next two months the Sac City El. Co. expects to erect a new concrete or brick power house (54 ft. by 105 ft.); also to purchase one second-hand 100-kw, two-phase, 60-cycle alternator (belted), two new 72-in. by 18-ft. return tubular boilers (one 150-hp and one 250-hp), a 300-hp Corliss engine, one 400-hp open heater and high-pressure piping for above equipment; also equipment for 11 miles of 13,200-volt high-tension transmission line, including step-up and step-down transformers, switch gear, lightning arresters, etc. H. W. Deininger is manager and engineer.

ST. ANSGAR, IA.—The Lt. & Pwr. Co., of St. Ansgar, expects to build a concrete dam (about 280 ft. long and 9 ft. high) across the Big Cedar River within the next year. O. H. Koch is secretary and treasurer.

WALKER, IA.—Arrangements, it is reported, have been made for the installation of an electric-light system in Walker. Electricity for operating the system, it is said, will be transmitted from Center Point.

WAUCOMA, IA.—At an election held March 2 the proposal to issue $12,000 in bonds to purchase water rights, build dam and erect an electric-light plant was carried. Work will begin on the project as soon as possible. H. H. Belding is city clerk.

BERNIE, MO.—A movement, it is reported, is on foot to organize a company to install an electric-light plant in Bernie.

CALLAO, MO.—At a special election held Feb. 24 the proposal to install a municipal electric-light plant was carried.

LINN CREEK, MO.—It is reported that a company will be organized under the name of the Central Missouri Pwr. Co. to construct and operate a hydroelectric plant at Linn Creek to develop 3000 hp. The plans provide for construction of dam, power house, transmission line, etc., to cost about $250,000.

BRYANT, S. D.—Within the next two months the commissioners of the municipal electric-light plant expect to erect an addition to power house and to purchase a 50-hp or 60-hp engine. W. A. McNulty is Mayor.

GAYVILLE, S. D.—A petition will be presented to the City Council asking that a special election be held to vote on the proposal to issue bonds for the installation of a municipal electric-light plant.

WINFRED, S. D.—The Town Council is considering the installation of electric street lamps. A transmission line will be erected from Howard to Winfred to furnish the service.

BETHANY, NEB.—Bonds to the amount of $4,500 have been voted for the installation of an electric distributing system in Bethany. Electricity for operating the system will be secured from Lincoln.

HOOPER, NEB.—A company, it is reported, is being formed for the purpose of furnishing electricity for lighting the town.

OMAHA, NEB.—R. B. Howell, manager of the metropolitan water district, has authorized the engineering department of the water district to prepare estimates of the cost of construction and operation of a municipal electric-light plant in connection with the municipal water-works system. It would be necessary to secure authority from the State Legislature to install such a plant.

SHICKLEY, NEB.—The Town Board has appointed a committee to secure estimates of cost of the installation of a municipal electric-light plant.

ALTON, KAN.—The Council has engaged Rollins & Westover, Midland Building, Kansas City, Mo., to prepare plans and estimates of the cost of the installation and maintenance of a municipal electric-light plant and water-works system.

HERINGTON, KAN.—The Herington Water and Light Department expects to erect within the next three months 3 miles of transmission line (no poles will be required); also to purchase two motor-driven triplex pumps and 2200-volt, three-phase, 60-cycle, remote-control, slip-ring motors. A 75-kva General Electric alternator and 125-hp compound engine have been purchased for the municipal plant. E. J. Walcott is superintendent.

HOLTON, KAN.—Bids will be received by the Mayor and Council of the city of Holton at the office of B. B. Norris, city clerk, until March 24, for the erection of a city hall and fire department, in accordance with plans and specifications prepared by Holland, Gamble & Holland, architects, Topeka, which are on file in the office of the city clerk, Holton, and the office of the architects, Topeka. Separate bids will be received for steam heating, plumbing and electric wiring.

LARNED, KAN.—An election will soon be called to vote on the proposal to issue bonds for the installation of a municipal electric-light plant and ice factory in Larned.

NATOMA, KAN.—Application has been made to the town of Natoma by T. C. Miller for a franchise to install an electric-light plant here.

OTTAWA, KAN.—Within the next three months the board of water and light commissioners expects to purchase a boiler and will probably install a turbo-generator set some time during 1915. W. O. Myers is superintendent of water and light plant.

ROBINSON, KAN.—C. I. Stocking, of Hiawatha, electrical engineer, has been engaged by the City Council to prepare plans and specifications for a municipal electric-light plant and water-works system in Robinson.

ST. JOHN, KAN.—The installation of a municipal electric-light plant and ice factory in St. John is reported to be under consideration.

SEVERANCE, KAN.—The City Council has engaged C. I. Stocking, of Hiawatha, electrical engineer, to prepare plans and specifications for a municipal electric-light plant.

SOUTH HAVEN, KAN.—Within the next six months the South Haven El. Lt. Co. expects to purchase one 50-hp oil engine for direct connection to generator. J. R. Britton is engineer.

Southern States

BENSON, N. C.—The Benson El. Lt. Co., recently incorporated with a capital stock of $10,000, is installing an electric-light plant to furnish electricity for commercial purposes. Alonzo Parrish is president.

HAZLEWOOD, N. C.—We are informed that the town of Hazlewood will not install an electric-generating plant in connection with its lighting system, but will secure electrical energy from the hydroelectric power plant below Waynesville, owned by B. J. Sloan & Son. John N. Schoolbread, of Waynesville, engineer, has charge of the work. Reported in the issue of Feb. 28 to be contemplating the installation of an electric plant. William H. Cole is chairman of finance committee.

MARSHVILLE, N. C.—The proposal to establish a municipal electric-light plant in Marshville will be submitted to the voters on March 31.

SCOTLAND NECK, N. C.—Improvements, to cost about $10,000, it is reported, are contemplated to the municipal electric-light plant. A. L. Purinton is secretary.

WILSON, N. C.—Bids will be received by the commissioners of the town of Wilson until March 31 for improvements to electric-power plant, consisting of building, foundations, radial brick chimney, reservoir, pipe lines, power piping, centrifugal pumps and cooling system. Proposals will be received at the same time for water-tube boilers, two 500-kw generating units (engine-driven or turbine-driven), condensers and switchboard, under specifications dated October, 1913, and sent out at that time by the Board of Public Works. Specifications and proposal forms will be mailed upon application to Gilbert C. White, Charlotte, N. C., or to T. A. Hinnant, town clerk, Wilson.

LATTA, S. C.—Bonds to the amount of $65,000 have been voted for the installation of electric-light, water-works and sewer systems, plans for which have been prepared by the J. B. McCrary Co., of Atlanta, Ga.

AUGUSTA, GA.—Within the next ten months the Augusta-Aiken Ry. & El. Corpn., of Augusta, expects to purchase 4000 kw in transformers, 300 irons and 200 cooking units, such as toasters, coffee percolators, etc. J. J. Borger is superintendent of electrical department.

MACON, GA.—The stockholders of the Central Georgia Pwr. Co. and the Central Georgia Transmission Co. have decided to install additional generators in the plant at the Butts County dam, increasing the output to 24,000 hp. The cost of the work is estimated at $100,000.

LEESBURG, FLA.—Within the next six months the Leesburg Ice Co. expects to build an addition to its power house (all work will be done by the company); also to purchase within the next eight months an engine and generator with a rating of about 100 kw (the size not yet decided upon). J. Y. Clark is president.

ST. PETERSBURG, FLA.—The St. Petersburg El. Lt. & Pwr. Co. expects to put in operation a new power station within the next 30 days. The company has installed three 335-hp Erie City vertical boilers with superheaters, two generating units, consisting of 1200-hp Lentz cross-compound condensing engines directly connected to 750-kw General Electric three-phase generator, one 35-kw motor generator set and one 15-kw turbine exciter set, one 500-kw Westinghouse rotary converter and one 200-kw General Electric motor-generator set.

TAMPA, FLA.—Within the next six months the Tampa El. Co. expects to purchase two 520-hp high-pressure, superheated boilers with stokers. J. C. Woodsome is manager.

COLUMBIA, TENN.—The City Council has granted John H. Carpenter, of Nashville, a franchise to construct and operate an electric-light, power and heating system in Columbia.

HALLS, TENN.—At an election held recently the proposal to issue $25,000 in bonds for purchasing the Hall Lt., Wtr. & Ice Co. was carried.

KNOXVILLE, TENN.—John W. Flenniken, commissioner of street and public improvements, in his annual report recommends the installation of a municipal electric-light plant and a garbage disposal plant.

BIRMINGHAM, ALA.—The Birmingham Ry., Lt. & Pwr. Co., it is reported, will build a substation to cost about $125,000, to distribute electricity generated at the hydroelectric power plant of the Alabama Pwr. Co. at Lock 12 on the Coosa River.

TUSKEGEE, ALA.—The trustees of the Tuskegee Normal and Industrial Institute have authorized the installation of an electrical system, water-distribution system, steam piping and sewer system. The cost of the work is estimated at about $240,000.

WAYNESBORO, MISS.—The Waynesboro Electrical Co., recently organized, is contemplating the installation of an electric plant to develop 60 hp, at a cost of about $6,000. C. C. Green is president.

GREEN FOREST, ARK.—The Green Forest El. Lt. & Pwr. Co., it is said, is planning to install an electric-light plant, to cost about $10,000. L. H. Smith is reported to be interested in the company.

HUNTINGTON, ARK.—The Huntington El. Lt. & Pwr. Co., it is reported, contemplates the installation of additional machinery in the fall. G. W. Skow is general manager.

MAGAZINE, ARK.—The Magazine El. Co., recently granted a franchise in Magazine, it is reported, will install an electric-light plant, bids for construction of which will be received soon. Electricity for operating the system will be secured from Booneville. A transmission line 7 miles long will be erected. J. L. Roberts is manager.

ABBEVILLE, LA.—Bids will be received by Adolph Brasseux, Mayor, until March 26 for furnishing and installing machinery for the municipal electric-light plant, according to specifications prepared by Harold Raymond, consulting engineer, New Orleans, La.

TEXHOMA, OKLA.—The plant of the Pleasanton Handle & Mfg. Co. has been purchased by F. M. Harn, who, it is said, will install an electric plant and ice factory. Mr. Harn, it is reported, would like to receive prices on a 100-kw, 60-cycle, 2300-volt generator.

BRENHAM, TEX.—The Brenham Wtr. Wks. Co., it is reported, is contemplating the installation of electrical equipment in its plant here. H. E. Booker is superintendent.

FLORESVILLE, TEX.—Extensions and improvements, including the installation of new machinery, are being made to the property of the Floresville Ice & Pwr. Co., which was recently purchased by J. B. McCluskey and H. E. Brown, of Brenham, and E. H. Shoults, of Houston. A street-lighting system for the city may be installed later on.

HAMILTON, TEX.—The Hamilton Lt. & Pwr. Co. has just completed reconstruction of its plant, changing the system from direct current to alternating current. A new 100-kw General Electric generator has been installed. All new transformers and meters are of the General Electric make. W. A. Haynes is manager.

ROCKDALE, TEX.—The city of Rockdale is reported to be negotiating for the property of the Rockdale Wtr. & Lt. Co.

SAN ANGELO, TEX.—The San Angelo St. Ry. Co., it is reported, is contemplating improvements to its system, including the erection of a new power house, installation of new machinery and the extension of transmission lines, at a cost of about $35,000.

SEADRIFT, TEX.—The installation of an electric-light plant in Seadrift is under consideration. Mr. Gill, of Texarkana, is reported interested in the project.

TEMPLE, TEX.—The City Council, it is reported, will soon ask for bids for the installation of an electrically operated pumping unit at the river station of the city water-works system, to cost about $4,000.

TEXAS CITY, TEX.—The installation of an ornamental street-lighting system on Sixth Street is under consideration. The plans provide for the erection of concrete posts (12 ft. high) carrying three-lamp clusters.

Pacific States

BELLINGHAM, WASH.—The contract for the equipment for the power plant of the Bloedel-Donoval Mills Co., of Bellingham, has been awarded to the Allis-Chalmers Mfg. Co., of Milwaukee, Wis. The equipment will consist of two 750-hp Stirling water-tube boilers, one 1000-kw, three-phase, 60-cycle, 480-volt turbo-generator, switchboard and barometric condenser; also 42 three-phase, 60-cycle, 440-volt motors to drive the various machines in the lumber mills. W. V. Sullivan, of San Francisco, Cal., is engineer in charge of construction.

EDMONDS, WASH.—Within the next six months the Edmonds El. Lt. & Pwr. Co. expects to erect 1 mile of 2300-volt transmission line to furnish electricity in the rural district north of Edmonds, with secondary branches also to purchase 50 meters, several 3-kva and 5-kva transformers and wire, and within the next three months to purchase several electrical cooking stoves. A. A. Cobb is vice-president, secretary and superintendent.

RAYMOND, WASH.—The Willapa El. Co., of Raymond, expects to purchase material for some miles of distribution line in Raymond and South Bend. J. S. Thornton is president.

SPOKANE, WASH.—The city commissioners have granted the Trustee Co., a local corporation, a franchise to lay pipes, conduits and wires in certain streets of the city, in connection with a steam or hot-water-heating system and electric light and power system which the company proposes to build in Spokane, at a cost of $100,000. Harry A. Flood is president.

FLORENCE, ORE.—The Florence El. Co. expects within the next 24 months to develop a water-power and erect 10 miles of high-tension transmission line to connect the system with its steam plant in Florence; also to purchase waterwheel to develop 200 hp under a 300-ft. fall, with minimum of 20 second-ft. of water. The company handles electrical appliances and supplies. G. G. Bushman is president.

NEWPORT, ORE.—The property of the Yaquina El. Co., of Newport, is reported to have been purchased by A. Welch and C. E. Welch, of Portland, construction engineers, who, it is said, will make improvements and extensions at once. Welch Brothers, it is reported, are contemplating the construction of a generating station in Toledo to supply electricity in Toledo and Newport. Water rights were recently secured by the Welch Brothers on the Siletz River in Lincoln County, where, it is understood, they will erect a hydroelectric plant to develop 2500 hp, at a cost of about $150,000.

PORTLAND, ORE.—The contract for the electrical installation for the new Broadway Theater has been awarded to the West Coast Engineering Co., Couch Building, Portland. This company was also awarded the contract to overhaul the electric wiring system in the Portland Academy. The work will include the rewiring part of the premises, the installation of new lighting units and a general overhauling of the entire system of wiring.

COVINA, CAL.—The city of Covina is installing an ornamental street-lighting system to cost approximately $15,000. Forty-two posts have been erected, covering both sides of street (4000 ft.), at a cost of $5,000. Bids for the remainder of the work will be asked about April 15. Pressed-steel and copper-fluted posts, 11 ft. 6 in. high, carrying a 16-in. globe, are being erected. The plans provide for 132 standards, of which 42 will carry 100-watt tungsten lamps and the remainder 60-watt lamps. About 23,000 ft. of sherardized conduit (from ¾ in. to 2 in. in diameter) will be used. F. G. Dessery, Central Building, Los Angeles, is city engineer.

LOS ANGELES, CAL.—The power committee has asked the City Council to call an election at once to submit the proposal to issue $6,500,000 in bonds to the voters, the proceeds to be used to complete the aqueduct power project and to install or acquire a municipal distributing system for aqueduct power. E. F. Scattergood is chief electrical engineer.

LOS ANGELES, CAL.—The Consolidated Utilities Co., operating in Compton, and the Glendore Lt. & Pwr. Co., which furnishes electrical service in Glendora, have applied to the State Railroad Commission for permission to sell their properties to the Pacific Lt. & Pwr. Corpn., of Los Angeles. The consolidated company agrees to sell its plant for $8,500 and the Glendora company values its property at $10,500.

SAN DIEGO, CAL.—The San Diego Gas & El. Co. expects to purchase one 5000-kva Curtis General Electric horizontal turbo-generator, two 600-hp Babcock & Wilcox horizontal water-tube boilers, one 100-kw Curtis General Electric horizontal turbo-exciter unit, three 100-kva, 2300/11,000 transformers. H. H. Jones is manager.

SAN FRANCISCO, CAL.—Bids will be received by Lt.-Col. George McK. Williamson, office of constructing quartermaster, Fort Mason, Cal., until March 25 for constructing ward at Letterman Hospital, San Francisco, including plumbing, heating and electric wiring. Plans and specifications may be obtained upon application to the above office upon deposit of $10, which will be refunded upon return of same.

CAMBRIDGE, IDAHO.—The Rush Creek falls, situated near Cambridge, will be utilized by the Adams County Lt. & Pwr. Co. to generate electricity, which will be transmitted to Cambridge, thence to Midvale and Council. The plant will be situated 12 miles north of Cambridge. The plans provide for the construction of a 16-in. pipe line 1200 ft. long, which, during low water periods, will generate between 450 hp and 500 hp.

HOMEDALE, IDAHO.—The Homedale Lt. & Pwr. Co. has applied to the Public Service Commission for permission to construct and operate an electric light and power plant in Homedale.

LAPWAI, IDAHO.—The Village Board has granted the Lewiston-Clarkston Imp. Co., of Lewiston, a franchise to erect transmission lines in Lapwai. The franchise is for a period of 25 years and provides that the system must be in operation by July 15, 1914.

GLOBE, ARIZ.—The installation of a municipal electric-light plant in Globe is under consideration. H. C. Houser is city clerk.

GLENDIVE, MONT.—The Glendive Ht., Lt. & Pwr. Co., it is reported, contemplates the construction of a hydroelectric power plant on the Yellowstone River, near here, to cost about $75,000.

LEWISTON, MONT.—The installation of an ornamental street-lighting system in the business district is under consideration. The plans provide for the erection of five-lamp clusters to cost $125 per standard.

EVANSTON, WYO.—The Evanston El. Lt. Co. expects to complete changing its system from direct current to alternating current, which it started last year, within the next six months. Within the next 90 days the company expects to purchase one 250-kw generator and Corliss engine (belted unit), and one 150-hp horizontal tubular boiler, two generator switchboard panels, one feeder panel and one voltage regulator. H. L. Williams is manager and purchasing agent.

ALAMOSA, COL.—The Mutual El. Lt. & Pwr. Co. expects to purchase within the next six months two carloads of poles, one graphic recording meter and one tub transformer. H. A. Goodridge is manager.

GYPSUM, COL.—Within the next six months the Schumm Lt. & Pwr. Co., of Gypsum, expects to erect a power house and to purchase a 75-kw generator and waterwheel, waterwheel governor, switches, transformers, poles, wire, etc., for an auxiliary plant. Casper Schumm is president.

Canada

CALGARY, ALTA.—The city commissioners recommend that a by-law appropriating $300,000 for the purchase of new equipment for equipping the transforming and switching station at Victoria Park and for the underground cables for the municipal lighting system be submitted to the ratepayers.

EDMONTON, ALTA.—Within the next three weeks the city commissioners expect to purchase one 6000-kw turbo-alternator with surface condenser and auxiliaries; also boiler plant with a capacity of 120,000 lb. per hour. The city also expects to erect a new power house within the next 18 months. R. H. Parsons is superintendent of city power plant.

LETHBRIDGE, ALTA.—Within the next nine months the managers of the municipal electric-light plant expect to erect 2½ miles of 00-feeder line to replace old feeder line; also to purchase within the next six months switches and instruments for extensions of switchboard. Arthur Reid is commissioner of public utilities.

VERNON, B. C.—A by-law will probably be submitted to the ratepayers in the near future asking for an appropriation of $11,500 for extensions to the municipal electric-light system.

DAUPHIN, MAN.—Within the next three months the town of Dauphin expects to install one 100-hp return tubular boiler, one jet condenser, one vertical, two-cylinder condenser, one 225-kw Canadian General Electric generator, exciter and switchboard with accessories, all Canadian General Electric equipment. W. A. Brinkman is superintendent.

SHOAL LAKE, MAN.—The Village Council has engaged the John Galt Engineering Co. to prepare plans and to act as consulting engineer in connection with the construction of the proposed municipal electric-light plant, which will be installed as soon as debentures are sold. F. Dobbs is secretary and treasurer.

CREEMORE, ONT.—The Village Council has entered into an agreement with the Hydro-Electric Commission of Ontario for 75 hp. The commission will install the system. A. H. Watson is village clerk.

PRESTON, ONT.—The City Council is contemplating extensions and improvements to the municipal electric-light plant.

TORONTO, ONT.—Bids will be received by H. C. Hocken, Mayor, chairman of Board of Control, Toronto, until March 17 for construction of police station on Davenport Road, including plumbing, heating, electric wiring and lighting fixtures. Plans and specifications may be seen and form of tender obtained at the office of the city architect, city hall, Toronto.

PRINCE ALBERT, SASK.—The City Council is considering the installation of an additional 750-kw turbo-generator unit in the municipal steam power plant. H. E. Pawson is manager.

REGINA, SASK.—Bids will be received by the city commissioners of Regina, Sask., until March 28 for generating equipment as follows: (1) For station switchboard, consisting of two exciter panels, six generator panels, one totaling panel and 16 feeder panels; (2) six three-phase feeder regulators; (3) one 125-kw motor-driven exciter; (4) one 125-kw geared turbine-driven exciter, electrical end speed not over 900 r.p.m. Distributing equipment: (1) Weatherproof copper wire; (2) insulators, top pins, etc.; (3) cross-arms; (4) pole-line hardware; (5) cedar poles; (6) pole-type transformers; (7) street-lighting equipment; (8) cut-out mast-arms; (9) integrating wattmeters. Copy of specifications may be obtained from E. W. Bull, superintendent of light and power, Regina.

SUTHERLAND, SASK. — The Town Council has appointed a special committee to look into the question of installing an electric plant in Sutherland.

Mexico

CITY OF MEXICO.—The federal government has given a concession to Jacinto Barrera and Salvador Luque for the use of the waters of the Tonantongo River, State of Hidalgo, for hydroelectric purposes.

Miscellaneous

CORDOVA, ALASKA.—Application has been made to the City Council by H. H. Knox, of Cordova, for a franchise to construct and operate an electric-light plant here.

PANAMA.—Bids will be received at the office of general purchasing officer, Isthmian Canal Commission, Washington, D. C., until March 25 for furnishing sheet copper, curb boxes, valves, ball cocks, steam gages, street lamps, calcium carbide, etc. Blanks and general information pertaining to this circular (No. 833) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco. Major F. C. Boggs is general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until March 28 for furnishing light fixtures and supplies for batteries on the fortification on the isthmus. The specifications include lamp fixtures, switch boxes, boxes for plugging-in devices, junction boxes, couplings, plugs and nipples, globes, guards, snap switches, coupling gaskets, receptacles, switch panel boxes, outlet couplings, plug fixtures, feeder and service boxes, cable hangers, wood screws and expansion bolts, and lead-sheathed armored and unarmored cable. For further information address Major F. C. Boggs, general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until March 28, for lighting fixtures, switch panel and feeder boxes, cable hangers and armored cable for wiring within the batteries, Panama Canal fortifications; also steel plates and soft-steel bars. Blank forms and general information relating to this circular (No. 834) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

New Incorporations

LOS ANGELES, CAL.—The International El. Ltg. Co. has been incorporated with a capital stock of $500,000. The directors are B. T. Wilson, D. W. Shoemaker, T. L. Croom, H. W. Janicke and Mary W. Croom.

PORTLAND, MAINE. — The Central States Ry. & Lt. Co. has filed articles of incorporation under the laws of the State of Maine with a capital stock of $500,000. The company proposes to acquire and operate water power, generate and sell electricity, etc. M. M. Reid, of Ironwood, Mich., is president, and J. E. Chase, of Portland, Maine, is treasurer.

BROWERVILLE, MINN.—The Browerville El. Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by H. E. Hart, Thomas Heid, C. O. Scow, Henry W. Schroeder, George A. Monnie, Carl Zuhl and Lambert Irsfeld.

WAYNESBORO, MISS.—The El. Lt. Co. has been organized by J. A. Leggett, O. R.

Green and C. C. Green, with a capital stock of $30,000.

McINTOSH, S. D.—The McIntosh El. Co. has been incorporated with a capital stock of $5,000 by E. W. Luke, Harry Luke and W. D. Snyder. The company proposes to install an electric-light plant in McIntosh.

DAYTON, TENN.—The Dayton Lt. & Pwr. Co. has been incorporated with a capital stock of $100,000 by J. L. Faust, M. N. Whitaker, S. E. Whitaker, R. F. McClure and C. O. Lindsay.

QUANAH, TEX.—The Quanah Lt. & Pwr. Co. has been incorporated with a capital stock of $5,000 by J. C. Keys, E. W. McClintie and A. A. Keys.

ELKTON, VA.—The Valley Pwr. Co. has been incorporated with a capital stock of from $40,000 to $100,000. The officers are: Charles McCoy, president, and A. D. Hoyt, secretary, both of New York, N. Y.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 3, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

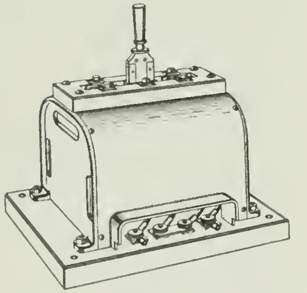
1,088,686. Transmitter for Wireless Telephony; W. T. Ditcham, Twickenham, England. App. filed April 9, 1913. Has high-frequency quenched-spark circuit connected to direct-current circuit between inductances.

1,088,704. Alternating-Current Regulator; S. E. Johannesen, Pittsfield, Mass. App. filed Sept. 16, 1909. Reactance coils and transformer are combined into one structure.

1,088,707. Trolley-Wire Connector; J. Kirby, Douglas, Ariz. App. filed May 31, 1912. Arranged so that trolley wheel can take current from the wire while passing over the connector.

1,088,734. Carbon Electrode Having Protective Covering and Process for Producing Same; C. H. Schroers, Duisburg-Meiderich, Germany. App. filed March 14, 1913. A layer of closely arranged particles of granular material unaffected by oxidizing gases is embedded in the surface of the electrode.

1,088,736. Magneto; L. J. and L. E. Sevlson, Elkhart, Ind. App. filed July 31, 1913. Special circuit-breaker spring and adjustable supporting yoke; also special lubricating system.



1,088,704—Alternating-Current Regulator

1,088,740. Method of Producing Light; C. P. Steinmetz, Schenectady, N. Y. App. filed March 5, 1900. Modifies colors of mercury-vapor arc lamps by addition of color-modifying vapors of a metallic salt.

1,088,769. Switch; H. W. Cheney, Milwaukee, Wis. App. filed Feb. 4, 1910. Double-throw oil switch.

1,088,771. Electromagnetic Device; W. W. Dean, Chicago, Ill. App. filed June 5, 1903. Bell of the "tuned reed" type.

1,088,780. Electromedical Exercising Apparatus; J. Katz, Chicago, Ill. App. filed July 5, 1913. Dumbbell containing battery, induction coil and hand contacts.

1,088,781. Electric Generator; J. F. Kelly, Pittsfield, Mass. App. filed Dec. 20, 1910. Multi-circuit compound-wound machine.

1,088,814. Railway Vehicle Magnet and Roadway Therefor; A. H. Fox, New York, N. Y. App. filed March 25, 1908. Magnet on train co-operates with magnetically interrupted running rail or other armature on the roadway.

1,088,821. Trolley Head; O. N. Iverson, Hills, Minn. App. filed Feb. 28, 1913. Suspended weight throws guards at opposite sides of trolley wheel into operation as car sways.

1,088,866. Lamp-Supporting Device; R. B. Benjamin, Chicago, Ill. App. filed April 7, 1911. Socket for series connection in high-tension circuits.

1,088,867. Electric-Lamp Socket; R. B. Benjamin, Chicago, Ill. App. filed July 18, 1910. High-tension series socket in which lamp contacts are short-circuited in case of destruction of the lamp.

1,088,868. Lamp-Supporting Device; R. B. Benjamin, Chicago, Ill. App. filed April 22, 1911. High-tension series socket whose parts are locked together by a plug having contacts separated and normally held apart by a dielectric.

1,088,878. Electromagnetic Device; H. P. Clausen, Rochester, N. Y. App. filed March 25, 1907. Telephone relay.

1,088,879. Telephone System; H. P. Clausen, Rochester, N. Y. App. filed Sept. 6, 1911. Central-energy multiple type.

1,088,884. Pneumato-Electric Tracker Bar for Musical Instruments; C. W. Dorricott, Philadelphia, Pa. App. filed June 21, 1912. For either sixty-five or eighty-eight note music and adapted to be associated with known forms of roll holders.

1,088,887. Electrical Heater; G. A. and L. Edmison, Los Angeles, Cal. App. filed May 26, 1913. Has hollow vertical iron tube with resistance wire wound thereon.

1,088,893. Automobile Horn; H. H. Frey, Chicago, Ill. App. filed June 29, 1912. May be operated by direct current or by alternating current from the usual ignition system.

1,088,897. Electrical Measuring Instrument; K. Gyr, Zug, Switzerland. App. filed March 27, 1911. Transmits indications from the dial (pivoted on a vertical axis) by optical means onto a screen from which the readings are taken.

1,088,901. Arrangement for Protecting Electric Circuits and Apparatus; P. V. Hunter, Newcastle-upon-Tyne, England. App. filed July 31, 1911. Current conditions in the faulty feeder alone control circuit-breaker to cut it out.

1,088,902. Cable for Electric-Current Distributing System; P. V. Hunter, Newcastle-upon-Tyne, England. App. filed Feb. 14, 1912. Pair of leads to be used in parallel separated by insulation of abnormally low insulation value but mechanically strong.

1,088,914. Incandescent-Lamp Socket; H. Marks and S. Helsel, Johnstown, Pa. App. filed March 13, 1913. Has lock for the lamp.

1,088,923. Electrical Sound Transmitter; M. E. Pearson, Seattle, Wash. App. filed March 31, 1913. Embodies two diaphragms.

1,088,963. Electric Conduit; N. W. Buch, New Castle, Pa. App. filed Jan. 29, 1912. Metal pipe interiorly coated with oil paint and then with flexible enamel.

1,088,997. Connector Plug; G. C. Knauff, Chicago, Ill. App. filed May 26, 1913. For automobile lamp sockets.

1,089,045. Circuit-Breaker; C. E. Carpenter and A. J. Horton, New York, and White Plains, N. Y. App. filed May 20, 1907. Overload switch construction.

1,089,048. Railway Cross-Tie; C. W. Giles, Attleboro, Mass. App. filed Feb. 24, 1913. Metallic tie on which rails are insulated; spreading of rails closes signal circuit.

1,089,051. Switch Mechanism; W. Herskovitz, Chicago, Ill. App. filed Jan. 9, 1913. Pull socket; pull on chain throws pawl against ratchet.

1,089,077. Electrical Machine; W. A. Price, Teddington, England. App. filed Jan. 31, 1911. Conversion of direct current into alternating current, employing commutator and electrolytic condenser.

1,089,081. Electric-Current Controller. P. J. Ray, Lakewood, Ohio. App. filed May 21, 1913. Compressible resistance with means holding the members thereof under slight pressure to prevent separation and formation of air gaps.

1,089,091. Receiving Device for Wireless Systems; W. E. D. Stokes, Jr., New York, N. Y., and G. W. Davis, Hoboken, N. J. App. filed Dec. 9, 1908. Stand carrying plurality of responsive elements composed of iron pyrites having carbonaceous shale embedded therein.

1,089,137. Brush-Lifting Device for Dynamo-Electric Machines; G. H. Krauskopf, Pittsburgh, Pa. App. filed June 21, 1912. Pawl engages ratchet to raise the brush.

1,089,142. Brush-Lifting Device for Dynamo-Electric Machines; E. Mattman, Wilkinsburg, Pa. App. filed June 21, 1912. Embodies a resiliently mounted pawl engaging a ratchet on the brush.

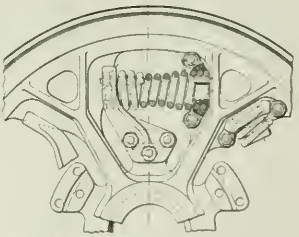
1,089,167. Starter Switch for Dual Ignition Systems; G. W. Wacker, East Orange, N. J. App. filed Dec. 20, 1912. "Kick switch" construction.

1,089,168. Resilient Driving Connection; J. E. Webster, Pittsburgh, Pa. App. filed July 24, 1911. Large-ended coil springs interposed between propelling motor and driving wheels of electric locomotives.

1,089,197. Street and Station Indicator for Cars; A. Fernandez, Mobile, Ala. App. filed Oct. 20, 1913. Automatically indicates names of cross streets being approached.

1,089,202. Rail Bond; T. C. Folsom, Tampa, Fla. App. filed Sept. 9, 1912. Mass of fusible conducting material secures the terminal in place.

1,089,277. Bed Cooler or Heater; G. F. Shepard, Dodge City, Kan. App. filed Nov. 18, 1913. Receptacle of human length which can be made either a heater or a cooler.



1,089,168—Resilient Driving Connection

1,089,300. Electric Furnace; C. C. Whitmore, Butte, Mont. App. filed April 16, 1913. Has longitudinal electrodes, one of which may be lowered and raised in respect to the other electrode.

1,089,335. Hole Closure; D. J. Diel, Jersey City, N. J. App. filed March 29, 1913. For closing conduit openings in outlet boxes, etc.

1,089,336. Indicator for Measuring or Weighing Machines and Devices. T. W. Fitzgerald, Boston, Mass. App. filed May 31, 1912. Rotary spindle of the primary indicating mechanism is restored to its starting point without influencing or disturbing the secondary indicating mechanism.

1,089,343. Socket Structure for Electric Incandescent Lamps. J. P. Naylor, London, Eng. App. filed Jan. 10, 1914. When one lamp is removed from the sign or like structure, contacts spring together to maintain the circuit complete.

1,089,384. Electric Braking with Alternating-Current Motors; E. F. Alexanderson, Schenectady, N. Y. App. filed Oct. 19, 1911. Employs a special design of transformer for connecting the armature and exciting windings in series so as to avoid low-frequency pulsations.

13,693 (reissue). Automatic Block Signaling System; D. J. McCarthy, Wilkinsburg, Pa. (Original patent 867,563). App. filed Oct. 1, 1907. Control of distant signals effected by reversing polarity of the track circuit by a pole charger operated by the home signal.

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The Telephone as a Monopoly

Impressive figures of one of the most widespread public utilities are those presented in the annual report of the American Telephone & Telegraph Company, abstracted in this issue. With one telephone station for each dozen inhabitants of the United States, this company controls perhaps two-thirds of the stations and three-fourths of the wire used in telephone service in this country. To an extent much greater than is true with any other electrical utility telephone service approaches 100 per cent effectiveness, and hence efficiency, in proportion to the degree that it is monopolistic. It is recognition of this fact that is the basis of the present agitation for government ownership and operation of the telephones. That to telephone users should be given the power through the government to determine the adequacy of the service rendered and the reasonableness of the charges therefor no one can doubt. Experience with privately owned public utilities operated under commission control justifies us in asserting that much better results for the country as a whole can be obtained through private operation under strict governmental regulation than through governmental ownership and operation under the complex political influences existing in the United States.

Compensation for Bond Salesmanship

One of the most vital problems confronting the electrical industry is purely financial—that of raising month by month the enormous amount of new capital required for construction and expansion of all kinds. For maintaining a rate of increase of 20 per cent per annum the industry is indebted, first and foremost, to the men who are finding the capital that makes this expansion possible. Every year electric lines are extended into many square miles of territory where previously nothing was known of the benefits of electric service. Putting up the money for such extensions involves some risk, and, though the underwriters themselves may be familiar with the factors upon which success and failure depend, such knowledge must be shared with the investing public before the latter can become somewhat convinced of the trustworthiness of the venture. The salesman of bonds is as important a man to the industry as is the salesman of turbines. It may require much skill to sell electric service in a town of 20,000 population in a far Western state, but no less skill is required to sell in the East the bonds of the company which will call the service and the business into being. If it is equitable to receive a given percentage for handling the bonds of, say, an established railroad of which the promise-to-pay is known to be as safe as the Rock of Gibraltar, is it not equitable to receive twice as much for disposing of the securities of some frontier enterprise requiring twice as much effort to launch? Every business man will admit the full justice of according a somewhat higher rate of commission to individuals who, having shouldered the full responsibility for performing what is after all a public service, have then to spend much time and money in disposing of the bonds to the investing public. "Truly the laborer is worthy of his hire"; and the armchair executive and the bond salesman are no less laborers than the dare-devil lineman and the mining electrician.

The Late Mr. Westinghouse

Seldom does it become the duty of an engineering paper to record the death of a man so intimately associated with the profession and industry it represents as is the case with the *Electrical World* in making note in this issue of the passing away of Mr. George Westinghouse. In his death the world loses a great inventor, an indomitable advocate of sound engineering development and, most of all, a man of controlling personality, exerted always for the best interest of his fellow-men. Although a pioneer in electrical development and widely recognized as a leading manufacturer of electrical apparatus, Mr. Westinghouse's reputation as an inventor was acquired largely through the non-electrical air brake, perhaps his most valuable gift to humanity and civilization. To him more than to any one else must be attributed the introduction of the alternating-current system now employed almost universally throughout the whole world. From the point of view of engineers, no characteristic trait of the man was more prominent than that which caused him to advocate the use of a system condemned by many as being dangerous, deadly and unworthy of serious consideration. Time has served to prove to all the foresight of Mr. Westinghouse, whose career viewed in retrospect shows him to have been one of the wisest engineer-inventor-manufacturers of his generation. A financier of the highest integrity, Mr. Westinghouse's most successful methods differed so widely from those employed in banking circles that he was considered a poor financier among financiers. Death delayed his coming until these men were convinced of the soundness of Mr. Westinghouse's unusual financial policies for reorganizing the Electric company without jeopardizing the interests of its creditors, stockholders or employees. His heart was ever in the welfare of the Electric company, even after he had been relieved of the arduous duties of the office of president of this great organization. To what extent the relinquishing of control over this product of his creative imagination was in accord with Mr. Westinghouse's personal desires the public will never know, but one cannot fail to be impressed by the fact that recognition of achievements withheld when he was most active was freely bestowed upon him in later years. As recently as December 6, 1913, we honored ourselves by recording the honor bestowed upon Mr. Westinghouse when he received the Grashof Medal in recognition of his services for the good of humanity. Contrary in many respects to the proverbial prophet, Mr. Westinghouse was best loved and appreciated by those who knew him best. Many of his lifelong friends and business associates have willingly contributed for this issue eulogistic notes characterizing the man and his career.

The Standardization of Frequencies

In an article abstracted in the Digest in this issue Mr. C. W. Stone brings to the front the fact that the time has arrived when for most purposes, if not all, sixty-cycle apparatus is far more advantageous than twenty-five-cycle equipment. At the higher frequency turbo-generators are cheaper and more compact and efficient than those for twenty-five cycles. The motors and transformers are cheaper to build and more efficient, and motors can be built with less restriction as to speed. Moreover, synchronous converters at sixty cycles are now reliable and efficient so that the never very adequate reason for adherence to the lower frequencies for converters is no longer worth mentioning. It is, of course, uneconomical to spend money for frequency-changer sets for use with twenty-five-cycle apparatus operated in most cases at a distinct disadvantage. Wherever it is inadvisable to install sixty-cycle synchronous converters in any specific case it will probably be better to use motor-generators than frequency changers plus synchronous converters. In short, for large systems for the distribution of energy such as modern electrical supply systems the advantage, in Mr. Stone's opinion, lies altogether with the sixty-cycle apparatus, and in the interest of economy there ought to be a steady effort to eliminate the less useful low-frequency machines and to utilize the standard line of the more efficient and economical apparatus.

It is against the first principles of efficiency to adopt for general electrical distribution a frequency that cannot be utilized conveniently in the lighting work which is still the backbone of the profit in electrical energy supply. It is quite unnecessary to retain the low frequency even for conversion into direct current because sixty-cycle converters are perfectly feasible machines at the present time, and even if they were not available it would often be desirable to use cascade converters or motor-generators for the sake of the better control of the voltage. Even for motor service work alone, such as is represented by railway loads at the present time, all conditions of service can be well met without being forced to use a frequency that is inapplicable or seriously disadvantageous in lighting service.

Central-Station Industry Growth

The Bureau of the Census is instructed under act of Congress to collect and publish the statistics of various industries, including those of public utilities in the central-station field, street railways, telephones and telegraphs. These statistics are collected in five year periods, overlapping those of manufacturing, which of course include electrical apparatus. The latest periods are 1902, 1907 and 1912, so that we are already almost midway to the next period of 1917. The figures are now available for 1912, and their presentation in these pages last week affords a basis for a great deal of interesting comment, discussion and forecast, as well as "hindcast." We find for 1912 a gross income of $302,000,000 from "straight" central stations. This is supplemented by nearly $37,000,000 from electric railway systems furnishing electric-lighting service. The total for 1912 would therefore be about $340,000,000. The growth for ten years has been at the rate of over 25 per cent per annum. This would bring the income in 1913 up to about $425,000,000. The estimate in these pages at the beginning of the year was that it might possibly reach $450,000,000, which will pass as a fairly good guess. The estimate of income in these pages for street and electric railways in 1913 was $650,000,000. The reported figures for 1912 are $585,000,000, not including electric service on steam railways. The average rate of increase on street railways has been nearly 14 per cent for ten years, so that it looks as though the figures would stand, and be even a little bit under the mark.

Some little doubt may be entertained as to the Census Bureau figures for incandescent lamps. With most large companies or systems that must be now a matter of guesswork. As to arc lamps, the figures are doubtless true, and they show how vast a change has been effected in the last five years. At the same time, the statistics do not take note of the heavier energy consumption of the flaming-arc units now on the circuits.

The extraordinary effect of the use of water-power on the general returns would suggest that some kind of classification of plant is necessary, or else that some differentiation is desirable as to the big bulk customer and the small individual consumer. The fact that electric service has steadily grown cheaper in face of "higher cost of living" has not yet been driven home into the public consciousness.

Many interesting facts develop from the general table, corroborated or intensified by those of the territorial groups. It will be noted, for instance, that while the gross income has increased 252 per cent in ten years, the income from all other sources has increased 899 per cent, and this does not include motor service. The table gives the increase in horse-power of motors as 843 per cent. The obvious inference is that with modern central stations the "diversity-factor" plays more and more an important part, and that lighting, once the chief load, has sunk to a position of secondary or tertiary significance as far as size is concerned. It has all worked to a common end in the lowering of rates and the universality of service.

Artificial Daylight

In a lecture delivered before the Franklin Institute by Dr. Herbert E. Ives an interesting exhibit was made of artificial daylight obtained from a Welsbach burner as a source. The particularly important feature of this work is the fact that the absorbing medium depended upon to give the color balance is a single sheet of tinted glass. Formerly screens for artificial daylight have, we believe, been compound, either of glass or of stained films. Any and all of these devices are able to give a good simulation of daylight color values for the respective illuminants for which they are designed. Obviously a light that is weak in the blue just where daylight is strong must have its other components greatly reduced in order to reach the proper color balance, and the more blue in the source the easier on the whole it is to produce a daylight screen. It is reported that similar experiments made with the nitrogen lamp have shown practically the gain in efficiency due to increase in radiation in the blue that would be indicated by theory, albeit even the nitrogen lamp is considerably weaker in blue than ordinary daylight.

In the present state of affairs no particular difficulty seems to be encountered in obtaining artificial daylight if one really knows what is wanted. There is much more difficulty in determining what is to be considered standard daylight than in reproducing it once its composition is known. For certain purposes "north light"—that is, light which on a clear day is exceptionally rich in blue—is much in favor, but it should be pointed out that it is by no means certain that such light is desirable for all purposes. Certain delicate shades are not properly shown in a north light, just as blues shift under illumination of a yellower tone. It is very easy to exaggerate either effect in screening lamps, so that although we now have the possibility of good artificial daylight it is important to know whether, having obtained it, it is quite the thing really wanted. The definition of what is to be considered normal white light is a rather difficult matter, and the time is now ripe for its serious consideration by physicists and illuminating engineers. The values heretofore obtained for so-called white in terms of the three primary colors differ very materially among themselves, and actual daylight passes through a rather wide scale of color values which succeed each other so gradually that one quite fails to take account of them. It is when one color scheme is suddenly contrasted with another, as in passing from daylight to lamplight or back again, that the differences become strikingly apparent. Moreover, some colored fabrics are not intended to produce their normal color effect by daylight, but rather by artificial light, so that a still greater element of uncertainty is introduced. While, therefore, we are now able to reproduce daylight artificially, the details of its best practical application still remain to be worked out.

The Glare from Paper

A practical study of glare from paper in its quantitative aspects is outlined in this issue by Prof. L. R. Ingersoll, who has made use of the familiar principle that paper, in common with most other substances, polarizes that portion of the light which is specularly reflected from it. With most surfaces polarization is fairly complete at a certain critical angle. The proportion of polarized light reflected at this or any other angle can readily be determined by the use of some one of the forms of polarimeter, a convenient and ingenious type of which Professor Ingersoll describes. Such an instrument provides a rather handier way of investigating the specular reflection from paper than is found in the ordinary photometric processes for determining this quantity, and we hope that it will be freely used in practice to obtain data for the improvement of printing papers.

The tables of results reported by Professor Ingersoll are very striking particularly in showing the great difficulty of avoiding specular reflection and the effect of calendering on the amount of the surface reflection. As Professor Ingersoll shows, the varying texture of the paper produces astonishing variations in the amount of glare, the coated book papers being particularly high in specular reflection. Colored papers have almost as much surface gloss as uncolored ones so that the proportion of specularly reflected light, on the whole, is large in them. Some little experimenting will undoubtedly be necessary in order to determine from the measured percentage of specular reflection by this or any other process the working qualities of the paper as viewed by the printer. It seems now to be fairly well understood that even halftone cuts can be used successfully on paper with a much less glossy surface than was once supposed to be necessary, even without particular attention to the character of the blocks. When the photo-engraver understands better how to make cuts for printing on unglazed paper the probability is that results of a very high class can be obtained without any particular difficulty, except perhaps in the case of some reproductions with intricate detail for which plate paper may still have to be used to secure the best results. However, the gain from the reduction of glare from paper is so marked in its relation to comfort in reading that publishers should make a serious effort to utilize matte-finished paper, and the *Electrical World* is now experimenting with this end in view. Our thanks and those of other journals are due Professor Ingersoll for his investigations, which seem destined to lead to improvement in printing papers from the viewpoint of legibility.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Marconi Patents Held Valid

In a decision handed down on March 18 in the United States District Court in Brooklyn, by Judge Van Vechten Veeder, three important radio-telegraph patents owned by the Marconi Wireless Telegraph Company were held valid, namely, No. 11,913, issued to Dr. William Marconi on July 13, 1897; No. 609,154, issued to Sir Oliver Lodge on Aug. 16, 1898, and No. 763,772, issued to Dr. William Marconi on June 18, 1904. It was held that the National Electric Signaling Company had infringed the two patents of later dates, and not the earlier Marconi patent, the scope of which is somewhat limited. It is understood that an appeal will be taken to a higher court.

Washington Section of E. V. A. Organized

A Washington (D. C.) section of the Electric Vehicle Association of America was organized March 12 and will be conducted along the same lines as the parent association.

Mr. F. W. Smith, New York president of the Electric Vehicle Association of America, was present at the Washington meeting and addressed the members of the new section, reminding them of the wonderful possibilities for the electric vehicle in the Capital City and its environs. He pointed out that the electric vehicle is no longer in an experimental stage, and that from an engineering standpoint the battery-driven car is setting the pace for simplicity of design and construction.

The following officers of the local section were elected: Chairman, Mr. E. S. Marlow, manager commercial department Potomac Electric Power Company, Washington; vice-chairman, Mr. R. Bruce Emerson, of Emerson & Orme, and secretary-treasurer, Mr. C. M. Marsh, commercial engineer of the Potomac Electric Power Company.

Water-Power Control Sought by New York State

The policy of having the State develop its own water-power resources, instead of leaving that work to private enterprise, is recommended in the report of the Velte committee submitted to the New York State Legislature on March 12.

A bill was also introduced by Senator Velte designed to repeal laws incorporating the Niagara County Irrigation & Water Supply Company and other Niagara power corporations, in accordance with the recommendations of the committee.

The creation of a State waterways commission is the purpose of a bill introduced by Senator Peckham. The commission would consist of Henry W. Hill, president of the New York State Waterways Commission; John Claflin, president of the New York Chamber of Commerce; George S. Swain, president of the American Society of Civil Engineers, and Robert H. Treman, president of the New York State Bankers' Association. The salary of the president would be $5,000, and that of each of the other members $3,000, the bill carrying an appropriation of $42,000.

It is specified that the commission shall make an investigation and report to the Legislature of 1915 what legislation is advisable to conserve the waters of the State and provide for utilizing the flow of the rivers.

N. E. L. A. Convention Arrangements

The thirty-seventh convention of the National Electric Light Association will be held at Philadelphia June 1, 2, 3, 4 and 5, 1914. The headquarters of the association will be at the Bellevue-Stratford Hotel. All the regular sessions will be held in three commodious meeting rooms on the ballroom floor, where more than 2000 members can participate conveniently in the exercises at one time and can, within a minute, go from one section to another. The exhibition committee, on behalf of the Class D members, has made arrangements for the occupancy of the entire roof garden of the hotel and has planned an exhibit of rare beauty and interest in a setting of unequaled artistic attractiveness. The garden has a wide view over the whole city and has also a separate restaurant of its own. Thus the entire convention will be housed in one building, while the facilities are such as to minimize any crowding or difficulty of circulation. The offices of the secretary, the hotel, transportation and local registration and information committees and the main registration bureau and the counters for the distribution and deposit of convention reports and papers will all be on the ballroom floor, within immediate access of every meeting hall. Telephonic bulletins will keep each room and the offices advised as to the progress of business in the various sections.

Work of the Convention

The work of the convention will begin on Tuesday morning, June 2, and will close on Friday morning, June 5. A very full program has already been arranged in the general, executive, technical, commercial, accounting and hydroelectric sections and sessions, but it is proposed to limit mere reading of papers and reports as much as possible and to develop discussion. There will be several parallel sessions during Tuesday, Wednesday and Thursday, culminating in a most important general and executive meeting on Friday morning.

Entertainment

The convention will open on Monday night, June 1, with the annual reception to the president in the grand ballroom. With this and the public policy meeting of Wednesday night special features of interest will be associated. On Wednesday afternoon the annual baseball game will be played for the trophy cup, and there is already keen interest among the competing company section teams. At the close of the convention a great rejuvenation will be held by the Jovian Order, whose membership is very large in the ranks of the N. E. L. A. Other general entertainment for ladies is being arranged for during the week by the special entertainment committee of the convention committee, of which announcement will be made in due course. Opportunities will also be provided for visiting the numerous historic spots in which Philadelphia is so rich.

Registration

For some years past it has been the practice of the association to issue in advance a set of separate registration cards for attendance, papers, hotel accommodation, transportation, etc. A change in method is being attempted this year in combining these cards in triplicate form, which the member fills up and returns, once for all, to the association office, stating his plans, preferences, arrangements and other details. The set of cards will be issued with a supplemental circular about the middle of April. The registration of the large membership in the Philadelphia district will be in the hands of a local registration committee.

Hotel Accommodations and Transportation

Philadelphia is fortunately very well provided with excellent hotels, and the hotel committee, of which Mr. A. H. Manwaring, of Philadelphia, is chairman, will see that requests for reservations shall receive due and proper attention. A reception committee will assist at the railway depots and hotels. In the event that the desired reservation cannot be secured at the hotel selected by the member, the committee will place a reservation with some other hotel offering similar accommodation and rates.

The transportation committee, Mr. G. W. Elliott chairman, has practically completed arrangements for the movement of members of the association from all sections of the country to Philadelphia. Special trains are being arranged for from Chicago, one over the Pennsylvania Railroad, leaving probably in the evening and making the daylight run between Pittsburgh and Philadelphia, arriving at the convention city in the early afternoon. The committee is also trying to arrange for a special train from Chicago over the Lake Shore Railroad, leaving in the morning and taking on at Toledo members from Detroit and other adjacent points, and also at Cleveland the large delegation that usually goes from that large electrical center. The train will reach Buffalo late in the evening and take up Buffalo and Canadian travel. Another special is being arranged for from the Southeastern section, and much is expected for the success of this train, as all the members in that section are bending every effort to make it a representative movement. Definite decision has not yet been arrived at regarding the Pacific Coast members. It may be found necessary to run a special from San Francisco. The Kansas City and St. Louis contingents will move to Chicago and there feed the two specials from that point as before described. This will also apply to St. Paul, Minneapolis and Northwestern points. On account of the short run between New York and Philadelphia and the excellent train service between these two cities, it has been decided not to attempt to arrange for special trains. This will also apply to Boston, the New England delegates preferring to go to New York and from there to Philadelphia. The transportation committee and the railroads between New York and Philadelphia will be in close touch all the time to insure sufficient train equipment on the days when the members are going and returning from the convention.

A strong general convention committee has been organized under the chairmanship of Mr. W. C. L. Eglin, vice-president of the Philadelphia Electric Company and past-president of the association. The foregoing announcements are an outline of its work and plans and of what is proposed by its sub-committees.

Census Returns on the Electric Railways of the United States

The Bureau of the Census has given out preliminary figures of its forthcoming quinquennial report of the electric railways of the continental United States. The statistics relate to the years ended Dec. 31 for 1912 and 1907 and June 30 for 1902. The totals, as intimated in the *Electrical World* last week, include electric-lighting plants operated in connection with electric railways and not separable therefrom, but do not include reports of mixed steam and electric railroads or of railways under construction during the census year which had not begun operations.

The figures as presented for the continental United States show general gains for the decade 1902-1912. The number of operating companies increased from 817 in 1902 to 975 in 1912, or 19 per cent. There were 41,065 miles of track in 1912, as compared with 22,577 in 1902, or an increase of 82 per cent. The persons employed numbered 282,461 in 1912, as compared with 140,769 in 1902, or an increase of 101 per cent. The revenue passengers carried in 1912 numbered 9,545,554,667, as compared with 4,774,211,904 in 1902, or an increase of 100 per cent. The gross income in 1912 amounted to $585,930,517, as compared with $250,504,-

CENSUS DATA ON THE ELECTRIC RAILWAYS OF THE UNITED STATES

	1912	1907	1902	Per Cent of Increase, 1902-1912
Number of companies	1,260	1,286	987	27.7
Operating	975	945	817	19.3
Lessor	285	291	170	67.6
Miles of line	30,437.86	25,547.19	16,615.34	82.9
Miles of single track†	41,064.82	34,381.51	22,576.99	81.9
Cars, number	94,016	83,641	66,784	40.8
Passenger	76,162	70,016	60,290	26.3
All other	17,854	13,625	6,494	174.9
Electric locomotives	277	117	3	....
Persons employed	282,461	‡221,429	‡140,769	100.7
Salaried employees	23,271	11,700	7,128	226.5
Wage earners (average number)	¶259,190	209,729	133,641	93.9
Power:				
Horse-power, total	3,665,051	2,476,479	1,349,211	171.6
Steam and gas engines (including turbines)—				
Number	2,312	2,552	2,351	*—1.7
Horse-power	3,193,744	2,384,518	1,300,058	145.7
Waterwheels—				
Number	383	228	159	140.9
Horse-power	471,307	91,961	49,153	858.9
Kw capacity of dynamos	2,508,066	1,723,416	898,362	179.2
Output of stations, kw-hr.	6,052,699,008	4,759,130,100	2,261,484,397	167.6
Current purchased, kw-hr.	2,967,318,781	§	§	.....
Passengers carried	12,135,341,716	9,533,080,766	5,836,615,296	107.9
Revenue	9,545,554,667	7,441,114,508	4,774,211,904	99.9
Transfer	2,423,918,021	1,995,658,101	1,062,403,392	128.1
Free	165,869,025	96,308,157	§	......
Car mileage (passenger, express, freight, etc.)	1,921,620,074	1,617,731,300	1,144,430,466	67.9
Condensed income account of operating companies:				
Gross income	$585,930,517	**$429,744,254	**$250,504,627	133.9
Operating revenues	$567,511,704	$418,187,858	$247,553,999	129.2
Transportation revenues	$520,184,773	$390,276,347	$235,997,005	120.4
Non-transportation revenues††	$47,326,931	$27,911,511	$11,556,994	309.5
Income from other sources	$18,418,813	$11,556,396	$2,950,628	524.2
Operating expenses	$332,896,356	$251,309,252	$142,312,597	133.9
Gross income less operating expenses	$253,034,161	$178,435,002	$108,192,030	133.9
Deductions from income (taxes and fixed charges)	$191,123,408	$138,094,716	$77,595,053	146.3
Net income	$61,910,753	$40,340,286	$30,596,977	102.3
Dividends (operating companies)	$51,650,117	$26,454,732	$15,882,110	225.2
Surplus	$10,260,636	$13,885,554	$14,714,867	*—30.3

*A minus sign denotes decrease.

†Includes track lying outside the United States, namely, 1912, 31.91 miles; 1907, 27.52 miles, and 1902, 4.20 miles, and exclusive of track not operated.

‡For 939 companies in 1907 and for 797 companies in 1902.

¶Number employed Sept. 16, 1912.

§Figures not available.

**For 939 companies in 1907 and for 799 companies in 1902.

††Income from sale of energy included: In 1912, $36,500,030; in 1907, $20,093,302; in 1902 $7,703,574.

627 in 1902, or an increase of 134 per cent. The operating expenses amounted to $332,896,356 in 1912, as compared with $142,312,597 in 1902, or an increase of 134 per cent. The total horse-power of the power plants was 3,665,051 in 1912, as compared with 1,349,211 in 1902, or an increase of 172 per cent. The horse-power of the waterwheels increased from 49,153 in 1902 to 471,307 in 1912, or 859 per cent. The output of stations amounted to 6,052,699,008 kw-hr. in 1912, as compared with 2,261,484,397 in 1902, or an increase of 168 per cent. The energy purchased in 1912 amounted to 2,967,318,781 kw-hr., the figures for 1902 not being available.

Government Aid and Additional Water Rights Wanted by Ontario Hydro Commission

Resolutions calling upon the Canadian government to assist the Hydro-Electric Radial Railway scheme to the extent of $6,400 per mile bonuses, asking that the plans for the furtherance of the deep waterways projects be favorably acted upon, and praying the Hon. Adam Beck to reject the Canadian Commissionership if it is given him, that he may remain in Ontario to continue his work on behalf of the people, were passed by unanimous votes at the Hydro-Electric Radial field day convention held in London, Ontario, March 5. Delegates were in attendance from every municipality in the Province west of Guelph and all were in accord with the resolutions offered. Enthusiasm for Hydro radials was most pronounced, especially when the Hon. Adam Beck delivered his address, forecasting a degree of success for the radial projects not even exceeded by the Hydro power project.

It appears certain that a very large deputation will be prepared to go to Ottawa to ask for the $6,400 per mile bonus. This deputation will be merged with that of the Waterways Association, which asks for the immediate deepening of the Welland Canal, of the Sault Ste. Marie Canal, of the St. Lawrence Canals, and in the same connection for the preservation to public ownership of the water rights on those waters. One of the resolutions embodied a clause asking that the necessary procedure by which to secure an additional supply of power be sanctioned. Mr. Beck pointed out that there is now but 6000 cu. ft. a second of water available at Niagara Falls for the development of power and announced that tenders have been received from a number of development companies asking for these rights. One of them—the most liberal, he said—claims to be able to develop by an advanced method upward of 100,000 hp. The right is asked to export only 40 per cent of this, whereas existing companies are exporting 50 per cent. This concern, however, asks the government to pay $12 per hp-year, as against $9 paid to the Ontario Power Company. The Hydro-Electric Power Commission has gone into the matter and has learned that by diverting the water to the Welland Canal and taking advantage of certain facilities thereby obtainable 224,000 hp can be developed, and at a much smaller cost. The commission's contract with the Ontario Power Company calls for 100,000 hp, but because of the fact that 90,000 hp of this will be in use before the end of 1915 immediate action must be taken to augment the supply.

Mr. Beck stated that the economic questions of the day would be solved to a large degree by the construction of Hydro-Electric radials. Bonuses, he said, are given freely to private corporations, and there should be no difficulty in the way of subsidizing public enterprises that are to be honestly and economically conducted.

Death of Westinghouse

"The history of this organization from the time of its creation by Mr. Westinghouse to its present magnitude is the story of the genius, wisdom, courage and foresight which placed him among the foremost men of his age.

"By his death a high-minded and inspiring leader of men has been taken away. There has been a great public loss.

"It is with sorrow that the board registers this last sad memorial among the chronicles of the company built by him, and orders it engrossed and forwarded to his family."

Thus did the directors of the Westinghouse Electric & Manufacturing Company at a special meeting held on Tuesday place on record their estimate of the founder of the company, George Westinghouse, who died on March 12 after last week's issue of the *Electrical World* had gone to press. The great inventor and captain of industry succumbed to heart disease at his residence in New York in his sixty-eighth year. This ailment first manifested itself about fifteen months ago and necessitated his withdrawal almost wholly from business affairs. However, his mental alertness and activity remained unimpaired to the end.

At his funeral, which took place from the Fifth Avenue Presbyterian Church, New York, last Saturday, a notable gathering witnessed the last rites. Representatives of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the National Electric Light Association, the New York Electrical Society and numerous other professional bodies were in attendance. The honorary pallbearers were Messrs. Charles Francis Adams, Horace F. Andrews, Charles J. Canda, Charles Crane, president Crane Company, Chicago; George Gibbs, electrical engineer Pennsylvania Railroad; T. A. Gillespie, early associated with Mr. Westinghouse in installing first service of natural gas in Pittsburgh; J. M. Guffey, of Pittsburgh; J. H. Gantt, vice-president American Society of Mechanical Engineers; W. S. Hawk, of Hawk & Wetherbee; E. M. Herr, president Westinghouse Electric & Manufacturing Company; H. T. Herr, vice-president and general manager Westinghouse Machine Company; A. L. Humphrey, vice-president and general manager Westinghouse Air Brake Company; Alexander C. Humphreys, president Stevens Institute; T. B. Kerr, Walter M. McFarland, vice-president Babcock & Wilcox Company; J. R. McGinley, president Chicago Pneumatic Tool Company; William H. Newman, chairman of the board New York Central Railroad; George T. Oliver, United States Senator, Pittsburgh; Col. H. G. Prout, vice-president Union Switch & Signal Company, Pittsburgh; Samuel Rea, president Pennsylvania Railroad; L. B. Stillwell, former president American Institute of Electrical Engineers; Charles A. Terry, vice-president Westinghouse Electric & Manufacturing Company; E. B. Thomas, president Lehigh Valley Railroad; G. E. Tripp, chairman of the board Westinghouse Electric & Manufacturing Company; W. D. Uptegraff, director Westinghouse Air Brake Company; S. T. Wellman, Wellman, Seaver, Morgan Company, Cleveland; Daniel Willard, president Baltimore & Ohio Railroad; F. V. Underwood, president Erie Railroad; W. H. Marshall, president American Locomotive Company; Admiral Robert E. Peary, and the Rev. Dr. D. Wortman, Orange, N. J., the pastor of the church in Schenectady attended by Mr. and Mrs. Westinghouse at the time of their marriage and up to the time of their departure for Pittsburgh in 1867.

Forty-seven veteran employees of the Westinghouse companies came from Pittsburgh to pay their respects

Geo. Westinghouse

to their dead chief, and the 25,000 men in the Westinghouse industries around Pittsburgh suspended work on Saturday as a tribute to his memory. A memorial service was also held in the Welfare Building at Wilmerding, Pa., which was attended by about 2000 people. A Westinghouse Memorial Association was formed in Pittsburgh Monday the object of which is to raise a fund by popular subscription for the erection of a monument that will be one of Pennsylvania's greatest memorials.

It was stated that the death of Mr. Westinghouse will not cause any great change in the policy or operation of the Westinghouse industries. A system which he devised several years ago for their continuance will go into effect. For three years he had been limiting his activities and placing greater responsibilities upon trusted associates. These same men had handled the affairs of the industries during his frequent business trips to Europe and will now form a Board of Trustees, headed by his brother, Mr. H. H. Westinghouse, which will have full management over the estate.

Career of Westinghouse

George Westinghouse was born at Central Bridge, N. Y., Oct. 6, 1846. His parents were George and Emeline Vedder Westinghouse. Mr. Westinghouse's father was also an inventor and in 1856 removed with his family to Schenectady, N. Y., where he established the Schenectady Agricultural Works, which is still standing directly opposite the great works of the General Electric Company at Schenectady. George Westinghouse was one of five sons, only one of whom, Herman H. Westinghouse, is now living. The boy attended the public schools of the town and spent his leisure moments in his father's machine shop. Before he was fifteen years old he invented and built a rotary engine. In June, 1863, although not seventeen, young Westinghouse enlisted in the Twelfth New York National Guard and shortly after joined the Sixteenth New York Cavalry. He was honorably discharged in November of the following year and a month later accepted an appointment as third assistant engineer in the United States Navy.

At the close of the civil war Mr. Westinghouse entered Union College, where he remained until the end of his sophomore year, leaving to enter upon active life and to find a wider scope for his inventive genius. In 1865 he invented a device for replacing railroad cars on the track, which was manufactured by the Bessemer Steel Works at Troy, N. Y. His first patent for an air brake was awarded a few years after, on April 13, 1869, and the Westinghouse Air Brake Company was formed on July 20 of that year. He invented the automatic feature of the brake and in 1886 was awarded a patent for a quick-action brake. In 1863 Mr. Westinghouse became interested in the operation of railway signals and switches by compressed air and developed and patented the system now manufactured by the Union Switch & Signal Company.

Formation of the Electric Company

In 1886 the Westinghouse Electric Company was formed for the manufacture of lamps and electric lighting apparatus, Mr. Westinghouse having become interested in the subject. The business rapidly developed and in 1889 and 1890 the company absorbed the United States Electric Lighting Company and the Consolidated Electric Light Company. In 1891 all these properties were reorganized into the Westinghouse Electric & Manufacturing Company, which owns extensive works at East Pittsburgh, Pa. While the company was still growing Mr. Westinghouse had the foresight to gather about him such able and talented engineers as William Stanley, Nikola Tesla, O. B. Shallenberger and others in the development of alternating-current machinery. Mr. Westinghouse rendered an invaluable service to the industry when in spite of strong opposition he succeeded in introducing the alternating-current system of distribution. The direct-current system was then used exclusively in this country. In 1885 Mr. Westinghouse sent the late Franklin Pope, then on the consulting staff of the Westinghouse company, to England to purchase the American rights to the invention of Messrs. Goulard and Gibbs, two British electricians who experimented with what they called alternating currents. Within a month after Mr. Pope's return Mr. Westinghouse had set up a laboratory to develop the Goulard-Gibbs invention commercially. From that moment the real growth and application of electricity to lighting, manufacturing and transportation may be said to date. He backed Tesla financially and with shop facilities in developing the induction motor, and built the first ten great dynamos for Niagara Falls. The alternating current which Mr. Westinghouse fought into universal recognition has alone made possible long-distance transmission of energy and the development of hydroelectric power far remote from the point of its utilization.

After the panic of 1907 the Westinghouse Electric & Manufacturing Company went into the hands of receivers and Mr. Westinghouse lost control of the company. However, the recent reorganization of the company was due to the adoption of a plan which he originated and which he carried through successfully with full protection to creditors and stockholders and without interruption to the work of the thousands of employees.

Almost akin to his work for electric transmission of energy was his system for controlling natural gas and conveying it through pipe lines for long distances, thereby establishing the practicability of utilizing natural gas as fuel in homes, mills and factories. Mr. Westinghouse also took a foremost part in the development of gas engines and in adapting steam turbines to electric driving. Besides his genius as an inventor, Mr. Westinghouse was well known as an organizer and financier. The Sawyer-Man incandescent lamp, the Nernst lamp and the Cooper Hewitt mercury vapor lamp were all put on a commercial basis by Mr. Westinghouse.

One of his notable triumphs was in obtaining, in 1892, the service contract for lighting the World's Columbian Exposition at Chicago. The Chicago World's Fair was the first of the great international expositions where all the lighting and the operation of all machinery (outside of Machinery Hall, where steam engines, steam turbines, steam pumps, etc., were exhibited) was done by means of electrical energy. More things that were then novel and interesting were done by electrical means at the Chicago World's Fair than at any of the great expositions before or since. Electrical accomplishment was comparatively new then, and it was recognized that the advertising value of furnishing the electrical energy for the buildings and grounds would be very great. The only plan considered was the erection of a service plant in Machinery Hall. The idea that the energy might be purchased from a central-station organization did not, perhaps, occur to anybody; at any rate, it was not seriously advanced. The year 1892 witnessed the consolidation of the two great rivals of the Westinghouse company, the Edison General and the Thomson-Houston companies, into the General Electric Company. Both of the two great electrical organizations remaining were very anxious to get the contract for lighting the World's Fair. Apparently the General Electric Company, controlling the very important Edison incandescent-lamp patents, which had been upheld by the courts, had the better chance. But Mr. Westinghouse entered the lists personally, made a number of visits to Chicago, and conducted such a hot fight that he secured the contract. The original specifications were dated Feb. 22, 1892, but the bids received were rejected, and new specifications were issued. About 90,000 16-cp incandescent lamps were required. Bids were opened on May 16, 1892, and the contract for supplying, installing and operating the plant for the period of the fair was awarded to the Westinghouse Electric & Manufacturing Company for $5.25 per lamp. Alternating current was used, and the 1000-hp generators in the service plant were looked on with awe as veritable giants in dynamo-electric machinery. All of the primary circuits except one were laid underground. The largest transformer was rated for 200 lamps. But the most interesting feature of the job was the lamp used. It was the Westinghouse or Sawyer-Man "stopper" lamp, provided with a ground-glass stopper to permit the renewing of the filament, which was operated in an attenuated atmosphere of nitrogen. Iron leading-in wires were substituted for platinum, and the lamp was operated at 105 volts. This lamp never came into general use, but it did not infringe the Edison patents, apparently, and it served its purpose. The upshot of the whole contest and the World's Fair undertaking was greatly to increase the prestige of Mr. Westinghouse's company.

To Mr. Westinghouse was given the honorary degree of Doctor of Philosophy by Union College in 1890, and in 1906 the Königliche Technische Hochschule of Berlin bestowed upon him the degree of Doctor of Engineering. His decorations comprised the Legion of Honor of France, Royal Crown of Italy, and Leopold of Belgium. He was the second recipient of the John Fritz medal and was awarded the Edison Medal by the American Institute of Electrical Engineers in 1912. On behalf of the engineering profession of Germany the American Society of Mechanical Engineers presented him with the Grashof Medal last December. Mr. Westinghouse was an honorary member of the American Society of Mechanical Engineers, of which he was also a past-president, the National Electric Light Association and the American Association for the Advancement of Science. He was president of a large number of corporations having an aggregate capital of over $100,000,000, the largest of which are the Westinghouse Air Brake Company, the Westinghouse Machine Company and the Union Switch & Signal Company. He was also the head of about a dozen companies abroad, the largest of which are in London, Manchester and Havre. Mr. Westinghouse was married Aug. 8, 1867, at Brooklyn, N. Y., to Marguerite Erskine Walker, who with one son, George Westinghouse, Jr., survives him.

Tributes of Former Associates

It is not in one profession alone that the memory of Westinghouse will live. Kelvin said of him: "George Westinghouse is in character and achievement one of the great men of our time." Physically he was a big man; he also was great in character and mind. Interesting sidelights on his brilliant career contributed by men formerly associated with him and published herewith show how highly he was esteemed, and what was lost in his passing away.

From William Stanley

I can only add my appreciation of the great qualities of leadership that Mr. Westinghouse possessed. His strong, vigorous purpose, his wonderful grasp of the opportunities of life and his high courage overcame all obstacles and were of inestimable value to the electrical engineering profession and the world.

Great Barrington, Mass. William Stanley.

From Peter Cooper Hewitt

In George Westinghouse the world has suffered the loss of a great and valued citizen and much should be said in honor of his accomplishments and advancement of modern industry. Essentially an American, he had universal reputation and respect.

The vast and divers works which he pioneered give an idea of his force and energy and illustrate dominant characteristics. Every effort of his genius was expended for humanity in advancing the arts of civilization. As the problems involved in nature's secrets unfolded themselves before him he strained every effort and means at his disposal to turn their use to the benefit of mankind.

He appreciated the enormous danger to humanity that accompanies the harnessing of vast forces of nature for public use, and by his foresight and skill prevented disasters which might conceivably have been of enormous extent.

The memory of George Westinghouse will live through his appreciation of nature's forces and his love of mankind.

New York. Peter Cooper Hewitt.

From Nikola Tesla

The first impressions are those to which we cling most in later life. I like to think of George Westinghouse as he appeared to me in 1888, when I saw him for the first time. The tremendous potential energy of the man had only in part taken kinetic form, but even to a superficial observer the latent force was manifest. A powerful frame, well proportioned, with every joint in working order, an eye as clear as a crystal, a quick and springy step—he presented a rare example of health and strength. Like a lion in a forest, he breathed deep and with delight the smoky air of his factories. Though past forty then, he still had the enthusiasm of youth. Always smiling, affable and polite, he stood in marked contrast to the rough and ready men I met. Not one word which would have been objectionable, not a gesture which might have offended—one could imagine him as moving in the atmosphere of a court, so perfect was his bearing in manner and speech. And yet no fiercer adversary than Westinghouse could have been found when he was aroused. An athlete in ordinary life, he was transformed into a giant when confronted with difficulties which seemed unsurmountable. He enjoyed the struggle and never lost confidence. When others would give up in despair he triumphed. Had he been transferred to another planet with everything against him he would have worked out his salvation. His equipment was such as to make him win easily a position of captain among captains, leader among leaders. His was a wonderful career filled with remarkable achievements. He gave to the world a number of valuable inventions and improvements, created new industries, advanced the mechanical and electrical arts and improved in many ways the conditions of modern life. He was a great pioneer and builder whose work was of far-reaching effect on his time and whose name will live long in the memory of men.

New York. Nikola Tesla.

From Calvin W. Rice

Of the many remarkable qualities that come to one's mind in thinking of Mr. Westinghouse, none stands out more prominently than those which characterize him in his home life.

While Mr. Westinghouse had a tremendous capacity for work and power of concentration and always carried an atmosphere of one whose work was his first desire, it was evident to those who knew him intimately that it was not the work itself but the desire to accomplish results. Nowhere was this shown more clearly than in his relations to the routine of his well-ordered home. He followed with precision the program for the day but was so gentle and gracious withal that one yielded as a matter of course to his plans.

When separated from Mrs. Westinghouse, as he usually was for two or three days of each week, it was his uniform habit to hold a daily conversation over the telephone. It made no difference how far separated or how busy Mr. Westinghouse may have been, that greeting was exchanged not only at a definite hour, but with fondness and thought of every detail of Mrs. Westinghouse's comfort. Another beautiful feature of the conversation was the never-failing inquiry on the part of both for the guests of the other and the sending of messages of greeting for the guests.

Mr. Westinghouse had the most perfect balance between strength and gentleness, both physical and mental, of anyone I ever knew. In fact, one might say he had the gentleness of strength under complete control.

His sense of dignity was always present, and one was conscious also that Mr. Westinghouse knew and was satisfied with his own superiority of equipment and mastery of any situation and that his self-respect was absolute. His successes in life under great difficulties were the result not only of masterly genius but of supreme confidence.

New York. CALVIN W. RICE.

From Walter M. McFarland

As I review my association with Mr. Westinghouse for almost twenty years, the dominant thought that comes to me is the way in which his greatness impressed itself upon all about him. One could not be with him and know him without feeling that he was in the presence of one of the world's great and wonderful personalities.

This was not because of any peculiarity of manner, for he was singularly unaffected and simple in his dealings with everybody, and one of the most approachable of men. You knew of all the wonderful things that he had done, and you realized that he was different from the average man of ability.

The mental qualities which brought about the success of his wonderful career were numerous and diversified, and it was the fact that he possessed them all which differentiated him from those who possessed only a few. Imagination, organization, executive ability, foresight, courage, tenacity of purpose and cheerfulness were the great qualities that were all his. It would be difficult to say which of these contributed most to his success, but my personal association and knowledge of his history would lead me to place tenacity of purpose first, and then courage and foresight.

The wonderful success of the air brake, which was the foundation of his fortune, and by which he is known to most people, has rather masked the still more wonderful history of the successful introduction of alternating-current machinery and the organization and development of the great electric company bearing his name. If a writer like Kipling had all the facts of his life, the history of his electrical work would prove one of the most fascinating stories that have ever been written.

The high quality of technical work which Mr. Westinghouse conducted led to the employment of an unusually large number of talented men. Many of these are still in his companies, while a very large number have gone out into other electrical and engineering enterprises. It is safe to say that no man ever inspired his subordinates and associates with more affectionate admiration and respect, and, as one of those who, after serving him for many years, have recently been in touch with him only as personal friends, I wish to add my tribute of respect and admiration for his wonderful work and my gratitude for his many personal kindnesses to me. It is a great privilege to have worked for such a man, and to have been associated with him as one of his officers, and it is a still greater privilege to have been honored with his personal friendship.

New York City. W. M. MCFARLAND.

From Charles A. Terry

A prominent business man recently made this statement: "To say that George Westinghouse was a man of a generation would be inadequate; he was a man of centuries." It is interesting to consider what were the qualities of a man of whom this could so justly be said. That he was a great inventor is a fact of world-wide recognition, but there have been other great inventors. We look then for further qualities, and it is in these, which rival even his unusual inventive genius, that we find the character of his greatness. Prominent among these qualities those who knew him well would place his powerful intellect, his tremendous will power, his indomitable courage, all being different manifestations of his strong personality. His quick insight into the verities of any problem enabled him to arrive rapidly at conclusions, and when convinced of the justice and feasibility of the end to be attained and satisfied as to the course to pursue he trained the full force of his will upon its accomplishment. Large obstacles served only to intensify his interest in the pursuit. Small obstacles made no impression. Threatened defeat, which would often dishearten his associates, called into play only that dauntless courage which was so much a part of his being that he seemed not to recognize it as a quality distinct in itself. But even this persistence and this courage alone would not have availed to develop the numerous industries bearing his name nor to construct the acres of buildings in which the thousands of employees find congenial occupation. Back of these forces there was a far-sighted apprehension of not merely the possibilities but the certainties of future scientific and industrial development. A powerful scientific imagination gave to his opinion almost the character of accurate prophecy. He had, besides, a remarkable quickness of perception and clearness of vision unhampered by the limitations of the average observer. These, backed by sound judgment and practical sense, made it possible for him to turn into material benefit to the world the varied inventions which found their origin in his fertile brain.

Combined with these qualities of genius, will force and far-sightedness, there was a personal charm which won for him the admiration and affection of those who labored with and for him, as well as of those who, in the struggle of commercial progress, were his business competitors. His winning smile, his cordial grasp of the hand, evidenced a heart warm in its regard for mankind, loyal in friendship and gentle in affection.

The life and deeds of the man who was gifted with these qualities and who utilized them to their fullest extent have been an inspiration to those living in his own generation and will be an object of admiration through generations to come.

New York. CHARLES A. TERRY.

From L. B. Stillwell

The dominating characteristics of George Westinghouse were intellectual vigor, dauntless courage and tireless energy. During an acquaintance extending over more than twenty-seven years the impression of his ability and energy, first formed when I had the good fortune to enter his employ at Pittsburgh in October, 1886, has been deepened and strengthened. The ten years of my connection with his interests covered a period of extraordinary activity and progress in the development and commercial application of alternating currents, and during this period, at first as assistant electrician and later as chief electrical engineer of the electric company, I was thrown into very intimate professional and personal relations with him.

For the last seventeen years, as the representative of other interests having large dealings with the Westinghouse Electric & Manufacturing Company and with other companies established by Mr. Westinghouse, my observation has been from a different point of view; but during all these years and from both points of view the conviction has grown that in ability and energy no captain of industry in our time has excelled him and few, if any, have been his equals.

The wide range and great variety of the products of the manufacturing companies which he organized and which in no small measure were based upon his own personal inventions testify to his remarkable versatility in the field of applied mechanics and differentiate him strikingly from the majority of his leading contemporaries in commerce and industry. He is most widely known as the inventor of the air brake, but it should not be forgotten that the introduction in this country and the development and wide industrial application of the alternating-current system for transmitting and distributing electricity were due primarily to his foresight, courage and personal efforts. He was the central figure also in the utilization on a large scale of the natural-gas resources of western Pennsylvania and adjacent states, while for his work in development of the automatic-block-signal system the traveling public owes him a debt only less than that which it owes for the air brake.

From the outstart his influence upon the young men associated with him was extraordinary. His lieutenants inevitably partook of his own bouyant hopefulness and his determination to find the solution of the many problems encountered in his development work.

In character and habits of life Mr. Westinghouse set a high standard, which has influenced hundreds of men connected with his various enterprises. He never preached, save by example, but his preaching was remarkably effective. He never smoked, and I cannot recall that I ever saw him drink even a glass of wine at his own table, although both wines and tobacco were provided for his guests. There are hundreds of men whose standards of living are better for their association with George Westinghouse, and there are thousands of men, women and children whose material prosperity and happiness are due in no small measure to his creative and constructive work. Civilized communities everywhere have benefited by his inventions, his organizing ability, his courage and his tireless work to an extent which it would not be easy to measure.

New York. Lewis B. Stillwell.

From E. M. Herr

A great man has passed away. In the death of George Westinghouse we, his friends, lose and the world loses (for his work was world-wide) a man not of a generation merely but a man in a century. Men with the many brilliant attainments of Mr. Westinghouse are so rare that several generations are likely to pass before one is met with.

It is as an inventor that he was best known, and in the exercise of his remarkable inventive ability he found his greatest pleasure. His inventions were not only great in numbers, but many of them were of epoch-making importance to humanity.

Great and famous as he was as an inventor, to those closely associated with him he was even more remarkable for his splendid courage, quickness of perception and far-seeing and accurate judgment of future needs and tendencies in the world's progress. These characteristics made him always an optimist and, combined with his indomitable will and ability as an organizer, enabled him to build up in about thirty-five years of his business career the large aggregation of manufacturing industries with which his name is associated and which are established not only in many states in this country but also in Canada, England, France, Italy, Austria and Russia. These industries together require an investment of about $200,000,000 and employ upward of 60,000 people.

The profits of these great corporations which came to Mr. Westinghouse were used only in very small part for his personal needs, his interest in the acquisition of money being almost wholly to enable him to exploit and develop, for the good of humanity, more of the inventions of himself and others.

He was always open-minded and quick to see good in the work of other inventors, and much of the progress and development made by his great industries was due to his appreciation and acquisition of the valuable inventions of others, using his own great ability to perfect and adapt them to commercial needs.

In dealing with others he was eminently fair and liberal, but independent and courageous in his own work, never hesitating to assume the entire responsibility for anything he undertook, impatient of interference and rarely accepting or adopting suggestions from his engineers or associates.

His courage was of the highest kind. He would fight to the last ditch and, no matter what the odds against him, was never known to surrender or even accept a truce. On the other hand, his nature was most kindly and considerate.

With unfailing courtesy and kindliness he prosecuted his work but always insisted on the best efforts of his employees, his own unflagging zeal and great energy setting a pace which few could follow and none ever exceed.

Mr. Westinghouse lived very simply, was plain and unostentatious in his manner, very approachable, of a keen sense of humor and a most engaging personality. His kindly courtesy and consideration for all endeared him to his employees and inspired in them a spirit of great loyalty and affection for their chief.

Pittsburgh, Pa. E. M. Herr.

Threaten Reduction to 3-Cent Maximum Rate at Cleveland

A mandatory ordinance now pending before the City Council of Cleveland, Ohio, will, if passed, reduce the Cleveland Electric Illuminating Company's maximum rate to residence customers to 3 cents per kw-hr. The ordinance has passed its first reading in the Council.

Residence customers are now served under a sliding scale of prices, the maximum being 10 cents per kw-hr and the average rate earned under this schedule being 6.25 cents per kw-hr. The average lighting bill in Cleveland homes to-day is $1.91 a month. At present the company has no established minimum bill. The general impression seems to prevail among members of the Cleveland company's staff that the rate is confiscatory and will not be sanctioned by the Ohio Public Service Commission.

Annual Report of the Bell Telephone System

The continued growth of the Bell Telephone system, its earnings and expenses and general financial prosperity, its attitude as to government ownership, its agreement with the Department of Justice, the sale of its Western Union holdings and its relation with the general public, are all set forth in detail in the annual report of the American Telephone & Telegraph Company just issued.

President Theodore N. Vail has something very definite to say in regard to the government ownership of telephones, and his frank discussion of this question is one of the most interesting features as well as the most voluminous part of the report.

Government Ownership and Operation

In summing up the attitude of the company toward this subject, Mr. Vail says:

"Our opposition to government operation and ownership is not based on pecuniary, partisan, prejudiced or personal reasons. It is because of our interest in the upbuilding of a great public utility and its preservation."

He states that the common impression that the Postmaster-General has made a report favoring the acquisition of the wire lines is erroneous. It is not a departmental report, he says, but merely the conclusions of three officials of the Post Office Department, transmitted without comment by the Postmaster-General.

As to possible government purchase, Mr. Vail quotes Congressman Lewis, the Congressional exponent of government ownership, to the effect that there is no water in the Bell capitalization, and urges the stockholders not to be induced to part with their holdings through fear of confiscation.

The advantages of one telephone system are clearly set forth, as are the differences between the exact technical knowledge required for operation and the judicial ability necessary for regulation.

"Government administration," the report says, "is more or less a game of politics, and while with government operation it may sometimes be possible to have efficiency, it will always be impossible to have economy.

"The government-owned European telephone plants, notwithstanding the low price of foreign labor, are carried at a much higher cost than those of the Bell system, and yet every one of them uses the Bell system as a model. The book value of the plant of the Bell system per station is less than 60 per cent that of Belgium, less than 75 per cent that of Austria, about 85 per cent that of Germany, Great Britain and Switzerland, and all of these are government-owned."

Mr. Vail maintains that Americans are better supplied with telephone facilities than any other people, having six times as many telephones per capita as Great Britain and thirteen times as many as France.

In showing the inability of the Post Office Department to operate the telephone business efficiently he says:

"The success of the parcel post has been set up as a reason for the government operation of the telephone and telegraph. Why it should be is hard to understand. The two services have nothing in common and are in no way comparable. The parcel post is not in any sense a new service; it has merely increased the volume of the mails by removing some limitations as to size and weight of packages mailed, and making some reduction in rates of postage for merchandise.

"It would not be a question of capacity; the experiment would be disastrous principally because the postmasters are not fitted by experience or training for the telegraph or telephone business, but also because it would be secondary to their grocery-dry-goods-notion shop, their principal business."

Another reason is that the telephone already reaches more places than there are post offices.

He concludes his remarks on this subject by saying that:

"Regulation by commissions of high standing composed of individuals of ability and integrity, and good impartial judgment, is the greatest protection to the public interests as against private exactions that ever was devised. Its effectiveness depends upon 'the standing with the public of the commission as a whole and the commissioners as individuals.'"

Growth of the Bell System

During the past year subscribers' telephone stations have increased until now there are 8,133,017, a gain of 676,943. These stations reach 70,000 localities, or 10,000 more than the number of post offices. The total wire mileage is 16,111,011, of which 92 per cent is copper.

More than half the wire mileage is underground, the total underground plant representing a cost of $181,500,000.

The number of daily telephone connections showed a growth of nearly 2,000,000, reaching an average of 27,237,000 a day. Europe has only two-fifths of the telephone traffic of the United States.

The extension of the telephone plant during the year amounted to $54,871,856, making a total for fourteen years of $646,915,200. According to present estimates, the construction for the current year will cost in the neighborhood of $56,000,000, of which the local resources of the companies will supply $25,000,000.

Large reserves have been made for maintenance, reconstruction and depreciation, and a steady improvement of service has been achieved.

The report says:

"The gross revenue in 1913 of the Bell system—not including the connected independent companies—was $215,600,000, an increase of over $16,000,000 over last year. Of this, operation consumed $75,400,000; taxes, $11,300,000, or 1½ per cent on the outstanding capital obligations; current maintenance, $32,500,000, and provision for depreciation, $37,700,000.

"The surplus available for charges, etc., was $58,700,000, of which $16,700,000 was paid in interest and over $30,300,000 was paid in dividends.

"The total capitalization, including inter-company items and duplications but excluding reacquired securities of the companies of the Bell system, is $1,390,242,470. Of this, $620,127,086 is owned and in the treasury of the companies of the Bell system. The capital stock, bonds and notes payable outstanding in the hands of the public at the close of the year were $770,115,384. If to this be added the current accounts payable, $26,471,681, the total outstanding obligations of every kind were $796,587,065, as against which there were liquid assets, cash and current accounts receivable of $72,237,885, leaving $724,349,180 as the net permanent capital obligations of the whole system outstanding in the hands of the public."

In the case of the associated companies, excluding the American Telephone & Telegraph Company, particular attention is called to the percentage of net earnings and of dividend and interest disbursements to total plant and other assets: Net earnings to plant and other assets, 5.69 per cent; dividends and interest to plant and other assets, 4.92 per cent. In other words, the property employed earned less than 6 per cent per annum, and the dividends and interest paid were less than 5 per cent upon the value of the property, which could not be considered unreasonable.

Taken by itself the American Telephone & Telegraph Company shows net earnings of $40,576,746.19, an increase of $2,669,101.93 over 1912. The total outstanding capital stock and bonds were $504,207,300, which represents payments into the treasury of over $24,500,000 more than the par value of the capital obligations.

The number of shareholders, 55,983, showed an increase of 5,686 during the year.

Engineering

At the beginning of 1914 there were in the Bell system 12,000,000 telephone receivers and transmitters owned by the Bell company. Of these practically none were made prior to 1902, and of all the instruments now in service the average are less than five years old.

During the year 1913 further advances in the art of loading and balancing underground circuits have so greatly improved the intermediate apparatus that it is now possible to talk satisfactorily by underground wires from Boston to Washington, in part through types of cable formerly suitable for short-haul distances only. These short-haul cables make up 47 per cent of the total cable in the line.

An exhaustive study of the New York-Denver line during the last year has shown that these improvements in transmission through underground wires are also applicable to overhead lines. Plans are now making for the rearrangement of the New York-Denver circuit. When this is accomplished the telephone transmission between New York and Denver will be equal to that now given between points about 200 miles apart and will insure satisfactory talk from the Atlantic to the Pacific and in due course bring all points in the United States within telephonic speaking distance of each other.

It has frequently been asserted that the Bell system did not employ automatic switchboards because of patents controlled by others. The report states that "the Bell company owns or has rights in every United States patent and patent application which would be necessary to operate its system upon the so-called automatic plan —which is not automatic for the subscriber as the subscriber does all the manipulation in the making of a connection. As yet it has not been demonstrated that the automatic system would give as good and dependable service as we now render to the public, when used in connection with the extensive and comprehensive suburban and interurban telephone system of the Bell company." At headquarters the Bell system has a force of 550 engineers and scientists engaged on studies of these subjects.

Legal

In describing the work of the legal department, the co-operation of the Bell system with the Interstate Commerce Commission is shown, and the correspondence is given setting forth the agreement with the Department of Justice.

Mr. Vail shows how the disposal of some $30,000,000 of Western Union stock was brought about so as to separate completely the two companies. During the three years of association the gross revenue of the Western Union increased 45 per cent, the wages of operators were increased 55 per cent, and large sums were set aside for revenue and reconstruction.

The report says that the financial condition of the Western Union, with some $15,000,000 net of liquid assets, was never better.

Employees' Benefits

The report shows that, under the pensions, disability benefits and insurance plan, in 16,054 cases employees of the Bell companies had participated in the benefits and the payments have aggregated more than $1,000,000.

Public Service Commission News

Indiana Commission

A ruling of the Indiana Public Service Commission last week on the petition of the Fort Wayne & Northern Indiana Traction Company is interesting to electric lighting companies. The traction company seeks to establish lighting service at Lagro, Ind., on its interurban line between Fort Wayne and Lafayette. The Town Council gave the company a franchise. Under the Indiana law, the company did not know whether the commission's approval was needed for the ratification of the franchise. The question was put up to the commission, and it held, without prejudicing possible change in its ruling on similar cases, that it had no authority to approve or disapprove such a situation. In case the company desires to surrender the franchise later, or in case a petition regarding rates or some other factor should be presented to the commission simultaneously with a similar situation, it is possible the utility law would allow the commission to approve or disapprove the granting of the franchise.

Illinois Commission

Mr. Charles N. Hebner has been appointed secretary of the State Public Utilities Commission of Illinois. The salary attached to the position by law is $5,000 a year. Mr. Hebner is thirty-seven years of age and has had practical experience as an accountant in public-utility work, having been employed by the Chicago Railways Company in that capacity under Mr. John Z. Murphy, now electrical engineer of the Chicago Surface Lines.

Massachusetts Commission

The Gas and Electric Light Commission has authorized the Leominster Gas Light Company to issue 850 shares of additional capital stock of $100 par value for the payment of floating debt incurred in plant additions. The company petitioned for the right to issue 1250 shares, but the board refused 400 shares on the ground that "not less than $30,000 of the expenditures which were the basis of the debt on Dec. 31, 1913, represented the cost of property substituted for other property which had been abandoned rather than actual additions." "Such expenditure," says the board, "is in fact a provision against extraordinary depreciation and essentially a replacement of plant. The cost of such work is a proper charge upon income and should not be represented in additional stock."

Vermont Commission

By a vote of two to one, the Public Service Commission of Vermont on March 16 issued an order reducing the rates of the New England Telephone & Telegraph Company throughout the State by an average of about $3 per subscriber per year. Seven thousand subscribers are affected, the reduction applying to lines on which six or more parties are connected. The board finds that the existing toll rates are reasonable and does not disturb them. Chairman R. C. Bacon stated in an interview that in no instance would the earning capacity on plant valuation as fixed by the commission be reduced below 6 per cent, and that in some instances the earning capacity would be over 7 per cent. Commissioner Warner, of Vergennes, dissents on the ground that the evidence, he thinks, shows no cause for a reduction at present. It is expected that the company and affiliated local companies affected by the decision will appeal. Vice-president E. K. Hall, Boston, made a statement upon receipt of the finding to the effect that the reductions proposed by the majority of the commission would practically wipe out every dollar of net revenue now earned in the State by the telephone interests concerned.

Current News Notes

Panama Canal Lighting Tested.—Preparatory to making the Panama Canal ready for navigation, the first test of the electric lighting of the locks, etc., was successfully carried out March 13. The various buoys, lighthouses, range lights, etc., were also lighted along the entire course of the trans-isthmian waterway.

* * *

San Francisco Office of the Electrical World.—A permanent Pacific Coast office of the *Electrical World* has been established in the Rialto Building, San Francisco, Cal. The editorial representative in charge will be Mr. N. A. Bowers, who has been news correspondent for this paper for the past year in the Northwest and previous to that time was associated editorially with the *Engineering Record.*

* * *

An Overloaded Rural Transmission Line.—The manager of a transmission system which distributes energy to several large farm users was hurriedly summoned to the telephone to answer an excited call from one of his principal rural customers. "We don't seem to be gettin' as much power up this way as we should," declared the farmer. "Mebbee it's 'cause our line is overloaded," he continued; "I just noticed that the wires are all sagging."

* * *

Dinner to Huber.—Mr. Emil Huber-Stockar, engineer in charge for the Swiss government of the electrification of the Gothard tunnel and president of the Swiss national committee of the International Electrotechnical Commission, was a guest of honor at a dinner given at the Engineers' Club, New York City, March 13, by Mr. C. O. Mailloux, president of the American Institute of Electrical Engineers. Among those who took part in an informal discussion of railway electrification as exemplified by American and Swiss installations were Messrs. Frank J. Sprague, Lewis B. Stillwell, Charles F. Scott, Cary T. Hutchinson, Norman W. Storer, A. H. Armstrong, W. S. Murray, H. M. Hobart, George Gibbs, C. O. Mailloux and Emil Huber-Stockar.

* * *

Small Electric-Service Plants in Wisconsin—The hamlet of Clayton, population 220, is perhaps the smallest community in Wisconsin having an independent central-station plant generating its own electricity. The Clayton Electric Company has an operating force of one man, and its generating equipment consists of a 12-hp gas engine belted to a 5-kw direct-current dynamo. The street-lighting load consists of eight incandescent lamps, and commercial lighting is given from dusk until 11 p. m. The Railroad Commission of Wisconsin reports 140 villages in Wisconsin with less than 1000 population having electric-service utilities. Of these forty-one are of less than 500 population. The total number of electric-service utilities in the State is 293. There are seventeen gas or oil-engine plants and eighty-two plants operated either wholly or in part by water-power. No less than seventy-eight cities and villages are supplied from municipal plants.

* * *

SOCIETY MEETINGS

Meeting of Mississippi Electric Association.—The next annual meeting of the Mississippi Electric Association will be held at Meridian, Miss., April 27, 28 and 29. Mr. Frank J. Duffy of Natchez, Miss., is secretary-treasurer.

* * *

Annual Meeting of the Arkansas Association.—The seventh annual convention of the Arkansas Association of Public Utility Operators will be held at Little Rock April 21 to 23. Mr. W. J. Tharp, Little Rock, Ark., is secretary of the association.

* * *

Jovians of Dayton, Ohio.—At the Dayton Club, Dayton, Ohio, March 16, Mr. S. G. McMeen, president of the Columbus Railway & Light Company, Columbus, Ohio, was scheduled to address Dayton members of the Jovian Order on the subject "The Age of Energy." A rejuvenation has also been arranged for the same place on Saturday evening, March 21.

* * *

Performance of Electric-Truck Motors.—At the March meeting of the Electric Vehicle Association of America, to be held March 24 at the Engineering Societies Building, New York City, Mr. T. H. Schoepf, of the Westinghouse Electric & Manufacturing Company, will present a paper on "The Performance Characteristics of Electric Motors and Their Influence on the Operation of Electric Trucks."

* * *

A Week of Iowa Conventions.—Three Iowa conventions will be held in Cedar Rapids in the week beginning April 19. The Iowa Electrical Contractors' Association will hold its first annual meeting in the city named on April 21 and 22; the Iowa Electrical Association, of which Mr. A. L. Dodd, of Charles City, is president, and Mr. H. B. Maynard, of Waterloo, is secretary, will meet on April 22, 23 and 24, and the Iowa Street and Interurban Railway Association on April 23 and 24.

* * *

Chicago Electric Club Told About Steel Making.—Mr. Arthur H. Young, supervisor of labor and safety for the Illinois Steel Company, Chicago, was the speaker at the luncheon of the Electric Club of Chicago on March 12. He gave an illustrated lecture on steel making, referring, among other things, to the part played by the Heroult electric furnace in the South Chicago steel works. Mr. Young is especially interested in welfare work and the "safety-first" movement, and he devoted a portion of his time to these subjects.

* * *

Pittsburgh Section, I. E. S.—The April meeting of the Pittsburgh Section of the Illuminating Engineering Society will take place on Friday evening, April 17, in the auditorium of the Engineers' Society of Western Pennsylvania, 2510 Oliver Building. Mr. C. E. Stevens, of the Westinghouse Electric & Manufacturing Company, will present a paper on "The Development of Flame Carbon Arc Lamps." The address will be preceded by the usual dinner at the Fort Pitt Hotel at 6 p. m. Mr. Alan Bright, 827 Wabash Building, is secretary of the section.

* * *

Chicago Section Illuminating Engineering Society.—At the March 11 meeting of the Illuminating Engineering Society (Chicago Section) papers were read by Messrs. Philip Polacheck, of Milwaukee, and Charles A. Luther, of Chicago. They discussed respectively the electric and gas fixtures for a dwelling house. Mr. William A. Durgin delivered another address in his series on the fundamentals of illumination. At the April 10 meeting the section will meet jointly with the Railway Signal Association. Mr. Thomas S. Stevens, of Topeka, vice-president of the latter association, will read a paper on "The Illumination of Signals"; Dr. William Churchill, of Corning, N. Y., will contribute a paper on "Signal Lenses," and Dr. Nelson M. Black, of Milwaukee, will discourse on "The Physiology of the Eye in Relation to Signaling."

Combination Power Plant and Pumping Station

Electric service and water-works supply for Kansas City, Kan., a city of 100,000 population—Economy effected through off-peak water pumping and motor service

KANSAS CITY, Kan., has a population of about 100,000. Numbered among its residents are perhaps no millionaires, but it is the home of middle-class and working people, including factory operatives and the employees of the meat-packing establishments operating in the lowlands along the Missouri River. There are no very large stores or high buildings, the city relying for much of its business and pleasure facilities on its neighbor across the river—Kansas City, Mo. Apartment houses are almost unknown, most of the people living in detached wooden dwellings.

In 1911 $350,000 worth of bonds were issued and sold by the city for the erection of an electric plant and distributing system. The site was purchased and a building was erected in which the generator room for the electric-service station measures 60 ft. by 60 ft. and the engine room for the water-works occupies a space 120 ft. by 60 ft. The station site lies along the Missouri River in a village which was formerly known as Quindaro, Kan.

The present generating equipment of the station consists of one 1000-kva, three-phase, sixty-cycle, 2300-volt Allis-Chalmers horizontal turbo-generator operating at 3600 r.p.m. and a 500-kva unit manufactured by the same company and delivering energy at the same voltage and frequency. The turbines are set directly on the floor of the station, being supported by I-beams in the flooring and the reinforced-concrete pillars, but without the heavy monolithic foundations generally supporting units of this size. As will be seen in the foreground, space has been left vacant in the station for the installation of a 3000-kva unit which has been ordered and which it was expected would be installed before March 1. As designed, the ultimate rating of the station is 7500 kva.

Excitation for the turbo-generator units is furnished by two 37-kw motor-generator sets which supply energy to a common station exciter bus. A bank of transformers in the basement reduces the potential from 2300 volts to 440 volts for the motors of these machines.

The steam auxiliaries for this turbine equipment consist of a 5-in. by 8-in. vertical engine directly connected to centrifugal pumps for circulating water and to a "rotrex" vacuum pump. Receiving steam from the boiler room at 150 lb. pressure and 360 deg. Fahr., the turbines discharge into a Wheeler surface condenser which maintains approximately a 28-in. vacuum.

Switching and metering operations for the entire station are accomplished on a thirteen-panel marble switchboard with marine finish. This board consists of three exciter panels, one Tirrill regulator panel, three feeder panels, three generator panels, an arc-lighting

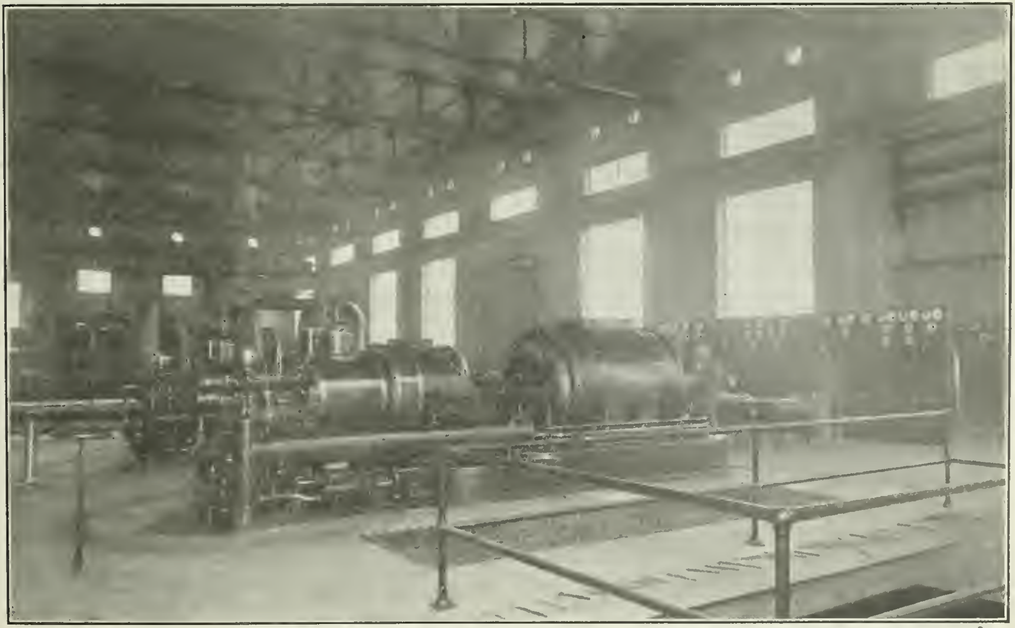

FIG. 1—TURBINE ROOM, MUNICIPAL PLANT, KANSAS CITY, KAN.

feeder panel, one panel for the exciter motors, and a 200-hp pump-motor panel. Manual remote-control apparatus has been installed on all switching panels of the board, energy for the motor-service circuits being handled at 6600 volts, while the two lighting circuits for the north and the south sides of the city are operated at 2300 volts. The power-factor indicator and synchroscope are mounted on a swinging bracket at the end of the board.

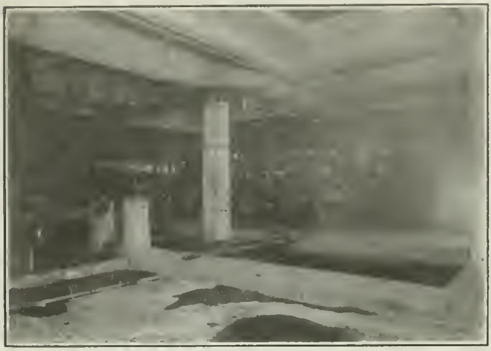

FIG. 2—WIRING AND CONDENSER EQUIPMENT IN BASEMENT

Standing behind the switchboard in the 11-ft. space which has been left between the board and the wall are six Westinghouse regulating transformers, each capable of supplying energy for 100 10-amp arc lamps. On the feeders for the lighting circuits which lead to the north and to the south ends of the city induction regulators capable of maintaining the voltage within 10 per cent above or below the normal have been installed. These units are inserted in the line with disconnecting switches on either side and with jumper wires so arranged that the regulators may be cut out of the circuit at any time for inspection or repair. No conduit has been employed in the station wiring as all high-tension bus structures, lightning-arrester equipment and choke coils are placed in the basement below and beneath the switchboard.

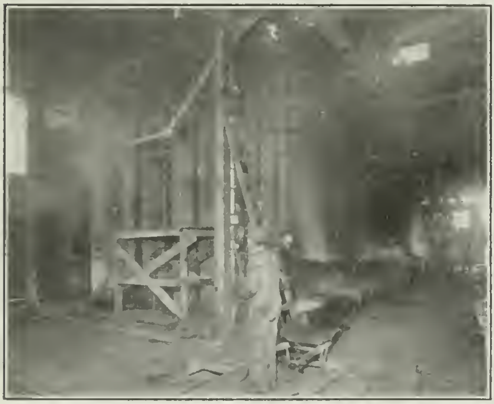

FIG. 3—BOILER-ROOM EQUIPMENT WITH UNDERFEED STOKERS

Separate banks of boilers have been installed for operating the electric-service plant and the water-works station, but either of these banks of boilers has ample rating to supply steam for both the engine-driven pumping plant and the turbines of the electric station at their present outputs. One of these sets of boilers consists of two 500-hp Bonus-Freeman units with Foster superheaters placed directly under the two 36-in. main drums. These units are set on a 6-ft. firebox and are equipped with Jones underfeed stokers. The water level is controlled by means of Williams automatic feed-water columns. All settings for these boilers are built with double walls. As auxiliary boilers there are one 300-hp Babcock & Wilcox and one 250-hp Heine unit, neither of which is equipped with a superheater. The boiler equipment ordinarily furnishing steam for the pumping plant consists of four 350-hp Heine boilers equipped with Billow's oil burners.

All steam lines from the boiler room to the engines and turbines are carried beneath the floor through underground ducts and receive a 2-in. coat of lagging with a material known as "asbestos-cell." The absence of pipe lines in the engine room is notable and gives free head room for the operation of the 20-ton crane.

Feed water for the plant is furnished by a 2000-hp Blake-Knowles feed-water heater capable of supplying 60,000 lb. of feed water an hour. The heater contains 75 sq. ft. of tray surface and is supplied with water through two boiler-feed pumps controlled by Fisher governors and having cylinders measuring respectively 12 in. by 10 in. by 14 in. and 12 in. by 14 in. by 8.5 in.

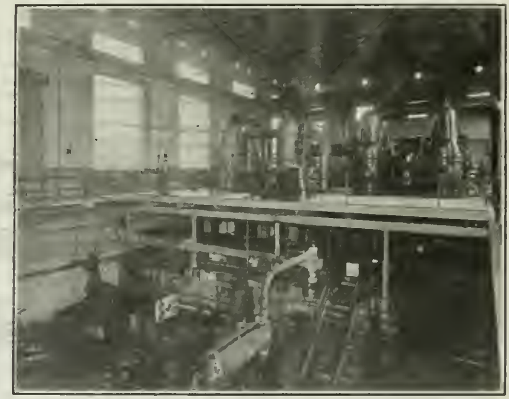

FIG. 4—PUMPING STATION OPERATED WITH POWER PLANT

Except for one 200-hp motor-driven direct-connected pump, all water for the city water-works is supplied by steam pumps. This 200-hp motor-driven pump is capable of delivering 15,000,000 gal. of water every twenty-four hours against a 38-ft. head. The remaining steam-pump equipment on the low-pressure end consists of one 15,000,000-gal. centrifugal pump directly connected to a 185-hp Corliss engine operating at 165 r.p.m. and one 8,000,000-gal. pump designed to operate against a pressure of 70 lb. per square inch but used only for low-pressure emergency service. The four high-pressure pumps operate against a pressure of 125 lb. per square inch. Of these there are two capable of delivering 12,000,000 gal. of water, one 9,000,000 gal. and another 6,000,000 gal. The two low-pressure pumps are driven by cross-compound engines of the flywheel type, while the high-pressure pumps are driven by a twin-tandem compound engine without a flywheel.

Under the present administration of Mayor Greene, Mr. L. H. Chapman is commissioner of water-works and street lighting and Mr. F. E. Williams is electrical engineer for the station.

A Means to Measure the Glaze of Paper

Outline of the theory and construction of the glarimeter, an instrument designed to provide a simple method of specifying the amount of glaze. By L. R. Ingersoll

THE subject of glare from paper is one which has been attracting ever-increasing attention of late on the part of both publisher and paper maker. The demand of the reading public for a paper of less gloss, which shall cause less strain on the eyes, has already been met by a number of magazine and textbook publishers, and it is apparently only a question of time before the use of highly calendered paper will be a rarity for ordinary reading matter. This is especially probable in view of the improvements now being made in the halftone and other reproduction processes. It becomes then very desirable to be able to specify exactly the quality of any given paper as regards its glossiness or glaze—these terms being used in the present case to mean that quality of paper which gives rise to glare—and this article describes a simple instrument which will determine this quality with precision.

It is almost obvious that a satisfactory method for measuring glaze or glossiness must be optical rather than mechanical in character, for the smoothness of a paper is by no means a safe measure of its qualities in this respect. Following a suggestion made to the writer by Mr. J. H. Thickens, formerly of the Forest Products Laboratory of the United States Department of Agriculture at Madison, Wis., but now of the Beaver Companies, Buffalo, N. Y., to the effect that it might be possible to apply polarized light to the measurement of glaze, some experiments were performed in the Forest Products Laboratory which led to the subsequent development of the instrument about to be described.

To appreciate the principles involved, it seems well first to discuss briefly the character of the light reflected from a sheet of paper. As pointed out in numerous articles and papers by Black and Vaughn, Sweet, Luckiesh and others, one may distinguish in this connection three different types of reflection. These are: Specular reflection, as from a polished surface of metal or sheet of glass, the "angle of reflection" equaling in this case the "angle of incidence"; diffuse reflection, as from a perfect matte surface, characterized by the light being sent off almost equally in all directions from the surface, and a combination of these two which might be thought of as produced by overlaying a perfect matte surface with one or more sheets of glass.

The first type, or specular reflection, causes what is known as "glare" from the paper; that is, the brilliant directly reflected light which to a certain extent dazzles the eye of the reader, causing contraction of the pupil with consequent loss of visual acuity and resulting eye strain. The diffuse reflection gives rise to the soft, evenly illuminated appearance of a matte surfaced paper, which if used with a dead-black ink gives the combination which affords greatest ease to the eye of the reader. As a matter of fact, it is the third type which is really characteristic of the reflection from paper, as the most highly glazed paper still gives a little diffuse reflection, while even as dead a surface as that of a soft blotter shows a small amount of specularly reflected light.

It is characteristic of most glass surfaces that light reflected from them at an angle of 57.5 deg. is (almost) completely plane-polarized, and the writer found by experiment that the same is true of the specularly reflected component from paper. Pieces of glazed white paper, calendered black cardboard, calendered white paper and brown solio paper all showed at this angle a polarization of the glare component estimated at more than 99 per cent complete. This instrument, then, was designed to measure the glare by determining the fraction of the light reflected from the paper at an angle of 57.5 deg. which is polarized, the illumination falling on the paper at approximately this same angle.

It must be kept in mind that it is not the absolute brilliancy of the glare spot which is to be measured, but, rather, the fraction of the total light entering the instrument which is glare; this, in the writer's opinion, is the basis on which the matter should be discussed, as it is the relative proportion of glare and diffuse reflection which determines the readability of a given paper rather than the absolute magnitude of either.

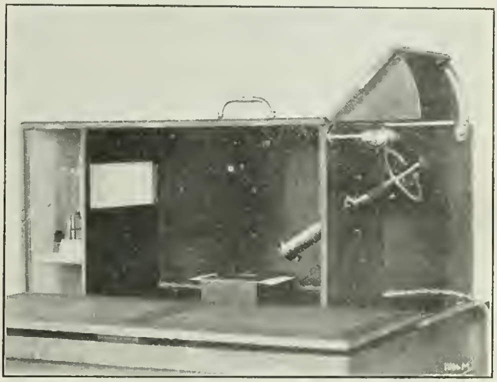

FIG. 1—INSTRUMENT USED IN MEASURING GLAZE OF PAPER

The glare, or, as it might be called, percentage glare, as measured in this way will evidently not depend on the intensity of the illumination, but it will be greatly influenced by the shape and extent of the source of light, whether it be broad or narrow, a window or an incandescent bulb. It is necessary, then, to specify some particular type of illumination to which to refer all the measurements. For use with this instrument the illumination chosen is that from a vertical opening 3 in. square whose center is at a distance of 11⅝ in. from that of the (horizontal) test piece of paper and the line from whose center makes an angle of 57.5 deg. with the perpendicular to this sheet. The opening is covered with two thicknesses of tracing cloth, behind which is placed a tungsten lamp rated at from 40 watts to 60 watts, with reflector. It must be understood that, while the selection of this arbitrary standard of illumination is highly desirable, it is not entirely necessary, for a larger (or smaller) opening would merely result in lowering (or raising) the fraction which represents the glaze of each specimen of paper and would not, in general, alter the order in the series in which any particular specimen came.

Description and Theory of Instrument

The instrument as designed and constructed at the Forest Products Laboratory is shown in Figs. 1 and 2. Light from the window *S*, already described, falls on the paper at *P*, this being covered with a small brass frame which keeps the sample perfectly flat and exposes only about a square inch of the surface. The construction of the part *A* is shown in Fig. 3. The light passes first through a ¼-in. diaphragm, part of the opening of which is covered with a small Nicol (Lippich) prism *N*, and the remainder with a piece of smoked glass *G* ("No. 2 smoked glass") which absorbs about one-half of the light.[1] The beam then passes through the eyepiece, which is another Nicol (Glan-Thompson) prism *M*, and thence to the eye. The prism *M* is mounted to rotate in a divided circle *C*, which reads with the aid of the vernier *V* to five minutes of arc.

On looking into the eyepiece one sees a divided field of view (Fig. 4), with the Nicol *N* below (say) and the smoked glass *G* above. The instrument is carefully adjusted so that *N* shuts off completely the specular (polarized) component of the light from the paper. A measurement is made by turning the divided circle until the two fields appear of equal brilliancy, or, in other words, until the dividing line between the two fields seems to disappear. This gives a reading which enables one at once to compute the glare.

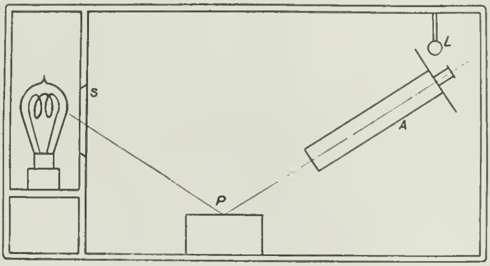

FIG. 2—DIAGRAMMATIC SECTION OF GLARIMETER

To show how this is done it will be necessary to enter into a brief mathematical discussion of the theory of the instrument. Let x represent the fraction of the light which is plane-polarized; in short, let x represent the *glare* as defined above. Also, let a represent the transmission coefficient (for light polarized in its plane) of the prism N, and b the transmission coefficient for the smoked glass. Then the intensities of the two beams transmitted through this part of the instrument will be proportional to $\frac{1}{2}a(1-x)$ from N, and b from G.

When these beams are viewed through the eyepiece prism M, the principal plane of which makes an angle Q, with that of N, these intensities are reduced to $\frac{1}{2}a\cos^2 Q(1-x)$ and $\frac{1}{2}b(1-x)+bx\sin^2 Q$, respectively.

When these two are made equal by altering the angle Q, $\frac{1}{2}a\cos^2 Q(1-x) = \frac{1}{2}b(1-x) + bx\sin^2 Q$

$$= \tfrac{1}{2}b(1+x)\sin^2 Q + \tfrac{1}{2}b(1-x)\cos^2 Q \qquad (1)$$

To eliminate a and b, a reading is made on unpolarized *illumination* (furnished by a sheet of soft blotting paper illuminated directly from above) in which case, since $x = 0$,

$$\tfrac{1}{2}a\cos^2 Q' = \tfrac{1}{2}b,$$

$$\text{or } \frac{b}{a} = \cos^2 Q' \qquad (2)$$

Then one may write for (1)

$$\frac{1-x}{1+x} = \frac{\cos^2 Q' \sin^2 Q}{\cos^2 Q - \cos^2 Q' \cos Q}$$

which, after a little reduction, becomes

$$\frac{1-x}{1+x} = \frac{\tan^2 Q}{\tan^2 Q'} \qquad (3)$$

It appears then from equation (3) that it is possible to determine the quantity x if the two angles Q and Q' are known. As Q' may be determined once and for all and is really a constant of the instrument, this means that a determination of Q is all that is necessary, and this is measured by taking the average of a series of, say, from three to five settings with the instrument. Having determined Q, the value of x is given at once by means of a small table computed with the aid of equation (3), so the whole process of determining the glare of a particular specimen requires hardly a minute of time.

The following measurements made on some standard papers show the use of the instrument:

Paper	Per Cent Glare
Warren Standard Warrentown Olde Style	15.1
Warren Standard Warrentown Eggshell, 70-lb	18.3
Warren Standard Cameo Plate, white	19.3
Fine ground glass	21.4
Warren Standard Artogravure, white, 80-lb	22.4
Bryant Paper Company, British opaque	38.9
Warren Standard Cumberland M. F., 70-lb	43.0
Warren Standard Library Text	45.7
Bryant Paper Company, English Finish Magazine	55.8
Postal card	63.7
Glazed onion-skin, 8-lb	66.7
Warren Standard Cumberland Super	75.4
Warren Standard Superfine	79.3
Warren Standard Lustro coated book	77.5
Warren Standard Cumberland coated book, 100-lb	79.7
Warren Standard Printone, 80-lb	80.4
Warren Standard Superfine coated book	82.5
White glazed paper	90.5
Brown solio paper	99.2

One of the most interesting tests was that conducted on a series of sheets of unsized newspaper made at the Forest Products Laboratory, the sheets being originally identical but differing in finish by having been passed through the calendering rolls once, three times, five times, and so on, up to twenty-nine times, respectively. The measurements on this series are as follows:

Paper	Per Cent Glare
Uncalendered	27.7
One pinch	33.3
Three pinches	45.0
Five pinches	46.7
Seven pinches	52.8
Eleven pinches	57.0
Nineteen pinches	62.2
Twenty-nine pinches	64.8

An inspection of the results of these tests developed some striking facts. It will be noted that glazed onion-skin paper showed when tested in this fashion almost the same glare as postal card, and this was so inconsistent with the results of a hasty visual inspection—which would make the glare from the onion skin far greater than that of the postal card—that a particular study was made of this case. It was found that when the onion skin was laid perfectly flat so as to avoid wrinkles, and in several thicknesses so as to insure only reflected light, the eye estimates of glaze approximated much more nearly to the indications of the instrument. The consideration of this and one or two similar cases served finally only to strengthen the confidence in the results obtained with the instrument, and to show that casual eye observations of glaze are unreliable when the papers are of widely differing texture, for example, cardboard and thin paper.

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[1] This combination of Lippich prism with smoked glass might profitably be supplanted by a two-prism field of view with polarization planes at right angles. The present simple arrangement is so satisfactory, however, that it is not believed that the more complicated optical part would justify the additional expense

Black and colored papers give higher glare readings than do white papers of the same finish. A little thought will serve to show that this ought to be so, since the specularly reflected light is almost independent of the shade of the paper, while the diffusely reflected light is much less for the darker shades. The glare, as defined above, will accordingly be higher for the darker colors. Readings on solio paper of various shades gave measurements in illustration of this point.

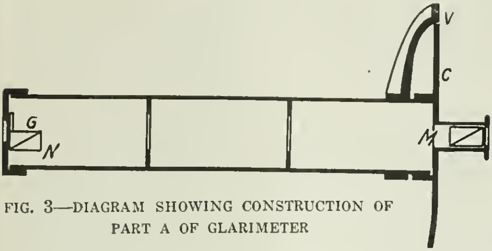


FIG. 3—DIAGRAM SHOWING CONSTRUCTION OF PART A OF GLARIMETER

Metal surfaces, since they do not plane-polarize light by reflection, cannot be tested with this instrument. Thus, polished silver will yield almost the same readings as does a perfect matte surface. If a type of paper exists which gives what is termed "metallic reflection," it would not be possible to measure its glare in this way either; however, the writer has never seen any such paper and doubts if any such exists. The case which would be thought to approximate most closely to this, namely, brown solio paper, still gives almost perfect polarization on reflection. In view of this fact, the writer feels that the indications of the instrument may be accepted with confidence for all classes of papers.

In conclusion, it is believed that this instrument will fill a rapidly growing need for some simple and exact means of specifying the glaze of paper. One does not need to analyze what a glare reading of 50 per cent with this instrument means; whether one can say that half the surface reflects as glass and the remainder as a matte surface—an erroneous conclusion, as a little thought will show—or that the surface is a mass of fine wrinkles, all of which reflect specularly but in so many directions that diffusion results. One neither needs nor is able to say exactly how this glare is produced, but one is able to state with positiveness that a paper which shows a 50 per cent glaze reading will give less glare than one of 60 per cent and, other things being equal, will be easier on the eye of the reader than the latter. The instrument will permit the printer to order a book paper of less than, say, 40 per cent glare, and will enable the paper maker to meet this requirement with certainty; and if the net result shall be to render even the slightest service to the movement to abolish, where possible, the annoyance of glare, it will be felt that it has achieved its purpose.

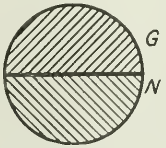


FIG. 4—DIAGRAM ILLUSTRATING DIVIDED VIEW ON LOOKING IN EYEPIECE

Perhaps note should be made of the fact that a patent on the instrument and method has been applied for.

Report of Railway Management on Swiss Electrification

In a report lately submitted to the administrative council of the Swiss Federal States Railway by Chairman Dinkelmann of the railway management the substitution of electric for steam locomotives on the St. Gothard line is recommended in order to obtain higher speeds on grades, lower cost of locomotive maintenance and the elimination of smoke from the tunnels. This report supplements and largely confirms the report of the Swiss railway study commission commented on editorially in the *Electrical World* for March 7, 1914. It is pointed out that the lack of native fuel and the abundance of waterfalls make the electrification of Swiss railways very attractive. Water-power concessions ample for electric traction had already been acquired as part of the franchise grants of the original St. Gothard Railway Company. More recently rights were obtained to utilize the headwaters of the Binna, Rhone and Sihl Rivers.

On account of its heavy traffic and profile conditions, the Erstfeld-Bellinzona section of the St. Gothard line is well suited for initial electrification. The cost will not be excessive and the section is ample for trial purposes. Local traffic on the Erstfeld-Bellinzona line is so small that the railway management does not recommend motor-car service until the electrification can be extended to Lucerne. Only locomotives can be considered, and most of these should be adapted for hauling any kind of train. As a general rule, passenger trains should have one locomotive, and freight trains two, one acting as pusher. These machines must be capable of exerting the present maximum drawbar pull of 22,000 lb. If desired by the connecting foreign railways, the locomotives of a through express train should be capable of exerting a maximum drawbar pull of 27,500 lb. In this event ten-car trains would be possible in place of eight.

Regeneration possibilities had been carefully studied. The economy in the use of water at Ritom would be of little practical importance, and even then only for three or four months a year. The possible water saving of 10 per cent would hardly balance the higher cost of the locomotives. Regeneration is less important for a water plant than for a steam station. In no wise does electric traction on the St. Gothard line depend upon regeneration as a factor.

According to estimates, the traffic of 1918 would be 35 per cent, and that of 1928 70 per cent, greater than in 1911. The fluctuations in traffic throughout the year are very great. Thus in 1911 the daily minimum was 1,680,000 ton-km and the maximum 2,282,000 tons-km.

Generating-station sites have been chosen on opposite watersheds of the St. Gothard line, namely, Amsteg station on the north and Ritom station on the south. Fortunately, the high-water conditions for the two stations occur at different seasons. These stations would suffice for a long time for the whole of the Fifth District, in which the St. Gothard line is situated, without building a third station, which would supply enough power for many of the eastern, central and northern lines of Switzerland.

Choice of Traction Systems

The study commission had recommended single-phase operation at from 10,000 volts to 15,000 volts with fifteen cycles, not because the single-phase system is the best for any one condition, but because it is the most flexible for Swiss railroad electrification as a whole. In commenting on this decision Mr. Dinkelmann's report takes up the three systems as follows:

The direct-current system is the oldest and best tried, but it is universally agreed that high tensions are needed for supplying energy to heavy trains from an overhead wire. The necessary current could be obtained with a 1000-volt third-rail, but the management considered such a proposition speculative and so did not take it into serious consideration. On the other hand, a 3000-volt direct-current overhead line would have to be very heavy to handle the loads on the St. Gothard line, nor would it be possible to use a high direct-current voltage without sacrificing some of the good weight and speed-regulating qualities of the direct-current motor. Moreover, a high-tension direct-current line would find it very difficult or practically impossible to use directly connected storage batteries.

The adoption of the single-phase system, as recommended by the commission, has been assumed in estimating the costs of the system, because it is now clear that single-phase motors of the desired output can be built, and that the single-phase locomotive has all the speed flexibility required.

The three-phase system has certain advantages over single-phase. It is characterized by the simplicity of its traction motors, but this advantage is inseparable from very narrow speed limitations. The three-phase locomotive is superior for certain conditions, but where there are a great many profiles the running speeds would often be too high or too low for economy. Thus the Simplon locomotives, 1906 model, are limited to the approximate speeds of 35 km and 70 km an hour, while the 1907 model has four speeds, namely, 26, 35, 52 and 70 km an hour. No intermediate speeds with full tractive effort are possible. Not even a light Simplon train exceeds 70 km an hour, and if one standard speed was raised all the others would increase also. The continuous use in three-phase equipment of a maximum speed actually required for short periods only would in one case mean an increase of one-third in station generating equipment.

The rigid limitations of three-phase equipment appear in another way. Thus the 1906 type of the Simplon locomotives can be coupled to those of the 1907 type only for the common speeds of 35 km and 70 km an hour. The Giovi locomotives, which operate at 45 km and 22.5 km an hour, could not be worked economically with the Simplon machines. In general, the three-phase system does not give the desired flexibility in speed. Moreover, lost time could be made up on down grades only by sacrificing regeneration, the very quality for which three-phase is most highly praised.

If single-phase is adopted for the Erstfeld-Bellinzona line, it would be possible with little extra cost to use one potential, 15,000 volts, in some sections, and another potential, 7500 volts, in tunnels. However, the experiences with 15,000-volt suspension in the Lötschberg tunnel will serve to settle the necessity for lower voltages in tunnels.

Despite the foregoing remarks, the management does not definitely recommend the immediate adoption of single-phase, as the final decision concerning the type of propulsion equipment can be made after the hydroelectric development is fairly well advanced.

Stations and Transmission Lines

The Amsteg and Ritom stations would be fitted with 8000-hp, 7500-8000-volt, single-phase generators, driven by Pelton wheels, and connected to the contact line either directly or through step-up transformers.

The transmission potential would be 60,000 volts. The first feeding-in points would be at the two generating stations and at the Biasca substation. Up to say 1918 a 7500-volt trolley would be used and then the emf could be raised to 15,000 volts with the establishment of substations at Goeschenen, Lavorgo and Bellinzona. The transmission system would be in duplicate and each line would be proportioned to carry the power needed by all lines in the Fifth District. All substations would be tied in with each other to minimize interruptions.

The contact line would be of catenary type with transverse bridges on open sections. In the tunnels the overhead structure would be carried from supports fixed in the arched roof. Suitable precautions would be taken to localize mechanical failures. The rails would be bonded and depended upon for the return current.

Locomotives

Generally speaking, the use of the larger electric locomotives will make it possible for two such locomotives to do the work of three steam locomotives. One class of electric locomotives should be designed for a drawbar pull of 27,500 lb. and a maximum speed of 90 km (56 miles) per hour. This type would be used primarily for through passenger service but would also be available for other operation. A second class of locomotives would be designed for miscellaneous service.

Electric operation of the Erstfeld-Bellinzona section would require from thirty-six to forty-two or even more locomotives according to the increase in the number of trains following electrification.

Results Expected from Electrification

One result of electrification would be faster trains. Thus express train No. 58, which now requires 132 minutes from Erstfeld to Bellinzona, would make the trip in 114 minutes, a saving of 13 per cent. Again, the headway would be improved by saving time in going through the St. Gothard tunnel. Passenger trains which now traverse the tunnel in seventeen minutes would do so in fourteen minutes, and freight trains would cut down their time from thirty to twenty-three minutes.

In 1911 the steam locomotives of the Erstfeld-Bellinzona section ran 3,712,000 km. Electric locomotives of from 2000 lb. to 27,500 lb. drawbar pull would have to run only 2,950,000 km, a saving of 21.2 per cent. Assuming a 35 per cent increase in travel by 1918, steam locomotives would have to run nearly 5,000,000 km, compared with 3,950,000 km by electric locomotives. In 1911 the actual cost per steam-locomotive km on the Erstfeld-Bellinzona line was 1.27 francs, covering maintenance, interest and amortization of locomotives, coal, wages, stations and payments to superstructures renewal fund. If steam were used in 1918, this cost would be 5,000,000 × 1.27, or 6,350,000 francs. On the other hand, electric traction exclusive of energy expense would cost only 0.73 franc per locomotive-km.

The annual expenses in francs for electric traction would be as follows:

Traction service	2,883,500
Energy	3,104,400
Heating	100,000
Total	6,087,900

This is an approximate saving of 260,000 francs a year in comparison with steam. The superiority to steam will increase with the growth of traffic and with the extensions of lines much of whose basic expenses is comprised in the present electrification. Moreover, locomotive fuel is likely to increase in cost, and the rising wage rate will affect steam more than electric operation.

In view of the foregoing statement, an appropriation of 38,500,000 francs plus 290,000 francs for amortization of scrapped steam equipment was approved, to cover the electrification of the Erstfeld-Bellinzona line.

Communication Topics Discussed by A. I. E. E.

Papers on telephone-exchange traffic, the telegraph and telephone in railroad service, and the Goldschmidt system of radio-telegraphy read at March meeting of American Institute of Electrical Engineers

THE meeting of the American Institute of Electrical Engineers at New York March 13 was under the auspices of its committee on telegraphy and telephony, in conjunction with the Institute of Radio Engineers. Three papers were presented, those by A. I. E. E. members being "A Comparison of the Telegraph with the Telephone as a Means of Communication in Steam Railroad Operation," by Mr. M. H. Clapp, St. Paul, Minn., and "Traffic Studies in Automatic Switchboard Telephone Systems," by Mr. W. Lee Campbell, Chicago, Ill. On behalf of the Institute of Radio Engineers, Mr. E. E. Mayer presented a paper on "The Goldschmidt System of Radio-Telegraphy," which he illustrated with lantern slides. President C. O. Mailloux called upon Vice-chairman Cloyd Marshall of the telephony committee to preside in the absence of Chairman Frank F. Fowle, and Mr. John Stone Stone presided for the radio engineers.

Traffic Studies in Automatic Telephone Systems

Mr. Campbell's paper pointed out that a comprehensive analysis of telephone traffic should contain the number of calls made in a given period, the duration of each and the number of simultaneous connections made during rush hours. The author called attention to the disadvantages of the peg-and-plug count methods of recording traffic and described a new device which performs these duties automatically. This recorder consists of a mechanism for passing a continuous paper tape over forty electrically operated markers which record when and how long a trunk is occupied by a call. A record made by one of these devices on an automatic telephone system in Michigan showed that the trunks are idle during only remarkably short periods of time.

A "chartometer" may be used to sum up the duration of the calls on the trunks and the data then applied in plotting traffic curves. The curves show, as had previously been suspected, that large-trunk groups are more efficient than small-trunk groups, owing to the smaller ratio of the peak load to average load. From data obtained with the automatic recorder, a curve can also be plotted between the busy-hour calls carried per group of trunks and the trunks per group, to show the number of trunks needed at the peak instant for busy-hour loads of various sizes.

The average duration of about 10,000 calls observed in automatic plants is slightly in excess of 83 seconds, of which time 66.5 seconds was occupied in conversation and the remainder in making connections, waiting for the called party to respond and releasing the connection. An average duration of 43 seconds was noticed on some private-branch exchange calls and as high as 103 seconds in outlying residential-district offices. In the studies made by the author about 12 per cent of the calling parties received a busy signal, and 15 per cent received no response. The trunking scheme indicated herewith was suggested by the author for interconnecting two offices with a peak load in either direction of 175 busy-hour calls which do not occur at the same time.

The Telegraph Versus the Telephone in Train Dispatching

The principal physical characteristics of telephone and telegraph systems for train dispatching were compared in Mr. Clapp's paper, in which were also discussed the first cost, operating and maintenance expenses, and the advantages and disadvantages of each system. In the brief historical account of the development of electrical methods of communication, attention was directed to the fact that the first train was handled by telegraph in 1851 and by long-distance telephone in 1907. Trains are now dispatched by telephone over about 70,000 miles of railroad in the United States. Telephone circuits are not as well adapted for the transmission of railway messages, however, as for train dispatching, because the first use is justified only by a considerable amount of traffic.

Telegraph systems are preferable to telephones for railway use because of their relatively low first cost and simplicity of installation, operation and maintenance. Other advantages are the unsusceptibility of the telegraph to minor inductive disturbances and defects in the circuit and the ability to transmit messages distinctly over long distances. The latter is more easy to obtain with the telegraph than the telephone, since the telegraph sounder is in a local circuit and does not depend for its operation on definite frequencies, wave-shapes and amplitudes as does the telephone. Among the disadvantages of telegraphic communication are its lack of universality (only experienced operators can communicate with each other), lack of adaptability to emergency calls, slower rate of transmitting messages and inability to arouse the called operator as quickly as with a telephone bell. Considerable trouble is also experienced nowadays in obtaining competent operators especially during prosperous times or labor troubles.

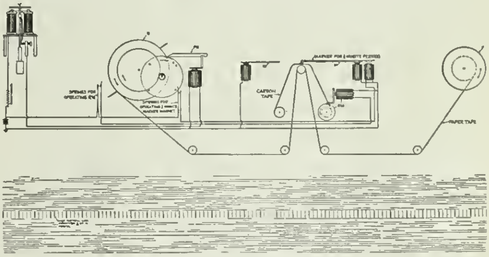


FIG. 1—TRAFFIC-RECORDING MACHINE AND SECTION OF RECORDER

In general practice on railway-telegraph systems, except near large transportation centers or where the lines are subjected to salt sea air, galvanized-iron wire is used for conductors. Of 9516 miles of telegraph circuits maintained by the Northern Pacific Railroad out of St. Paul, Minn., about 85 per cent operate quadruplex, 13 per cent single and about 2 per cent duplex. The estimated total number of messages on this entire system is about 5,000,000 per year, or about 833 messages per year per mile of main-line track. The labor cost per message in the relay offices is a trifle over 2 cents.

For telephone communication the author cited the following advantages: Universality of operation; direct communication between parties transacting business; speed in obtaining the called operator and in transmitting messages; psychological effect of the human voice in transmitting the message; decreased likelihood of disturbance from earth currents, aurora borealis, heavy fog, rain, mist and snow; lack of necessity of trained operators, and increased speed of handling trains. By copying communications down on a typewriter about twice as many messages can be received by telephone as by telegraph and the trains can consequently be handled from 10 to 20 per cent faster. By its use of telephones the Northern Pacific Railroad estimates that $200 per month is saved in overtime pay on one division alone.

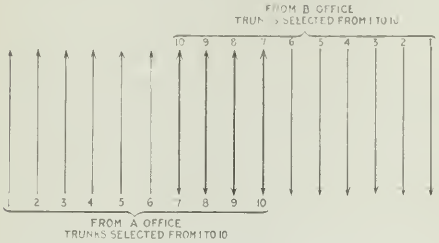


FIG. 2—TRUNKING SCHEME BETWEEN OFFICES ALLOWING 175 BUSY-HOUR CALLS IN BOTH DIRECTIONS

COST OF FURNISHING AND INSTALLING VARIOUS PARTS OF A RAILWAY COMMUNICATING SYSTEM

TELEGRAPH SYSTEM	
No. 8 B. W. G. iron wire, per mile (including insulators, tie wires and pins)	$25.00
With intermediate offices, good for 200 miles.	
Without intermediate offices, good for 400 miles.	
Can be worked single, duplexed or quadruplexed.	
No. 9 B. & S. copper wire, per mile (copper at 15 cents per lb.)	38.00
Cutting in a way station (including gravity battery)	12.00
Ten-line in and out switchboard (peg type)	42.00
Twenty-five-line Western Union switchboard and eight sets of telegraph instruments	140.00
Nineteen-conductor cable (No. 14 A. W. G.) per connecting line to office	0.30
Quadruplex set	200.00
Single-line repeater set	50.00
TELEPHONE SYSTEM	
No. 9 A. W. G. copper wire, per mile (15 per cent copper)	$75.00
Good for 500-mile transmission.	
No. 6 A. W. G. copper wire, per mile (same basis)	150.00
Good for 1000-mile transmission.	
Selector, telephone and protector equipment per station (including wiring)	80.00
Dispatcher's telephone and selector equipment with battery	250.00
Selective telephone system along 100 miles of track, with thirty offices	10,000.00
Telephone booths on right-of-way, with equipment	30.00 to $90.00
Portable telephone sets	12.00

On the other hand, first cost and maintenance expenses of telephone equipment are higher than for the telegraph. Two wires are required instead of one, and transpositions and twisted-pair cables are necessary to prevent cross talk. A type of selector for railway telephone systems was described capable of calling 125 stations on the same line.

The author expressed belief that no railway telephone circuit should have a greater length than that equivalent to a 26-mile cable having a resistance of 88 ohms per unit (No. 19 A. W. C. metallic) and a mutual capacity of 0.054 microfarad per mile. He also prophesied that telegraphs will continue to be used for some time on railroads requiring from 500-mile to 1500-mile transmissions. The telephone, however, is not used, he conceded, so much as it could and should be.

Discussion

Messrs. William Mavor, Jr., W. E. Harkness, R. N. Hill, S. P. Grace and J. B. Taylor, all of New York, took part in the discussion of the foregoing papers.

Mr. Mavor said that, given the option of using the telegraph or the telephone over distances of from 200 miles to 1000 miles, his own experience had favored the accuracy, speed and reliability of telegraphic communication between expert operators, in comparison with which the uncertainty of some words in telephone conversation frequently called for repetition. The telephone is most useful, he declared, when the conversation concerns topics or words with which both speakers are familiar.

Mr. Harkness made the comment that operators using the telephone are under less nervous strain than those using the telegraph and can consequently handle nearly twice as much work, thus correspondingly reducing the pay-roll. The average Morse operator sends twenty-five to thirty words per minute, but by telephone the same man can transmit fifty to seventy-five words per minute. Installation of each telephone circuit incidentally makes available an additional telegraph line. Introduction of the telephone, said the speaker, has involved few telegraph operators losing their jobs, for they are necessarily first of all railroad men rather than telegraphers and hence can always make themselves useful elsewhere on the system.

Mr. Hill described the new "booster" type of telephone circuit, which he declared might be better characterized as a "conservation circuit" since it increases the efficiency of both the transmitter and receiving circuits.

Mr. Grace suggested that the traffic-recording device described in Mr. Campbell's paper might be applied to good advantage in manual exchanges. He also urged that more rugged design be introduced into telephone apparatus for railway use. Mr. Taylor pointed out that with respect to disturbances from outside power circuits the telegraph is less sensitive to extraneous currents, while the advantage of the telephone lies in its operation with little regard to the actual magnitude of the speech current.

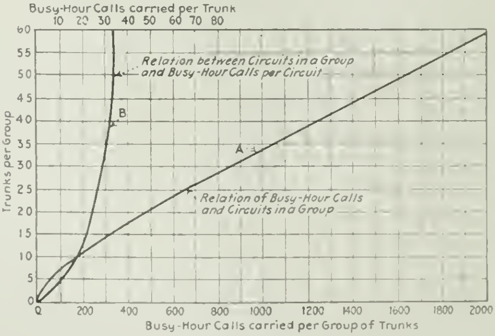


FIG. 3—CURVES TO DETERMINE TRUNKS NECESSARY FOR BUSY-HOUR CALLS

The Goldschmidt System of Radio-Telegraphy

After paying tribute to the work of Tesla, Fessenden and Alexanderson in developing high-frequency alternators, Mr. Mayer described the high-power radio generators of Goldschmidt, particularly the 100-kw units for transatlantic communication. Starting with a frequency of 10,000 cycles, produced in the ordinary way, tuned circuits are employed to produce an alternating field which, acting with the rotation of the rotor, produces a frequency of 20,000 cycles. In turn this 20,000-cycle frequency, through tuned circuits, is again combined with the rotation to produce 30,000 cycles. Such addition of frequencies is limited only by the copper, iron and insulation losses, but for the best output it is necessary to keep the magnetic leakage low and to limit the number of reflections to four or five.

One of the machines described has 400 poles. Revolving 3000 times per minute, it produces, first, 10,000 cycles, and ultimately 50,000 cycles. The rotor weighs 5 tons and measures 4 ft. 1 in. in diameter. The poles are 0.4 in. wide, with one conductor per slot, each conductor consisting of a bundle of No. 40 insulated wires. Both rotor and stator are made up of iron sheets 0.002 in. thick, separated by paper 0.0012 in. thick. The air gap measures but 1/32 in., although the peripheral speed is about 625 ft. per second. If owing to misalignment the slots are even 1 mm out of adjustment, a loss of 20 per cent results. The sending key is in the excitation circuits, enabling the interruption of 5 kw to control the 100-kw output of the generator.

Since April, 1913, two such 100-kw machines (maximum output 200 kw) have been in operation at Neustadt, near Hanover, Germany, and at the Tuckerton (N. J.) station. The towers used are 825 ft. high, supporting thirty-six-wire double-cone antennas which are stretched to 40-ft. masts arranged in a 1500-ft. circle. The towers are supported on glass insulators.

The most notable feature of the receiving apparatus is the "tone-wheel," which makes and breaks the receiving circuit. If the receiving circuit is excited by a 50,000-cycle signal and the tone-wheel makes and breaks the circuit 50,000 times per second, no sound is heard in the telephone, but if the tone-wheel makes and breaks the circuit 49,000 times per second, a tone having a sound frequency of 1000 cycles will be heard in the telephone. The result is a musical note which penetrates "static" and permits of close tuning. By adjusting the tone-wheel to break in synchronism with the frequency of an interfering station, the interloper may be cut out.

Using these devices the Goldschmidt company has been able to telegraph from Eilvese, Germany, to Tuckerton, N. J., since the beginning of July, 1913. Mr. Mayer also intimated that his company has under way a telephone transmitter which will modulate sufficient energy to transmit speech wirelessly over long distances.

Discussion

Mr. Mayer's paper was discussed by Mr. R. H. Marriott, New York; Mr. E. F. W. Alexanderson, Schenectady, N. Y.; Dr. Lee De Forest, New York; Dr. M. I. Pupin, New York, and Mr. John Stone Stone, New York.

Mr. Marriott pointed out that messages from the Tuckerton station can probably be received over a minimum radius that includes Hanover, Germany, Spain, Peru, Alaska and the North Pole. At night under the best winter conditions it is even probable that the waves could be detected at 40,000 miles were such a terrestrial distance available. Mr. Marriott predicted that the time is near when news will be sent from one or two high-power transmitting stations to a great many inexpensive receiving stations scattered all over the world.

Mr. Alexanderson referred to the great difficulties besetting the design of a machine like the Goldschmidt high-frequency alternator, and referred to his earlier construction of a 15,000-cycle "trigger" alternator for use in wireless telephony. Later a constancy-controlling device was instead developed, employing the general principle of the transformer.

Dr. De Forest compared the advantages and disadvantages of the Goldschmidt system with the Poulsen arc for producing high frequencies. The Goldschmidt apparatus, he pointed out, has the drawbacks of high cost, complication of circuits and lack of flexibility. The Poulsen equipment has the disadvantages of requiring occasional changes of electrodes, attention to the gas supply and the water-cooling supply, and lower efficiency. During the last three years the efficiency of the large Poulsen generators has been increased from 30 per cent to 60 per cent. At New York, however, signals are received from the 60-kw South San Francisco plant with considerably more distinctness than from the 150-kw station at Hanover, Germany.

Dr. Pupin commented on the fact that he had lectured on the principle of the machine described by Mr. Mayer five or six years before Mr. Goldschmidt actually developed it. From his own investigations he detected in the secondary a very large number of frequencies, recognizing 136 harmonics within the limit of audibility. In this type of machine, however, Dr. Pupin declared that he had never placed much confidence on account of its large magnetic leakage, large losses, crowding of many currents requiring iron and copper conducting area, etc. He promised, however, to describe shortly before the A. I. E. E. another machine which differs in principle from the first and which he considers a great improvement. In closing, Professor Pupin paid a high tribute to the skill and art of the constructors of the Goldschmidt apparatus and the completeness and persistency with which they carried out their undertaking.

Mr. Stone pointed out how Mr. Mayer's paper revealed the recent increase in wave-lengths, resulting in the gradual but rapid departure from the highly damped wave train of the early open-spark systems, and finally leading to continuous or undamped wave trains. Had the wave lengths used at the Tuckerton station been made to correspond to the fundamental of the antenna, or approximately 1500 meters instead of 6000 meters, the radiating power of the antenna, said Mr. Stone, would have been sixteen times greater, while the receiving or absorptive power of distant receiving stations would have been similarly increased approximately sixteen-fold. Such a wave-length would require, however, a frequency of 200,000 cycles.

Electrical Voting Device for the House of Representatives

An electrical device which, by automatically recording the votes of the members, will replace the arduous task of calling the roll in the national House of Representatives is being considered by the rules committee of that legislative body. Aside from eliminating the forty-five-minute roll call, this device will do away with the delay in action sometimes caused by obstinate minorities.

To record the attendance and votes of the members, at the same time preventing interference from unauthorized persons, the apparatus will consist of locked push-buttons at each representative's seat and a recording device operating on the principle of an adding machine.

To each member of the House will be assigned a particular seat, which will be numbered. At each of these positions there will be a push-button for indicating a positive or negative vote, the presence of the seat holder, and possibly a paired vote.

The recording apparatus, which will be installed at the Speaker's desk, will automatically register on a card bearing the names of all members, by punching a hole in one of the columns marked "yea," "nay," "present" or "paired" opposite each name. The device will be designed also to add the votes when a lever is pressed. The stamped card may then be removed from the machine and kept as a record of the particular vote written across it.

To inform the members how a vote is progressing several indicating devices will be placed at different points in the House. These devices will have bulletin boards bearing the names of all the Representatives and will indicate their votes as soon as they are cast, by illuminating differently colored lenses, probably red for "yea" and blue for "nay."

The advantages of this system of voting will be absolute accuracy, considerable saving in time, and accessibility of records. The scheme was devised by Representative Walsh, of New Jersey, who was assisted in designing a device meeting the requirements of voting by Representative Garret, of Tennessee, Speaker Clark and others, including Mr. Elliott Woods, superintendent of the Capitol.

Result of Electrolysis Mitigation Methods in Springfield, Ohio.

In the *Electrical World* for Jan. 31, 1914, were printed editorial comments relating to suggestions made by the United States Bureau of Standards for minimizing electrolysis in Springfield, Ohio. Since that time the proposed installation of insulated negative feeders has been made together with additions that were considered necessary to make a complete arrangement. Recently a series of tests were made upon the new system, and the report upon these has been issued in Springfield by the committee of investigation, which included representatives of the National Bureau of Standards, the city of Springfield and the telephone, telegraph and gas companies in the city.

The system actually installed included insulated return feeders for the Ohio Electric Railway as well as for the Springfield Railway Company, the former company now having installed negative copper amounting to 33 per cent of its positive copper, and the latter company 35 per cent. The conditions were very favorable to a system of insulated negative feeders owing to the fact that the substations of the two companies were at opposite sides of the city so that by interconnecting the tracks it has been possible to interchange current on the negative sides to a very considerable degree, thus aiding in securing low potential differences.

The negative feeders were designed to reduce the potential gradient in all parts of the track system to a mean value not exceeding 0.5 volt per 1000 ft. under net average schedule traffic. This corresponds to approximately 0.8 volt per 1000 ft. averaged during the hour of peak load. The test data show that this condition has been substantially realized.

In the report it is stated that the present conditions existing in Springfield correspond to those prevailing in cities in Great Britain and Germany where experience has shown that there is substantial freedom from injury by electrolysis. The regulations in effect in Great Britain limit the maximum over-all voltage drop in any city to 7 volts, the maximum being defined as a mean value between the highest momentary peak and the average for the hour of maximum load. In Springfield the tests showed that the highest value obtained exceeded the British limit by only 2 volts, and in the majority of cases the over-all voltage readings were considerably lower. The limiting value prescribed in Germany prevents the over-all voltage within city limits from exceeding 2.5 volts during average schedule traffic. In Springfield only 19 per cent of the readings were above this value.

With regard to potential gradient measurements the highest average value in Springfield for any one hour was 0.98 volt per 1000 ft., where there were defects in the track which could be repaired. The average of all the values obtained throughout the city was 0.23 volt per 1000 ft. The German regulations prescribe for suburban lines a gradient limit of 0.3 volt per 1000 ft. of track during average scheduled traffic. In Springfield the average of all peak load gradients is found to be 0.35 volt for the hour and 0.64 volt for the highest ten-minute period.

The over-all voltage prescribed by law in Lorain, Findley, Galion, Fremont and Canton, Ohio, is limited to 7 volts between any two points on the non-insulated portion of the track return during the ten minutes showing the highest value, and the potential gradient for the corresponding period is limited to 1 volt per 1000 ft. The values of over-all voltages and potential gradients existing in Springfield are considerably below these limits, except in isolated cases where there is bad rail bonding.

From the results obtained the authors of the report state that they are convinced that the insulated return-feeder system combined with proper maintenance of track bonding is the best means of dealing with the electrolysis problem in all cases where it is not practicable to insulate the tracks from the ground. They make strenuous objection to the use of pipe drainage under any circumstances for the city of Springfield, but instead recommend that the insulated return-feeder system should be supplemented by a certain proportion of insulating joints in the water pipes and the gas pipes.

With regard to lead cable sheaths of the telephone and telegraph companies, however, they say that it would not be commercially practicable to extend the insulated return-feeder system so that these could be safeguarded against electrolytic action. It is therefore cheaper to apply a limited amount of drainage protection to the cables, which can be protected in this way. The problem of draining cables differs in many respects from that of draining pipes, particularly in that cables are continuous conductors and the difficulties arising from high resistance joints are not encountered. Great care, however, should be exercised not to overdrain the cables, as such overdrainage may involve danger of electrolytic action that will damage neighboring structures.

The report presents definite recommendations which are briefly as follows:

(1) The insulated return feeders now installed should be made permanent, subject to necessary extensions.

(2) No insulated negative feeders are necessary on the interurban lines in the city at the present time, on account of the light loads.

(3) All electric railway tracks within the city limits should be so constructed and maintained that no rail joint will exceed the resistances of 8 ft. of rail.

(4) All tracks within city limits should be inspected once each year.

(5) No metallic connections between water or gas pipes and the railway return circuit should be permitted

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

The Influence of Suggestion

A firm believer in the influence of suggestion, Mr. C. H. Felker, assistant new-business manager of the Toledo Railways & Light Company, turned on his own porch lamp every night during the month of December. He gave no reason to his neighbors for so doing, nor did he mention to them the fact that he was operating this lamp continuously. However, by the tenth of the month ten of Mr. Felker's neighbors on both sides of the street were operating their porch lamps every night. The fact that this was not a coincidence was established when on Jan. 1 Mr. Felker discontinued the operation of his porch lamp and was followed by all of his neighbors.

A lesson, and perhaps a suggestion, is to be found in this incident as viewed from the standpoint of an electrical salesman. The suggestion has been made that it might be a good investment for central-station companies to furnish all employees in the new-business department with energy, either at a reduced rate or free of charge, in order that they might set examples to their neighbors by keeping their houses brilliantly lighted.

Electric-Vehicle Parade in New Orleans' Mardi Gras

A street parade of electric vehicles was a feature of New Orleans' Mardi Gras celebration of 1914. A number of shining electric coupés and runabouts headed the procession, and these were followed by twenty elaborately decorated electric trucks carrying banners advertising the advantages of electric vehicles. With its band and bugle corps, the procession measured three city blocks in length. The parade was arranged by Mr. William E. Clement, commercial agent of the New Orleans Railway & Light Company, who is also secretary of the recently organized Electric Vehicle Association of New Orleans. Mr. Thomas Bart Rhodes is president of the new association, with which the local branch of the Jovian Order participated in the Mardi Gras parade.

ELECTRIC VEHICLES IN NEW ORLEANS MARDI GRAS PROCESSION

House-to-House Demonstration of Washing Machines and Vacuum Cleaners

With its accustomed enterprise, the Denver Gas & Electric Light Company is making free demonstrations of the use of electric washing machines, electric vacuum cleaners and other domestic electric appliances. This method is adopted to introduce these modern conveniences in the homes of the company's residence customers. As shown in the accompanying illustration, a 1,500-lb. electric delivery wagon of local construction is used for the delivery of appliances of this character. The driver is an employee of the company who is also skilled in demonstrating and repairing electrical apparatus. He makes many of his deliveries alone and himself installs the washing machine, vacuum cleaner or other device that may be under consideration. He then demonstrates how the apparatus is used and goes away. Another representative of the company calls within a day or two in order either to make a sale of the appliance or to order it transferred to another home. In a large percentage of the cases these demonstrations result in sales.

DEMONSTRATING WASHING MACHINES AND VACUUM CLEANERS AT DENVER

Co-operative Benefit Association for Columbus Employees

Bulletins recently issued by the Columbus Railway & Light Company, Columbus, Ohio, announce that a Co-operative Beneficial Association will soon be inaugurated there, incorporating both an insurance system and a pension plan. Any white employee who has been in the service of the company for three months and who is not less than eighteen years of age nor more than forty-five years of age, and who is receiving a salary not exceeding $200 a month, will be eligible for membership. The entrance fee is $1, with monthly dues of 50 cents, the company contributing to the funds of the association each month the equivalent of one-half of the total monthly income of the association paid by its members. Sick benefits will amount to $1 a day for a period not exceeding twenty-six weeks. The insurance system covers employees who have been in the service of the company for more than two years. Pensions will be awarded to workmen who attain the age of sixty-five years after having completed twenty years of continuous service with the company.

Coffee with Your Lighting-Bill Receipt

During the cold, raw days, when the month of March "came in like a lion," patrons of the Massillon (Ohio) Electric & Gas Company, in the neighboring village of Orrville, were served with hot coffee when they came to the Orrville branch office to pay their electric-light bills. Mr. O. A. Acuff, new-business manager for the Massillon company, made arrangements with the local man who handles collections so that for all who came to the office during the cold period a cup of the steaming beverage was waiting. Such thoughtfulness on the part of the public-service company certainly cemented a closer relationship with the local public, showing them that a corporation properly conducted is not without a heart.

Energy-Consumption Data from Eight Brick Factories in St. Louis

The new-business department of the Union Electric Light & Power Company, St. Louis, Mo., has been particularly successful in equipping dry-press brick plants in and about the city with motor drive. Comparison of the data collected from these plants brings out some interesting facts and also shows what results can be expected from motor drive in similar installations. Equipment in plants Nos. 1, 2 and 3 is practically the same, but the energy consumption for No. 3 is shown to be considerably lower than either of the others. This is, however, accounted for by the fact that plant No. 3 was in operation only during the most favorable season of the year. So, eliminating this figure, the energy consumed in the manufacture of 1000 bricks may be said to range from 4.45 kw-hr. to 8 kw-hr., according to the number of machines which are electrically driven.

DATA ON EIGHT MOTOR-DRIVEN BRICK PLANTS

Plant No. 1, 30-hp Motor	Plant No. 2, 20-hp Motor	Plant No. 3, 20-hp Motor	Plant No. 4, 30-hp Motor
One five-mold brick machine	One five-mold brick machine	One five-mold brick machine	Two four-mold brick machines
One set rolls	One set rolls	One set rolls	One two-mold hammer
One mixer	One mixer	One mixer	Four disintegrators
One elevator	One elevator	One elevator	One conveyor
			Two mixers
Kw-hr. per 1000 bricks, 5.18	Kw-hr. per 1000 bricks, 4.45	Kw-hr. per 1000 bricks, 3.10	Kw-hr. per 1000 bricks, 4.5
Plant No. 5, 50-hp Motor	Plant No. 6, 10-hp Motor 40-hp Motor	Plant No. 7, 75-hp Motor	Plant No. 8, 50-hp Motor
Two-four-mold brick machines	Two five-mold brick machines	Two six-mold brick machines	One six-mold brick machine
One two-mold hammer	One set rolls	One two-mold brick machine	One two-mold brick machine
Four disintegrators	One elevator	Four mold hammers	Two disintegrators
One conveyor	One screen	One 60-in. disintegrator	Cup elevator
Two mixers	Machine shop	One set rolls	Kw-hr. per 1000 bricks, 8
Kw-hr. per 1000 bricks, 4.5	Kw-hr per 1000 bricks, 5.6	Cup elevator	
		Kw-hr. per 1000 bricks, 8	

When these unit energy figures are multiplied by the cost of electricity and compared with the costs of operation in steam-driven mills (for St. Louis approximately 24.5 cents per 1000 bricks), the advantage of electric drive stands out quite clearly.

Supply Dealers' Exhibits in a Central-Station Showroom

Several months prior to the recent rearrangement of its general offices the Merchants' Heat & Light Company, of Indianapolis, Ind., took up with the six leading local electrical supply houses the question of opening, on a co-operative basis, an "electric shop" in its new showroom, at 33 South Meridian Street. As the result of several conferences it was finally decided that the company would furnish in the showroom a table for each supply house, and on these the dealers now make representative displays of the appliances sold by them. The tables selected have 8-ft. by $3\frac{1}{2}$-ft. tops and are covered with green felt.

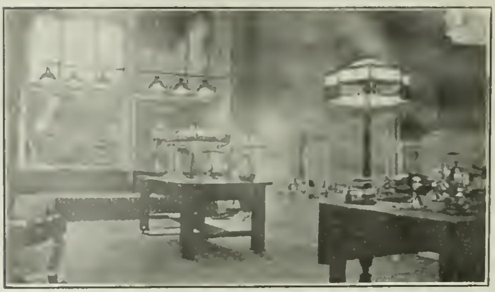


FIG. 1—DEALER'S EXHIBIT TABLES IN CENTRAL-STATION SHOWROOM

FIG. 2—SHOWROOM OF MERCHANTS' HEAT & LIGHT COMPANY, INDIANAPOLIS

The plan being followed at the present time is working out to great advantage to both parties, according to Mr. C. F. Klu, assistant sales manager. When a customer comes in and selects an appliance from a certain table an order is taken and sent to the corresponding supply house, which then makes the delivery from its own stock. If the order is a C. O. D. account the central-station company is credited with a percentage on the sale. If it is a cash sale, the company sends the supply firm a requisition and is billed in the usual course of business. In this way each supply dealer's table at all times has on it the original consignment. If, however, the customer desires to take with him the appliance he has selected, he is allowed to do so and a requisition is issued to the supply house, which immediately sends another appliance to take the place of the one carried away. In every case the customer is invited to look over all the different devices on display and to make his own choice. The prices on all goods exhibited are maintained by the Merchants' company at the same values as listed by the supply houses themselves.

In addition the company has itself put on display about fifty floor and table lamps. The prices of these will be maintained at about the same level as those charged by the dealers.

In the front of the room is a display window measuring about 15 ft. by 5 ft. This window is given over in turn to each supply house for a week at a time. Each dealer is supposed to dress the window and to take care of it during the time it is in his charge. In this way each supply house has the window every sixth week.

In the front of the main showroom, as shown in Fig. 1, are displayed two steam radiators, with regulators and meters attached. With these it is expected to explain to customers the advantages of buying steam heat on a meter basis. One of these radiators is also equipped with a "built-in" oven, in which the housewife can warm plates before serving dinner.

At the rear of the room is the cashier's desk, and back of her booth is a rest-room fitted up for women customers. This room is equipped with a telephone and writing desk and will have a maid in attendance. The display room is in charge of the chief clerk, with a young woman assistant. In addition to his duties as salesman, the clerk attends to any complaints that customers may wish to make with regard to service or bills.

It was intended to have a formal opening of the room some time during March. It is also planned to give special demonstrations from time to time, for which special invitations will be issued. During one week, for instance, an experienced woman will demonstrate a chafing dish, preparing various good things to eat for the instruction of visitors. Such a demonstration will be followed with others on the uses of electric irons, toasters, washing machines, vacuum cleaners, etc.

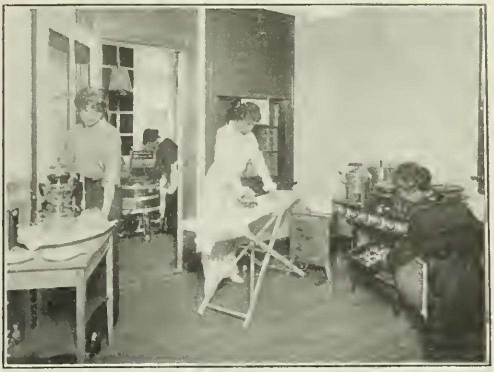
So far, with no advertising and with only the attendance of the customers who come into the office to pay bills, the sales in the showroom have been very gratifying. As soon as the room is formally opened the electric shop will be advertised extensively in the local papers.

The "House Electric" of the Potomac Electric Power Company

The Potomac Electric Power Company, of Washington, D. C., is operating an electric house at Chevy Chase, Md., one of the fashionable residential suburbs of Washington, and in this model dwelling are shown all kinds of electric heating, lighting and mechanical appliances.

A building contractor has given the company the use of the newly completed house, and the power company put in the special wiring for the electrical devices. It has also employed operators to demonstrate the labor-saving, cleanly and safety qualities of the devices. Washington retail merchants loaned the interior furnishings, a pianola and a victrola.

Incidentally the house is being regularly used as a residence, the demonstrators sleeping there and cooking all of their meals on an electric stove. Visitors are met at the door by a maid, and after they have taken off their wraps, one of the demonstrators shows them over the entire house and operates the various electric devices. In the kitchen the callers are served with coffee made in an electric percolator and hot biscuit cooked in the electric stove. On the back porch there is a meter exhibit showing the saving effected by the use of tungsten lamps instead of carbon units.



KITCHEN OF WASHINGTON'S "HOUSE ELECTRIC"

Near the car line a large electric sign directs attention to the "House Electric," as it is called, and two 750-watt nitrogen-filled lamps iluminate the way. Callers are asked to register when leaving the house, and during one three-week period there were more than two thousand visitors.

A Lamp-Post Centerpiece for Window Displays

The Central Illinois Public Service Company, which operates interconnected properties in the southern central portion of the State, is using a miniature ornamental lighting standard, fully equipped, as the centerpiece for its window displays. When the little lighting standard has ceased to be an attraction in one city it is moved to the next and exhibited there. Although at present no concerted effort is being made to secure street-lighting contracts, the impression created on the minds of the various communities will be favorable and lasting, so that when the time comes for talking "white ways" in towns not yet supplied with adequate lighting systems everyone will have a definite idea of what an ornamental lighting standard is. The illustration herewith shows the window display grouped about the miniature post in the company's central office at Mattoon, Ill.

WINDOW DISPLAY, MATTOON, ILL.

Illumination and Wiring

Electric Line Wagons of the Commonwealth Edison Company, Chicago

In its service and repair work the Commonwealth Edison Company, Chicago, makes use of a number of specially designed electric trucks each of which is a veritable supply store. Doors which let down at the sides give easy access to the numerous compartments with which the truck bodies are equipped, so that all tools and supplies are readily reached from the sides of the vehicle. The company has a dozen of these wagons, having purchased the initial lot of eight trucks more than twelve months ago, since which time they have been in continuous successful service.

Near the forward end on the left side of the truck body, as shown in Fig. 1, is a group of some twenty pigeon-hole compartments for the drills, saws, wrenches, etc. Behind these are two large metal-lined compartments for the gasoline cans and furnace, and next comes a third full-size space in which are carried salt and water for the preparation of ground-pipe connections. At the rear is a second group of compartments and drawers for the solder, taps, primary cutouts and such small hardware as bolts, screws, steps, washers, etc.

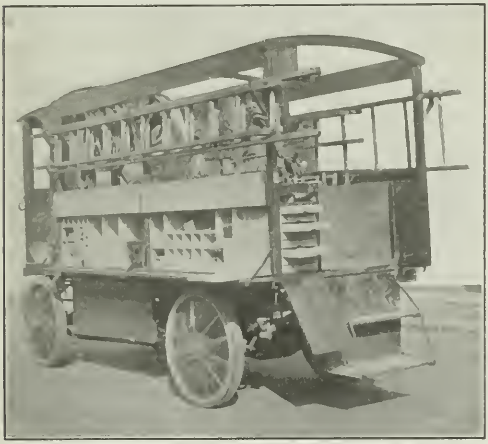


FIG. 1—ELECTRIC WAGON, SHOWING COMPARTMENTS FOR TOOLS AND HARDWARE

The long compartment on the right-hand side near the front (Fig. 2) provides for laying out rubber coats, boots, etc., at full length, preventing cracking due to folding. The spaces below are for brackets and short braces. In the group behind the horizontal openings are seen the drawers for the glass insulators. These have pins which support the insulators out of the way of injury to one another. The rear compartment contains knobs, strain insulators, spurs, belt tools, etc.

The side doors which close these compartments swing downward and serve as shelves for sorting material. On the uprights are racks for holding the ground-wire molding, ground pipes, cross-arm braces, etc. The inside of the body is approached from the rear by a pair of easy steps, and at the left of the end gate are eight trays of various lengths for framing bolts.

Forward in the body of the car are two pay-out reels of wire, and adjoining these there is space for carrying transformers. Coils of rope and extension ladders are carried on hooks on the side standards. The latter also support a frame over which a tarpaulin can be thrown in rainy weather.

The trucks described were designed primarily for the installation of customers' services from the overhead system, but they have also been found well adapted to repair work and line extensions which do not require pole setting. The trucks were built by the Walker Electric Vehicle Company at its Chicago factory.

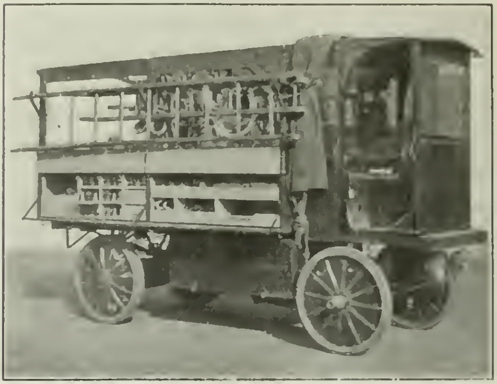
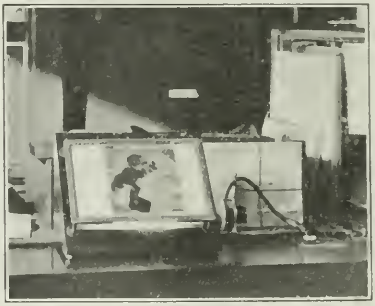


FIG. 2—DRAWERS FOR INSULATORS, LINE MATERIAL, ETC.

Handy-Box for Examining Photographic Negatives

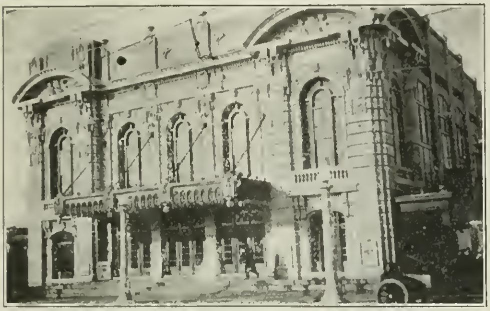
The box shown on the counter in the accompanying photograph represents another electrical device for the convenience of the photographer, the object being to avoid the tiresome process of holding developed and finished negatives repeatedly up to daylight in order to identify or study their features. In the arrangement shown two 8-cp incandescent lamps of the tubular type are mounted on the inside of a triangular box about 7 in. long, 6 in. wide and 6 in. high. On the front of the box is a double ground-glass cover against which the negative is laid when under examination, the glass top being 4.75 in. wide and 6.75 in. long and mounted on four brass posts 1 in. high. A snap switch on the side of the box controls the lamp's operation; the rear side is open, with a light cardboard curtain to enable the heat from the lamps to be readily dissipated, and electricity is supplied by a flexible pair of wires plugged into a flush receptacle in the counter.



HANDY BOX FOR EXAMINING NEGATIVES

Nitrogen Lamps and Concrete Posts

Without exaggeration it may be said that the curb lighting before the Park Vaudeville Theater on the West Side of St. Louis, Mo., is the last word in exterior illumination. Here, as shown in the illustrations, are installed four 750-watt nitrogen-filled tungsten lamps in Alba globes. At night these units light the street for considerable distances at both sides of the building. Four other similar units will be installed on the face of the building near its top. The units at the curb are supported on concrete columns of neat and simple design which harmonize well with the exterior of the theater.



CURB-LIGHTING UNITS, PARK THEATER, ST. LOUIS, MO.

At another theater under the same management nitrogen lamps have been used to replace the internal parts of several old arc lamps which were rendering inefficient service as exterior illuminants.

An Electric Sign on a Gate

A Boston (Mass.) trucking house utilizes electricity to advantage to light a somewhat unusual sign mounted on an alleyway gate just outside the office of the firm.

ELECTRIC SIGN ON GATE

When the gate is closed the two halves swing together and two triangular electric signs are switched into service by hand, the central portion of the gate being occupied by two circular signs, 24 in. in diameter, bearing the street number and the words "Auto Truck Service." The triangular signs are each 6 ft. high and contain five 16-cp frosted lamps, while the circular signs contain three lamps each, of the same size. The controlling switches are of the push type and are inserted in the circuit of a flexible pair of wires terminating at the sign proper and connecting with flexible metal duct on the wall at the rear of the gate.

Durability of Cable Circuits

On account of dredging operations by the government in the neighborhood of Coney Island and Jamaica Bay, New York, the Commercial Cable Company was recently forced to relocate its cables which connect two transatlantic and other deep-sea circuits. The route from the main office in New York now extends to Far Rockaway instead of to a point on the eastern end of Coney Island. A new underground line was laid between New York and Far Rockaway.

The transfer of the ocean cables and the connection with the office having been accomplished, there was no further use for the cables over the Coney Island route, so it was decided to take them out of the conduits and utilize them as extra conductors over the Far Rockaway line. This installation consisted of three cables of four conductors laid in 1900 and three cables of four conductors laid in 1904, and it was made by the Okonite Company, New York. Tests show the electrical and physical conditions of the conductors to be practically unimpaired after ten and fourteen years of uninterrupted service.

Recent Telephone Patents

Difficulty has sometimes been encountered with automatic-exchange systems in operating lines of different classes. In order to overcome this difficulty Mr. F. R. McBerty, of New Rochelle, N. Y., has invented an automatic-exchange system which was patented recently for working the direct-line, party line and underlined groups, as well as interchangeable lines. For party lines, however, an individual contact set in the contact banks is assigned to each station, the designation of each station comprising a number only. A "busy" circuit may be interconnected between all contact sets of the line, thus eliminating interference. Reversals may be made automatically to insure the proper ringing current for selecting the desired station only. The contact sets of all the lines of underlined groups are so wired that when a call is made and the first set is busy, the selector will try the successive ones of the group until one not busy is located. If all are being used, the busy signal will be given. Automatic ringing is employed throughout. The key to the system lies in the association of a polarized and a current-strength relay in the busy test circuit so that combinations of these two, both acting differently, determine the subsequent result. This patent is assigned to the Western Electric Company.

Mr. M. L. Johnson, of Chicago, has also obtained several patents relating to the operation of party lines with automatic systems, these patents being assigned to the Corwin Telephone Manufacturing Company, of Chicago. In all these systems relays are located at the substations, and when any station has the line either for incoming or outgoing purposes the telephone talking apparatus and the impulse-sending switches are cut out at all the other stations of the line. This is accomplished by controlling these circuits jointly through a polarized relay and a light-resistance relay at each station, the latter latching the hook switch. An additional feature of these systems which relates to both automatic and manual working is the running of an auxiliary line between stations of the party line with means for intercommunication without effect upon the exchange line.

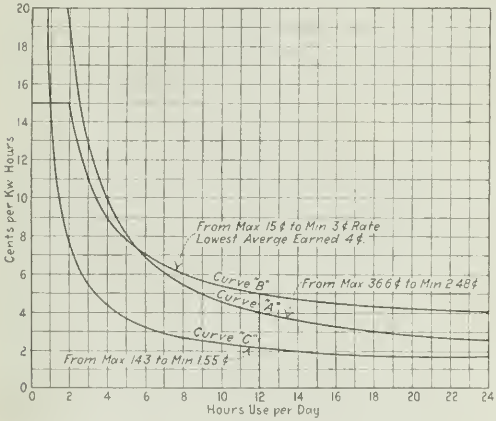
Letters to the Editors

Electric-Service Rates

To the Editors of the Electrical World:

Sirs:—Perhaps no subject of interest to the public has received more attention during the past few years than that of electric energy and service rates. The searchlight of investigation has been thrown on it from every angle by state commissions, private experts and electric property operators. It is fair to say that these investigations, both on the part of the consumers and the companies, have been made with the prime view of arriving at the real truth. Electric rate making has, therefore, passed from the haphazard guess methods of a few years ago to a science in which due consideration is given to every factor affecting the question. On this question there is and must always be more or less disagreement, and it is only through such disagreements and diversity of opinion that the real truth is ultimately to be arrived at.

In the making of a proper rate there must necessarily be taken into consideration the following factors:



CURVE CHART SHOWING VARIATION OF ELECTRIC-SERVICE RATES

First—A proper interest return on the investment.

Second—A depreciation charge that will not only cover loss through wear and tear but will also provide for the cost of discarding machinery, as is constantly made necessary through the rapid developments, improvements and changes in electric generating and distributing apparatus.

Third—The cost of labor.

Fourth—The lubricating and fuel costs.

The above naturally divide themselves into two classes that are properly known as fixed costs and varying costs. The first two items constitute the fixed cost. The labor cost, or third item, is properly divided between the two classes but belongs primarily to the first classification, and for simplicity may be thus treated. The fourth item constitutes the varying cost.

In making a rate the aim is so to arrange the schedule that under all conditions of the requirements of the consumer he will always pay a price that will net the company a just and fair return. The form of the bill should be as simple and as easily understood as it is possible to make it. This should also apply to the application or contract. The expert, absorbed as he is in his study, is apt to lose sight of the fact that to the large majority of users "kilowatt," "kilowatt-hours," "maximum demands," "minimum demands," "load-factors" and other technical expressions are pure Greek and the direct cause of much misunderstanding.

In the opinion of the writer, a fair rate should be one that protects the company at every point of use, whether by a one-hour-a-day user or a twenty-four-hour-a-day user. It, therefore, becomes a rate that varies from a maximum charge for energy to the short-hour user to a minimum rate to the long-hour user. It should be such a rate that on a station demand of 100 lamps used on an average ten hours per day the price paid by the consumer per kilowatt-hour should be practically the same as that paid where the demand is 1000 lamps on the station, the only difference being the saving to the company in getting its revenue at a reduced transformer, meter and office expense where the same amount of energy is furnished to one customer rather than to ten.

In arriving at a rate, the curve chart is most useful and expedient, and on it should first be outlined the costs of operation, varying from an amount of energy sold equivalent to what the plant could turn out (with proper reserve amount set aside for protection in case of shut-down of active units) in one hour per day running to what it would turn out in twenty-four hours' constant operation.

After some fifteen years' experience, during which time many rates have been worked out and tried, the following simplified method has been developed: The equivalent of two hours' use per day of the station demand at X cents per kw-hr. All use in excess at Y cents per kw-hr.

Applying this rate to such a plant as is found in towns of from 5000 to 6000 inhabitants—say, a plant consisting of two 150-kw units, one for use and one for reserve—the following would result:

Assume that the actual investment was $75,000; that the labor, as paid out for salaries to superintendent, engineers, firemen, linemen and office help, was $600 per month; that the total fuel bill and cost of lubricants divided by the monthly kilowatt-hours output was 1 cent per kw-hr.; then, with interest charge at 8 per cent, $500 per month; depreciation at 8 per cent, $500 per month; labor, $600 per month, the total fixed charge would be $1600 per month.

A 150-kw plant, running on a one-hour-a-day load-factor would generate 4500 kw-hr. per month at a fixed cost of $1600, plus a fuel cost of 1 cent per kw-hr., or $45. The cost per kilowatt-hour under one-hour load conditions would, therefore, be $1600 \div 4500 + 1$ cent per kw-hr. $35.6 + 1 = 36.6$. Under twenty-four-hour load the cost would be 2.48 cents per kw-hr., as shown in the accompanying curve sheet at A. Assuming the maximum price allowed under franchise rights is 15 cents per kw-hr., the following rate could be made: Rate X, or first two hours' use per month of the demand, at 15 cents per kw-hr. Rate Y, or excess use, at 3 cents per kw-hr. The results are shown in curve B. From this rate the maximum paid for energy would be 15 cents per kw-hr. The lowest average rate that could be earned would be 4 cents per kw-hr.

To credit the large consumer with the reduced cost to the company for transformers and meters, a quantity discount of 1 per cent for each ten-dollar value of the bill up to 25 per cent could be allowed, and on account of saving in expense of collecting a cash discount of 1 per cent for cash payment on or before the 10th instant could also be allowed. As an offset to the loss shown by the chart up to a five and one-half hours' use, a minimum charge of 5 cents per lamp (50-watt) should be required on commercial lighting, but not less than $1, and no installation should be considered less than 1000 watts. With this addition, the rate not only enables the long-hour user to obtain a low average rate but also guarantees to the company a fair return.

By careful analysis of local conditions and manner of use, a basis of estimating the active installation or actual demand should be worked out, the value usually ranging in commercial lighting from 90 per cent to 50 per cent, on motor service from 75 per cent to 25 per cent, and on residence use from 75 per cent to 25 per cent.

W. A. Smith,
Vice-president the Light & Developing Company.
St. Louis, Mo.

Rates for Electricity

To the Editors of the Electrical World:

Sirs:—I have been much interested in the letters in your paper regarding rates on electricity, for it is a subject upon which I have spent much time, and I am fast getting to the point where I believe that the public service companies, particularly the large ones, are not serving the best interests of the community, or even their own best interests, by taking contracts for either lighting or motor service in large quantities at very low prices.

The electric companies state that the large users can be served at low price because their load for the most part is off-peak and the amount of power used is so large that they can afford to sell the energy at a very low rate. The amount of power used by these companies may be large, but that it represents an off-peak load is not true. Practically every one of the large users of energy either for lighting or motor service demands service during the peak period. It may be for only two or three hours during three or four months of the year, but it occurs during the peak and therefore requires in the station apparatus for generating, and in the streets apparatus for distributing, the energy which would not be required if this load did not exist. Under these conditions the people who should pay for the interest, maintenance and depreciation as well as the operating charges on the machinery are those who make this apparatus necessary, namely, the large as well as the small users.

According to the figures of one of the very large generating companies for 1909, the average rates for motor service were 4.47 cents per kw-hr. The amount of energy delivered was approximately 92,244,000 kw-hr. Assuming that energy was used for 365 days out of the year, this would represent 253,000 kw-hr. per day, and assuming a use for nine hours a day the average kilowatts or the total kilowatt rating required in the station, not allowing for transmission losses, would be 28,100. For illustration purposes, assume this as a peak load, which is manifestly incorrect but errs in being too small and not too large. Assuming that the indicated rated equipment could be installed with its distributing lines for $300 per kilowatt, including all costs against the plant—which is a low figure when one takes into account costs in a large city—the total cost would equal $8,430,000. Allowing 16 per cent for interest, maintenance and depreciation, the annual cost would be $1,348,800, or approximately 1.46 cents per kw-hr. for these three fixed charges, no allowance whatever being made either for taxes or for operating charges.

From the amount of energy sold and the average price it is found that 42.4 per cent of the energy was sold at 1.44 cents per kw-hr., or less than the interest charges on the investment of the apparatus required to produce it. Five per cent was sold at an average of 1.99 cents, 5.5 per cent at an average of 1.88 cents, 2 per cent at an average of 4.03 cents and 45.1 per cent at an average of 7.97 cents. In other words, a very considerable proportion of the energy was sold at a price less than the cost incurred to maintain the apparatus.

Taking up now the other items which add to the cost of energy, the taxes are found to be approximately 0.4 cent per kw-hr., station operation expense 0.4 cent, management 0.6 cent, and distribution 0.25 cent, making a total for these charges of 1.65 cents. Adding fixed charges as above, the total cost of the average energy alone is 3.11 cents, showing that 52.9 per cent of the energy was sold at less than cost, whereas 45.1 per cent was sold at an average of over double the cost. What proportion of it was sold below the actual cost of producing it, including operating charges, is hard to state; but unquestionably the company would have been better off if it had not delivered at least 50 per cent of the energy, particularly that to railroad and electric corporations, which unquestionably were in a position to supply energy themselves at a low price. The only reason it was supplied to them at this low price was because the business could not be obtained otherwise. In other words, the rates are fixed by the condition of getting all that the traffic will bear.

In another case it is found that the plant required approximately two-fifths more machinery in it to carry the motor load than it required in case it carried only the lighting load. The actual figures of the plant are used in determining the interest, maintenance and depreciation charges, these figures being obtained from the public service commissioners' report. The interest, maintenance and depreciation at 16 per cent, 6 per cent for interest, and 10 per cent covering maintenance and depreciation for motor service, shows $1,688,400. The total income from the motor load was $1,112,277, showing that the total income to the plant from the motor load did not equal the fixed charges on the apparatus required to produce and distribute it.

In direct contradiction to this, the lighting figures are as follows: Interest, maintenance and depreciation, $2,532,600; income, $4,575,137. In this case the lighting load paid not only all its interest, maintenance and depreciation but also the interest, maintenance and depreciation in part of the motor load and all of the operating charges on both loads.

It may be that the small lighting customers have no material reason to complain of the rates they pay for energy during lighting hours, and I personally do not feel that there is much reason for them to complain. There does, however, seem to be a reason for them to ask that they should have an opportunity to use energy for general purposes during the off-peak period at a price comparable with the lowest price paid by the motor users, because this could be done without in any way encroaching upon the peak load. By the use of a two-rate meter they could pay the lighting rate or peak rate during the peak period and the low rate during the non-peak period. The same type of meters could be used for motor customers, arranging that they too pay a low rate during the off-peak and a high rate during the peak period, this rate being such that they would pay for the interest, maintenance, depreciation, taxes and operating expenses of all kinds for the energy used during this period. Evidently this price would be exceedingly high, but as the price during the non-peak period would be low, the average price might not be high. Whether or not the average price be high is a secondary consideration, because it should be evident that the people who use energy during the peak should pay for the apparatus required at this time.

Boston, Mass. Henry D. Jackson.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

A Portable Pipe-Thawing Outfit

The thawing of water pipes with electrical energy taken from central-station mains has come to be a familiar practice, but it is not often that a portable power plant is employed for thawing work. Such an outfit has, however, been successfully used during the past winter by Mr. B. B. Hayford, superintendent of the water department of Waukesha, Wis. In changing the grade of certain Waukesha streets the water mains were lowered and owing to the cold weather the exposed $\frac{3}{4}$-in. service pipes promptly froze.

A traction engine was available and a 15-kw compound-wound, direct-current generator belonging to the department was mounted thereon and belted to the fly-wheel, as shown in the accompanying illustration. This generator was wound for 115 volts, and it was realized at the outset that it would be necessary to waste a lot of energy in resistance in order to get sufficient current to perform the work. A 1.5-kw generator was therefore mounted on the engine and belted to it, and it was used to excite the shunt fields of the larger generator, which was then run at one-half its rated speed. With this combination it was possible to obtain 275 amp at a range of from 5 volts to 15 volts. Such a current would thaw out 100 ft. of 0.75-in. pipe in about twenty minutes. The saving in energy effected through using this scheme is shown by the fact that the 275 amp required to thaw the pipe when delivered at 110 volts represents 30 kw of power, while by separately exciting the fields it was possible to obtain the same current at 15 volts with a power demand of only about 4 kw. Furthermore the higher voltage had a deteriorating effect on the wiped joints of the lead goosenecks of the service pipes.

OUTFIT USED FOR THAWING PIPES

During the thawing operation one side of the circuit was connected to a fixture in the building, preferably an outside hose connection, and the other side to a hydrant on the street or to a fixture in the adjoining building. In the latter case two services could be thawed in the same time as one. The current was carried by 300 ft. of No. 0 cable, to the outer ends of which were soldered strips of sheet copper 2.5 in. wide and 10 in. long. These were wrapped around the plumbing fixtures and held in place by ordinary cabinetmaker's clamps to insure good contacts. A rheostat, a voltmeter and an ammeter were mounted on a board just under the generator.

Superintendent Hayford reports having thawed out from eighteen to twenty services a day at a cost of approximately $8.

Purchase of Oil Fuel—I

By R. T. Strohm

When it comes to the purchase of oil fuel, the buyer is interested in obtaining the greatest possible heat value for the money expended; therefore he wishes to know the amount of water, sulphur and sediment in the oil, the heat value, the flash point and the specific gravity. From a knowledge of these properties he can determine how well the oil is suited to his purposes.

The Bureau of Mines has issued a pamphlet detailing the specifications for oil purchased by the United States government and describing methods of sampling. The following information concerning the requirements of oil for fuel purposes and the methods of obtaining samples is taken largely from this publication.

The oil available for fuel may be either crude oil or fuel oil. In the first case it is simply natural petroleum as it comes from the well, and in the latter case it is the residue left after the lighter and more volatile constituents of crude oil have been driven off. In either case the oil should be homogeneous, or of uniform composition throughout. It should not be a mixture of light and heavy oils in such proportions as to give the desired specific gravity.

If it is a fuel oil—that is, has been subjected to a preliminary heat treatment—the temperature to which it was heated should not have been so high as to burn it, nor should the temperature have been so high as to cause the separation of carbon, which would afterward appear as flecks in the oil.

Flash Test

To be quite safe the oil should have a flash point of not less than 140 deg. Fahr., and this point should be determined by means of a closed tester. The flash point of an oil is the temperature at which the oil will give off vapors that will ignite when a naked flame is brought in contact with them. A crude form of test for the flash point may be made by putting a sample of oil in a cup, placing the cup in an iron vessel containing sand and applying heat to the sand so as to increase the temperature of the oil gradually. At short intervals during the heating the flame of a match is passed over the surface of the oil and about ½ in. from it. Eventually a point will be reached when the gases rising from the heated oil will ignite and burn with a blue flash when the match is applied. The temperature of the oil when this action is first noticed is called the flash point.

The open cup, though forming a simple means of finding the flash point, is not accurate, because there is too much opportunity for variation in the conditions under which the test is conducted. It is very difficult to screen an open cup from all drafts and air currents, and if these are not prevented the gases rising from the oil will be diffused more or less quickly and the results will not be correct. The quantity of air in the top of the cup, just above the surface of the oil, influences the flash point. The rate at which the oil is heated will affect the result. The more rapid the heating, the more rapid the formation of gases and the lower is the flash point.

The quantity of oil also has a bearing on the result obtained. The greater the quantity of oil, the greater is the quantity of gases driven off and the lower the flash point. The form and size of the oil cup are controlling factors. The evaporation is most rapid with a large, shallow cup, and the flash point with such a cup is lower. The most nearly uniform results are to be obtained with a cup that is fairly deep in comparison with its diameter and that is filled about half full.

The flame by which the test is applied should be of constant size and shape if uniform results are desired, and the time during which it acts should always be the same. Again, its distance from the surface of the oil at the instant the test is made should not vary. The larger the flame or the closer it is brought to the surface of the oil, the lower is the flash point. It is best to pass the flame across the center of the cup, from one edge to the other, because the mixture of gas and air is most complete at the edge of the cup.

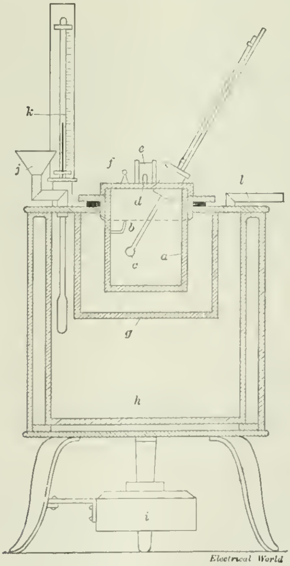


FIG. 1—DEVICE FOR TESTING FLASHING POINT OF OIL

To obtain accuracy of results and to allow the results to be compared, flash tests should be made in a closed tester, such as the Abel tester, shown in section in Fig. 1. It consists of a cup *a*, about 2 in. in diameter and 2¼ in. deep, into which the oil to be tested is poured, always to the same level, as indicated by the tip of a bent wire *b* soldered to the inside of the cup. The cover of the cup carries a thermometer *c* for registering the temperature of the oil. It also carries a slide *d* to which is swiveled a lamp *e* by which the flash test is made. The arrangement of the lamp on the cover of the cup is clearly shown in Fig. 2. The body of the lamp is filled with colza oil or rape oil, and at the end of the spout is a wick. In the slide is a rectangular slot, and under the slide are three slots in the cover of the cup; thus, when the slide is drawn across the cover, its slot registers with the slots in the cover. A pin projects from the slide, and when the latter is pulled out the pin tilts the narrow spout of the lamp down into the slot and thus brings the flame in contact with the gases in the cup. There is a white bead *f* (Fig. 1) fixed to the cover just opposite the flame of the test lamp, and the size of this bead is a guide to the size of the test flame to be used.

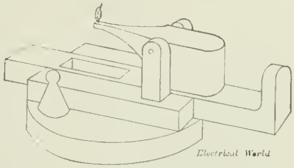


FIG. 2—LAMP FOR MAKING FLASH TEST

The oil to be tested is heated by a water bath contained in the copper vessels *g* and *h*. Heat is applied by the spirit lamp *i*. The water for the bath is poured into the funnel *j*, its temperature is indicated by the thermometer *k*, and the excess escapes at the overflow *l*.

To make a test, the apparatus is placed in a fairly dark place, so that the size of the test flame can easily be compared with the bead *f*; also, the flame is shielded from all air currents. The water bath is filled with water at a temperature of 130 deg. Fahr., and the oil to be tested is poured into the cup to the level of the gage wire *b*. The thermometer *c* is next inserted and the spirit lamp *i* is lighted. When the oil reaches a temperature of 66 deg. Fahr. the test flame is applied for the first time, and again after that every time the temperature of the oil has increased one degree.

To insure absolute uniformity, the test flame is applied according to the swinging of a pendulum 24 in. long, which is set up near the operator. The slide *d* is slowly drawn out while the pendulum is making three full swings in both directions and is pushed back to its original position during the fourth swing. When the vapor rising from the oil is ignited by the lamp and gives a momentary flash of blue flame, the temperature registered by the thermometer *c* should be noted. This reading is the flash point of the oil. The firing point may be determined next, if desired. It is the temperature at which the gases are given off in such quantity that they burn continuously when ignited by the test flame.

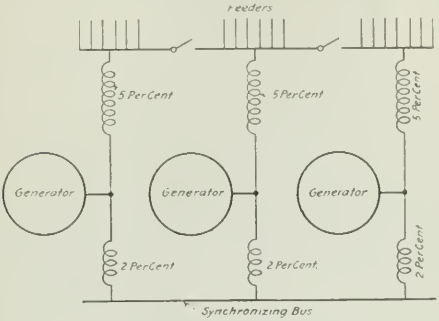
Determining Percentage of Impurities in Oil

If the oil contains water, the sample to be used for the flash test should be freed from water before being put into the tester; for as little as 1 per cent of water in oil will cause the flame to be extinguished when making a flash test.

Methods of determining the percentage of water in oil and of taking samples will be described in a later issue of the *Electrical World*.

Connection of Reactors

Bus-tie, generator and feeder reactors, despite their limitations, have been advocated in varying degrees, but the arrangement of reactors shown herewith apparently combines the advantages of the former schemes and has few of their objectionable features. The feeders are grouped and fed from different bus sections which are individually energized by generators delivering current through 5 per cent reactors. The bus sections are normally operated separately but may be instantly connected by tie switches. To permit this emergency connection, each generator in operation is permanently connected to a common synchronizing bus through 2 per cent reactors which keep the generators in step and also serve the purpose of bus-tie reactors. When this scheme is employed with a bus divided into several sections the voltage regulation is much better when there is current exchange than when ordinary bus-tie reactors are used. This is obvious from the fact that to get the same protection as here obtained 5 per cent bus-tie reactors would have to be used and the energy exchanged between two non-adjacent sections would suffer a large voltage drop. If it is not considered necessary to protect the generators themselves against current surges, the 5 per cent reactors can be omitted and the operation still considerably improved over that obtained with bus-tie reactors. This scheme was described by Mr. H. G. Stott, of the Interborough Rapid Transit Company, New York, at the recent A. I. E. E. meeting.



ARRANGEMENT OF REACTORS

Increased Production with Electric Braking Control

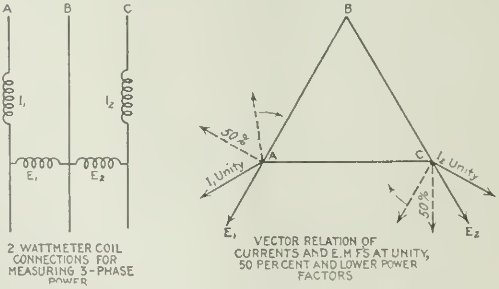
In a paper entitled "Electrical Aids to Production in Factories," presented by Mr. H. E. Eastwood, Cleveland, Ohio, at a recent meeting of the Detroit-Ann Arbor Section, A. I. E. E., the author pointed out the fact that dynamic braking and automatic control of machine-tool motors will safeguard the lives of workmen and increase the output of machine shops considerably. On lathes, planers, shapers, etc., operating at high speed where frequent stops have to be made to adjust the cutting tools, increases of 45 per cent in production have been obtained by employing automatic motor control. This figure of increased production was estimated from the number of pounds of chips which were removed per horse-power per minute. The speaker also described in detail a scheme for simultaneously braking all the machines on a group-drive system in case of emergency. Conveniently placed push-buttons operating a dynamic brake on the motor are installed on each machine so that if an attendant observes an impending accident he may prevent serious injury or even loss of life by pushing the nearest button. This device, it is said, will stop all of the machines in half a second without shearing the motor or the connecting shafts.

Fluctuating Synchronous Motor Load Affects Relative Meter Readings

What changes the ratio between the readings of two single-phase wattmeters when measuring the power delivered to a synchronous motor operating at a greatly fluctuating load? Will you also explain what causes similar ratio changes in the instrument readings when the motor-field excitation is changed? L. C. T

By observing characteristic curves taken from synchronous motors you will note that the power-factor ordinarily takes a sharp drop below half load. The motor you refer to is probably working below the knee of this curve at times, thus causing a considerable variation in power-factor as indicated by the changing ratio of your wattmeter readings. When the motor field is excited above normal the power-factor will at fluctuating loads alternately become leading or lagging, this depending on the load. A vector diagram explaining this phenomenon of synchronous motors is shown in the "Standard Handbook for Electrical Engineers." Changing the field excitation will also cause a change in the power-factor and a corresponding change in the ratio of the instrument readings. At 50 per cent power-factor one meter will read zero and the other give the total power delivered. Below this power-factor one meter reads negative and the other positive. Above 50 per cent the readings will both be positive but differ until unity power-factor is reached. With the two-wattmeter method of measuring three-phase power the algebraic sum of the readings always represents the total power delivered.

The changing ratio of meter readings is best explained by the accompanying vector diagram. The sides of the triangle represent the phase relation of the emf across each phase and also the current flowing in each leg at unity power-factor. In the two-wattmeter method the potential and current coils are connected as shown in the diagram. At unity power-factor the currents flowing through wattmeters W_1 and W_2 will be equal and are represented by vectors I_1 and I_2. The emfs measured by the wattmeters are also equal and are represented by E_1 and E_2. The power in each case is the product of E and the component of I in phase with it. When the current in each leg has changed its phase relation with the emf by 60 deg., corresponding to a power-factor of 50 per cent, the current component in phase with E_2 is zero, hence that meter reads zero. Further reduction in power-factor causes the component of I_2 to become negative, thus causing a negative reading on wattmeter W_2.



2 WATTMETER COIL CONNECTIONS FOR MEASURING 3-PHASE POWER

VECTOR RELATION OF CURRENTS AND E.M FS AT UNITY, 50 PERCENT AND LOWER POWER FACTORS

GRAPHICAL EXPLANATION FOR DIFFERENT METER READINGS WITH TWO-WATTMETER POWER MEASUREMENT

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Iron for Electrical Construction.—A note on a recent British patent (No. 3445, 1913) of W. Rübel. In this iron the eddy-current and hysteresis losses are small and the iron itself is soft and can be rolled without breaking. The material, which, it is said, is cheap to manufacture, is obtained by the addition to iron, containing less than 0.5 per cent impurities, of an amount of aluminum and silicon not exceeding 3 per cent of the alloy. Of this total the aluminum represents between 1.3 and 2 per cent, and the silicon between 0.8 and 2 per cent. Boron may be substituted for the silicon, and beryllium or calcium for the aluminum.—London *Elec. Eng.*, Feb. 26, 1914.

Calculation of Direct-Current Machines.—L. Isambert.—A mathematical paper, illustrated by diagrams, in which the author points out that, besides the methods of direct-current machine calculation which permit computing the value of the magnetomotive forces of the teeth of the armature, it is interesting to know a graphical construction which gives directly the actual induction of the corresponding magnetomotive forces in ampere turns per centimeter.—*La Lumière Elec.*, Feb. 28, 1914.

Cascade Induction Motor.—L. J. Hunt.—A paper read before the (British) Institution of Electrical Engineers in Leeds, giving a detailed illustrated description of the author's cascade induction motor and its operation.—London *Elec. Review*, Feb. 27, 1914.

High-Tension Insulation.—A. Matthias.—An illustrated article on high-tension insulation construction, with special reference to transformer design.—*A. E. G. Zeit.*, February, 1914.

Starting Squirrel-Cage Motors.—E. Jackson.—An illustrated article describing the following five methods of starting squirrel-cage induction motors—direct-starting, auto-transformer starting, star-delta starting, resistance starting and starting with generator.—London *Elec. Review*, Feb. 20, 1914.

Lamps and Lighting

Electric Lighting.—A symposium of papers on electric lighting. W. R. Whitney and E. P. Hyde discuss the general problem of light production, C. P. Steinmetz the efficiency of illuminants, Dushman modern theories of light, and Elihu Thomson the spectroscope. Then follow articles by J. B. McCall, J. W. Lieb, Jr., C. W. Stone, H. R. Summerhayes, R. H. Tapscott, L. B. Bonnett, J. R. Crouse, S. E. Doane, J. R. Werth, E. P. Edwards, J. E. Kearns and C. M. Green, on different subjects of generation and distribution. Next come contributions by L. A. Hawkins, E. Wintraub, J. W. Howell, E. J. Edwards, J. E. Randall, S. H. Blake, C. A. B. Halvorsen and I. Langmuir on various lamps, including the "half-watt" tungsten lamp, the quartz-tube mercury-arc lamp, the gas-filled tungsten lamp, the magnetite arc, etc. The symposium is concluded by articles by L. Bell, W. C. Allen, G. N. Chamberlain, G. H. Stickney, A. L. Powell, M. Luckiesh and W. D'A. Ryan on such subjects of illumination as tendencies in street lighting, ornamental lighting, interior illumination, etc.—*Gen. Electric Review*, March, 1914.

Manufacture of Tungsten for Drawn-Wire Filaments.—A note on a recent British patent of the British-Thomson-Houston Company and the General Electric Company of this country (No. 1915, 1913). This is an improvement on the method of preventing "offsetting" when the filaments are used on alternating current, described in Patent No. 184,670, 1911. The solution of a rare-earth compound is incorporated with the tungsten oxide or compound from which the powder for use in the production of drawn filaments is to be produced. The mixture is heated in an oxidizing atmosphere and then reduced. A particular method consists in the use of a solution of thorium nitrate.—London *Elec. Eng.*, Feb. 26, 1914.

Miners' Electric Lamps.—F. J. Turquand.—A long abstract of a paper read before the London branch of the Association of Mining Electrical Engineers. The author first discusses the design of miners' lamps with respect to the three following points: first, the shell or case; second, the battery, and, third, the methods of mechanically and electrically connecting the lamp to the case containing the electric bulb with the battery, including the locking device. In the second part of the article the author deals with the maintenance of miners' electric lamps.—London *Electrician*, Feb. 20, 1914.

Train Lighting.—T. Ferguson.—A long abstract of a paper read before the Manchester Section of the (British) Institution of Electrical Engineers. The author gives a table of twelve different electric train-lighting systems, the principal distinguishing features of the different systems being clearly tabulated. An account of the extended discussion which followed is also reproduced.—London *Electrician*, Feb. 20, 1914.

Water Model of the Musical Electric Arc.—W. Duddell.—An abstract of a (British) Physical Society paper. In the model the arc is represented by a mushroom valve. The pressure of the valve on its seat is so arranged that the pressure tending to reseat the valve diminishes very rapidly as the valve lifts. Water is admitted beneath the valve, flows through the valve into the vessel which contains it, and overflows. In order to indicate the difference of pressure on the two sides of the valve (which represents the arc) a glass pressure column is introduced into the pipe leading to the valve and quite close to it. As the water overflows freely from the tank in which the valve is immersed, the pressure on this side of the valve may be taken as the zero of reference, and consequently the height of the water column in the pressure tube above or below the level of the overflow gives the pressure underneath the valve. If water be admitted below the valve, the pressure in the pressure tube rises to a high value; finally the valve lifts—i.e., the arc is struck—but the pressure still remains high. If, however, the flow of water is increased, the valve will open considerably and the pressure below it will decrease. If nicely adjusted, this effect can be made to take place over a considerable range. If instead of connecting a pressure tube of small bore to indicate the pressure on the underneath side of the valve a large-diameter tube be introduced so that the water column in it has a periodic time of its own and is able to oscillate similarly to a condenser circuit shunting the arc, oscillations will be set up in this column, and if the periodic time of the liquid in this column be altered, the period of the oscillations will be altered. This effect can easily be obtained by connecting air vessels of different capacities to the open end of the tube, in this way altering the controlling force acting on the water, or, in other words, altering the capacity of the circuit shunting the arc. With such a water model a great many of the properties of arcs, both intermittent and oscillating, can easily be shown. The one point of difficulty in constructing the model is to obtain a force acting on the valve which decreases rapidly when the valve lifts and which occasions no friction. So far the only successful method which the author has tried is to hang from the underneath side of the valve a piece of soft iron which nearly touches the pole of a small electromagnet. This gives a force which without interposing any friction rapidly decreases as the valve lifts, and works very well.—London *Electrician*, Feb. 27, 1914.

Determination of the Color of Light.—L. Bloch.—An illustrated English translation in abstract of his German paper recently noticed in the Digest. The author has three color screens, after the method of Ives, and compares the red, green and blue so obtained with those of daylight through the intermediary of a tungsten lamp as a standard. A large number of results are given.—London *Electrician*, Feb. 27, 1914.

Pentane Lamp as a Working Standard.—E. C. Crittenden and A. H. Taylor.—A paper in which the authors describe fully the method of testing pentane lamps at the Bureau of Standards, give brief general directions for the use of the lamps, discuss more fully the question of fuel, and furnish data on the effects of pressure and moisture in a form which may be useful for those who have occasion to reduce observations on flames to normal candle-power values.—*Scientific Papers, Bureau of Standards*, No. 216.

German Illuminating Engineering Society.—A report of a recent meeting in which Bode spoke on the evolution of incandescent gas lighting, Norden discussed the definition and calculation of the diffusion of any system of lighting, and Klebert described light sources for marine purposes.—*Zeit. f. Beleucht.*, Feb. 28, 1914.

Traction

Electrified Mountain Railway in Japan.—An illustrated article on the electrification of the Usui-Tage mountain railway in Japan, which was formerly operated by steam, but for which twelve direct-current gear-and-pinion locomotives have now been provided. The power plant contains three 1000-kw turbo-generators producing three-phase energy at 6600 volts and fifty cycles. The voltage is reduced in two substations to 240 volts alternating current and then changed to 650-volt direct current by synchronous converters. Energy is supplied to the locomotives by means of a third-rail.—*A. E. G. Zeit.*, February, 1914.

Suburban Railroad of Stockholm.—F. F. von Holmgren.—The first part of an illustrated article on the electrification of the suburban railroad from Stockholm to Saltsjöbaden. The 600-hp motor-car equipment and the line construction are described, as well as the converter station which produces 1350-volt direct current. Results obtained during the first half year of operation are also discussed. The paper is to be concluded.—*Elek. Zeit.*, Feb. 26, 1914.

Rail Corrugation.—S. P. W. Sellon.—An abstract of a paper read before the (British) Institution of Civil Engineers. The author believes that rail corrugation can be avoided with hard rails containing a high proportion of carbon (more than 0.55 per cent) and also a high proportion of silicon. He also suggests that the essential points to be specified are mechanical properties corresponding with the working stresses imposed upon the rails and compressive strength. The whole specification of the rail in respect to its mechanical qualities should be a direct relation to the stresses which it will be called upon to resist.—London *Electrician*, Feb. 27, 1914.

Electric Locomotives.—F. Lydall.—The first part of an illustrated paper read before the (British) Institution of Electrical Engineers on motors and control equipments for electric locomotives. The question of motor capacity in relation to certain characteristics of the locomotive is touched upon, and the influence of the weight of the locomotive and the conditions of service upon the design of the control equipment is considered by means of an example. Various systems of control are dealt with, and the author discusses from a practical standpoint the design of the resistance grids, contactors, reversers, circuit-breakers, apparatus for automatic working and induction regulators.—London *Electrician*, Feb. 27, 1914.

Installations, Systems and Appliances

Standardization of Frequencies.—C. W. Stone.—The author points out that there are as many as five different frequencies in use in this country to-day, although there has never been an excuse for more than two of them, twenty-five and sixty cycles. The latter frequency possesses decided advantages for incandescent and arc-lighting circuits and affords the manufacturer a greater range of speed and a more economical design for his generators and motors. The lower frequency was justified a number of years ago, when the operation of synchronous converters on sixty-cycle circuits was far from satisfactory; but now that these machines have been improved to the point where their performance is entirely successful at the higher frequency, it would seem that all parties concerned—the public, the operating companies and the manufacturers—would be benefited by the gradual adoption of sixty cycles as standard.—*Gen. Elec. Review*, March, 1914.

Electric Cooking.—F. S. Grogan.—A paper read before the Wolverhampton and District Engineering Society on "The Cooking Problem—Why Electricity Is Winning." The following advantages of electric cooking are discussed in detail: Perfect cleanliness; simplicity and convenience of operation; actual monetary saving owing to reduced loss in weight when cooking food (the saving effected being not only water but also nutritive food stuffs of proteid and fat, which latter increase the digestibility of the cooked food by the presence of the extractives and juices); absolute safety, and the absence of fumes. Figures of cost are given and compared with those for gas cooking.—London *Electrician*, Feb. 27, 1914.

Electrophysics and Magnetism

Cathode Disintegration in a Vacuum Tube.—A. M. Tyndall and H. G. Hughes.—The disintegration or "sputtering" of the cathode in a vacuum tube has been the subject of much investigation. In the present paper an account is given of some experiments on the influence of certain factors on this disintegration. These are the duration of the discharge, the previous history of the cathode, the pressure and nature of the gas, the current density, and the cathode fall of potential. Provided that a constant cathode-fall is maintained, the following three losses hold good: First, considerable changes in pressure have no influence on the amount of disintegration for a given current and duration of discharge. Second, new and old cathodes of the same area disintegrate practically to the same extent under the same conditions of current and duration of discharge. Third, the rate of disintegration for a given current density is constant throughout discharge. Thus it is not affected by the removal of gases from the surface of the cathode by previous discharge. The influence of the cathode-fall of potential on the rate of disintegration was investigated at low values of the cathode-fall. No simple relationship (such as exists at high values) was observed. The rate of disintegration appears to vanish at the normal cathode-fall. The linear relationship which exists between current density and rate of disintegration at small current densities and high cathode-falls does not hold in the general case. Preliminary work on the influence of the nature of the gas shows that at low values of cathode-fall there is no appreciable difference between the rates of disintegration in hydrogen and air under similar conditions. Certain theoretical considerations are advanced in connection with the results.—*Philos. Mag.*, March, 1914.

Eutectoid Transition Point of Carbon Steels.—S. W. J. Smith and J. Guild.—A note on a recent paper presented before the Royal Society in London. The magnetic properties point at temperatures near the eutectoid transition point deserve further examination. Simultaneous observations of intensity of magnetization and of temperature were made over various ranges of heating and of cooling in different magnetic fields. Nine steels containing proportions of carbon ranging between 0.1 and 0.5 per cent were used. Each steel contained about 0.2 per cent or less of silicon and manganese. It was found that the temperature corresponding with the beginning of the transformation of the eutectoid during heating could be fixed within + 1 deg. C. under suitable conditions. This temperature was 735 deg. C. as read by the thermometers used, although these were better adapted for comparative measurements than for determination of absolute value. It was the same for all the steels.—London *Electrician*, Feb. 20, 1914.

Units, Measurements and Instruments

High-Frequency Ammeters.—J. H. Dellinger.—An account of a long experimental investigation of reliable ammeters for high-frequency work. The circuit within a high-frequency ammeter must be of as simple form as possible. This requirement is best fulfilled by a single straight wire of very small diameter, and no other arrangement can be taken as *a priori* reliable at all frequencies. The heat production is readily measured in any form of circuit, and in consequence all successful ammeters for high-frequency use utilize the thermal effect. The thermometric means of measuring the heat production, whether expansion, calorimetric effect, resistance or thermal emf, do not affect the accuracy. Two similar wires in parallel, the integrated heat production in the whole being measured, constitute a system nearly as reliable as a single wire. With such a system immersed in an oil bath currents up to 10 amp can be measured. For larger currents other combinations of current elements are necessary, and a great variety of ammeters have been developed and studied experimentally and theoretically in this investigation. Experimental instruments and commercial instruments of three different companies were included. All the types in use are subject to errors when used at the frequencies of radiotelegraphy, the errors being in some cases very large. In some the readings increase with increase of frequency and in others they decrease. In most cases the design can be so changed as to eliminate the errors. The current in a conducting circuit has no meaning for extremely high frequencies; for in any circuit above a certain high frequency the capacity between parts of the circuit and of auxiliary apparatus is so important that an appreciable fraction of the current is shunted through the dielectric and the current is of different amount in different parts of the wire circuit. The changes of current distribution in the instruments whose working parts were of low-resistivity metal all occurred in about the range of radiotelegraphic frequencies, 100,000 cycles to 1,500,000 cycles. That is, the current distribution was constant for frequencies from 0 up to about 100,000, then underwent changes and became constant at different values for frequencies above about 1,500,000 cycles. An approximate experimental method for investigation of the current distribution in thin strips at high frequency has been devised and is used to obtain qualitative results. Most of the errors of commonly used high-frequency ammeters are found to be due to mutual inductances or to self-inductance of parts, which had been supposed negligible. The use of high-resistance metals in the working parts, and the design of the latter with very small cross-sections, eliminates errors in most cases. The location of the current leads is of great importance, particularly in the so-called unshunted ammeter, determining whether the error shall be large or inappreciable.—*Bulletin Bureau of Standards*, Jan. 15, 1914.

Determining Ballistic Constant of Moving-Coil Galvanometer.—Paul E. Klopsteg.—An abstract of an American Physical Society paper. From the equation for damped periodic motion of a galvanometer coil, expressing the condition for the discharge of a quantity Q of electricity through the coil at rest, the value of the first maximum displacement is found by the usual method of differentiation. This value represents the ballistic throw of the slightly damped galvanometer. From the expression so found the equation for the ballistic constant is obtained. In the transformation a substitution is made which is based upon the equation for the damped-coil method of measuring the magnetic field. The resulting expression is

$$K_1 = \pi \sqrt{\frac{I_0 \ \varepsilon^{l}}{10^7 R T_0 \ (L - l)}}$$

the value of K_1 being equal to the number of coulombs per radian. I_0 is the moment of inertia of the coil, T its period, l its logarithmic decrement on open circuit and L its logarithmic decrement with R ohms in the galvanometer circuit. When the value of l is about 2.5 per cent of π, the value of K_1 is too large by 0.1 per cent, the difference increasing as l grows larger. The following more exact formula may then be used:

$$K_2 = \varepsilon^{(\lambda/\pi) \tan^{-1} (\pi/\lambda)} \sqrt{\frac{I_0}{10^7 R T_0} \cdot \frac{\pi^2 - l^2}{L - l}} \ .$$

An explanation is offered for the frequently observed difference between the values of the ballistic constant in a given instrument with a strip or ribbon upper suspension on the two sides, A and B, of the scale. This difference is due principally to a certain amount of torsion in the lower suspension which necessitates a corresponding amount of "counter torsion" in the upper suspension in order to keep the coil in the position of the null reading. The effect of torsion in a strip suspension is to shorten it, the case resembling that of a bifilar suspension for angles less than 180 deg. For a throw in one direction, say A, the coil must be raised; in the opposite direction the turning moment of the force of gravity acts in the same direction as the electromagnetic torque. Consequently, with a given quantity of electricity the throw in the direction B is greater than in the direction A. The same "bifilar effect" introduces an error into the determination of I_0 of a coil by the comparison of vibrations method when a strip is used as the suspension fiber, unless the masses of the coil and of the comparison disk, as well as their amplitudes, are the same. The error due to this effect becomes negligible if a wire of circular cross-section is used as the suspension fiber.—*Phys. Review*, February, 1914.

Telegraphy, Telephony and Signals

Time of Calls Through Odense Exchange, Denmark. —J. von Linstow.—An illustrated description is given of the means employed of measuring the answering time (the time elapsing from the moment a subscriber calls his central office until the operator answers), and the author then discusses mathematically the effect of calls coming in before the previous call is answered. A formula is deduced for an ideal answering time by means of which the respective service given by operators can be compared.—London *Electrician*, Feb. 27, 1914.

Long-Distance Exchange.—W. Schreiber.—The first part of an illustrated description of the new long-distance central office in Munich, which is the first European exchange of the kind operating in connection with automatic exchanges. Some of the new features are a semi-automatic long-distance connection system and the automatic distribution of calls with manual reserve, etc.—*Elek. Zeit.*, Feb. 26, 1914.

Improving Telephone Service.—W. Aitken.—An illustrated paper read before the (British) Institution of Electrical Engineers at Newcastle. The author describes a number of methods which he suggests for increasing the efficiency of the telephone service. These take the form of automatic or semi-automatic devices intended to assist the operator in her work and to eradicate such faults as charging for service that has not been given, operating mistakes, wrongly reporting lines engaged, and premature severing of connections. —London *Electrician*, Feb. 27, 1914.

Automatic Telephones.—A long, illustrated description of the automatic telephone clock and indicator systems in use in King's College Hospital in London.— London *Electrician*, Feb. 27, 1914.

Wireless Telegraphy.—J. Reyval.—Some illustrated notes on wireless telegraphy service in the Tchad district of the French Congo in Africa.—*La Lumière Elec.*, Feb. 28, 1914.

Wireless Telegraphy.—L. B. Turner.—A letter criticising some points in A. S. Blatterman's recent paper on the calculation and design of a wireless-telegraph transmitting station.—London *Electrician*. Feb. 27, 1914.

Book Reviews

Gas Power. By C. F. Hirshfeld and T. C. Ulbricht. New York: John Wiley & Sons. 210 pages, illus. Price, $1.25.

A handy volume, treating of the internal-combustion engine in a simple manner. Although it may well serve as an introduction to more advanced works on the subject, it should not be classed among the "primers" or elementary books. The principles of operation are clearly explained, and the illustrations and diagrams are clear and instructive. Introduction of mathematics has been avoided as far as possible. Without giving a complete list of the various chapters, it may be said that the topics covered include a comparison and classification of fuels, the historical development of the internal-combustion engine, four-stroke and two-stroke cycles, classification and description of modern gas and gasoline engines, methods of cooling, governing, ignition, carburetors, and in fact all that is necessary to give the reader a good insight and working knowledge of gas power in its various forms. The illustrations are numerous, and the line drawings, which show the essentials without including a mass of unnecessary detail, are well reproduced. The photographic illustrations, which do not always add to the value of a technical book, are few, but they are above the average in quality and have been carefully selected. The book should prove very useful to students and engineers desiring a working knowledge of this class of engines.

Electrical and Magnetic Calculations. By A. A. Atkinson. New York: D. Van Nostrand Company. 310 pages, illus. Price, $1.50.

An excellent textbook and drill book for use in electrical engineering classes, based upon arithmetical applications. We believe in this method and consider it to be of the greatest practical utility. The minimum amount of explanatory text is inserted for the elucidation of the principles dealt with arithmetically. This is what such a textbook ought to be. Of course, it may be contended that a student could study in such a textbook how to work out numerical problems without having any sufficient idea of the underlying principles involved. A reply to this objection is, first, that a student who can correctly work out such problems is at least a useful man to his employer, and, second, that a student who would be content merely to study engineering arithmetic without ambition to learn the underlying physical principles would probably be a man upon whom it would be waste of energy to lavish physical instruction. The subjects dealt with in the volume can be gleaned from the titles of the successive chapters. namely: Explanation of units; relation of quantities; general laws of resistance; electrical energy; wiring for light and power; batteries; magnetism; relation of magnetic quantities; the emf of dynamos and motors; calculation of fields; elements of dynamo design; alternating current, and alternating-current distribution. The book has marked merit, as is also indicated by the fact that this is its fourth edition.

Conservation of Water. By Walter McCulloh. New York: Yale University Press. 99 pages, illus. Price, $2.

This is a collection of the Chester S. Lyman lectures delivered by the author in 1912 before the senior class of the Sheffield Scientific School, Yale University. The Chester S. Lyman Lectureship Fund was established in 1910 for the purpose of maintaining a course of lectures on the subject of water-storage conservation. This book is the first of the series of memorial lectures. The ground covered includes a review of the data essential to the comprehensive study of water storage, water-power developments in the United States, especially in regard to the amount developed as compared with the available power; water storage for town supplies and irrigation, and a special study of the water resources of New York State. Much useful information is collected for easy reference, thus obviating the necessity of turning to many scattered sources of information, including the government publications. It must not be supposed, however, that these lectures are merely a statement of facts more or less easily ascertained. The author has taken pains to treat his subject in such a manner as not only to instruct his audience but also to emphasize in the right place those facts and considerations regarding the conservation of our natural resources which are not only of engineering interest but also of national importance. The statistics given, and especially the illustrations and diagrams showing in the clearest possible manner the undeveloped water-power, the waste due to absence of storage reservoirs and the waste due to leaks and carelessness on city water supplies, are of the greatest interest and deserve close study. The value of the book is also greatly enhanced by the fine whole-page reproductions of photographs showing the river and reservoir conditions at many points of interest.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Sectional-Type Control Desks

Where economy of space is an important consideration a control desk may often be used to advantage for the mounting of control apparatus. Standard control desks are sectional in form, each section being a unit in itself corresponding to the panels of a switchboard.

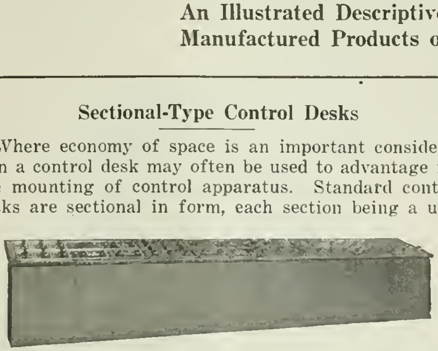


FIG. 1—PLAIN CONTROL DESK

The desks illustrated herewith are built up on a pipe framework having a channel-iron base. They are designed so that sections can be easily added to an existing desk by moving one or both end sections and without disturbing the apparatus already installed. The top sections are of slate and the sides are of steel. Black marine finish is used for both the top and sides to correspond with the standard finish of the controlling devices and indicators. Access to the desk for wiring is obtained from either the rear or sides by means of cover plates which can be easily removed.

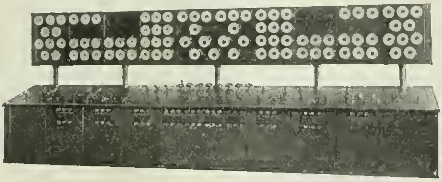


FIG. 2—CONTROL DESK WITH INSTRUMENT FRAME MOUNTED ON POSTS

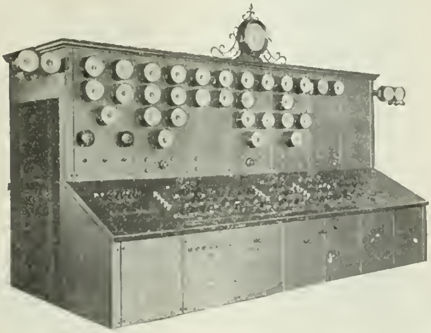


FIG. 3—CONTROL DESK WITH SPECIAL REAR INCLOSURE

Fig. 1 shows a plain desk having no provision for instruments. This type may be placed in any convenient part of the station and still permit of an uninterrupted view. Instruments are generally mounted on a supplementary panel switchboard or on instrument posts or frames to suit local conditions.

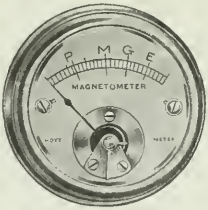
Fig. 2 shows another type of desk which has an instrument frame mounted on posts. The frame is supported at a height which permits of a view of the station floor. The instrument frame is also of pipe construction with slate panel sections of widths to correspond with those of the desk top. The posts supporting the frame are hollow, and the instrument leads are brought up through them from the desk below. A section of the desk includes a section of the instrument frame.

A third type of desk, illustrated in Fig. 3, has an instrument section extending upward from the rear edge of the desk top, without intervening space. A section of the desk includes a corresponding instrument section. This type is commonly combined with a panel switchboard.

The desks described above are built by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Instrument for Testing Magnetos on Automobiles

A device for testing the magnetos used on Ford automobiles is manufactured by the Hoyt Electrical Instrument Works, Pennacook, N. H., and is connected permanently in the circuit so that it will show the strength of the magneto at all times when running. This magnetometer is 2 in. in diameter.



DEVICE FOR TESTING AUTOMOBILE MAGNETOS

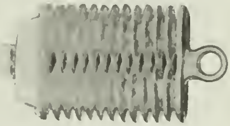
After a series of tests made on Ford cars of all ages under different operating conditions it was found that almost invariably there was a point at which the magneto, although generating, did not satisfactorily ignite the charge at all times. This point was indicated on the scale in the illustration as *P*, meaning "poor." At still another point the magneto, while operating without skipping, ignited the charge so slowly that there was an appreciable lack of power. This was indicated on the scale as *M*, meaning "medium." The lowest points at which efficient ignition took place were designated as *G* for "good" and *E* for "excellent."

The magnetometer is located at a point on the dashboard where it can be most conveniently observed by the driver. At the same time, for the sake of appearance, it is so placed that the terminals extend through the dashboard under the hood, rather than above it.

The magnetometer is secured in position by mounting it on two studs placed in 3/16-in. holes drilled in the dashboard and placing a nut and washer on each stud. A cable is attached to each stud, one being connected to the insulated plug in the top of the magneto which conveys the energy to the coil and the other being grounded to the transmission case.

Automobile Radiator Heater

The appliance department of the Edison Electric Illuminating Company of Boston has recently brought out an electric heater to prevent automobile radiators from freezing and bursting in cold weather. The device consists of a ribbed casing which contains standard General Electric heating units rated at 180 watts. The casing is made of either aluminum or cast iron and is provided with a hook support and an electric plug connector. Its energy consumption is low so the device may be connected to any electric-lamp socket.

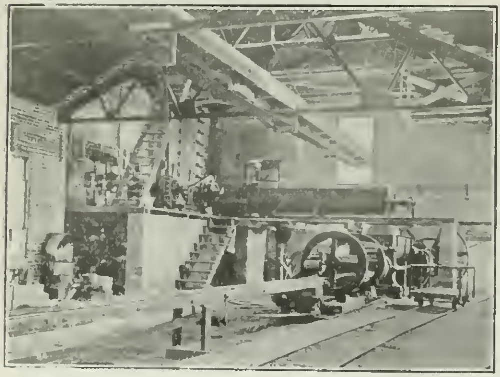


AUTOMOBILE HEATER

Electric Drive in a Brick Plant

The brick plant of Mr. L. I. Stevenson, situated about 12 miles from Birmingham, Ala., represents all that is modern and efficient in equipment and layout. The machinery is all motor-driven, energy being purchased from the Alabama Power Company. The kilns are operated on the waste-heat system.

The plant has an output of 10,000 bricks per hour, the product being common red-shale and Oriental brick. Shale is mined at a point several hundred feet from the plant and is hauled by cars which are pulled up the slope by a 50-hp motor. The shale is first sent to a crusher, driven by a 30-hp motor, and is then passed through either pulverizers or dry pans, depending on its condition. A tripper conveyor finally distributes the material over a 100-ft. storage space.



INTERIOR VIEW OF BRICK PLANT

The pug mill is driven by a 50-hp motor and the combination brick machine by a 125-hp motor. The illustration shows these two machines. An electrically driven transfer car conveys the brick from the drier to the kilns, of which there are sixteen, each having a capacity of 70,000 bricks. Three motor-driven fans are used to provide draft, circulation and exhaust for the kilns. Energy is received at 22,000 volts and is stepped down to 550 volts for the motors and to 110 volts for lighting. A two-panel switchboard equipped with oil circuit-breakers protects and controls the various circuits.

The electrical equipment, except the hoist motor and transfer car, was supplied by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Gas Producer

The gas-producing plant shown herewith operates on the suction-gas principle, no more gas being generated than the amount required by the engine. If the load is heavy, the supply of gas is increased; if it becomes light, the supply is decreased. Pea anthracite coal is the fuel used. The method of starting the plant is quite as simple and almost exactly similar to lighting a closed stove. After the producer has been charged and lighted a small fan or blower is used at first to create a draft, the heated air and smoke passing away to the outside atmosphere. On their way, however, this heated air and smoke are brought in contact with the water-jacket head of the producer and thence go through an evaporator. In this way the necessary supply of moist and steamed air is provided, which can be drawn through the incandescent fuel in the producer on the first suction stroke of the engine. After ten or fifteen minutes of blowing with the fan the gas is diverted to the engine by operating a valve and the engine is started in the usual way, after which the producer or gas-generating plant requires practically no more attention for several hours.

GAS-GENERATING PLANT

This producer is the product of the Jacobsen Gas Engine Company, Saratoga Springs, N. Y.

Pneumatic Recording Tachometer

A recording tachometer whose principle of operation depends on the centrifugal action of air in a revolving cylinder which is connected to a recording device through a line of flexible tubing has been developed by the Bristol Company, Waterbury, Conn. Fig. 1 shows the complete apparatus. Fig. 2 illustrates diagrammatically the construction of the revolving mechanism. Here *B* designates a hollow circular protecting base with a bearing at its upper surface for supporting the hollow shaft *D*. This shaft is rotated by means of a belt and pulley or a sprocket and chain connected to the shaft whose revolutions are to be measured and recorded.

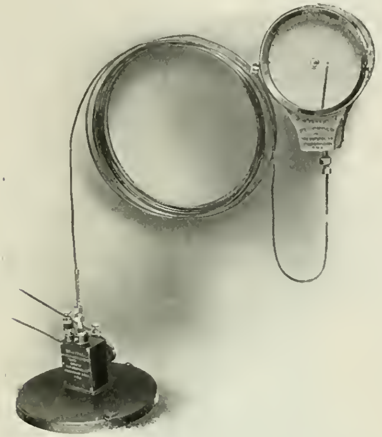


FIG. 1—RECORDING APPARATUS COMPLETE

The lower end of the hollow shaft *D* terminates in a horizontal tube *A* which is open at its extremities. The upper end of the shaft *D* is surrounded by a casing *E*. This casing is partly filled with oil and the free end of another tube *F* extends into it. The tube *F* is stationary and it is joined at its outer end to the flexible capillary tubing *G* leading to the recording device. The latter is equipped with a low-range recording vacuum gage. This recording instrument may be installed either near to or at a distance from the shaft the speed of which is to be recorded, and flexible copper tubing connects the recorder with the cylinder.

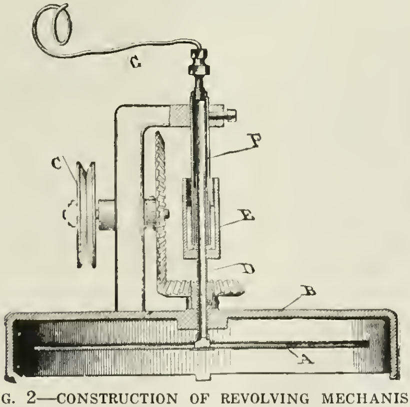
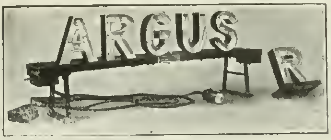


FIG. 2—CONSTRUCTION OF REVOLVING MECHANISM

Miniature Display Sign

A miniature section display sign is shown herewith any letter of which can be replaced without disturbing the others. A feature of the sign is that the burning out of a lamp in any of the letters will not affect the brilliancy of any of the others in the sign. The letters, which are made of aluminum castings 3.5 in. high, contain white-enameled channels in which special miniature 4-volt tungsten lamps are recessed. The sections are plugged together in series and set in a tray as shown. Each section requires 15 watts. The trays are made to accommodate three, six and nine-letter signs, the longest being 31.5 in. These signs are designed to operate on 100-volt to 125-volt direct-current or alternating-current circuits. They are manufactured by Harvey Deschere, 50 Church Street, New York City.



SECTIONAL DISPLAY SIGN

Elevated-Oven Ranges

The Simplex Heating Company, Cambridge, Mass., is putting on the market several elevated-oven ranges of different sizes suitable for families of from four to ten persons. The range shown in the accompanying illustration is designed for use in families having eight to ten members. It is 24 in. wide and without the utensils has a maximum height of 36 in. Its maximum output is 4150 watts.

LARGE-SIZED RANGE WITH ELEVATED OVEN

This range has an oven 15 in. wide, 18 in. deep and 11.5 in. high inside and a plate-warming compartment 15 in. wide, 15 in. deep and 7 in. high inside. It is equipped with one 9-in. by 12-in. broiler with griddle top, two 6-in. disk stoves, two 8-in. disk stoves, one three-point blazer for one of the 6-in. stoves, one three-point double boiler (porcelain food vessel) for one of the 6-in. stoves, one 5-qt. vegetable boiler for one of the 8-in. stoves, one 4-qt. tea kettle for one of the 8-in. stoves, one green signal lamp on the plate warmer and one red signal lamp on the main circuit.

Engine-Driven Three-Wire Direct-Current Generators

Three-wire direct-current generators of the commutating-pole type recently placed on the market by the General Electric Company, Schenectady, N. Y., are built in standard ratings from 25 kw to 400 kw. Similar two-wire machines are also available. These units have either shunt or compound field windings and the armatures are designed to deliver the rated output at any pressure from 115 volts to 125 volts and from 230 volts to 250 volts. Larger sizes wound for 250-volt operation are also manufactured.

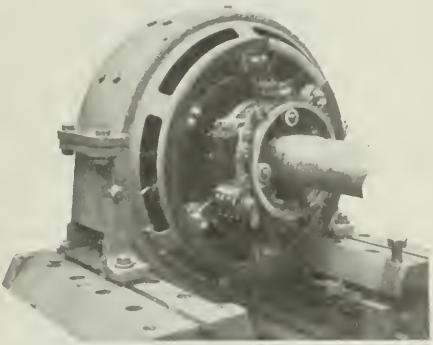


FIG. 1—250-VOLT THREE-WIRE ENGINE-TYPE GENERATOR

A new feature of these generators is the development of the three-wire machines with a special type of revolving compensator or auto-transformer, one point of which is connected to a single collector ring for obtaining the neutral for three-wire operation. This revolving compensator consists of a circular magnetic core on which are mounted suitable exciting coils, the core with its coils being assembled on a cast bracket bolted directly to the back end of the armature spider. The compensator fits under the overhanging end windings of the armature. The neutral brushes bearing on the collector ring are supported by but insulated from the main brush-holder studs.

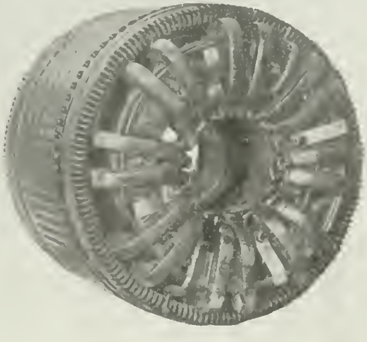
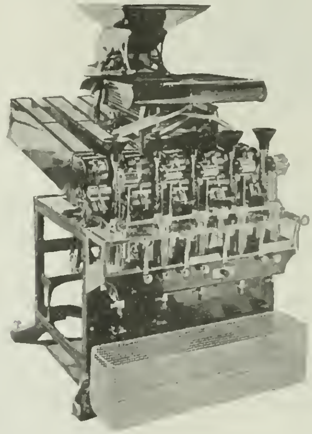


FIG. 2—ARMATURE WITH REVOLVING COMPENSATOR

In the three-wire generator the series and commutating fields are equally divided between the two sides (positive and negative) of the armature, insuring exact compounding for all load conditions, whether balanced or unbalanced. The three-wire machines are designed to carry an unbalanced current of 25 per cent of the rated full-load current in the neutral.

Coin-Handling Machine

The machine shown in the illustration is designed to sort out into their respective denominations the coins placed in its hopper, count them in dollars and cents and wrap them up into standard packages or sack them as desired, at the same time separating out mutilated coins and throwing them into a special receptacle.

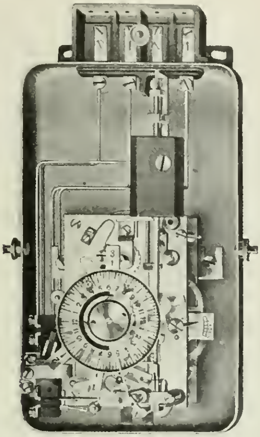


MACHINE FOR SORTING AND COUNTING COINS

The device is adapted for use by companies which have to handle small coins in large quantities, among these being street-railway companies, gas and electricity supply companies, department stores, tax-receiving offices, banks, moving-picture theaters, etc. Use of the machine will, it is declared, cut down materially the time required to handle coins, eliminate errors in counting and prevent pilfering. The machine is made by the Sattley Coin-Handling Machine Company, Detroit, Mich., and is operated by a small Westinghouse motor.

Automatic Switches for Staircase Lighting

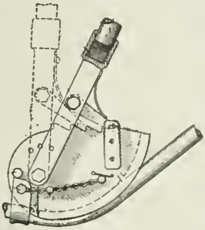
Messrs. Landis & Gyr, of Zug, Switzerland, who have a sales office at 168 North LaSalle Street, Chicago, manufacture the form of automatic switch shown herewith, which is extensively employed abroad for controlling the lighting of staircases in apartment houses, public buildings, etc. The clock mechanism switches the lamps on and off at any predetermined hours, at the same time making it possible to obtain light at other times for a limited number of minutes by pressing push-buttons which can be placed at the main entrance to the building or on one or more landings. The push-buttons actuate auxiliary circuits and light the lamps for two to six minutes, depending upon the setting of the dial mechanism. In this way the lighting of halls, stairways, etc., is turned on during certain hours, and is also available for intervals of a few minutes at all other times when the lamps are regularly extinguished. The clock mechanism is of the hand-wound type and runs for five weeks on one winding. These switches can be furnished for direct-current, single-phase and polyphase circuits.



SWITCH FOR AUTOMATIC STAIRCASE LIGHTING

Pipe-Bending Tool for Conduit Work

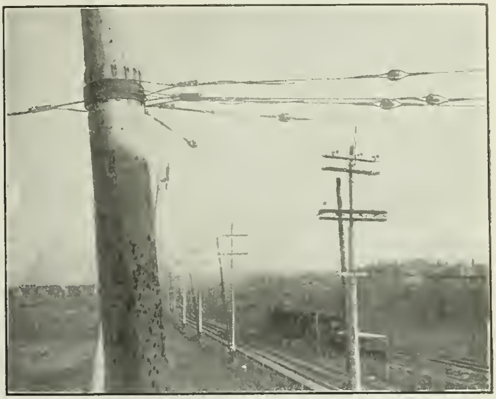
Messrs. O. A. Malo and F. H. Melat, 7514 Dante Avenue, Chicago, have recently invented an improved pipe-bending tool to be used where neat bends of equal radius are required. The tool consists of a cast-steel forming shoe to which is attached a ratchet and pawl and a long iron-pipe handle. It is claimed that neat bends of practically identical radius can be made with this tool at a speed impossible with other devices. Shifting the pin attached to the small chain shown in the illustrations allows the manipulator to reverse operations and straighten a bent pipe to any desired degree. Removable shoes are supplied with the tools to make bends of different radii. The method of setting screw threads for the handle is said to be a feature devised to prevent the handle breaking on account of reduced section in the threads.



PORTABLE PIPE-BENDING TOOL

Boltless Guy Clamps

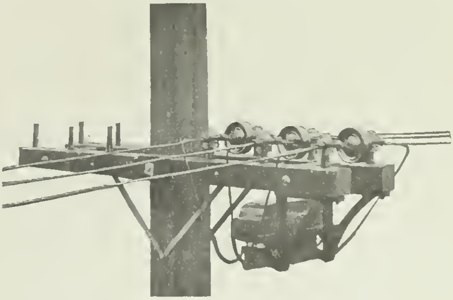
In the accompanying illustration is shown an installation of boltless guy clamps used on the construction work of the Electric Company of Missouri. These "Giant" clamps, as they are called, are designed to bear all strains that may be put on 0.25-in. and 0.3125-in. strands. The clamps are sherardized to prevent rusting. They are manufactured by W. N. Matthews & Brother, St. Louis, Mo.



INSTALLATION OF BOLTLESS GUY CLAMPS

Pole-Switch Bracket Equipment

The High-Tension Electrical Specialty Company, of Newton, Mass., has brought out a special design of brackets and strap-hanger irons, as shown in the accompanying illustration, for facilitating the hanging of pole-type switches. The brackets are attached under the double cross-arm and the switch is hung on the brackets. As the distance between the brackets varies according to the pole thickness, compensation is secured by the strap hanger on the back of the switch, which allows the latter to be hung under all conditions of pole thickness. This method of installation also makes the operating handle on the front of the switch easily accessible to the man climbing the pole. In a similar manner the switch may be hung on a buck-arm or header when it is desired that the circuit out of the switch shall lead off at right angles to the main line.



METHOD OF SUPPORTING SWITCH ON POLES

Jobber, Dealer and Contractor

Contractors at the Buffalo Electric Show

Without doubt the success of the electric show held in Buffalo, N. Y., last week was in very large measure due to the enterprise of the electrical contractors of that city. Ordinarily electric shows are given under the patronage of the local lighting companies, but, although the Buffalo General Electric Company and the Cataract Power & Conduit Company both took an active part in the exhibit at Buffalo, their influence did not predominate. The electrical contracting was the largest interest in evidence, indicating very clearly to what extent the broad spirit of co-operation has permeated that branch of the electrical industry. Among the large Buffalo contractors taking part in the show were the Buffalo Electric Contracting Company, the Buffalo Electric Company, the Electric Shop, Inc., McCarthy Brothers & Ford, the J. C. Sterns Electrical Company, the Robertson Electric Construction Company and the Sterns Electric Equipment Company. The exhibits made by these firms were in keeping with the diversified character of their business. Various accessories used in wiring houses and industrial plants and the many appliances which contribute so much to the comfort of the home and to the increased efficiency and convenience of manufacture were on exhibit.

BUFFALO ELECTRIC SHOW

Results of Forty-Dollar Group Appliance Campaign in Toledo

In a group appliance campaign, conducted for one month only, the Toledo Railways & Light Company sold 350 forty-dollar groups of electrical appliances. Customers had their choice of eight groups of appliances, each containing an electric vacuum cleaner, together with such other apparatus as ordinarily sells for $50. The part-payment scheme was used, the purchaser paying $5 down and the remainder in monthly payments of $5. The feature of the campaign was, of course, the vacuum cleaner.

When it became known among the supply dealers in Toledo that the central-station company contemplated putting on a campaign of this nature several dealers protested against the step, declaring that it would ruin their business. The extent to which they were wrong, however, is shown by their own statements following the campaign. One of these dealers reported that on account of the publicity given the vacuum cleaner during this one month's campaign he was able to sell one sweeper a day for two successive months, although heretofore local sales were decidedly dull. While the campaign was in progress and since its completion practically every dealer in the city handling vacuum cleaners has admitted that the campaign not only did not hurt his business but was directly responsible for an appreciable increase in sales.

Why Contractors and Central Stations Should Co-operate

At the round-table convention of the commercial men of Ohio central stations held at Toledo last month Mr. P. L. Miles, of Cleveland, took up the cudgels for the electrical contractor. He said the continual hue and cry, that the electrical contractor is a poor business man, that he is commercially unprogressive, is today an oft-repeated story. The charge has been made time and time again that the contractor does not take full advantage of the offers of co-operation received from both manufacturers and central stations, that good business opportunities are overlooked, that no efforts tending toward proper and efficient business-building and sales methods are employed.

While these articles calling attention to the contractor's business methods, or rather lack of business methods are legion, yet suggestions having a commercial and practical value are seemingly few. The criticisms are made, yet remedial methods directing the electrical contractor along proper lines of commercial development have been sadly missing.

Channel of Development

If the contractor is guilty of the charge of not giving sufficient attention to the business-building and sales end of his business, he does not stand alone by any means. It is only a matter of a few years back when the central-station man was in the same position. To-day garage men are resting under the same indictment; and so it has been with most businesses in their infancy.

The development in the contracting business, as in the central-station business, has been largely along mechanical and engineering lines, and the development in this direction has been nothing short of phenomenal. Not so many years ago the sales department or new-business department of the central station was unheard of. But to-day it is one of the most important departments in the up-to-date and progressive public utilities.

The channel of development for the electrical contractor should be largely along this same line, that of business building and sales effort—following in the lines of central-station practice. Proper appreciation should be given to this work as a means of increasing business—as a means of earning more and greater profits. Advantage should be taken of the many offers of co-operation from the manufacturer, the jobber and the central station, and mediums of known value in increasing sales should be adopted.

The various phases of business building, as well as the co-operation which may be expected from the manufacturer and the central station, whereby the contractor can materially increase his business, were taken up and an attempt was made to show how the various services of the manufacturer may be utilized to the greatest extent and how cordial relations may be established between the contractor and the central station to their mutual advantage.

This is a large and important subject, and in order to give it a thorough and detailed treatment, the speaker dwelt upon only one phase of the contractor's business, namely, that of the wiring of residences, and with special reference to the wiring of houses built but not wired for electricity.

Wiring of Residences

The magnitude of this field should be borne in mind. In the smallest of towns there are hundreds of houses which are not wired, while the occupants are well able to afford the expense of doing this work. In the entire country it is estimated that only about 8 per cent of all houses are equipped for electricity. These figures, of course, take in both urban and suburban homes, yet the percentage in cities alone is as low as 12 per cent or 15 per cent. In Toledo, for instance, there are approximately 55,000 homes, and of this number there are only 9000 electric-light users, or about 16 per cent. Within the last few months over 10,000 prospective customers in Toledo alone have received a series of letters from the central station relative to house-wiring. It will be seen from this that the field is practically unlimited.

The question to be decided is what is the proper method to go about wiring these homes.

Granting for a moment that the electric contractors are lax in their selling methods, granting that they have no men that are properly equipped as salesmen to go out and close contracts for wiring, the central stations as a rule are willing to bear this portion of the selling expense. They have a well-equipped and efficient sales force—men whose entire business is that of selling. They can go out among the residences in the town and bring in orders for wiring—orders which are, as a rule, turned over to the contractors for completion.

These central-station salesmen have all of the talking points at their fingers' tips and can tell why electricity should be installed, tell of its economy, convenience and safety, can give an approximate idea of the monthly bills, can quote terms of payment. But can these salesmen quote prices for doing work—give estimates of the wiring cost?

No contracts for house wiring can be closed until this point of "How much will it cost?" is settled. The home owner will not give an order to do the work unless he knows how much it will cost. Many times this is where the central-station salesman runs up against a stone wall. He has to get in touch with one of the local contractors, come back the next day with the contractor and go over the job, and the day following submit the proposition to the home owner. This is a poor selling arrangement. The estimate should be given at the time the "prospect" is interested, given while he wants it and while he is in the mood to sign the contract. But how can the central-station salesman do this? He is not a wireman himself and could hardly be expected to estimate a job in such a manner that his estimate would be acceptable to the contractors. Estimating is part and parcel of the sales work. It would be a poor lamp salesman who could not tell a prospective purchaser what a certain lamp would cost.

A little co-operation between the central stations and the contractors will soon solve this problem. The contractor is weak in not having a sales force. But this is supplied by the central station. The central station is weak in not having a definite proposition to offer to the "prospect," an estimate of the cost of doing the work of wiring. This must be supplied by the contractor. Here is an admittedly weak point on the part of the contractor and also one on the part of the central station. But a little of the "get-together" spirit on the part of both will soon show a way in which all objections may be overcome. Every job offers a profit to the contractor, while to the central station it gives a revenue for energy. Why should not they co-operate when their interests are mutual?

Flat Rate per Outlet

There are several ways in which the difficulty may be overcome. Probably the method which is most commonly in use is the adoption by the contractors of an easy basis of estimating the cost of house wiring. Such methods are the flat-rate-per-outlet basis, the flat rate per house of a certain number of rooms, and the flat rate per a certain number of outlets.

"Yes, indeed," the contractor is heard to say; "this is very fine—fine for the central station. But no method of estimating along these lines can be devised which will eliminate the likelihood of our losing money. Every job needs an individual estimate to insure us a fair margin of profit."

This admits of no argument. Central-station men readily acknowledge as much. At the same time the central-station man has no disposition to see the contractor lose money on any job. The central-station man of to-day is given to the policy of "live and let live." He wants the contractor to make a profit on every job, knowing that as the profits increase the contractor will become a better business man and better equipped to take care of the electrical needs in the community.

However, the profit on the individual job should not be the important point to consider. Profit at the end of the month should be the deciding factor as to the feasibility of such a program. It is true that a flat-rate basis of estimating may force the contractor to do the work at actual cost, or even below cost, on some particular job of hard construction; yet on another of easy construction the margin of profit will be decidedly more than might be considered a fair profit, entirely offsetting the loss on the previous estimate. By averaging the profit on these two jobs it will be found that a good margin exists for each outlet. This basis of estimating should be so arranged that any danger of loss is guarded against. It should be so arranged that at the end of the month the books will show a fair margin of profit on the total of all wiring contracts.

To accomplish this means very little on the part of the contractor. It only means that all the reliable contractors in a certain locality get together, talk matters over and submit an outline of a proposition to the central station whereby the lighting company can allow its salesmen to do the estimating. Such co-operation will pay—pay both the contractor and the central station. For instance, if at the present time there are only 100 houses wired per month in a town, and through this method of estimating the selling ability of the salesmen is increased only 50 per cent, it means that there will be 150 wiring jobs for the contractors to complete. More than this, such a plan, of a certain stipulated amount per outlet, agreed to by all the electrical contractors in a community, means that they will no longer be harassed by vicious competition and destructive price cutting. The price is the same for one and all. So not only will each job show a fair margin of profit to the contractor, but there will be 150 jobs on which this profit will be made instead of only 100.

A little lunch where the contractors may get together, discuss the plans and agree upon some method of estimating will soon pave the way to more wiring contracts and a greater profit on each contract. It probably rests with the lighting company to take the initiative in getting the contractors together, to agree upon some equitable method of estimating the cost of wiring.

This is not a new scheme by any means. It is in operation in Toledo, Dayton, Cleveland and Columbus, and it is also in operation among the larger central stations of New York, Brooklyn, Boston and Baltimore. It is not an untried theory. It is an actual practice and is proving its value to the contractors in these different localities, as they most readily agree.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

American Engineers Retained on Proposed Canadian Electrification.—Westinghouse, Church, Kerr & Company, of Montreal and New York, have been retained by the Canadian Pacific Railway as engineers to investigate the matter of the proposed electrification of the new double-track 5½-mile Selkirk Tunnel in British Columbia. The investigations will cover in general the type of system to be installed, the relative economies of steam and water-power and the effect of the electrification upon operating conditions.

Large Generating Units for Scranton and Canton.—The American Gas & Electric Company, of which George N. Tidd is senior vice-president and general manager, has closed contract with the General Electric Company for large turbo-generators for its properties at Scranton, Pa., and Canton, Ohio. The machines will be duplicates, each consisting of a steam turbine and a 10,000-kva, sixty-cycle, three-phase generator. One will be installed in the plant of the Canton Electric Company, where there is enough boiler equipment to serve steam demands of the new unit. The other will be placed in the plant of the Scranton Electric Company, where new boilers, already ordered from the Babcock & Wilcox Company, will be needed. Sargent & Lundy, of Chicago, are the consulting engineers for these plant extensions.

Recent Westinghouse Achievements Reviewed.—At a recent dinner of the Westinghouse companies in Pittsburgh, Pa., Vice-president C. A. Terry of the Westinghouse Electric & Manufacturing Company reviewed briefly some of the more notable and interesting of that company's recent achievements. He first mentioned the 3000-kw vertical, synchronous-booster, commutating-pole rotary converter developed in 1912, of which two were supplied to the New York Edison Company, and which was the largest device of that character ever built. Among the other features mentioned were the equipment of a 150,000-volt transmission line for the Pacific Light & Power Company, with transformers tested to 375,000 volts, the supplying of a 6000-hp motor (the largest motor ever built) to the Minnesota Steel Company at Minneapolis, and the application of a split-phase locomotive to the electrification of the Norfolk & Western Railroad in Virginia. Mr. Terry said, in closing, that during 1913 his company sold over 100,000 fan motors and about 380,000 electric meters.

Bell Telephone Statistics for 1913.—The financial statement for the associated companies in the Bell Telephone System, covering the year ended Dec. 31, 1913, shows—with all duplications between companies eliminated—gross earnings of $215,572,822, expenses of $156,883,299, interest payments of $16,652,624, dividends of $30,301,705 paid, and surplus earnings of $11,735,194, realized. The total surplus and reserves of the combined companies on the above date were $174,497,695 and the total assets reached a figure of $980,004,095. The figures on the American Telephone & Telegraph Company, the largest of the Bell companies, show for the year ended Dec. 31, 1913, gross earnings of $45,909,991, expenses of $5,333,245, interest payments of $7,656,655, dividend payments of $27,454,037, and a balance carried to reserves and surplus of $5,466,053. The total surplus of the American company on the above date was $100,492,160, and its total liabilities amounted to $655,956,307. Some interesting statistics on the Bell system were included in its annual report. On Dec. 31, 1913, it had 323,051 miles of pole line in service and 16,111,011 miles of wire. A total of 8,133,017 stations were connected by this system on that date, and the combined exchange and toll connections made daily averaged 27,237,161. The combined companies employed 156,928 persons.

Oil Engines and Centrifugal Pumps Find Extensive Use in Europe.—J. E. Noeggerath, of 59 Wall Street, New York, returned recently from a business trip of several months to Switzerland, Germany and Belgium, and in a short interview this week he gave some interesting information concerning the advances made abroad in the applications of the Diesel engine and the centrifugal pump, two pieces of apparatus in which Mr. Noeggerath was specially interested. The former, he said, is enjoying an increasing use for generator drive and other purposes in spite of the fact that oil fuel is not as plentiful there as in certain sections of this country. He stated that there, as here, certain limitations to the size of the unit cylinder in this type of engine are recognized, but he thinks that improvements in design may overcome some of the difficulties. He stated that in the design and application of centrifugal pumps the foreign engineering practice is far ahead of our own. Mr. Noeggerath spoke of the proposed St. Gothard Tunnel electrification which is now under way and expressed the opinion that matters of government policy have played a large part in the determination to use single-phase construction. He said that greater activity is being shown in Europe than in the United States in the development of turbine-driven direct-current generating units.

Taxes on Foreign Commercial Representatives in Bolivia and Chili.—Taxes are levied on foreign business agents in all Bolivian cities. The rates vary from $80 to $400 and the collection system is very irregular. The licenses are generally good from the date of issue to the end of the calendar year. No legal provision is made for the free importation of samples; but this is customary on furnishing of security for the final re-exportation within a certain limit of time, or the payment of the duty. Foreign agents in Chili are not required to take out licenses. Samples may be imported duty free for a maximum period of six months, on furnishing of security for the final payment, if not re-exported within that time. Samples shipped from one Chilian port to another have to go through the entire customs formality at the second port, just as if they came directly from a foreign port. A departing traveling agent has to submit a list of the articles on which duty-free entry was allowed, along with a list of the articles actually being re-exported, and duty is charged on any items missing from the second list. The traveler has also to furnish proof of the actual entry of the samples into a foreign port, this proof taking the form of a foreign customs document, authenticated by the Chilian consul at that port or the consul of a friendly nation. The time allowed for this is 90 days for ports in South America and 180 days for other ports of the world.

Large Storage Battery Installed by Indiana Utility.—The Electric Storage Battery Company, of Philadelphia, Pa., has recently supplied to the Indianapolis (Ind.) Light & Heat Company a battery consisting of 156 "Exide" type H-61 cells, with a capacity of 4500 amp for one hour or 9300 amp for twenty minutes. It is installed with seventy-eight cells on each side of the neutral of a three-wire system, and of this number twenty-two are end cells. There are four remote-control, motor-driven, end-cell switches, two on each side of the system, each having a continuous capacity of 5000 amp, with an overload capacity sufficient to carry any output that the battery can give. The switchboard equipment for the control of the battery consists of eight panels. On this board, in addition to the knife switches for connecting the end-cell switches to the bus and the usual indicating instruments, there is installed for each end-cell switch one of the Electric Storage Battery Company's recently developed indicating control switches, a description of which appeared in the Feb. 28 issue of the *Electrical*

World. This battery installation is at Substation No. 6, which is equipped with a 1000-kw motor-generator set, driven by a three-phase induction motor and delivering direct current to the 240-volt bus. The neutral point of the battery is connected to the neutral of the system, but no other neutral is provided at this substation, the motor-generator set being connected directly across the outside wires at 240 volts. For charging the battery there is installed a three-unit booster set, consisting of a synchronous motor driving two direct-current generators.

Foreign Activities in the Electrical Industry.—The electrical manufacturing enterprises in Japan are becoming continually more prominent and are rivaling the operating companies in activity. The Shibaura Engineering Works, at Tokyo, in which the General Electric Company has a large interest, makes motor, generator, transformer and other power apparatus in sizes up to 4000 kw, but a large part of the big electrical apparatus used is still imported. The General Electric Company is also heavily interested in the lamp-manufacturing enterprises of Japan, including the Tokyo Electric Company, Ltd., which has extensive factories at Kawasaki and furnishes a large portion of the lamps used in Japan. In Silesia, Germany, there is some sale of electrical heating and cooking appliances, and these are generally operated at 220 volts. At present the German manufacturers have control of the market, but they have instituted branch retail houses in competition with the local dealers, and the latter are inclined to favor American-made appliances where they can compete with the German articles in price. Very small stocks of this kind of apparatus are carried, and in many cases appliances are sold from catalogs only, so the American manufacturer wishing to enter the field would have to approach the wholesale jobber as a possible distributing agent.

Another Method for Pushing Production.—In the Feb. 21 issue of the *Electrical World* a note was given on the system used by one of the leading manufacturers of the country for keeping track of orders in their progress through its shops. A letter recently received from the Terry Turbine Company, of Hartford, Conn., on the same general topic, contains additional matter of interest and may draw out other ideas by which the industry as a whole will profit. This company writes, in part, as follows: "We are quite pleased with and rather proud of our system for following orders and keeping production up to a maximum. This consists primarily of a large bulletin board, divided into the days of the year by means of vertical lines, and ruled horizontally to form small squares. When an order is received here at the works the same is entered on one of the horizontal lines of this board, and a certain colored tack immediately placed in the square showing the date on which shipment must be made. As the order progresses through the shops, variously colored tacks signifying certain operations, such as approval of contract, ordering of outside material, completion of erection and completion of testing, are placed on this board under the days on which these respective operations took place or were completed. In this way it is possible to tell at a glance just how any particular order stands, and if the tacks do not appear at regular intervals in connection with any order, or as soon as previous experience would indicate was the proper time, investigation is immediately made in order to ascertain the reason for the delay."

Co-operation of School and Factory in Technical and Commercial Training.—The Western Electric Company takes into service at its Hawthorne Works boys who have had rudimentary technical and manual-training instruction in the Phillips, Lane and Crane technical high schools of the Chicago public-school system. Mr. J. W. Dietz, manager of the educational department of the company, is quoted as saying that the company finds that the young men it obtains from the technical high schools have been helped by their work in those schools. The time spent in the technical high schools seems to result in putting students in a position to advance more rapidly when they begin practical work in the manufacturing establishment. The company also co-operates with the Austin High School in employing students from the commercial classes of that school for alternate weeks; that is, the students work for the company one week and then go back to school the next week, and so on. The Western Electric Company has a school department which is designed to supplement public-school work by giving instruction in specialized lines. For the college men who come to the establishment well grounded in the theories underlying technical work three courses are provided. One of these is in the commercial end of the business, the second in the manufacturing end and the third in engineering work. Some boys receive instruction to help them to become skilled mechanics or toolmakers. There is also instruction in drafting for high-school boys who enter the drawing department. For office people there is a class in stenography and the use of the comptometer. The Hawthorne Men's Club conducts classes from 6 to 7:30 p. m. in elementary electricity and magnetism, in shop mathematics, telephone practice and shop practice. All of this educational work, which is under the general supervision of Mr. Dietz, is intended, not to make up for deficiencies in public-school or college preparation, but rather to give the more specialized information which is required in the activities of the Western Electric Company.

Electrical and Allied Imports in the Third Quarter of 1913.—In the Dec. 27 issue of the *Electrical World* some statistics were given on the electrical import business for the year July 1, 1912, to June 30, 1913. The following table, compiled from a recent bulletin of the Department of Commerce at Washington, D. C., shows the figures on the same items for the third quarter of 1913 from July 1 to Oct. 3, the rates in the tariff law of 1909 applying. Comparison of the two tables gives an idea of the slump in these imports during the latter period. The total duty collected on these particular items from July 1 to Oct. 3, 1913, was only 17.8 per cent of the collection during the year from July 1, 1912, to June 30, 1913.

ELECTRICAL AND ALLIED IMPORTS JULY 1-OCT. 3, 1913.

Items	Valuation	Duty
Aluminum:		
Crude form, scrap and alloys	$527,785	$218,852
Plates, sheets, bars and rods	88,008	35,347
Asbestos:		
Unmanufactured	528,397	....
Woven	22,223	8,889
Carbons:		
Electric-light lampblack or retort carbon	61,808	22,517
Electrodes and brushes	34,859	10,457
Coal:		
Bituminous and shale	661,876	107,161
Culm and slack	134,190	10,430
Copper:		
Pigs, ingots and bars	12,333,126	....
China and porcelain wares not decorated	287,439	158,091
Electric lamps:		
Arc	7,802	3,510
Metal filament	73,409	33,034
Carbon filament	1,510	679
India rubber and gutta percha:		
Crude	18,096,773	....
Manufactured	195,035	68,262
Hard rubber	64,277	22,497
Iron or steel sheets	5,749	1,261
Mica:		
Unmanufactured	228,130	73,992
Ground	384	77
Manufactured	22,927	5,885
Models of inventions	6,046	....
Nickel:		
Alloys, ingots and pigs	16,669	2,215

NEW YORK METAL MARKET PRICES

	Mar. 10			Mar. 17		
Copper:	Bid		Asked	Bid		Asked
Standard spot*	13.37½		14.00	13.60		14.25
	Selling Prices			Selling Prices		
	£	s.	d.	£	s.	d.
London, standard, spot*	63	18	9	63	16	3
Prime Lake	....		....	14.50		to 14.75
Electrolytic	14.25		to 14.35	14.12½		to 14.25
Casting	14.10		to 14.20	14.00		to 14.12½
Copper wire base	15.50		....	15.50		....
Lead		4.00			4.00	
Nickel	40.00		to 45.00	40.00		to 45.00
Sheet zinc, f.o.b. smelter		7.25			7.00	
Spelter, spot	5.35		....	5.35		....
Tin, spot	37.62½		to 37.87½	38.10		to 38.50
Aluminum:						
Prompt delivery	18.37½		to 18.62½	18.00		to 18.25
Future	18.37½		to 18.62½	18.00		to 18.25

*OLD METALS

Heavy copper and wire	13.62½	13.62½
Brass, heavy	8.62½	8.62½
Brass, light	7.62½	7.62½
Lead, heavy	4.00	4.00
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to March 17 24,854

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*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Receivers for Central Union Telephone Company.—The receivers for the Central Union Telephone Company have been appointed by the court. They are David R. Forgan, Edgar S. Bloom and Frank F. Fowle, for the properties in the States of Illinois and Ohio, and the same gentlemen, with the addition of John A. Moriarty, for the state of Indiana. The receivers have established an office at Chicago.

Northern States Company Reports Increase in Earnings.—The Northern States Power Company, one of the Byllesby properties, reports gross earnings for itself and its subsidiaries for the year ended Jan. 31, 1914, as $3,916,065. The net earnings are given as $1,992,091, which may be compared with $1,789,728 for the preceding year. From the net earnings interest charges amounting to $1,223,008 were paid, as well as preferred stock dividends of $574,430.

Western Union Telegraph on 4 Per Cent Basis.—At the meeting of the board of directors of the Western Union Telegraph Company on March 11 a quarterly dividend of 1 per cent was declared on the outstanding $99,786,700 capital stock of that company, raising the rate from 3 to 4 per cent per annum. Announcement was made of the resignations from the board of directors of J. P. Morgan, Henry Walters and W. H. Moore, and of the election of E. G. Merrill to the latter vacancy. About two weeks ago a profit-sharing plan was inaugurated by the company whereby its employees are allowed to buy stock of the company, at approximately market price, in even shares to the extent of about half of their annual salaries. In order to prevent this stock being used in a speculative manner, none will be delivered until March 1, 1915.

January Earnings of Electrical Utilities.—Reports received from sixty-seven electric utility companies indicate substantial gains in earnings for January, 1914, as compared with January, 1913. These returns are not sufficiently comprehensive to afford any reliable conclusions regarding the condition of the industry as a whole, but the properties, which include electric railway plants and central light and power stations scattered over various sections of the Union, show that a gross income of $2,516,505 for January, 1913, has increased to $2,821,213 for January, 1914—an expansion of a trifle over 12 per cent. The earnings of all the railway and lighting plants in the country were probably in the neighborhood of $90,000,000 for the month. Of the sixty-seven companies, whose reports have been analyzed just as received, without any attempt at a systematic census, half a dozen show a decrease in gross earnings ranging from a fraction up to 4 and 5 per cent, and apart from this it is probable that the present rate of increase which the electricity supply stations of the country are experiencing is appreciably less than was the case eighteen months ago, when 20 or 25 per cent was, as it had been for years, the annual expansion constant. The probable reason is not an approach to saturation. Times just now are not booming; but a slow betterment is apparent and probably companies showing only 5 and 10 per cent increase now will be returning 15 and 20 per cent increase by the end of the year, when business generally will possibly have resumed a vigorously healthy condition.

Organization Changes in Two Barstow Holding Companies.—The following officers have been elected to serve the Eastern Power & Light Company during the present year: President, W. S. Barstow; vice-presidents, J. B. Taylor and F. V. Henshaw; secretary and treasurer, A. P. Taliaferro. The General Gas & Electric Company has elected for the same period W. S. Barstow as president, J. B. Taylor as vice-president, and O. C. Swenson as secretary and treasurer. The first-named company controls the following operating companies: Colonial Power & Light Company, Claremont Railway & Lighting Company, Claremont Power Company, Clarendon Power Company, City Electric Lighting Company of Vincennes, Vincennes Electric Company, West Virginia Traction & Electric Company, Reading Transit & Light Company. The second mentioned controls the following operating companies: Western Vermont Power & Light Company, Rutland Railway, Light & Power Company, Pittsford Power Company, Northwestern Ohio Railway & Power Company, Sandusky Gas & Electric Company, Port Clinton Electric Light & Power Company. T. R. Robinson has accepted the position of operating engineer with W. S. Barstow & Company, Inc., and will have supervision over the operations of the subsidary companies of the General Gas & Electric Company. William Buchsbaum has tendered his resignation as treasurer of the Reading Transit & Light Company and the Metropolitan Electric Company of Reading, Pa., to take charge of the auditing department of W. S. Barstow & Company, Inc. E. D. Gault has been elected treasurer of the Reading Transit & Light Company and the Metropolitan Electric Company of Reading, Pa., vice William Buchsbaum, resigned.

Annual Report of the Washington Water Power Company.—For the year ended Dec. 31, 1913, the gross receipts of the Washington Water Power Company amounted to $2,909,147, and the operating expenses came to $1,291,673. The payment of dividends, interest and various fixed charges required a reduction of the surplus, and this item amounted to $1,119,105 on the above date. The total assets of the company amount to $23,405,810. The maximum load on the generating stations of the company during 1913 was 40,521 hp and the total output for the same period was 157,061,662 kw-hr. The outstanding stock of the company amounts to $14,081,900, its outstanding bonds to $5,524,000, and its notes and other debts to $2,333,500. The principal expenditures for extensions and improvements during 1913 totaled $2,012,845. The company acquired on July 1, 1913, the Idaho-Washington Light & Power Company, which operates in the towns of Moscow, Genesee, Troy and St. Maries, Idaho, and in Tekoa, Garfield, Colton, Uniontown, Palouse, Farmington, Oakesdale and Pullman, Wash. The property of the Big Bend Light & Power Company, covering the local distributing systems in the towns of Reardan, Davenport, Sprague, Harrington, Ritzville and Lind, Wash., was acquired Jan. 1, 1914. The wholesale power supply for these towns was heretofore purchased from the Washington Water Power Company. The work contemplated in 1914 for the electric light and power system consists principally of continuing the construction of the Long Lake power station and extending the distribution system in Spokane and in the surrounding territory, especially in the country districts. Much work has been done during the past year to extend electric light and power service to farmers near the country lines of the company, and this last field is considered to be a very promising one for future work.

American Water Works & Guarantee Reorganization Plans.—A statement has finally been given out concerning the plans for rehabilitating the finances of the properties controlled by the American Water Works & Guarantee Company, which has been in the hands of receivers for about eight months past. The name of the new company which will take over these properties is the American Water Works & Electric Company, and its authorized capitalization consists of $10,000,000 of 7 per cent cumulative first preferred, $10,000,000 of 6 per cent participating preferred and $10,000,000 of common stock, and $20,000,000 of collateral trust 5 per cent twenty-year bonds. Of this it is proposed to issue at the present time $5,000,000 of first preferred, $10,000,000 of participating preferred and $7,000,000 of common stock, and $6,250,000 of the bonds, of which not exceeding $3,700,000 are to be available as collateral. Holders of preferred stock of the old company will be entitled, under the reorganization plan, on payment of $35 per share, to $40 par value of first preferred stock of the new company and $100 par value of participating preferred stock of the same. An alternative for preferred stockholders of the old concern is the receipt of $50 par value of participating preferred stock on the payment of $5 per share of the old stock held. Common-stock holders of the old company will receive on payment of $10 per share $10 per value of first preferred and $70 par value of common stock of the new concern. The alternative for common-stock holders of the old corporation is to receive $10 par value of new common stock on payment of 50 cents per share of old stock held. On March 16 Judge Orr in the United States District Court at Pittsburgh, Pa., granted the application of the receivers of the American Water Works & Guarantee Company for permission to sell the property of that corporation. The sale will be conducted by H. B. Bruno on April 15. This court decision will mark the end of the receivership.

Business Notes

The Driver Harris Wire Company, of Harrison, N. J., has recently advanced Arlington Bensel from the position of sales manager to that of vice-president and sales manager.

The Connecticut Telephone & Electric Company, of Meriden, Conn., maker of ignition apparatus, has recently appointed C. E. Stahl, of Chicago, Ill., to the position of sales manager.

Meikleham & Dinsmore, bankers and public utility managers, of 25 Broad Street, New York City, have recently added to their sales force in eastern Pennsylvania S. M. Conger, People's Bank Building, Scranton, Pa., and Edward Stair, York, Pa.

The Steel City Electric Company, of Pittsburgh, Pa., has announced the appointment of W. L. Commiskey as its exclusive sales representative in the States of Missouri, Arkansas, Kansas and Oklahoma, with offices at 1117 Olive Street, St. Louis, Mo.

The C. & C. Electric & Manufacturing Company, of Garwood, N. J., announces that its Cincinnati representative, F. A. Saylor, whose headquarters are at Sixth and Vine Streets in that city, will have temporary charge of the Indianapolis territory of the company.

The United Electric Lamp Company, of Bush Terminal, Brooklyn, N. Y., has secured the services of J. H. W. Rees as its general manager. Mr. Rees is well known in the commercial and industrial field, was formerly executive advertising manager of the national Progressive party, and until recently held the position of advertising manager of Deuth & Company, of New York, incandescent lamp importers. The United company claims to be operated along independent lines, handling a wire-drawn tungsten lamp of domestic manufacture.

The Esterline Company, of Indianapolis, Ind., has appointed the following men to agency managerships in the new branch offices mentioned: F. C. Morton, Walker Bank Building, Salt Lake City, Utah; G. W. Pieksen, Railway Exchange Building, St. Louis, Mo.; J. S. Black, 908 Hennen Building, New Orleans, La.; G. L. Priest, 229 Sherlock Building, Portland, Ore. The W. W. Geisse Company, McKnight Building, Minneapolis, Minn., and the General Supplies Company, Ltd., of 122 Eleventh Avenue West, Calgary, Alta., have also received agency appointments. The above offices are to be completely equipped for handling the company's business in graphic meters in their several localities.

New Industrial Companies

E. C. Sykes & Company, of Rochester, N. Y., have been incorporated with a capital stock of $25,000 to do a general contracting business and electrical work. The incorporators are E. C. Sykes, E. D. Wilcox and S. P. Sykes, of Rochester, N. Y.

The Main Electric Manufacturing Company has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $100,000 and proposes to manufacture and sell electrical machinery. The incorporators are H. E. Latter, W. J. Maloney and O. J. Reichard, of Wilmington, Del.

The Pennsylvania Indicator Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $300,000. The company proposes to manufacture stop or designating indicators for use in electric, steam or horse cars. The incorporators are E. O. Babcock, of Niagara Falls, N. Y.; G. C. Jones and W. A. Norris, of Erie, Pa.

The Electrical Steam Radiator Company, of Portland, Maine, has filed articles of incorporation under the laws of the State of Maine. The company is capitalized at $200,000 and proposes to manufacture and deal in electrical appliances, machinery and electrically heated or lighted devices. The officers are: J. D. Ross, president, and C. T. Sweet, treasurer, both of Portland, Maine.

Trade Publications

Grounding Device.—Bulletin R, published recently by the Lord Manufacturing Company, Bush Terminal, Brooklyn, N. Y., refers to "Hydroground," a device for grounding electrical circuits. Its structural features are illustrated and described.

Oil Engines.—The De La Vergne Machine Company, New York City, has issued a four-page folder on its types "HA" and "FH" oil engines, the first mentioned varying in size from 10 bhp to 100 bhp, and the other type from 90 bhp to 360 bhp.

Wiring Specialties.—M. B. Austin & Company, Chicago, Ill., have just issued replacement sheets 49, 50 and 56 for their perpetual catalog of wiring specialties. The items covered in the new sheets are conduit bushings, lock nuts, nipples and the Anthony adjustable conduit hickey.

Household Devices.—Bearing the simple title "Electrics," a twenty-four-page catalog has been issued by Manning, Bowman & Company, showing their line of electric household devices. Some artistic designs in coffee percolators, chafing dishes, tea urns, egg boilers and other useful household devices are illustrated and briefly described.

Vacuum Cleaner.—The "Dunmore" vacuum cleaner is the theme of a recent booklet issued by the Manhattan Electrical Supply Company, New York City. This cleaner is made by the Wisconsin Electrical Company and is of comparatively simple construction, with a double fan and a two-piece aluminum case. It has no revolving brushes.

Electric-Vehicle Equipment.—Westinghouse Electric Vehicle Equipment, Section 3223, gives a detailed illustrated description of the construction of the electric motor and its application. Curves are given, showing the performance of 60-volt and 80-volt motors. An illustrated article describes the equipment for charging electric-vehicle batteries.

Rectifier.—Folder 4237, issued by the Westinghouse Electric & Manufacturing Company, is entitled "The Way to Charge Three Cells." It describes the Westinghouse mechanical vibrating rectifier for charging small storage batteries used for ignition and lighting sets on automobiles. This device changes the alternating to direct current by means of the vibrating mechanism.

Instruments.—Bulletin 104 of the Wagner Electric Manufacturing Company, St. Louis, Mo., on portable instruments, admirably carries out its title, "A Manual of Electrical Testing." The forty-eight pages of thoroughly practical reading matter and the illustrations and well-planned diagrams showing methods of connection add another excellent bulletin to the Wagner Company's trade literature.

Steam Boilers.—The Hawkes Boiler Company, Chicago, Ill., has devised a novel method of illustrating the action in its fire-tube boilers, description of which is given in a recently issued pamphlet on that company's product. The device, which is called its "silent salesman," consists of a complete working model in glass and metal, which is capable of developing 1 hp and shows all the processes in the generating of steam in a boiler of that type. This novel working model is sent for inspection by such prospective customers as appear sufficiently interested to make it worth while. The catalog referred to above contains much of interest concerning the various types of boiler apparatus produced by this company, together with numerous illustrations.

High-Voltage Detector and Recording Synchroscope.—Schweitzer & Conrad, 1770 Wilson Avenue, Chicago, manufacturers of high-voltage specialties, have recently issued bulletins Nos. 2 and 3. The first relates to the Schweitzer high-voltage detector, which is said to be a reliable device for detecting high voltages and for "phasing out." It may be placed in stations or substations or used in connection with overhead or underground cables. The Schweitzer recording synchroscope, described in Bulletin No. 3, makes a permanent record of each operation of switch-closing when paralleling. It places the blame definitely for disturbances to the system during synchronizing and gives the operator a tangible record by which he can study his work. The record is taken on a paper ribbon.

Personal Mention

Mr. George R. Scribner has tendered his resignation as superintendent of the Carthage (N. Y.) Electric Light & Power Company, effective April 1.

Mr. James S. Storey has severed his connection with the Carthage (N. Y.) Electric Light & Power Company, for which he has been local manager for about a year.

Mr. Charles A. Bergen, manager of the Mount Pleasant (Tex.) property of the Texas Public Service Company, has also assumed charge of that company's Gilmer plant.

Mr. George B. Foss, superintendent of the water and light department of Uniontown, Ala., has been appointed electrical engineer for the State in charge of the electrical development at Speigner, Ala.

Mr. Theodore Dienst has been appointed business manager of the Texas Public Service Company at Bay City, Tex., succeeding Mr. W. C. Duncan. Mr. Dienst was formerly stationed at Gilmer, Tex.

Mr. H. K. Morrison, general manager of the Brockton (Mass.) Electric Light Company, has been elected general manager of the Lynn (Mass.) Gas & Electric Company as successor to the late C. F. Pritchard.

Mr. W. C. Duncan has resigned as manager of the Texas Public Service Company, at Bay City, Tex., to undertake other work for the Albert Emanuel Company, of Dayton, Ohio, which owns and operates the Bay City property.

Mr. Dana Pierce has been designated by the New York Board of Fire Underwriters to serve as one of its representatives on the advisory board of electrical engineers for the Department of Water Supply, Gas and Electricity.

Mr. R. J. Wensley has been transferred from the engineering department of the Merchants' Heat & Light Company, Indianapolis, Ind., to the engineering department of the American Public Utilities Company, Grand Rapids, Mich.

Mr. F. Beeuwkes has been appointed electrical engineer of the Chicago, Milwaukee & St. Paul Railway Company, and is making his headquarters at Butte, Mont., where he will have much to do with the extensive mountain-division electrification of his company.

Mr. L. B. Cramer, for four years chief of the electrical lines of the Hill roads in the Northwest, has been appointed electrical engineer for the San Francisco-Oakland Terminal Railways, with offices at Oakland, Cal. He will have supervision of all matters pertaining to power.

Mr. L. O. Veser, chief engineer of the Mahoning & Shenango Valley Railway Light Company of Youngstown, Ohio, has tendered his resignation, effective April 1. Mr. Veser has been in the service of the company since 1909, previously to which time he was connected with various hydroelectric companies in Western States.

Mr. Robert Montgomery has been appointed new-business manager of the Louisville Gas & Electric Company. Mr. R. E. Flower, late of Mobile, has been appointed assistant manager. These gentlemen were guests at a recent dinner given in their honor at the Hotel Henry Watterson by Louisville employees of the Federal Sign System (Electric).

Mr. F. Miller has been chosen superintendent and manager of the Crawfordsville (Ind.) Electric Light & Power Company as successor to Mr. J. R. Thomas. Mr. Miller is a graduate of Purdue University and has acted as manager of the light and heating plants at Greenwood, Franklin, Seymour and Columbus for the Interstate Public Service Company.

Mr. J. H. Larmouth, consulting engineer of Toronto, Ont., has been appointed superintendent of the Edmonton (Alberta) Municipal Street Railway. Mr. Larmouth, who is at present in private practice in Toronto, will take up his new duties on the first of April. He succeeds Mr. W. T. Woodrofe, who resigned recently. Mr. Larmouth was engineer for the Peterboro (Ont.) Street Railway, which he built and managed for a number of years. He was general manager of the Electrical Power Company two years ago and is a graduate of McGill University.

Mr. Harry Reid, formerly vice-president and general manager of the Kentucky Utilities Company, Lexington, Ky., has been elected president of the company. He succeeds Mr. Martin J. Insull, Chicago, who is president of the Middle West Utilities Company, of which the Kentucky corporation is a subsidiary. Mr. Reid's headquarters will continue to be at Lexington. The Kentucky Utilities Company operates a number of electric-light properties in Kentucky and now has large plans for the construction of power plants in eastern Kentucky for the service of coal mines.

Mr. J. H. Trimingham has been appointed superintendent of power of the Sherbrooke Railway & Power Company, Sherbrooke, Que. Mr. Trimingham was graduated from the McGill University, Montreal, in 1908 in electrical engineering. He was attached to the electrical staff at the university as a demonstrator from 1908 to 1911. For the following eighteen months he was consulting engineer and superintendent of power of the Bermuda Electric Light, Power & Traction Company, Hamilton, Bermuda. During the latter part of 1913 he was engaged in work for the electrical commission of the city of Montreal.

Mr. W. S. Murray has been appointed by the New York, New Haven & Hartford Railroad Company consulting engineer in general charge of all electrical engineering and construction, reporting to President Huestis, with offices at New Haven. Mr. Murray, following the substantial completion of the construction of the system for complete electrical operation west of New Haven, will enter into closer relations with the railroad company. His jurisdiction will hereafter be extended to include also the electrical features of operation in addition to electrical construction. He will continue with the firm of McHenry & Murray in general consulting practice as before.

Mr. William A. Fox, one of the new vice-presidents of the Commonwealth Edison Company, was promoted from the position of secretary and treasurer. As vice-president Mr. Fox will have charge of finances, securities and claims, with supervision over the secretary and treasurer. Mr. Fox was born in Sandwich, Ill., in 1865 and has been employed by the Commonwealth Edison Company or its predecessor, the Chicago Edison Company, since 1893. For a long time he was secretary to President Insull and he has served as secretary and treasurer of the company for a number of years. Mr. Fox is a director in a number of public utility companies, including the South Side Elevated Railroad Company, the Metropolitan West Side Elevated Railway Company, the Northwestern Elevated Railroad Company, the Middle West Utilities Company and the Public Service Company of Northern Illinois.

Mr. John F. Gilchrist has been made vice-president in charge of the purchasing, stores, transportation and statistical departments by the recent executive changes in the Commonwealth Edison Company of Chicago. Mr. Gilchrist was born in Chicago in 1868 and has been connected with the Commonwealth Edison Company and its predecessor, the Chicago Edison Company, throughout his entire business career. He made a fine record as contract agent of the company, and in 1906 was promoted to be assistant to the president, a position which he held until promoted to the vice-presidency. Mr. Gilchrist has a number of outside business interests, being treasurer of the Federal Sign System (Electric), as well as vice-president of the Middle West Utilities Company. In 1911 and 1912 Mr. Gilchrist served as president of the National Electric Light Association. He is also vice-president of the Electric Vehicle Association of America and has served as a director of the Illuminating Engineering Society.

Mr. T. R. H. Daniels, who resigned as chief engineer of the Birmingham (Ala.) Railway, Light, Heat & Power Company, has been appointed engineer of the Terre Haute, Indianapolis & Eastern Traction Company of Indianapolis, Ind. Mr. Daniels was at one time assistant engineer for Westinghouse, Church, Kerr & Company, of New York, in the construction of the new terminal station of the Pennsylvania Railroad. He left Westinghouse, Church, Kerr & Company to take charge of the rebuilding of tracks, etc., of the United Railroads in San Francisco, after the earthquake, and in 1908 left San Francisco to become assistant engineer of the Terre Haute, Indianapolis & Eastern Traction Company. He acted as construction engineer in charge of the erection of the new West Tenth Street power station of that company at Indianapolis. In May, 1911, he left Indianapolis to become chief engineer for the Birmingham (Ala.) Railway, Light, Heat & Power Company, which position he has just relinquished to return to Indianapolis.

Mr. C. A. Thomas, the new manager of the Omaha office of the General Electric Company, has been connected with the General Electric Company and the Fort Wayne Electric Works for about fourteen years, with the exception of a year and a half, when he was engaged in other pursuits. Mr. Thomas was graduated from Cornell University in 1900 in the electrical engineering course and thereafter took the student's course at the Schenectady shops of the General Electric Company and a short course at the Lynn shops. He then became connected with the home office of the Fort Wayne Electric Works and later, for about three years, was manager of the Boston office of the Fort Wayne company. He was then transferred to Philadelphia and later was sent to St. Louis, where he was connected for four years with the office of the Fort Wayne Electric Works in that city and with the St. Louis office of the General Electric Company. About a month ago Mr. Thomas was promoted to be manager of the Omaha office of the General Electric Company.

Mr. R. E. Richardson, who recently resigned as general manager of the Commonwealth Power Company, Jackson, Mich., as announced in our issue of Jan. 31, was born at Concord, Mass., July 29, 1861. In 1885 he was graduated from the Massachusetts Institute of Technology, and after leaving school he spent five years with the Western Electric Company at Chicago. In 1889 he served as manager of the Milwaukee Electric Light Company. In 1892 Mr. Richardson laid out the lighting and wiring for the World's Fair at Chicago, and shortly after this he became a partner in the firm of Pierce, Richardson & Neiler. Subsequently he was engaged for ten years as general manager of the Kansas City Electric Light Company. Upon leaving that company in 1910 he made a commercial survey of 185 towns in Michigan within the present territory of the Commonwealth Power Company and the Consumers' Power Company and was later selected as general manager of the first-named company with thirty-two properties under his charge. Mr. Richardson will hereafter divide his time between general engineering work and the development of mineral and asphalt properties in the Southwest.

Mr. Van Rensselaer Lansingh, who as announced two weeks ago, was appointed manager of a recently organized department in the National Lamp Works of the General Electric Company, is well known in illuminating engineering circles, having been general secretary in 1906 and president in 1912 of the Illuminating Engineering Society. Mr. Lansingh graduated from the public schools of New York City and attended the College of the City of New York from 1888 to 1891. He is also a graduate of the University of Chicago and the Massachusetts Institute of Technology. He joined the testing department of the Western Electric Company February, 1899, and in July, 1900, formed the V. R. Lansingh Company in Chicago, sales agent for Holophane globes and reflectors. In September, 1904, he was appointed general manager and chief engineer of the Holophane Works of the General Electric Company, Cleveland. In the Johns Hopkins University course of lectures on Illuminating Engineering Mr. Lansingh gave the lecture on "Shades, Reflectors, and Diffusing Media." Mr. Lansingh has contributed to the technical literature of this and other countries. His book, "Practical Illumination," written in collaboration with Mr. J. R. Cravath, has had a wide circulation.

VAN RENSSELAER LANSINGH

Mr. Joseph H. Brewer, who was recently elected president of the American Public Utilities Company of Grand Rapids, Mich., was born thirty-eight years ago in that city. At the age of fourteen he entered the employ of the Michigan Central Railroad as stenographer. At sixteen he was stenographer for the general superintendent of the Chicago & Western Michigan Railroad, and in 1891 he went to Detroit and opened a stenographic office for court reporting. In 1892 he returned to Grand Rapids, associating himself with Charles H. Bender, then the leading court stenographer in western Michigan. He retired from this partnership and devoted himself to the public utility business which he had inaugurated in 1904 by the purchase of the Holland (Mich.) Gas Company. Later he purchased the Winona (Minn.) Gas Light & Coke Company and the Red Wing (Minn.) Gas Light & Power Company. His work with these properties brought about an affiliation with Mr. Charles B. Kelsey, who controlled the Albion (Mich.) and Valparaiso (Ind.) gas companies. The new firm acquired several other properties, and in 1912 the American Public Utilities Company was formed as a holding company. The company has $20,000,000 preferred stock and $20,000,000 common stock, of which $4,000,000 of the preferred and $3,000,000 of the common have been issued.

Prof. H. H. Norris has accepted an appointment as associate editor of the *Electric Railway Journal*, and, beginning July 1, when his term as secretary of the Society for the Promotion of Engineering Education expires, he will devote his entire time to that publication. Widely known through his long connection with Cornell University, Professor Norris has also established a reputation for work in the electric railway field. He was superintendent of the tests conducted by the Electric Railway Test Commission at the St. Louis Exposition and later on the lines of the Union Traction Company of Indiana in Anderson, and with Prof. B. V. Swenson edited the report of the commission. He was also a member of the international jury at the St. Louis Exposition and secretary of the electric railway section. In 1905 his services were secured by the American Electric Railway Association to formulate plans for the reorganization of that association, and he drafted the constitution and by-laws which are now in effect. Professor Norris is a native of Philadelphia, and, after going through the Manual Training High School of that city, he took a course in physics and applied electricity at Johns Hopkins University as a special student. He afterward entered Cornell, where he was graduated with the degree of M.E. in 1896. He served as an instructor in Cornell from the time of his graduation to 1900, when he was made an assistant professor. In 1905 he was advanced to a professorship, which post he relinquished in 1913 to join the McGraw Publishing Company forces as a special contributor for the *Electrical World* and the *Electric Railway Journal*. During his last four years at Cornell he also had charge of the department of electrical engineering. Professor Norris has done a great deal of electrical work outside of the college in addition to that done in the railway field. He has for a number of years been chairman of the educational committees of the American Institute of Electrical Engineers and of the American Electric Railway Association and has just been appointed by the National Electric Light Association to the committee on relations of that organization to educational institutions. He was manager of the American Institute of Electrical Engineers from 1909 to 1912 and since 1909 has been secretary of the Society for the Promotion of Engineering Education. He is the author of several books dealing with electrical engineering subjects and of numerous contributions to the technical press.

H. H. NORRIS

Construction

New England

EAST JAFFREY, N. H.—The committee appointed to investigate the installation of a municipal electric-light plant recommends taking over the present system and securing electricity from the New Hampshire Wtr. & El. Pwr. Co. The town is now served by the Jaffrey & Troy El. Co.

ASHFIELD, MASS.—At the annual town meeting held recently it was voted to light the streets of the village with electricity.

HUNTINGTON, MASS.—The Huntington El. Lt. Co. expects to purchase within the next six months a few new poles. E. E. Stanton is superintendent.

PITTSFIELD, MASS.—The Board of Public Works has voted to instruct the Pittsfield El. Co. to place certain series wires underground on North and West Streets and around City Hall Park.

STERLING, MASS.—Within the next four months the electric light commission expects to erect some distributing lines and will require wire, transformers, insulators, meters, etc. Harrison W. Rugg is superintendent of lights.

Middle Atlantic

JAMESTOWN, N. Y.—Bids will be received by the board of electric light commissioners, Jamestown, until April 16 for furnishing and installing one 1000-kw turbine generator, condenser and switchboard panel in the municipal electric-light plant in accordance with specifications on file in the office of the board of electric light commissioners. For details see proposal columns.

NIAGARA FALLS, N. Y.—The Public Service Commission, Second District, has granted the Canadian-American Pwr. Corpn. permission to import electricity generated in Canada into New York State; it has also granted the application of the company to merge itself with the Niagara Falls Electrical Transmission Co. The former company proposes to take over a contract with the Electrical Development Co. for furnishing 46,000 electrical horse-power to be sold in the United States. Permission was asked to issue $3,000,000 in capital stock on account of the contract and $435,000 for the purchase of holdings of the Niagara Falls Electrical Transmission Co. The commission restricted the issue of stock to $1,000,000 and $250,000, respectively.

OSWEGO, N. Y.—Plans are being prepared by the People's Gas & El. Co., of Oswego, for extensive improvements to both its gas and electric plants. The company has filed a petition with the Secretary of State for permission to increase its capital stock from $600,000 to $1,000,000. The improvements to the electric plant will include extensions to the overhead system, additional generating apparatus and switchboard equipment. Roy F. Whitney is manager.

ROCKVILLE CENTER, N. Y.—The proposal to expend $16,000 for extensions and improvements to the municipal electric light plant will be submitted to the voters.

PRINCESS ANNE, MD.—Bids will be received at the office of the town commissioners until April 3 for lighting the streets of Princess Anne. The specifications call for 65 lamps of 85 cp to burn all and every night. The town is to have the privilege to have additional lamps installed at same rate per lamp per year. J. Douglass Wallop, Albert Krause and Columbus Lankford are commissioners.

CORRY, PA.—Preliminary plans, it is reported, are being prepared for a power house for the Inter-State El. Co., to cost about $300,000.

HARRISBURG, PA.—Bids are being received at the office of the Pennsylvania-Panama Pacific Exposition Commission, State Capitol Building, Harrisburg, for the electrical work on the Pennsylvania Pavilion at the Panama Pacific International Exposition to be held in San Francisco in 1915.

NEW CASTLE, PA.—The capital stock of the New Castle Steel & Iron Co. has been increased from $100,000 to $500,000. The proceeds, it is reported, will be used for installing machinery for electric steel welding. W. H Schoen, of Pittsburgh, Pa., is interested in the company.

NORRISTOWN, PA.—The Counties Gas & El. Co., of Norristown, it is reported, is contemplating the construction of a one-story power house, 50 ft. by 64 ft.

PHILADELPHIA, PA.—Plans have been filed with the Bureau of Building Inspection by John T. Windrim, architect, for the new 15-story building, to be erected at Seventeenth and Arch Streets and the Parkway, for the Bell Telephone Co., at a cost of about $1,250,000.

PHILADELPHIA, PA.—The directors of the Pennsylvania Railroad have appropriated $300,000 to replace in vitrified-brick conduits 25 miles of telegraph and telephone wires torn down by the recent storm. Work will begin immediately between Rahway and Trenton. The conduits will have six ducts. Eventually, all wires of the company between New York and Pennsylvania will be placed in conduits.

ATLANTIC CITY, N. J.—The contract for the addition to the Steeplechase Pier, at Atlantic City, for George Tilyou, has been awarded to E. L. Bader, Bartlett Building, Atlantic City. The cost of the extension is estimated at $200,000 and calls for a large amount of electrical equipment for illuminating and power purposes.

CAMDEN, N. J.—Mayor Ellis will recommend that the City Council take some action to have all telephone and telegraph wires within the city limits placed in underground conduits.

CLAYTON, N. J.—The Borough Council has awarded Moore Brothers & Co., operating a glass-manufacturing plant, a contract for lighting the streets of the borough for a period of five years. The contract provides for the installation of 80-cp lamps on the main streets and 60-cp lamps on the side streets. Energy for operating the system will be supplied from the power plant in connection with the factory.

JERSEY CITY, N. J.—The Chamber of Commerce, it is reported, is negotiating for the installation of an improved street-lighting system along Grove Street. Ernest Rowe is secretary.

NEWARK, N. J.—The Common Council has approved the installation of a new engine and generator at the City Hall for auxiliary service, the cost not to exceed $6,000.

PERTH AMBOY, N. J.—The Board of Water Commissioners is considering the installation of an automatic electrically operated pumping plant (using water from the Raritan Bay) in connection with plans for the installation of a high-pressure salt-water system for fire, sprinkling, etc.

WILMINGTON, DEL.—The New Castle County Building Commission has engaged Palmer, Hornhostel & Jones, architects, of New York, to prepare plans and take charge of the construction of the new combined city and county building, to be erected at Tenth and King Streets, at a cost of $1,000,000. The new building will be equipped with the most improved electrical devices, for which contract has not yet been awarded.

BALTIMORE, MD.—The Consol. Gas, El. Lt. & Pwr. Co., of Baltimore, has applied to the Public Service Commission for permission to issue $1,106,800 in debenture stock, the proceeds to be used for construction purposes.

CUMBERLAND, MD.—Application has been made to the State Legislature by the Edison El. Illg. Co. and the Cumberland El. Ry. Co. for a charter allowing them to consolidate, with a capital stock of $1,000,000. As soon as spring opens, it is said, the consolidated company will begin work on the construction of an electric generating plant to cost about $40,000. The present plans provide for an ultimate installation of 11,000 kw, although the initial installation will be but 5000 kw. The old Union Street station, owned by the Edison El. Illg. Co., will be used as a distributing station, and also to supply steam for the company's steam-heating plant, which now covers the main business streets of the city. The company also proposes to enlarge and extend the street railway service.

EASTON, MD.—The State Senate has passed the bill authorizing the municipality of Easton to issue bonds for the installation of an electric-light and power plant.

ABINGDON, VA.—The Abingdon Wtr. & Lt. Co. may purchase a boiler within the next six months.

ELKTON, VA.—Tho Valley Pwr. Co., Elkton, recently incorporated with a capital stock of $100,000 (maximum), is building a 1300-hp hydroelectric power plant on the Shenandoah River, near Grove Hill, at a cost of from $50,000 to $60,000. The company will furnish electricity in Elkton, Shenandoah City and Stanley for lamps and motors. It also has submitted a proposal to furnish electricity in Harrisonburg. H. W. Bertram, of Harrisonburg, has been appointed attorney of record in Virginia.

KENBRIDGE, VA.—Steps have been taken by the Business Men's Association to secure the establishment of an electric-light plant and telephone system in Kenbridge.

WASHINGTON, D. C.—Bids are requested by the Direccion General de Obras Publicas, Ministerio de Fomento, Madrid, Spain, for the concession and construction of an electric tramway in Madrid. The cost of the tramway is estimated at $22,935, and the rolling stock must include two cars. For further information address No. 12701 Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—Experiments are now being made on a railway operating between two foreign cities with electric generators and accumulators for lighting trains. Tests have been going on for some time, two trains having been fitted out, and it is not yet known whether either system will be adopted or other systems will be invited to make experiments. An American consulate officer furnishes the name of the railway in question and states that correspondence in regard to other systems of lighting should be addressed in Spanish. For further information address No. 12,561, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or branch offices of the bureau, 315 Custom House, New York, N. Y.; 629 Federal Building, Chicago, Ill.; Association of Commerce Building, New Orleans, La., and 76-78 Appraisers' Stores Building, San Francisco, Cal.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 7, for furnishing at the various navy yards and naval stations supplies as follows: Norfolk, Va., Schedule 6537—53 mast arc arms, three single-phase transformers; Schedule 6536—cross-arms for electric-light poles. Brooklyn, N. Y., Schedule 6534—miscellaneous switches, frogs, etc., 51,000 lb. black-annealed wire; Schedule 6545—480 1¼-in. composition unions, 3320 lb. naval bar brass, 1000 lb. phosphor copper in 5-lb. ingots. Boston, Mass., Schedule 6545—miscellaneous copper pipe. Bids will also be received until April 14 as follows: For 2300 ft. conveyor belt to be delivered at the Brooklyn navy yard as per Schedule 6529. Applications for proposals should give the schedule desired by number. J. T. Cowie is paymaster-general, U. S. N.

North Central

BELDING, MICH.—Contract has been awarded by the Spencer El. Co., of Belden, for rebuilding its Smyrna water-power plant and penstocks to Brice Brothers, of East Jordan. The work includes 525 yd. of reinforced concrete, 9 tons of structural steel and 8 tons of reinforcing steel. The Fargo Engineering Co., Commonwealth Building, Jackson, has charge of the engineering work.

CLIO, MICH.—Within the next two months J. H. O'Rourke, owner of the local electric-light plant, expects to purchase a new steel smokestack, 34 ft. high by 40 in. in diameter.

DETROIT, MICH.—An electric elevator will be installed in the new addition to the plant of the Abbott Motor Car Co.

FLUSHING, MICH.—Within the next 60 days the Hart Milling & Pwr. Co., of Flushing, expects to erect power house, etc., and to purchase within the next three months poles for distribution system. R. O. Hart is manager.

GREENVILLE, MICH.—The R. J. Tower El. Co., of Greenville, has awarded contract for construction of concrete spillway and penstocks to remodel its present hydroelectric plant in Greenville to Brice Brothers, of East Jordan. The Fargo Engineering Co., Commonwealth Building, Jackson, has charge of the engineering work.

HARBOR BEACH, MICH.—The Harbor El. Co., of Harbor Beach, expects to purchase within the next 12 months six ornamental lamp standards and lamps to meet requirements; also electrical appliances and supplies as needed. B. F. Huestis is secretary and treasurer.

HARBOR SPRINGS, MICH.—The Board of Electric Light Commissioners expects to purchase within the next three months transformers and meters; also, within the next six months to purchase material for about 2 miles of distribution lines, including poles, lightning arresters, insulators, cable, wire, etc., and electrical appliances and supplies of all kinds. W. D. Wright is clerk.

HASTINGS, MICH.—The Thornapple Gas & El. Co., of Hastings, expects to erect within the next four months a new concrete substation to replace the present substation at Lake Odessa, and to purchase 25,000-volt outdoor switches; also within the next two months to purchase a carload of poles. The company has just renewed the street-lighting contract for a period of five years, calling for additional street lamps. L. W. Heath is general manager.

ISHPEMING, MICH.—The Marquette County Gas & El. Co., of Ishpeming, ex-

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The Anti-Holding-Company Bill The administration anti-holding-company measure is entitled "A bill to prohibit unlawful restraint of trade or monopolies in interstate or foreign commerce by corporations through the device of intercorporate stockholding." The clear intent of the bill is to make unlawful the acquisition of stock of one company by another company where the effect is to eliminate or lessen competition between companies engaged in interstate or foreign commerce or to create a monopoly of any line of trade in any section or community. If the transmission of electricity from a point in one state to a point in another state is interstate commerce, the text of the bill would bring under the law many companies whose operations are conducted in part across state border lines. If it is a "line of trade" to supply electricity as a monopoly in any section and two or more companies are affiliated through stock ownership in such an enterprise, they would be doing a forbidden act. These illustrations serve to show that as the bill now stands it may affect many companies in the electrical industry. It is no comfort to officials of these companies to reflect that the bill is not intended primarily to disrupt their organizations but is directed at trade operations of a wholly different character. It ought to be possible for the lawmakers to find legally binding language to restrict the law to the abhorrent practices which they seek to correct. If they think that this is not possible, they at least can add a clause plainly exempting from onerous restrictions the class of public utility properties and holding companies whose practices are not criticised.

A Concrete Case for Co-operation In the comprehensive campaign to secure the use of electric vehicles in parcel-post delivery service now being conducted by the Electric Vehicle Association of America, as described at length on a following page, there exists an unusual opportunity for the central stations of the country to do some definite, concrete co-operative work for the electric-vehicle cause—a cause which is of course identical with their own interests. Briefly, the vehicle association has undertaken to demonstrate to the authorities at Washington the advantages of specifying electric wagons for parcel delivery, and furthermore to encourage Congress to appropriate funds for the purchase of such electric-truck fleets. The extremely economical operation of electric delivery wagons in the service of department stores, express companies and the postal departments of other governments, no less than in the instances where they have been used in parcel-post service in this country, prove that the electric vehicle need stand only on its record of facts in order to sweep the field against all competitors. The work to be done at Washington, then, is simply that of bringing the truth about the electric vehicle adequately and persistently to official attention. This is already being done effectively by those who have the campaign in charge, but if the executives and commercial managers of the 6000 central stations of the United States will communicate to their Congressional representatives in both the Senate and the House their individual convictions concerning the desirability of electric parcel-post delivery, a powerful, country-wide influence—most potent because chiefly personal and direct—will be brought upon the national legislature to accomplish the result of parcel-post electrification.

A Problem in Steam Auxiliaries The account in this issue of the Lewiston - Clarkston transmission system is most instructive in exhibiting the difficulties which hydroelectric systems sometimes encounter and the methods used to overcome them. In the system described irrigation is combined with the supply of energy for electric lighting and motor service. Water is too valuable an asset in that part or the country to be allowed to go to waste, and the task of the engineer is not to design an irrigation plant as such, or a pure hydroelectric system, but to utilize the water between the two to the best possible advantage. Two hydrolectric stations were built and put into successful operation, but the time eventually came when the demand for water for irrigation purposes became too great to allow the use of any further quantity for energy production, and hence it became necessary to install an auxiliary steam plant. When this plant was erected along the Snake River, from which it drew water for feed and condensation purposes, trouble began. This stream shows an enormous difference between the high and low water stages and carries at times a huge quantity of suspended matter, the result being a clogging of the condenser and loading of the feed and steam pipes with mud. During very low water the circulating pump could not raise the water high enough and had to be reinforced by an auxiliary pump. About three years ago, when the steam plant was found to be of insufficient size, an investigation showed the cheapest way out of the difficulty to be the installation of an entirely new separate steam plant alongside the old one, and the plant described and illustrated here is the result. Originally intended to be an oil-burning equipment, conditions arising after the contract was let rendered the use of oil uneconomical, and a change was made to a coal-burning equipment. The new plant is built with a deep condenser pit, and the old difficulty with the condenser fouling has been overcome by an ingenious arrangement of piping which enables the flow through the surface condenser to be reversed to wash out the accumulated débris. The whole equipment shows what has to be done far oftener than one realizes in hydroelectric plants where water is scarce. It represents an ingenious adaptation of means to ends, rigorous economy in installation and the meeting of adverse conditions with prompt improvements.

Sixty-Cycle Synchronous Converters

The paper by Mr. L. P. Crecelius on the use of synchronous converters with a frequency of sixty cycles per second, read at the Cleveland Section meeting of the A. I. E. E. and abstracted in this issue, emphasizes the advantages to be obtained by adhering as far as possible to one and the same standard frequency. It used to be necessary to generate energy in large units at the lower frequency of twenty-five cycles per second in order to be able to use synchronous converters, because the difficulties in the design of these machines for the more generally used frequency of sixty were very great. In recent years, however, designers have been able to overcome many of the high-speed troubles in converters, so that sixty-cycle converters in large sizes are now recognized as standard machines.

We pointed out editorially last week that there exists a great advantage in retaining, as a uniform standard, the frequency of sixty. Not only is that frequency much more generally used than any other in this country, but it is also much better suited to arc and incandescent lighting than twenty-five, for purely physiological reasons. Finally, the size, cost and efficiency of alternating-current machines are usually improved by the use of the higher frequency. Frequency converters are not only expensive in first cost and maintenance, but they also consume a very appreciable amount of the energy they transform, besides adding to the mechanical inertia of the system in which they are installed. This added inertia reduces the flexibility of the system and its responsiveness to instantaneous demands.

The author draws attention to the practical importance of the power-factor on the heating of the sixty-cycle converters. If these must have their armatures boxed in to keep down the noise, the free ventilation of the machines is interfered with and the heat losses become more serious. A reduction of 2.5 per cent in the power-factor, from unity to 0.975, sounds very small, but the author points out that this means an increase of 57 per cent in the rate of heating the armature coils nearest to the taps. Incidentally, the author introduces a convenient means of defining and measuring the average monthly power-factor of a station. The "average monthly angle of lag" would have sounded rather austere in power-station contracts a few years ago, but no fault can be found with this measurement on the score of precision, unless the three-phase load should be much out of balance.

Power-Factor Adjustment

Mr. H. B. Dwight's article on power-factor adjustment offers some interesting suggestions for enlisting the aid of individual consumers in raising the power-factor of their alternating-current loads. There can be no dispute about the disadvantages of a low system power-factor, to which Mr. Dwight alludes. The installation by customers of induction machinery and apparatus at their own volition tends, as we all know, to lower the power-factor, choke the electric machinery and supply wires, impair the voltage regulation and make life less livable not only for the supply company but also for the other consumers on the same mains. The lowering of the power-factor by the heedless installation of lightly loaded induction motors is not merely an unfortunate mistake on the part of the customer guilty of the installation; it is, in a certain sense, a misdemeanor, in that it wastes energy unnecessarily and creates undue hardship for all others on the system. The customer may be, and often is, quite unconscious of wrong-doing. He is apt to suppose that any increase in his connected load is a pure beneficence to the electric-supply corporation. The idea that the installation of an induction motor on his premises may cause loss instead of gain to the central station ordinarily comes at first as a surprise, to say nothing of the bad effects on lamps and lighting in other houses on the same mains.

According to the author, the solution of the difficulty is to be found in persuading the customer to install synchronous motors, instead of induction motors, whenever possible, the inference being that, in order to improve his own voltage regulation, the customer will tend to take such precautions as will make the synchronous machines automatically improve the power-factor. Two general methods are suggested for influencing the choice of the customer in the installation of the proper kind of machinery. One is to insert an extra meter on his premises, so connected as to measure the reactive energy consumed, while the other meter measures the active energy in the usual way. He is then to be charged for the extra reactive energy at a rate, say, one-fourth of the regular rate for active energy. The other method is to offer a bonus for each kilovolt-ampere of synchronous motor machinery installed. It is probable that the equity of the case could best be met by the first method. That is to say, if a customer desires to install a machine that absorbs reactive energy to the disadvantage of the system and of all connected therewith, he should pay a proper price for the luxury, in proportion to the amount of reactive energy he consumes monthly. On the other hand, in view of the difficulty of explaining the nature of the trouble to the customer, the matter being essentially of a technical character, and also in view of the difficulty of establishing an authorized rate for reactive energy, it seems likely that the second method, in some of its many possible forms, is likely to be more generally practicable.

Electric Arc Welding

The voltaic arc almost from the date of its discovery, near the beginning of the nineteenth century, was found to be capable of maintaining temperatures well above the melting points of the most refractory metals. In 1810 Sir Humphry Davy publicly demonstrated the melting of metals, including platinum and iridium, in the carbon arc produced with the aid of a large voltaic battery of 2000 cells. It was not, however, until many years later, and until the dynamo-electric machine had been commercially developed as a source of continuous current, that the idea seems to have been suggested of using the voltaic arc as a means of melting welding metals, particularly iron and steel. Dr. Siemens experimented with the arc welding of steel about 1880, and Dr. Bernardo developed a carbon-arc steel-welding process in 1887, using the steel to be welded as the negative electrode, a carbon rod as the positive electrode, and a stick of iron held in the arc as the source of molten metal to fill the weld. The amount of heat that can be produced in this way with an arc of several hundred amperes at more than 100 volts can be realized when one sees through dark glasses in a face mask a block of steel several centimeters thick melting and running like wax on the side of a paraffin candle in a drafty room.

In spite of the many attempts made at different times to introduce arc welding into industry after the Bernardo process was first exhibited, comparatively little use has been made of it. In an article on page 705 of this issue Mr. Otis Allen Kenyon points out that the recent development of the electric arc-welding process is attributable to the substitution of a coated metallic electrode for the carbon electrode. The carbon arc could not be satisfactorily applied in a number of practical cases, as, for example, to an overhead weld. One has only to think of the numerous physical and chemical conditions that are capable of influencing an arc weld in order to perceive how much skill, experience and technical knowledge are required to produce uniformly successful results. The metal on each side of the weld must be brought to the melting point so as to incorporate thoroughly with the new metal melted in, yet there must be no oxidation on the surfaces, no extensive heat stresses, no material chemical changes in the molten metal. There must be heat enough to melt, but not enough to allow the metal to run off, or to burn into pits.

The process of arc welding to the rings of the tunnel in the Rondout siphon is a very interesting and difficult application of the metallic arc, considering the very great hydraulic pressure to which the walls of this tunnel have to be subjected. The curves in Fig. 3 of the article indicate that the time required to weld a given length of plate increases very nearly as the square of the thickness of the plate. They also indicate that the angles of the opposed plate sections influence the welding speed materially, one-inch plate, with the most favorable abutment shown, welding as fast as half-inch plate with the least favorable abutment. An arc-welded seam is advantageous in that any defect is more likely to be detected by the eye without recourse to hydraulic test than if the seam is calked by hand. It remains to be seen whether the metallic arc will take the place of the calking tool in the construction and jointing of high-pressure boilerplates near each line of rivets.

Swiss Railway Electrification

The Swiss plans for railway electrification discussed before the New York Railroad Club by Mr. Emil Huber-Stockar furnish much food for thought. Mr. Huber-Stockar has been carefully studying electrification for several years past, and his long experience as manufacturer and engineer has given him a peculiarly effective training in everything that pertains to a problem of this sort. As our readers know from reports already published, the decision regarding the system of electrification, made after exhaustive study, was in favor of single-phase traction with commutator motors using, at least ultimately, 15,000 volts on the working conductor. This decision was not reached without much deliberation as to the advantages of its two possible rivals, direct-current at high voltage, and three-phase. The turning point in the discussion seems to have been the evident necessity for high voltage at the working conductor in order to supply the necessary energy for heavy trains from an overhead wire.

It is rather surprising to the ordinary engineer to find the choice of the single-phase system in this important case depending on its great working flexibility as well as on the simplicity of distribution. The commission seems to have threshed over the matter very thoroughly indeed, and from every possible point of view, so that its conclusions for this particular case must be received with a great deal of respect. It is perfectly clear, as Mr. Huber-Stockar made evident, that the Swiss problem was strictly a special one, and the solution reached is not necessarily applicable to conditions elsewhere. However, since several Continental countries have come to a similar conclusion regarding their own electrification problems and are putting these conclusions into practice, the Swiss situation seems not to be altogether peculiar. Good engineering consists in the successful adaptation of means to ends, and it is not safe to adopt a system for one use merely because it has proved thoroughly successful in another. Electrification of trunk lines is a task that demands most exhaustive consideration before decision is finally reached. It is enough for the present if the report of Mr. Huber-Stockar and his confreres makes it explicitly evident that single-phase traction cannot be left out of the reckoning when large railway work is undertaken.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

A. I. E. E. Nominations

The directors of the American Institute of Electrical Engineers have announced the selection of the following nominees for the next annual election: For president, Prof. Paul M. Lincoln, Pittsburgh, Pa. For vice-presidents, Messrs. F. S. Hunting, Fort Wayne, Ind.; Farley Osgood, Newark, N. J.; N. W. Storer, Pittsburgh, Pa. For managers, Messrs. Frederick Bedell, Ithaca, N. Y.; John H. Finney, Washington, D. C.; Bancroft Gherardi, New York; A. S. McAllister, New York. For treasurer, Mr. George A. Hamilton, Elizabeth, N. J.

Memorial to Westinghouse

It is understood that a movement is on foot among the national engineering societies to perpetuate the memory of the late George Westinghouse, and that the memorial will probably take the form of a statue which will be erected in some open space in Washington, D. C., the city in which Mr. Westinghouse spent some of the last years of his life. It is likely that the services of one of the most eminent American sculptors will be enlisted for executing the work. It will be a source of the keenest gratification to members of the engineering professions if some lasting and notable tribute be paid to the memory of the great inventor and administrator. A subscription of some $25,000 or $30,000 will probably be adequate for the carrying out of the plan.

Water-Power Research Advocated in Massachusetts

Hydraulic engineers and public officials appeared before the committee on ways and means of the Massachusetts Legislature last week to favor a resolution appropriating $25,000 for a continuation of the investigation of the water-power resources of the State and the development of a broad policy of utilization along the lines considered in a preliminary way by the special commission on water-power. This commission recently reported to the General Court urging that the work be continued. Chairman Forrest E. Barker of the Massachusetts Gas and Electric Light Commission, Mr. W. S. McNary of the Massachusetts Harbor and Land Commission, and Mr. Charles S. Davis of the Turners Falls Power Company were the principal speakers.

To Develop the Great Falls of the Potomac

The Commissioners of the District of Columbia have sent a report to Congress urging the adoption of the bill introduced by Senator Norris, of Nebraska, providing for the establishment of the Great Falls water-power plant on the Potomac River near Washington, D. C. The bill authorizes the Secretary of War to construct on the Potomac at Great Falls a power plant for the generation of electricity for municipal and government uses and in connection therewith to provide for increasing the water supply of the District of Columbia. The estimated cost of the project is $15,021,600, as determined by a survey made under a recent act appropriating $20,000 for an investigation of the possibilities of the site.

Radio Research Laboratory for Bureau of Standards

The Department of Commerce has asked Congress for an appropriation of $50,000 for the establishment of a wireless-telegraphy research laboratory in connection with the Bureau of Standards at Washington. It is planned to locate the laboratory in the recently completed electrical building of the Bureau of Standards, and the tower for the antenna will be erected on the east side of the structure. It is proposed to build the tower of masonry in order to preserve the unity of the architecture of the group of buildings.

Cut in Tungsten Lamp Prices

On April 1 the manufacturers of tungsten lamps in this country will place in effect new price schedules cutting the list price of tungsten lamps from 10 to 15 per cent. The 10, 15, 20, 25 and 40-watt lamps formerly listed at 35 cents will be listed at 30 cents; the 60-watt lamps formerly listed at 45 cents will be listed at 40 cents, and the 100, 150 and 250-watt lamps formerly quoted at 80 cents, $1.20 and $2 list respectively will hereafter be sold at 70 cents, $1.10 and $1.80 respectively, in standard package quantities, for circuits of from 100 volts to 130 volts. The frosted lamps are 10 per cent higher in price than the clear-globe lamps.

Contemplated Legislation Limiting Holding Companies

The text of the holding company bill was gone over by President Wilson on March 16 in a conference at the White House with Messrs. Clayton, Floyd and Carlin of the judiciary committee of the House of Representatives. As made public the bill as drawn up will make it unlawful for one corporation engaged in interstate commerce to acquire directly or indirectly the whole or any part of the stock or other share capital of another corporation engaged also in interstate or foreign commerce, where the effect of such acquisition is to eliminate or lessen competition between the corporation whose stock is so acquired and the corporation making the acquisition, or to create a monopoly of any line of trade in any area or community, or where the effect of such acquisition, or the use of such vote, by the voting or granting of proxies or otherwise, is to eliminate or lessen competition between such corporations, or any of them, whose stock or other share capital is so acquired, or to create a monopoly of any line of trade in any section or community.

The act does not apply to corporations purchasing such stock solely for investment and not using the same by voting or otherwise to bring about, or in attempting to bring about, the lessening of competition.

It does not prevent a corporation engaged in interstate or foreign commerce from causing the formation of subsidiary corporations for the actual carrying on of their lawful business, or the natural and legitimate branches thereof, or from owning and holding all, or a part of, the stock of such subsidiary corporations when the effect of such formation is not to eliminate or lessen a pre-existing competition.

Illinois Ice Dealers Interested in Central-Station Energy

Following the short paper on electrical ice making read by Mr. C. J. Carlsen, of the Commonwealth Edison Company, before the sixth annual convention of the Illinois Ice Dealers' Association at the Hotel Sherman, Chicago, March 18, many questions were asked regarding the cost of central-station energy for ice manufacture. Mr. Carlsen explained the contracts existing between the Commonwealth Edison Company and the numerous ice manufacturers on its circuits, and stated that where electrical energy can be purchased for 1 cent per kw-hr. it competes favorably in production cost with a steam-driven ice factory.

Nitrogen-Filled Lamps for Hartford Street Lighting

Nitrogen-filled series tungsten lamps are to be installed by June 1 in the business district of Hartford, Conn., for ornamental street-lighting service under a five-year contract recently made by the city with the Hartford Electric Light Company. The lamps are to be placed on 141 double and 113 single standards and are to deliver 300 cp each at an angle of 20 deg. below the horizontal through acorn-shaped diffusing globes carried at a height of 15 ft. above the street surface. For each double-lamp standard the city will pay $80 per year and for each single-lamp standard $55 per year, the service to be from dusk until dawn. The city is to furnish the standards and the company is to care for their installation and maintenance and to provide and maintain all other equipment associated with the installation.

New Street-Lighting Contract at Boston

At its next regular meeting the Boston City Council will be asked to ratify a ten-year street-lighting contract between the city and the Edison Electric Illuminating Company, in which the price per lamp will be reduced from $103 to $87.53 per annum. Five thousand 6.6-amp magnetite-arc lamps are involved, and the saving to the city in ten years as a result of the company's willingness to grant the reduction will be $773,500. The proposed contract will be dated from April 1, the date on which the present five-year contract between the city and the company terminates. In a recent interview Mayor Curley expressed "much satisfaction over the magnanimous manner in which the officials of the company waived their advantage under the existing contract, under the provisions of which the company should have been notified by April 1, 1913, that a revision was to be taken up." On account of the absence of this notification, the company could have insisted upon the maintenance of the price of $103 per lamp for five years more, had it so desired.

Electric-Vehicle Co-operation in Chicago

At the luncheon of the Chicago Section of the Electric Vehicle Association on March 17 it was voted to indorse the "safety first" movement of the Chicago Motor Club. Preparations for the annual meeting in May were discussed, and some novel features are promised. The interesting announcement was made that the Chicago Garage Owners' Association has offered to give a "boost" of electricity without cost at any member's garage to any member of the Chicago Section of the Electric Vehicle Association who will identify himself as such. At the meeting of the section on March 31 Mr. Everett P. Stroup will give a talk on "Pneumatic Tires for Electric Vehicles."

Conductivity of Creosoted Cross-Ties

At the quarterly meeting of the Railway Signal Association held at Chicago March 16 much time was devoted to the approval of various standards and forms of specifications being prepared by standing committees. The report on signaling practice included interesting tests on the use of creosote for treating cross-ties, as well as electrical tests of cross-ties so treated. The results obtained from the latter experiments indicated that dry creosoted ties themselves are of low conductivity, nor is their conductivity increased to any great extent by the addition of a slight percentage of moisture. The addition, however, of a salt solution, such as the drippings from refrigerator cars, brings about so great a reduction in resistance as to interfere seriously with successful track-circuit maintenance.

$6,000,000 Expended on Ontario Hydroelectric System

According to the annual report of the Hydro-Electric Power Commission of Ontario, which was tabled in the Legislature of the Province on March 16, the system with all its branches represents a capital expenditure up to the end of 1913 of $5,915,000. Of this amount $5,190,000 has been spent for building the transformer stations and transmission lines of the Niagara district. The Port Arthur system represents an expenditure on capital account of $90,425; the St. Lawrence system, $93,666; the Severn, $234,946; the Renfrew, $17,761, and the Penetang, $15,153.

The money to build these various systems has been advanced by the provincial treasury, and the profits of the municipal systems are paying into the Province interest at the rate of 4 per cent on all advances. The expenditure of the Province, which represents the contribution for cheap electricity for the people as a whole, was at the year end $138,592. This covers engineering assistance to municipalities, investigations, reports, etc., and equipment for rural and farm demonstrations. The expenditure during the year was $1,333,408. The extent to which the Hydro-Electric system is serving the people of the Province is illustrated by a table showing that, while in 1912 there were 33,568 consumers of energy for lamps and 1399 users of energy for motor service, these figures increased at the end of 1913 to 63,157 and 2532 respectively, or a total of 65,689.

There are now forty-five municipalities in the various systems, with a total annual expenditure of $1,999,043, of which $1,511,048 represents operating and maintenance charges. In 1912 the total revenue was $1,617,674, and in 1913 the revenue was $2,611,918.

The surplus for the year is given as $620,875, as against $240,506 in 1912. Allowing $230,480 as a depreciation charge, the net profit for the year is stated to be $390,395. The total plant value of the municipalities is $9,196,483 and the net debenture debt and overdraft is $8,353,819. The gross surplus invested in plant extension now amounts to $861,381. There is a depreciation reserve of $410,327 and a net surplus from operation so far of $451,054.

Michigan Section, N. E. L. A., Plans Sightseeing Convention Trip

The Michigan Section of the National Electric Light Association has arranged elaborate plans for its annual convention June 17 to 20 inclusive. These four days will be occupied with water trips on Lakes Erie and Ontario and on the St. Lawrence River, and with electric and steam-railway rides in the vicinity of Niagara Falls. The delegates will gather at Detroit, Mich., leaving there at 5 p. m. on June 17 and traveling overnight by boat to Buffalo, whence the party will visit Niagara Falls. The trip on Lake Ontario and down the St. Lawrence will start at Youngstown, N. Y., passing through the Thousand Islands, with a stop at Ogdensburg, N. Y., and finally returning to Toronto, Ontario, from which point a daylight run will be made to Detroit by train. The convention sessions will be held during the several stages of the trip, the expenses of which will aggregate $30 per person. Mr. Herbert Silvester, 18 Washington Boulevard, Detroit, is secretary and treasurer of the Michigan Section, N. E. L. A.

Rate Investigations in the Twin Cities

Since last May an investigation has been under way in the city of St. Paul, Minn., to determine whether there should be any change in the rates charged by the St. Paul Gas Light Company and the Consumers' Power Company for gas, electricity and district steam heating. Mr. E. W. Bemis, of Chicago, the public utility expert, was retained by the city to make the investigation. Under his direction Mr. Charles L. Pillsbury, of Minneapolis, consulting engineer, has made an engineering appraisal of the property of both companies and Marwick, Mitchell, Peat & Company have made a study of the accounts of both companies. These reports have been turned over to Mr. Bemis and are now being examined by him. Mr. Bemis' report will be ready for presentation, probably next month.

In Minneapolis the city is engaged in an investigation of the rates of the Minneapolis Gas Light Company. Since Jan. 1 the consumers have been paying but 70 cents per 1000 cu. ft., the former rate having been 85 cents. The case is, however, in the courts. Mr. William D. Marks the city's public utility expert, died during the pendency of the case, and Mr. Bemis has been retained in this case also on the part of the city.

Southeastern Section of the N. E. L. A.

The next annual meeting of the Southeastern Section of the National Electric Light Association will be held at the Isle of Palms, Charleston, S. C., from Aug. 19 to 21. This meeting place is at one of the finest Southern beaches, about 12 miles from Charleston. Special rates to the convention have been arranged for. The association has made considerable progress during the last year under the able leadership of President Thomas W. Peters, of the Columbus (Ga.) Railroad Company. The secretary and treasurer, Mr. A. A. Wilbur, of Columbus, Ga., has also been very active in the affairs of the society. Mr. C. D. Flanigen, vice-president and general manager of the Athens Railway & Electric Company, is chairman of the committee on exhibits; Mr. C. M. Benedict, assistant secretary and treasurer of the Charleston Consolidated Railway & Light Company, is chairman of the entertainment committee; Mr. W. W. Fuller is chairman of the advertising committee.

Hearing at Boston on Regulation of Hydroelectric Companies

The committee on public lighting of the Massachusetts Legislature held a hearing on March 11 on the Horgan bill for the placing of hydroelectric companies under the supervision of the Board of Gas and Electric Light Commissioners. The bill extends the powers of the board along the lines at present applying to the jurisdiction of gas and electric lighting companies, with supervision of rates, service, security issues, returns of operating revenue, expenses, etc.

President Henry I. Harriman of the Connecticut River Transmission Company, Boston, stated that those in control of New England's largest hydroelectric system are not opposed to reasonable and proper regulation, the time being ripe for such a policy on the part of the State. He preferred, however, to have the subject taken up in connection with the proposed codification of laws relative to the manufacture, distribution and sale of gas and electricity. Mr. William H. Brooks, counsel for the Ludlow Manufacturing Associates and Holyoke Water Power Company, and Mr. W. Rodman Peabody, counsel for the Amherst Power Company, favored taking up the proposed regulatory powers under the forthcoming codification. Chairman Barker, of the Gas and Electric Light Commission, favored action upon the case as an independent matter.

New York Court on Going Value

The New York Court of Appeals rendered a decision on March 24 holding that the Kings County Lighting Company is entitled to an allowance for going value in a valuation for rate-making purposes. The decision reverses the order of the New York Public Service Commission, First District, which directed the company to reduce the price of gas from 85 cents to 80 cents per 1000 cu. ft. The decision also holds that the company is not entitled to include in its tangible assets amounts paid for street improvements and appreciation in the value of land owned. The case was returned to the commission for redetermination.

The decision of the court, which was unanimous, was written by Judge Miller and said in part:

"I define 'going value' for rate purposes, as involved in this case, to be the amount equal to the deficiency of net earnings below a fair return on the actual investment due solely to the time and expenditures reasonably necessary and proper to the development of the business and property to its present stage and not comprised in the valuation of the physical property. Going value is to be appraised by showing the actual expenditures of the company, the original investment, its earnings from the start, the time actually required and the expenses incurred in building up the business, all expenditures not reflected by the present condition of physical property, the extent to which bad management or other causes prevent or deplete earnings, and any other facts bearing on the question, keeping in mind that the ultimate fact to be determined is not the amount of the expenditures but the deficiency in the fair return to investors due to causes under consideration.

"The difficulty of determining the 'going value' will not justify the disregard of it. Rate making is difficult. But that will not justify confiscation. It may be conceded that going value has no existence apart from tangible property and that commercially there is but one value, that of the property as a whole, but as the rate cannot be made to depend upon the exchange value, which would in turn depend upon the rate, it would seem to be necessary to appraise the physical property and the going value separately."

Cost of Living and State Water-Power

One of the bulletins issued by the Empire State Gas & Electric Association in reference to the Velte-Smith hydroelectric bills now pending in the New York State Legislature discusses the cost of living in connection with the suggested plan of the State to develop water-power. It says in part:

"The avowed purpose of the advocates of the Velte-Smith hydroelectric bills, now before the Legislature, is to reduce the cost of living through lower rates for lighting.

"The cost of lighting at the present time averages only from 1 to 2 per cent of the cost of living and is one of the smallest items on the list of regular expenses. If it is really advisable for the State to go into business in order to reduce the cost of living, there are other lines in which even a small saving, if accomplished, would amount to more than the entire cost of lighting. For instance, food amounts to 35 to 45 per cent of the cost of living, and a 5 per cent reduction in this item would be the same as the furnishing of light for nothing. Besides this, the price of food is steadily going up while the price of light is steadily going down, and that without any great expense to the State.

"If the conservation commission and the other advocates of these bills are really sincere in their belief that the State can run a business economically and that it is the duty of the State to go to the extent of entering into competitive business in order to reduce the cost of living, why do they not start with some business where the saving might amount to something? Why do they not propose state butcher shops, state groceries, state bakeries and even state restaurants to be operated at cost for the benefit of the people?"

American Railway Engineering Association

Previous attendance records were broken at the fifteenth annual convention of the American Railway Engineering Association held at the Congress Hotel, Chicago, March 17 to 20. In his presidential address Mr. Edwin F. Wendt, member of the engineering board of the Interstate Commerce Commission, dwelt on the growth of the association and its financial affairs and committee work, and spoke at some length on recent advances in signal and track construction, development of electric traction and the valuation of common carriers. In closing the speaker stated that, in his opinion, the broad future of railroad electrification was dependent upon a thorough demonstration of its economic advantages over steam.

Of the committee reports submitted several were of electrical engineering interest. The report of the committee on electricity, of which Mr. C. W. Kittredge is chairman, was divided into two parts, one of which dealt with clearance diagrams, the other portion being confined to discussions of electrolysis. Five clearance diagrams presented by the committee were adopted, four of these having beeen considered jointly by the American Railway Engineering Association and the American Electric Railway Association. The fifth, a minimum clearance diagram, will be considered in the joint meeting of these committees. The report of the committee on electrolysis was received as indicating progress and the work of this committee will be continued.

President Wendt acted as toastmaster at the fifteenth annual banquet of the association given in the "gold room" of the Congress Hotel. In the course of the evening the election of the following officers for the coming year was announced: President, Mr. W. B. Storey, vice-president Atchison, Topeka & Santa Fe Railroad Company, Chicago; vice-president, Mr. Robert Trimble, chief engineer maintenance of way, northwest system of the Pennsylvania Lines West of Pittsburgh; second vice-president, A. F. Baldwin, chief engineer Illinois Central Railroad, Chicago.

Municipal Electric-Light Stations of the United States

The issue of March 14 contained statistics of all the electric-light stations in the United States based on information given out by the Bureau of the Census. Although the number of municipal plants was given in the compilation, information regarding their income, output, etc., was included with that of the private central stations of the country. The Bureau of the Census has just released detailed information on the purely municipal electric-light plants.

MUNICIPAL ELECTRIC LIGHT PLANTS OF THE UNITED STATES

	1912	1907	1902	Per Cent of Increase; 1902-1912
Number of stations	1,562	1,252	815	91.7
Income	$23,218,989	$14,011,999	$6,965,105	233.4
Electric service (light, heat and power, including fire service)	$22,663,708	$13,614,434	$6,836,856	231.5
All other sources	$555,281	$397,565	$128,249	333.0
Total expenses, including salaries and wages	$16,917,165	$10,316,620	$5,245,987	222.5
Total number of persons employed	7,940	5,566	3,417	132.4
Total horse-power	559,328	321,351	160,028	249.5
Steam and gas engines (including turbines):				
Number	2,307	1,792	1,078	114.0
Horse-power	429,067	289,500	147,975	190.0
Waterwheels:				
Number	269	153	82	328.0
Horse-power	130,261	30,347	11,218	1,061.2
Auxiliary engines:				
Number	*	72	36	.
Horse-power	*	1,504	835	..
Kw rating of dynamos	368,677	209,016	113,380	225.2
Output of stations, kw-hr	537,526,730	289,462,788	195,904,439	174.4
Estimated number of lamps wired for service:				
Arc	91,851	†82,940	50,795	80.8
All other varieties	7,057,849	†4,061,318	$1,577,451	347.4
Stationary motors served:				
Number	21,895	4,507	1,962	1,016.0
Horse-power	164,291	31,689	3,324	4,842.6

*Not reported separately.

†Includes, for purposes of comparison, 595 arc and 28,579 incandescent lamps reported by the electric companies to light their own properties. Lamps used for such service were included in the total number reported in 1912.

As a rule, no cash income is derived by municipal stations for electrical energy used for lighting streets and public buildings. In order that the income shown may approximate the total consumption and sale of electrical energy by the stations, the census schedule required that the income for service of this character should be estimated on the basis of what would have been charged for similar service by commercial companies in nearby localities. The number of persons employed may fall short of the total number actually engaged in work in connection with the operation of the electric stations, because employees for the electrical work often are not required for long or continued service, and they are reported with that branch of municipal work with which they are chiefly employed.

Minnesota Electrical Association at Minneapolis

The seventh annual convention of the Minnesota Electrical Association was held in Minneapolis, March 18, 19 and 20. Mr. P. T. Glidden, general manager of the Consumers' Power Company, St. Paul, presided, and the electrical men were welcomed to the city in a felicitous speech by Mayor G. Nye. After introductory remarks by Mr. Glidden and the reading of a report by Mr. Fred A. Otto, of the St. Paul Gas Light Company, secretary-treasurer of the association, the following papers were read: "Motor Applications," by Mr. C. W. Drake, of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; "The Public and Public Service Corporations," by Mr. R. F. Pack, general manager of the Minneapolis General Electric Company; "Co-operation," by Mr. M. J. Wolf, of the Chicago office of the Hotpoint Electric Heating Company (read by Mr. W. C. Beckford, of St. Paul); "Accounting," by Mr. F. C. Hoffman, of the St. Paul Gas Company, and "Safety First," by Mr. John P. Gardner, assistant commissioner of the Minnesota Department of Labor and Industries. Interesting addresses were made by Prof. W. T. Ryan, of the University of Minnesota, on extension work, and Mr. S. E. Doane, of Cleveland, chief engineer of the National Electric Lamp Association, on recent developments in electric lighting. Abstracts of these papers and addresses will be given in a later issue.

On recommendation of a nominating committee headed by Mr. B. W. Cowperthwait, of Faribault, officers were elected as follows: President, Mr. R. E. Brown, Mankato; vice-presidents, Messrs. B. W. Lynch, Minneapolis, and Alfred Horne, Fairmont; secretary-treasurer, Mr. Fred A. Otto, St. Paul Gas Light Company St. Paul; executive board Mr. Brown, Mr. Otto, Mr. P. T. Glidden, St. Paul; Mr. E. F. Strong, Chaska, and Mr. R. F. Pack, Minneapolis. Mr. Robert E. Brown, the new president, is manager of the Consumers' Power Company at Mankato, Minn. He was formerly first vice-president of the association.

Interstate Trade Commission Bill

The text of a new bill providing for the creation of an interstate trade commission has been made public. The bill was drafted by a sub-committee of the committee on interstate and foreign commerce of the House of Representatives. It provides for a commission of three members, to be appointed by the President by and with the advice and consent of the Senate. Upon the organization of the commission and the election of its chairman all the existing powers, authority and duties of the Bureau of Corporations and the Commissioner of Corporations shall be vested in the commission.

Every corporation engaged in commerce, excepting corporations subject to the act to regulate commerce, which, by itself or with one or more other corporations owned, operated, controlled or organized in conjunction with it so as to constitute substantially a business unit, has a capital of not less than $5,000,000, or having less capital belongs to a class of corporations which the commission may designate, shall furnish to the commission annually such information, statements and records of its organization, bondholders and stockholders and financial condition, and also such information, statements and records of its relation to other corporations and its business and practices while engaged in commerce, as the commission shall require.

Upon direction of the President, the Attorney-General or either house of Congress, the commission shall investigate and report the facts relating to any alleged violations of the anti-trust acts by any corporation.

In any suit in equity brought by or under the direction of the Attorney-General, as provided in the anti-trust acts, the court may refer to the commission any question relating to the relief to be granted or any proposed decree therein, whereupon the commission shall investigate the matters referred to it and make a full report to the court.

Whenever a final decree has been entered against any defendant corporation in any suit brought by the United States to prevent and restrain violation of the anti-trust acts, the commission shall have power and it shall be its duty upon its own initiative or upon application of the Attorney-General to make investigation of the manner in which the decree has been carried out. It shall transmit a report to the Attorney-General.

Nothing in the act shall be construed to prevent or interfere with the Attorney-General in enforcing the provisions of the anti-trust acts or the acts to regulate commerce.

Use of Sixty-Cycle Synchronous Converters at Cleveland

At Cleveland, Ohio, some 15,000 kw of sixty-cycle, six-phase, 600-volt synchronous converters have now been in railway service for more than a year. These machines are installed in four substations in the suburbs of the city, and their successful operation has established a precedent for the use of sixty-cycle alternating-current energy on such a large scale, according to Mr. L. P. Crecelius, superintendent of motive power for the Cleveland Railway Company, who on March 23 presented a paper on the subject before the Cleveland Section of the American Institute of Electrical Engineers.

The advantages of sixty-cycle railway apparatus, as pointed out by the author, include standardization of frequency, low cost and high efficiency. The converters are of the commutating-pole type and have a number of special features of design. The improvement of commutation due to commutating poles makes it possible to use fewer poles and higher armature speed, but the latter practice has the objection of increasing the noise to a degree which would have proved objectionable in neighborhoods where these machines were used. To overcome the noise the armature ends were sealed up and a shield was provided behind the front leads, thereby cutting down the ventilation to a considerable extent. The field windings were also compounded in order to hold the direct-current voltage constant. In order to maintain the power-factor of the supply circuit at unity the converters are operated over-excited, thus producing a leading wattless current sufficient to overcome the reactance drop. To overcome the heating effect due to restricted ventilation and over-excitation a density of 3500 amp per square inch of armature conductor, based upon direct current output of rating, was adopted. To permit of alternating-current starting copper dampers are interconnected between the poles to produce a squirrel-cage connection all around the field structure. Appended to the original paper are given extracts from the specifications under which the machines were built, as well as extracts from the contract under which the energy supplied to the substations is purchased.

In conclusion, from his experience with the use of sixty-cycle, 600-volt synchronous converters for railway work the author points out that: (1) Pulsations in the alternating-current supply circuit must be entirely eliminated; (2) the design must include, in addition to the commutating-pole feature, liberal proportions of iron and copper, notwithstanding the high speed; (3) field dampers must be very low in resistance and bridged to permit of alternating-current starting.

Heavy Railway Electrification

At a meeting of the New York Railroad Club on March 20 Mr. Emil Huber-Stockar, permanent consulting engineer on electrification for the Swiss Federal Railways, delivered an illustrated address relating to the plans of the Swiss government for hauling trains over the St. Gothard tunnel route by means of electric locomotives. He remarked that Switzerland can be considered nearer to general electrification than is any other country, because the public is aware of the desirability of utilizing water-powers to compensate for the lack of native coal. The principal benefits to be obtained from electrification are the raising of speeds on grades, the increase of tonnage per train, the elimination of extra and pusher locomotives, and, last but not least, the elimination of smoke in tunnels to encourage travel and reduce track maintenance.

Mr. Huber gave the report made by the board of managers to the board of directors of the Swiss Federal Railways, in abstract, as published in the *Electrical World* for March 21. Referring to the question of system, Mr. Huber said that the Electrification Commission (see *Electrical World*, March 7, 1914) recommended the single-phase system, although the costs of the direct-current three-phase and single-phase systems are not greatly apart, for the reason that single-phase will give the greatest flexibility in speeds on the Swiss railways as a whole. However, no final decision has yet been made because further data can be gathered while the power plants are being constructed. If the single-phase system be adopted ultimately, it is quite possible that half-voltage—7500 volts—will be used during the transition period from electricity to steam in order to avoid troubles from the deposit of smoke on the insulators, etc.

Discussion

Mr. George Gibbs, consulting engineer Pennsylvania Railroad, New York, referred briefly to the Norfolk & Western electrification, the first split-phase locomotive of which had just been tested at Pittsburgh. The electrified section will be ready for experimental runs in the autumn and will be completed in the early winter of 1914. With steam operation it is customary to use three Mallet engines, consisting of a head engine, helper and pusher. This combination will be replaced by a front and a rear electric locomotive. Each locomotive is a double unit weighing 150 tons, of which 110 tons is carried on the drivers. The locomotives are carried on six driving wheels with a pair of trailing wheels at each end. Guiding wheels are used because the curvature amounts to fully 42 per cent of the total trackage. The maximum drawbar pull of a half locomotive is 48,000 lb. during acceleration and 38,000 lb. during running. The maximum tractive effort of 62,500 lb. is equivalent to a drawbar pull of 100,000 lb. at the head of the train during acceleration, or five times the figure admissible on the Swiss Railways. Single-phase energy at 44,000 volts will be transmitted to the 11,000-volt contact line from a power house containing 9000-kw single-phase generators. On the locomotives a phase converter and transformer are employed to transform the current for use in three-phase traction motors.

The Pennsylvania Railroad is co-operating with the Westinghouse Electric & Manufacturing Company and the New York, New Haven & Hartford in adapting the mercury rectifier to locomotives. The Pennsylvania Railroad has loaned the Westinghouse company a standard steel car which is equipped with four 225-hp motors. A mercury rectifier and transformer have been placed in the baggage compartment for the experimental service. After very promising trials at Pittsburgh for some months, the car is now in experimental service on one of the lines of the New Haven company.

In concluding his remarks Mr. Gibbs expressed his disapproval of the tendency of electrical manufacturing companies to identify themselves exclusively with some one system of electrification. He complimented the manufacturers highly on the splendid work they have done in developing the apparatus, but felt that only the user and his consulting engineer can make a decision which will be free from commercial bias. He claimed that the tactics of an engineer-salesman should not be presented in the guise of engineering advice.

Mr. A. H. Armstrong, engineer railway department of the General Electric Company, did not agree with Mr. Gibbs that the engineer of a manufacturer is prejudiced as to systems of electrification. In fact, he said, such an engineer is likely to lean backward in his desire to avoid such a charge. As an example of satisfactory consulting engineering work by manufacturers he mentioned the 2400-volt direct-current electrification of the Butte, Anaconda & Pacific Railway, on which loads of 4000 tons are being hauled.

Mr. W. S. Murray, consulting engineer New York, New Haven & Hartford Railroad, described briefly the 22,000-volt balanced redistribution system which had been installed on the New Haven Railroad to eliminate electromagnetic effects on adjacent telephone and telegraph lines. The function of the new distribution system is to break up the cause of the disturbing lines of force. Mr. Murray stated that on the day that the system was changed over he stood in the Cos Cob power house at a telephone receiver connected to the Harlem River yards at New York, 25 miles away. With the original system in use he could not hear distinctly. After the 22,000-volt system had been substituted he could distinguish no difference in the clearness of the telephone transmission during a period of four hours while the load was varying from zero to 23,000 kva. Under the new system 11,000 volts are carried in each wire, but the total difference of potential between the two sides of the circuit is 22,000 volts. The rails act as if they formed the neutral conductor of a three-wire system. Auto transformers are used to transfer the return current from the rail to an aerial circuit connected with the power house.

Mr. N. W. Storer, Westinghouse Electric & Manufacturing Company, described the articulated double-truck locomotives of the Norfolk & Western Railway with the aid of a series of slides. In this locomotive use is made of the parallel-rod drive common to steam locomotives, the transmission from each pair of motors being obtained through one jackshaft. The first locomotive has been on the test track at Pittsburgh for six weeks, and the entire system has operated perfectly. All the weight is spring-supported to the same extent as in steam locomotives. The electrical characteristics of the locomotives are, of course, the same as those of a straight three-phase machine. The Norfolk & Western type was designed for the fixed speeds of 14 and 28 miles per hour. Originally cascade motors were provided to give the additional speed of 7 miles per hour, but the railway requested that this be omitted as too low for service.

The phase-converter itself is an induction motor with a squirrel-cage winding driven by single-phase current from the transformer, the other phases being obtained by automatically shifting taps of a transformer on the principle of the Scott two-phase, three-phase method. This type of machine is particularly desirable for heavy freight service, because it gives the same speeds on down-grades and up-grades. The one-hour rating of each locomotive is 1650 hp at 14 miles per hour and 2000 hp at 28 miles per hour.

A feature of the motor construction is that the stator and armature can be lifted bodily from the machine and that the armature bearings are carried in the side frames of the locomotives. The motor is of the standard induction type, the rotor having three collector rings on each end. The winding is as solid as an induction motor winding can be. The phase converter is provided with a starting motor to bring it up to speed. The phase converter also drives the fan motors and the compressor. The changes from the eight-pole to the four-pole combination are made by means of a commutating switch operated by compressed air.

Public Utility Regulation Discussed by Western Society of Engineers

Three papers relating to public utility regulation were read and discussed at the meeting of the Western Society of Engineers of Chicago on March 16. The meeting was held to discuss further the subject of reasonable charges for public utility service, which was the theme of an instructive paper read by Dean M. E. Cooley of the University of Michigan at the annual meeting of the society and summarized in the *Electrical World* of Feb. 14 last, page 356.

The first paper was read by Mr. Andrew Cooke, who considered public utility regulation from the investor's point of view.

Mr. Samuel O. Dunn, editor of the *Railway Age Gazette*, read a logical and clearly presented paper on public utility valuation from the railway point of view. The speaker argued vigorously for a fair allowance for going value and concluded by saying that he felt very confident that when the government valuation of the railways of the United States is made it will result in an advance in rates rather than in a reduction.

Mr. Harold Almert, a consulting engineer, was the third speaker. He discussed public utility regulation from the points of view of the public and the engineer.

Mr. John W. Alvord, past-president of the society, was called upon to open the discussion. He remarked that about a billion dollars' worth of property will be appraised annually in the next five to eight years. The fundamental principles of appraisal work rest in the law and in such questions as the definitions of property, value, etc. In this work the law should be regarded as the foundation, engineering judgment as the superstructure, and the work of the economist and business man as giving the finishing touches to the edifice.

Mr. William B. Jackson, consulting engineer, said that what the utility earns is not so important to the citizen as what it does with its earnings after it has earned them.

Mr. James E. Quan, chairman of the State Public Utilities Commission of Illinois, was called on, but retired in favor of Mr. Walter A. Shaw, the engineering member of the commission. Mr. Shaw spoke briefly, assuring his hearers that the Illinois commission would give the utilities a fair compensation on a fair valuation.

Mr. L. E. Cooley, consulting engineer and brother of Dean Cooley, said that if he had his way the utility would be financed with only one security. This one security would bear only a minimum rate of interest until the utility was a going concern, and other issues of the security would be put out during the early years to cover possible losses. When the utility was on its feet and a prosperous, going concern, the security would then have a fair return allowed to it, all over that to be turned into a surplus fund to provide for amortization or improvement to the property.

Mr. A. C. King, deputy commissioner of gas and electricity of Chicago, spoke briefly, and was followed by Prof. Morgan Brooks, of the University of Illinois, who dwelt particularly on quality of service rather than reduction of rates. Mr. Onward Bates, a past-president of the society, contributed a written discussion.

To Urge Electric Vehicles for Parcel-Post Service

To encourage the general use of electric vehicles in parcel-post delivery service the Electric Vehicle Association of America, co-operating with the National Electric Light Association, has undertaken a comprehensive campaign of education on electric delivery topics and in this effort is enlisting the interest and assistance of the post office authorities at Washington, members of Congress, central-station executives, manufacturers and local postmasters.

The inauguration of the parcel-post service, together with its later extensions, has made necessary at short notice extensive local delivery equipment. In two cities, New York and Indianapolis, Ind., the local contractors have had electric trucks in use, and the records of these vehicles (as reported in the *Electrical World* of Jan. 10 and 17) have been so satisfactory, from the viewpoints of economy, reliability and general performance, that the widest interest has been aroused in the "electric" as the logical means of conveyance for parcel-post delivery in other cities.

The present campaign of the Electric Vehicle Association has been placed by President F. W. Smith in charge of a special committee on parcel-post delivery, comprising Mr. James H. McGraw, chairman, president of the McGraw Publishing Company, New York; Mr. C. A. Terry, vice-president Westinghouse Electric & Manufacturing Company, New York; Mr. E. S. Marlow, manager commercial department Potomac Electric Power Company, Washington, D. C.; Mr. W. P. Kennedy, consulting transportation engineer, New York; Mr. S. G. Thompson, Public Service Electric Company, Newark, N. J., and Mr. O. H. Caldwell, *Electrical World*, New York.

To co-operate with the above committee on behalf of the National Electric Light Association, President J. B. McCall, Philadelphia, Pa., has appointed Mr. Frank W. Frueauff, president of the Denver Gas & Electric Company, chairman of a committee the other members of which are Messrs. C. L. Edgar, president Edison Electric Illuminating Company, Boston, Mass.; Arthur Williams, general inspector New York Edison Company, New York; L. A. Ferguson, vice-president Commonwealth Edison Company, Chicago, Ill.; J. A. Britton, vice-president Pacific Gas & Electric Company, San

Francisco, Cal.; W. W. Freeman, general manager Union Gas & Electric Company, Cincinnati, Ohio; Frank M. Tait, president Dayton Power & Light Company, Dayton, Ohio; T. W. Peters, commercial manager Columbus Power Company, Columbus, Ga., and T. I. Jones, general sales agent Edison Electric Illuminating Company, Brooklyn, N. Y.

That the case of the electric vehicle in parcel-post service may be adequately presented, the joint committee has just issued a sixteen-page pamphlet "The Electric Vehicle in Parcel-Post Service for Economy and Reliability," which is illustrated with a number of pictures showing fleets of electric cars used by government departments, city department stores and express companies. The text of the booklet is taken up with a statement of some of the problems of parcel-post delivery, brief sketches of the co-operating associations, the E. V. A. and the N. E. L. A., and an enumeration of the advantages of the electric vehicle for the service required.

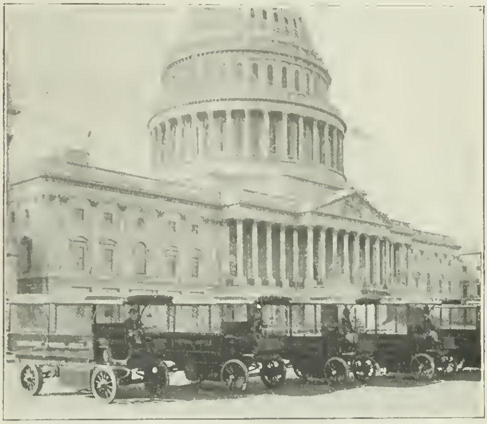
One of the purposes of the booklet is to make known the many and particularly interesting reasons, not yet fully appreciated, why the electric vehicle has superior advantages over any other type for transportation within the limitations of city and suburban service, as distinguished from either long-distance service or rural delivery. The electric machine, it is pointed out, has been evolved under the most rigorous and exacting service during the past fifteen years. As a successful device in quantity installations for commercial purposes it has commanded the indorsement and the investment of the merchant community to a greater extent than any other kind of motor vehicle.

Many millions of dollars have already been invested in electric commercial cars by the most conservative business organizations in the country, including express companies and others to whom reliability of transportation equipment is of vital importance. No corresponding collective investments have ever been made in any other type of commercial motor vehicle.

Wherever they have been installed within the field of their rational application electric trucks have not only remained but by reason of their economy have forced increase in their number. For some years they have been successfully employed in considerable numbers by many government departments, including the Navy Department, Treasury Department, Government Printing Office, the Insular Bureau and by some contractors in the service of the Post Office Department.

An approximation of the value of some of these large investments is as follows: Express and transfer companies, $3,010,000.00; public-service companies, $3,671,000.00; department stores, $5,627,000.00; packing-house organizations, $609,000.00; brewers, $5,350,000.00; wholesale merchants and manufacturers, $2,088,000.0; United States government service, $435,000.00.

Were electric-vehicle installations established in various cities of the country the Post Office Department would be assured that the local public-service electricity supply companies would exert a particular fostering influence to insure the successful, uninterrupted and economic service of these installations whether they are owned and operated by contractors or owned and operated by the department. Should the policy of department ownership be determined upon, this local co-operation would be the greatest possible insurance which the department could have against risk, while if the continuation of the existing contract method should be decided upon the co-operative efforts of the sister associations would be of particular value in furthering plans by which the contractors could secure and successfully employ electric equipment.


ELECTRIC TRUCKS OF THE GOVERNMENT PRINTING OFFICE, WASHINGTON

In Europe there are still some few survivals of the numerous forms of motor-bicycles, etc., but the more conservative governments are now inclined to employ the electric vehicle on account of its economic advantages, notwithstanding the fact that in Europe the "electric" has been only partially developed, compared with the status of the industry in this country.

Electric vehicles have superseded gasoline machines in Vienna, where forty-five 2.5-ton machines have been placed in service after fifteen months' test covering 312,500 car-miles. Electric vehicles are also used in considerable numbers for postal service in Berlin, Munich and Leipzig, and while gasoline machines are used in these latter cities, and also in Paris, Rome and Budapest, the electric is under observation for its economic advantages. Great Britain has 170 motor-vehicle mail-service contracts, nearly all of which are for long-distance transportation. The booklet closes with data showing the comparative economy of the New York and Indianapolis installations of parcel-post trucks.

FLEET OF ELECTRIC TRUCKS, AMERICAN EXPRESS COMPANY, NEW YORK

(See the *Electrical World* for Jan. 10 and 17, 1914.) Copies of the pamphlet are being sent to officials of the Post Office Department at Washington and to members of the Senate and House of Representatives. Other copies are being forwarded to central-station executives in towns of over 5000 population, with the request that they bring the topic to the attention of both their congressmen and their local postmasters. Postmasters in cities of 10,000 and over will also receive the pamphlets.

Characteristics of Saturated and Unsaturated Vehicle Motors

At the meeting of the Electric Vehicle Association of America at New York, March 24, Mr. T. H. Schoepf, of the Westinghouse Electric & Manufacturing Company, presented a paper on "The Performance Characteristics of Electric Motors and Their Influence on the Operation of Electric Trucks."

TABLE I—TRUCK WITH SATURATED MOTOR

Length of Run in Miles	Time in Seconds		Average Speed, M.P.H.	Average Amperes	Amp-Hours	Watt-Hours	Watt-Hours per Ton-Mile	$\sqrt{\text{Mean Amp.}^2}$
	Power On	Total						
⅙	64.4	84.5	7.09	57.0	1.02	81.6	103.2	59.5
¼	102.5	122.9	7.31	55.6	1.58	126.8	106.5	58.0
⅓	139.7	160.0	7.5	55.0	2.13	170.4	107.9	56.1
½	215.0	235.7	7.65	54.9	3.23	258.2	108.9	56.0

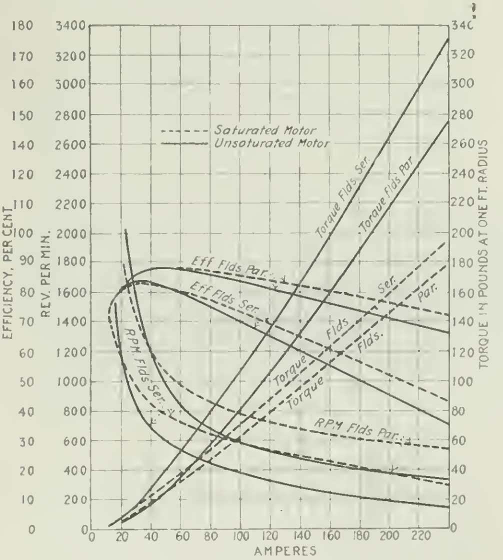


FIG. 1—CHARACTERISTICS OF TWO TYPES OF EQUAL-RATED VEHICLE MOTORS

His paper dealt with magnetically saturated and unsaturated motors, pointing out briefly the extent to which these magnetic qualities should be developed. The maximum torque ratio which can be obtained theoretically from a normal series or unsaturated motor is 6.25, but such a motor is impracticable as it would be very large and heavy and would be expensive per rated horse-power.

Where high speeds are desired at normal loads even with an increased current input and with a sacrifice of the ultimate car-miles obtainable per battery charge, a saturated motor should be employed. If the main object is to secure a large number of car-miles per battery charge even though the speed drops excessively at normal overloads, an unsaturated motor is preferable.

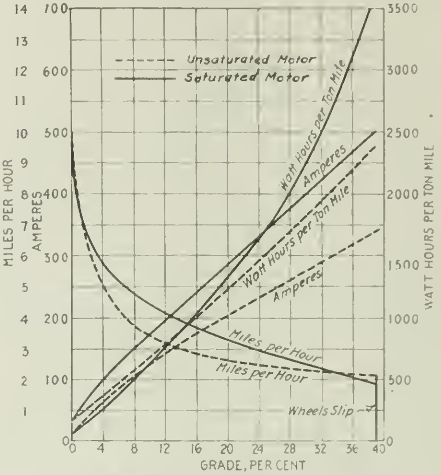


FIG. 2—PERFORMANCE OF TRUCKS EQUIPPED WITH SATURATED AND UNSATURATED MOTORS ON GRADE

The characteristic curves shown herewith are obtained with 80-volt, 40-amp, 1200-r.p.m. motors, the saturated type having torque and speed ratios of 3.0 and 0.65 respectively, while the unsaturated motor had ratios of 4.9 and 0.47. The truck assumed in these computations weighed 9500 lb. loaded and had wheel diameters of 36 in. and a total speed reduction of 14.3 to 1. Sixty-five per cent of the truck weight was assumed to be on the driving wheels, and 62 per cent was chosen as the coefficient of adhesion.

TABLE II—TRUCK WITH UNSATURATED MOTOR

Length of Run in Miles	Time in Seconds		Average Speed, M.P.H.	Average Amperes	Amp-Hours	Watt-Hours	Watt-Hours per Ton-Mile	$\sqrt{\text{Mean Amp}^2}$
	Power On	Total						
⅙	70.9	77.2	6.88	53.1	1.05	83.6	105.8	54.0
¼	110.8	127.7	7.06	51.2	1.57	126.0	106.0	53.4
⅓	149.0	165.8	7.25	50.8	2.10	168.2	106.3	53.0
½	227.8	244.5	7.36	50.5	3.20	256.0	107.8	52.5

In the discussion the following took part: Messrs. D. A. Baldwin, General Electric Company; R. McA. Lloyd, International Motors Company; E. W. M. Bailey, S. R. Bailey & Company, Inc.; P. D. Wagoner; F. S. Dellenbaugh, Westinghouse Electric & Manufacturing Company; H. H. Smith, Edison Laboratories; H. E. Pratt, Gould Storage Battery Company; Artemus Ward, New York; R. L. Lloyd, Philadelphia; J. F. Becker, New York, and others. A general opinion was expressed that saturated motors are preferable for passenger vehicles, and unsaturated motors for commercial vehicles as they are more foolproof. It was urged that an effort be made by the association to establish the term "passenger car" instead of pleasure vehicle.

Municipal Ownership and Holding Companies

At the West Side Branch of the Young Men's Christian Association in New York on March 23 an explanation of the disadvantages of municipal ownership of public utilities was given by Mr. Arthur Williams, of the New York Edison Company. The speaker was introduced by Mr. A. W. Burchard, who discussed briefly the relations between the various lines in which Mr. Williams has been prominent.

Municipal ownership was shown to be impracticable because it has not been a success in foreign countries and because it has not so far achieved the same record in this country as the privately owned plant. Mr. Williams divided utilities into two main classes, the first embracing such services as street cleaning and the maintenance of parks, buildings, sewers, police and fire departments, while the second includes railroads, electric service, gas, street-railway and also possibly water service. He said that the first group lends itself easily to municipal ownership and operation, although cases of private ownership of such utilities are not uncommon. The second group, he thinks, cannot be operated by the government, because the required talent for efficient operation cannot be obtained at government salaries and under the conditions of frequent change that characterize government in this country. Civil-service organizations are thought by Mr. Williams to form a serious menace to municipally operated enterprises, since they can tie up service by united action.

A number of instances were cited by Mr. Williams of the failure of municipally owned utilities at home and abroad, and in each case an analysis was made of the reasons back of the failure. In conclusion he stated that the public service commission offers a remedy for defects in private ownership and operation.

Holding Companies

At a lecture on March 16 Mr. Francis T. Homer, of Bertron, Griscom & Company, presented an interesting paper on the subject of public utility holding companies. This paper opened with a discussion of the several forms of holding companies, and the subject was limited so as to exclude consideration of such combinations in the manufacturing, commercial and railroad fields.

The main point which Mr. Homer sought to bring out in his talk was that the public utility holding company is fundamentally different from the holding company in any other line of industrial activity, in that public utility operations form a natural monopoly. While real competition in other lines has a tendency to result in lower prices to the public and an improvement of the service, he stated that competition in the public utility field tends to duplication of plant and a corresponding increase in the cost of the service.

The last part of Mr. Homer's address was given to an exposition of some of the advantages of the holding company in the public utility field. He thinks that the systematic tabulation and comparison of costs and receipts of the several subsidiary companies in such an organization works toward the most efficient and scientific operation of the same, and more than replaces the stimulating effect of local competition. From the engineering standpoint, he claims that advances can be made by the combining of resources of a number of companies which could not be achieved by the same concerns working individually, and the advantages of standardization can be obtained to an extent that separate organizations could not hope to obtain them. Other advantages mentioned for the holding company were the possibility of a larger and better legal department, the obtaining of better results through the purchasing department by the securing of discounts and wholesale prices, and the financial advantages secured through the institution of uniform methods of accounting. Some but not all of these advantages, according to Mr. Homer, are possessed by the management company form of operation.

Testimony on Trust Legislation

Testimony is still being heard by the judiciary committee of the House of Representatives in regard to pending trust legislation.

Mr. James F. Jackson on Interlocking Directorates

Mr. James F. Jackson, of Boston, called attention to the way in which the proposed legislation on interlocking directorates would affect certain local state-regulated public utilities. He assumes that the principle is settled that such directorates are objectionable in cases where railroads, telephone companies, telegraph companies or other interstate corporations would realize therefrom a power that would interfere with competition. The public utilities discussed by Mr. Jackson are necessarily monopolies and subject to regulation.

Mr. Jackson argued that where a state regulates issues of stocks and bonds no danger can come to the public from the presence of a banker on the board of directors of the company. Mr. Jackson criticised the suggestion that the law should not apply to companies in communities of less than a certain figure in population or to companies having less than a certain amount of capital.

Mr. Frederick P. Fish Urges Commission Study

Mr. Frederick P. Fish, of Boston, said that he was firmly convinced that the patent system of the United States is the mainstay, and almost the only mainstay, against an innumerable number of influences which adversely affect industrial development and prosperity. He urged the committee to give full consideration to that question before injecting into the situation any attempt to modify the substance of the patent law. That requires special investigation.

In regard to the general legislation purpose, Mr. Fish declared that he could not help feeling that the committee should carefully consider whether at the present time there is, to anything like the extent there was ten years ago, the occasion for drastic measures.

The most serious element of the business situation to-day, Mr. Fish added, is the tendency toward extravagant and destructive competition. Business men have instinctively tried to meet this evil and in doing so have fallen, through want of adequate experience, into ways that were not consistent with the public interest. The good in the resulting Sherman law may be saved and its harmful tendencies eliminated.

Mr. Fish renewed the suggestion which he has made that the whole matter be studied thoroughly by a strong commission before further legislation is enacted. He thought that new legislation may be ill-advised and that it is not necessary. If anything is to be done, however, he would like to have the Sherman law amended so that it would mean clearly what the Supreme Court, as he understood, construes it as meaning, which is that no agreement in restraint of trade is unlawful and punishable unless it is to the detriment of the public. He believes that it is perfectly proper for retailers, wholesalers and manufacturers to have trade understandings provided they are not contrary to sound morals.

Other Matters Before the Committee

Mr. Horace Stern, attorney of Philadelphia, discussed the methods of the German government in dealing with combinations and presented numerous data on this subject. In referring to the various cartels he mentioned the sales office of the united manufacturers of electric lamps in Berlin, organized in 1903.

A letter from Mr. E. R. Stearns, of Cincinnati, Ohio, addressed to Mr. A. Lee Thurman, solicitor of the Department of Commerce, was incorporated in the record. Mr. Stearns said that, as a stockholder in the Cleveland Electric Illuminating Company, he would like to see its control taken out of the hands of a holding company.

The Electrical Merchants & Manufacturers' Association, through Mr. P. C. Burns, president, sent a letter to Representative Allen which was incorporated in the record. It called attention to a condition in restraint of trade "caused by telephone operating companies using their shops, warehouses, exchange managers and other employees for the sale of merchandise throughout the United States in direct competition with merchants and manufacturers not having any special privileges or franchises from the government, thereby destroying legitimate competition." The letter requested that a provision be incorporated in the law to stop this practice. The letter referred to the control of the Western Electric Company by the American Telephone & Telegraph Company. A somewhat similar request was made by Mr. Garrison Babcock, general manager the Telephone Improvement Company of Chicago.

Rates and Negotiations in California

The Southern California Edison Company has reduced its maximum rate for Los Angeles, Riverside, San Bernardino, Orange and Kern Counties from 8 to 7 cents per kw-hr. These rates do not apply in the city of Los Angeles, where lower rates exist.

The Southern California Edison Company has established, with the approval of the Railroad Commission of California, a new schedule of rates for electric light and power service in certain localities in the county of Los Angeles. For incandescent lighting the rate for the first 100 kw-hr. or less of energy furnished in any one month to any consumer is to be 5 cents per kw-hr. The rate decreases with the increase in consumption to 3 cents per kw-hr. for energy of over 2000 kw-hr. Free renewals of metallized-filament lamps and carbon-filament lamps are given.

For arc lighting the rate for the first 100 kw-hr. or less is 4.9 cents per kw-hr. The minimum rate is 4 cents per kw-hr. for more than 500 kw-hr. A minimum monthly charge of 60 cents per meter of 3 kw rating or less and 30 cents for each additional kilowatt of meter rating required shall be made for each meter.

For motor service the rate is 4 cents per kw-hr. for the first 100 kw-hr. It decreases to 1.2 cents per kw-hr. for over 3000 kw-hr. There is a monthly minimum charge of $1 for 1.5 kw equipment rating or less and 75 cents for each additional kilowatt required.

Messrs. John B. Miller, president of the Southern California Edison Company; William Baurhyte, vice-president of the Los Angeles Gas & Electric Corporation, and G. C. Ward, vice-president of the Pacific Light & Power Corporation, have joined in a letter to the City Council of Los Angeles, Cal., in regard to the plan of the city to lease the energy-distributing systems and assume independent possession. They say that their attorneys are unanimous in the opinion that the contract desired by the city would violate the covenants of the trust deeds securing outstanding bonds. In addition to this difficulty, the engineers for the companies say that there would be no way of keeping the property of the companies and the additions to be made by the city from inseparable entanglement.

The letter outlines a plan under which the companies are willing to enter into a contract providing for the use of their distributing systems for the distribution of such energy as the city may generate and for eventual sale to the city of the distributing systems within the city and adjoining territory.

Wisconsin Conference on Electrical Rules of Safety

Responding to an invitation from the Industrial Commission of Wisconsin, about thirty-five electrical men attended a conference held in the State Capitol at Madison, Wis., on March 13. The purpose of the hearing was the consideration of tentative rules, or orders, which the Industrial Commission of Wisconsin may promulgate better to insure the safety of men employed in electrical work or near electrical apparatus. These "Orders for Safety in Electricity," constituting the more important part of a proposed electrical code, have been prepared by a committee of seven men representing electrical manufacturers, central-station companies, contractors and working electricians. The committee has given several months of careful study to the preparation of the tentative "orders." It is said that Wisconsin is the first state to have any electrical code in preparation.

Mr. C. H. Crownhart, chairman of the commission, called the meeting to order. He explained the course of procedure which is followed by the commission. The electrical rules have been formulated in their present tentative shape, he said, by a committee of experts. When they are finally adopted and promulgated by the commission they will have the force and effect of law. In the meantime the freest criticism and discussion are invited. Mr. Crownhart requested Mr. P. A. Schroeder, as chairman of the electrical committee, to preside at the hearing. The proposed orders are numbered from 600 to 629, inclusive. They were taken up section by section and read by Mr. Price, the secretary of the committee.

The proposed rules had to do chiefly with overhead-line construction and with provisions of safety within and without generating stations. Telephone and telegraph men complained of the lack of consideration given to both these branches of the electrical industry in the formulation of the rules, and provision was made to give adequate hearing to their grievances. Considerable discussion arose over the question of what was and what was not a dangerous voltage, the committee having set the limit of safe voltage at 300 volts. Those taking part in the discussion were Messrs. William Bennett, superintendent of telegraphs of the Chicago & Northwestern Railway Company; H. E. Bloomer, inspector for the Milwaukee Board of Fire Underwriters; R. S. Hartley, of Superior; E. J. Hutchins, division plant engineer Western Union Telegraph Company, of Chicago; C. M. Jansky, of the University of Wisconsin; E. H. Kifer, of the Madison Gas & Electric Company; L. H. Lathrop, of the Menominee & Marinette Light & Traction Company; M. G. Lloyd, of the *Electrical Review and Western Electrician;* C. R. Phenicie, of the Wisconsin Public Service Company; H. O. Seymour, of the Wisconsin Telephone Company, and W. L. Smith, president of the Wisconsin Telephone Association. Messrs. C. H. Crownhart and J. D. Beck, members of the industrial committee; J. N. Cadby and P. B. Turner, of the Wisconsin Railroad Commission, and T. E. Barnum, S. B. Way, W. F. Gute and C. W. Price, members of the committee which drew up the tentative orders, also participated in the discussion upon the proposed rules.

Joint Engineering Meeting in Milwaukee

The second joint meeting of technical societies of Wisconsin held in Juneau Hall of the Auditorium Building, Milwaukee, on March 21, was a successful affair. Sixteen societies, or sections of national societies, participated, including the Milwaukee and Madison Sections of the American Institute of Electrical Engineers, the Milwaukee Section of the American Electric Railway Association, the Milwaukee and Madison Sections of the American Society of Mechanical Engineers, the Chicago Section of the Illuminating Engineering Society, the Milwaukee Electrical League, Wisconsin Jovians and members of general engineering societies, as well as chemists, architects and gas engineers. Mr. Lewis E. Bogen, chairman of the Milwaukee Section of the American Institute of Electrical Engineers, presided. The other members of the program committee were Messrs. Francis A. Vaughn and Arthur Simon. The attendance was perhaps 300 or 350.

The first paper was by Mr. Alfred O. Crozier and was on "Cement and Clay Products Contrasted." This was a plea for wet-process cement products as contrasted with clay products. Mr. Bogen spoke of the remarkable extension of the use of concrete in power-house design and also in the construction of switchboards, oil-switch compartments and the like.

Significance of Wisconsin Public Service Commission Law

Prof. R. C. Disque, of the University of Wisconsin, read a scholarly paper entitled "The Historical Significance of the 1907 Wisconsin Law for the Regulation of Public Utilities." The author said that the law establishing the present commission system of the regulation of public utilities in Wisconsin has so far reasonably met the hopes of its sponsors and has been copied by similar laws in half of the states of the Union.

The law treats the problem as a two-sided regulation—that is, regulation which was to be for the benefit of all concerned. Valuation was required in the Wisconsin law. Two new ideas were introduced in this law—the abolition of the term "franchise" and the prohibition of the establishment of a second utility where a good one already exists. The Wisconsin law provides machinery for recognizing and enforcing the common-law rights of utilities. It is radical in the sense of going to the root of the matter rather than being any step outside of the evolution of regulatory doctrine and practice.

Among those taking part in the discussion were Prof. John G. D. Mack, University of Wisconsin; Prof. Edward Bennett, University of Wisconsin; Mr. John N. Cadby and others connected with the staff of the Railroad Commission of Wisconsin; Dr. M. G. Lloyd, chairman of the Chicago Section of the Illuminating Engineering Society; Mr. Ewald Haase, president of the Wisconsin Gas Association, and Mr. W. B. Voth, superintendent of the Sheboygan Railway & Electric Company.

Gas Measurements and Panama Canal Switchboard

Mr. J. C. Wilson, of Milwaukee, gave an illustrated talk on "The Measurement of Gases in Large Quantities." One feature was a brief description of the Thomas electrical method of measuring gas, which involves the introduction of electric heat into the gas pipe and electric measurements to determine the temperature of the gas before and after heating. Luncheon was taken at the Republican House, and Mr. A. A. Gray, of Chicago, gave a talk at that time. The first feature of the afternoon session was a motion picture illustrating the electrical control of the Panama Canal locks. These pictures were taken, apparently, in the General Electric works at Schenectady before the apparatus was shipped to the Canal Zone.

Street Lighting and Illumination

An illustrated paper on "Principles of Street Lighting," prepared by Messrs. Arthur J. Sweet and Francis A. Vaughn, Milwaukee, was presented by Mr. Sweet. The authors discussed the silhouette, direct-illumination, glint and shadow effects of street lighting. Of these the direct-illumination effect, throwing the light on the object, is the most important. Much was said in the paper about uniform illumination in street lighting, and the authors declared that the spacing between street-lighting units should be not more than four times the mounting height.

Mr. John Hayes Smith, of Milwaukee, read a paper entitled "Principles of Illumination." The author said that illuminating engineers do not take sufficient cognizance of the physiology of the eye. He criticised low-hanging street lamps.

Iron Manufacture and Machine Tools

Mr. G. F. Ahlbrandt gave an illustrated description of the manufacture of pure-iron products. In the plant illustrated electric traveling cranes, electric charging machines and lifting magnets were shown. The speaker said that the corrosion of iron is an electrolytic process. Pure iron is used, among other things, for transformer tanks. Mr. Wood, of the Lodge & Shipley Machine Tool Company of Cincinnati, gave an illustrated talk on "Special Operations on Machine Tools."

Recent Power-Plant Developments

Prof. A. G. Christie, of the University of Wisconsin, presented an illustrated lecture on "Developments in American Power-Plant Machinery." In the boiler room, he said, efficiency lies not in the boiler itself, but in the setting, the draft and the furnace construction. Professor Christie thinks that boilers have been set too low down. He referred briefly to water softeners and said that he thought they should receive more consideration than has been given to them by designing engineers. In relation to pumps, he asked if it might not be possible to use sheet-metal valves in them. Considerable attention was paid to steam-turbine practice. The combined Curtis-Rateau construction used in large units abroad was mentioned and also the characteristics of the Parsons type. The speaker said that non-condensing steam turbines are coming in the larger sizes. The vertical Curtis turbines will gradually disappear, he thinks. Blade failures in steam turbines are generally to be accounted for by increased speeds.

Professor Christie gave some consideration to the barometric type of condenser and described briefly the new Allis-Chalmers jet condenser, the La Blanc condenser, and also improvements in surface condensers, air pumps, etc., including foreign rotary air pumps. The Lentz steam engine and the new uniflow type of engine were mentioned, and the speaker devoted considerable time to the locomobile, or Buckeyemobile, as this type of combined boiler and engine is called by one American manufacturer.

The concluding portion of the author's paper related to the mercury boiler and turbine proposed by Mr. W. L. R. Emmet, of the General Electric Company. The idea here is to utilize temperatures impossible with steam boilers and turbines. One difficulty is in confining the mercury vapor, which is very elusive. The apparatus so far set up for carrying out this idea is tentative, but the whole investigation is very interesting. The mercury vapor is condensed, and the type of condenser proposed was also briefly described by Professor Christie. In the evening Dr. Herbert N. McCoy, of the University of Chicago, gave an illustrated lecture on radium.

Radio-Telegraph Patents Litigation

The decision of the United States District Court for the Eastern District of New York in the recent patent suits brought by the Marconi interests against the National Electric Signaling Company, of Pittsburgh, has aroused much interest in radio-engineering circles. In a lengthy and carefully written opinion dated March 17,1914, Judge Van Vechten Veeder finds the defendant guilty of infringement of Lodge's United States patent No. 609,154 and Marconi's No. 763,772, and holds Marconi's original patent No. 586,193 (the re-issue, No. 11,913, being in suit) valid but not infringed. The daily press throughout the country has stated repeatedly that the effect of this decision is to give the Marconi Wireless Telegraph Company of America a comprehensive monopoly of radio-telegraphy in the United States. Government officials and others who are possessed of full information in the matter do not, however, appear to hold so sweeping a view of the immediate result, especially since appeals to the higher court are being prepared on both of the later patents.

The conclusion of litigation, or at least of the second step in litigation of the original Marconi patent, marks a definition of scope of claims which is of great importance to all workers in radio signaling. This patent, re-issued as No. 11,913 (original filed Dec. 7, 1896, and issued July 13, 1897), was the basis of a suit against the De Forest Wireless Telegraph Company, and in 1905 was sustained as to Claims 3 and 5, though Claim 1 was invalidated. In the present case Claim 3 only was pressed, and this reads as follows:

"3. The combination, in an apparatus for communicating electrical signals, of a spark producer at the transmitting station, an earth connection to one end of the spark producer, an insulated conductor connected to the other end, an imperfect electrical contact at the receiving station, an earth connection to one end of the contact, an insulated conductor connected to the other end and a circuit through the contact, substantially as and for the purpose described."

Experts for the Marconi company construed this claim very broadly, urging that the patent disclosed the first use of a grounded antenna system for radio-telegraphy and that it therefore should be held to cover all uses of such ground-and-aerial-wire circuits. It is understood that the National company based its position of non-infringement upon the limiting clauses of the claim as to a "spark-producer with one end connected to earth" and an "imperfect contact . . . as described."

Judge Veeder accepted the defendant's views of this matter and says in his opinion:

"I find that the evidence establishes Marconi's claim that he was 'the first to discover and use any practical means for effective telegraphic transmission and intelligible reception of signals produced by artificially formed Hertz oscillations.' . . . Marconi accomplished his result by combining, in the utilization of known principles, features which had been disclosed by others, which he improved and co-ordinated, with additional features of his own invention. . . .

"With respect to infringement, it appears that the defendant's transmitting station is inductively connected with an oscillating path from antenna to ground. . . . At the receiving station the antenna is permanently connected in a closed circuit to ground. . . . The local oscillation circuit comprises one coil of the transformer, a condenser and either an electrolytic or a crystal detector. . . .

"In the defendant's device the spark-gap and detector are not in the antenna at all. . . . When the complainant's expert Waterman was asked which one of the ends of the detector . . . was connected to ground, he admitted that he would have to say that it was not connected with the ground at all. . . Marconi's claim was, not for a grounded connection in general, but for a particular connection, which the defendant does not use.

"It seems equally plain to me that the defendant's electrolytic and crystal detectors do not infringe the complainant's imperfect contact device or coherer. . . . The defendant's detectors do not operate in the same manner as the Marconi coherer. . . .

"Giving the claim in issue, therefore, the broadest construction to which it can possibly be entitled, it seems clear to me that it is not infringed by the defendant. Accordingly I find that the claim, although valid, is not infringed."

Thus the court has so restricted the patent's scope that the possibility of a broad monopoly including all uses of grounded antennas for radio signaling has been set aside. Although no statement has been made by the complainant company to this effect, it is believed that Judge Veeder's decision on the re-issue patent will not be appealed. It may be noted that the patent will expire on July 13, 1914.

The second patent in suit was issued to Sir Oliver Lodge Aug. 18, 1898, on application filed Feb. 1, 1898, and had not been the basis of any litigation prior to this suit. In fact, it was not the property of the Marconi company until a short time before the present action was brought. During this suit the complainant contended that Lodge was the first to appreciate and apply the useful action of a lumped self-inductance connected between capacity areas in a radiator or absorber for radio-telegraphy. One of the capacity areas might be the ground-surface and the other the usual antenna system. The defendant company was shown to use antenna loading coils in both sender and receiver, or their equivalents in oscillation-transformer coils, so that it is inferred there could be no disagreement as to infringement if the patent were held valid and construed broadly.

The claims in issue were Nos. 1, 2 and 5, the last reading:

"5. In a system of Hertzian-wave telegraphy, the combination, with a pair of capacity areas, of a variably-acting self-inductance coil, serving to syntonize such a radiator or resonator, whereby signaling may be effected between any two or more correspondingly attuned stations without disturbing other differently attuned stations." Claims 1 and 2 call for an inductance coil in a radiator or absorber, so constituting the system one of definite electrical pitch.

The defense urged that the laws of the effect of inductance in reducing the damping of an electrical oscillating system were well known at the time of Lodge's application, and that to utilize this principle in open circuits for radio-telegraphy was not invention. In addition, the earlier work of Tesla, Hertz and Lodge himself was stated to be an anticipation.

Judge Veeder took the position that all the prior work and knowledge related only to the use of self-inductance coils in closed oscillatory circuits, and that Lodge's patented use in open circuits was entirely new to the art. In his opinion he goes on to say:

"In Lodge's experiments with his syntonic Leyden jars, in Hertz's adjustment of his ring resonator, and in all the other references relied upon by the defendant, self-induction coils had been used only in closed circuits. Such use contained no instruction upon the effect of a coil in an open radiating circuit. One might as well attempt to study articulation by observing the sign language of deaf-mutes.

"He [Lodge] was the first to realize that if he could get a long train of waves he could afford to diminish the effect of the first few of them, the desired result being secured by cumulative effect. . . .

"It seems plain to me, therefore, that the patent in issue is valid, and that the subject matter was not disclosed by the prior art. . . .

"That the claims in issue read upon the defendant's structure admits of no doubt. Both its sending and receiving stations comprise an elevated conductor, acting as one capacity area, and the earth connection as the other, with a variable inductance coil between them for purposes of syntony."

In his discussion of the Lodge patent Judge Veeder does not refer specifically to the work of Tesla, though in other parts of his opinion he shows that he has considered this to fall within the divisions of telegraphy by induction or conduction, therefore not to be pertinent to radio-communication. As to the defense of laches, or undue delay in bringing suit, which was argued, the court says: "The fact that laches is not set up in the answer as a defense to this patent relieves me of the necessity of considering it."

Among engineers in the technical field of radio-transmission Judge Veeder's decision is causing much conflicting comment, most of it centering upon the distinction which is apparently drawn between application of a physical law to circuits which are of different construction but electrically similar. Attorneys for the defense state that the case will be taken to the Court of Appeals.

The remaining patent in issue was granted to Marconi June 28, 1904, on application filed Nov. 10, 1900, and is for the so-called "four-circuit tuning" of radiotelegraphy. The corresponding British patent (No. 7777 of 1900) was sustained in 1911 by Mr. Justice Parker in an action brought by the English Marconi company. In the present case the complainant charges infringement of fifteen claims, which were urged as covering the combination of a closed reservoir circuit with a similarly tuned open radiating circuit at a transmitter, or of an open absorbing circuit with a similarly tuned closed conserving circuit at a receiver, or of the four above-named circuits all tuned to the same period (or to multiples of each other). Claim 10 is typical of the broadest combination and may be quoted:

"10. A system of wireless telegraphy, in which the transmitting station and the receiving station each contain an oscillation transformer, one circuit of which is an open circuit and the other a closed circuit, the two circuits at each station being in electrical resonance with each other and in electrical resonance with the circuits at the other station, substantially as described."

The main defense seems to have been invalidity of the patent when interpreted so broadly as urged by the complainant. Early work of Lodge, Tesla, Pupin, Thompson, Marconi, Ducretet, Fessenden and others was cited as anticipating the alleged broad invention. Double-wave-length and coupling effects were also presented, as were proofs intended to show the patent to have been unlawfully broadened by introduction of new matter between dates of filing and issue. The court, however, finds no completed anticipation and believes the other contentions not proved. The references which had been considered (by radio-engineers generally) the strongest supports for an attack against this patent were those on the work of Fessenden and Tesla. As to the first of these, Judge Veeder says, in part:

"It is claimed that the application filed by Fessenden on Dec. 15, 1899, for his patents Nos. 706,735 and 706,736 discloses not only two circuits tuned together at the transmitting and at the receiving stations, but four-circuit tuning as well. But neither the specification nor the claims contain a word about tuning. . . . In response [to the Patent Office] to this invitation to disclose any peculiar function of the condensers or their connections, Fessenden, without any reference to the function performed by the condenser in shunt to the spark-gap at the transmitting station, stated that the purpose of the condenser at the receiving station was to reduce the current in the receiving wire without reducing the current in the coil or coils 7, so that the resistance drop is eliminated. . . . Fessenden stated, not that the purpose of this condenser at the receiving station was for tuning, but that it was for the purpose of 'obtaining as large a current as possible in the field coil 7, as this increase in current will give greater torque to the ring 8.'"

These very statements had been argued by complainant to show that Fessenden had a knowledge of tuning and its effects, since such current increases as referred to could be made only by tuning. Judge Veeder does not accept this point of view, however.

With regard to Tesla the opinion states:

"Tesla's patents . . . relate to a later conception, in which he abandoned the idea of electrostatic induction and proposed to produce direct conduction in the upper strata of the atmosphere. . . . Tesla's conception seems to be entirely remote from the subject matter in issue."

As to the equivalence of the "Tesla coil" and the oscillation transformer used in present-day instruments, Judge Veeder goes on to say:

"The Tesla coil was one having a coarse wire and a fine wire winding, and it was subject to a species of adjustment whereby the length of the fine wire winding or the size of the condenser was such as to give maximum potentials at the terminal. It was not pretended that the 'resonance' referred to in this connection was true resonance. . . . Dr. Kennelly introduced a composite sketch of what he understood Tesla's suggestions to be, as applied to wireless telegraphy. But Mr. Waterman shows that if the Tesla coil were used as depicted by Dr. Kennelly the circuit would be inoperative because the secondary would be unable to carry the energy imposed upon it and would burn out. If the coil were connected with an antenna and ground, the condition of resonance would be obliterated and the circuits into which the coil was incorporated would not be tuned circuits. . . .

"My conclusion is that the claims in issue are valid, not anticipated, and infringed."

The view of Tesla's work taken by Mr. Waterman and followed in the opinion of the court has caused a degree of astonishment in electrical fields generally, and Mr. Tesla has sent statements of protest to the daily press.

Broadly, the present decision arranges the work of Lodge and Marconi in three steps. Marconi first operated radio-telegraphy, but without any marked tuning or selecting powers on account of his rapidly damped oscillators and absorbers. Lodge then saw that persistence of oscillation was highly desirable, and, in compromising between powerful radiation and selectiveness (by the insertion of self-induction coils), sacrificed the whip-crack discharge previously sought for long distances to gain tuning. Finally, Marconi reconciled the two actions of powerful radiation and persistence due to conservation, by combining open circuits and closed ones.

The final effect of these decisions upon radio-telegraphy is not, of course, definable. It is understood that appeals or petitions for rehearing are being filed by the defendant company as to each of the two later patents, and at least until the points brought up in these are disposed of it is expected that the practice of radio signaling will remain in its present state in so far as these three patents are concerned.

Public Service Commission News

New Jersey Commission

The Board of Public Utility Commissioners has rendered a decision in the complaint of Michael Carroll and others of South Bound Brook against the Public Service Gas Company to order the extension of the company's system on Canal Street. The board refuses to order the extension unless the petitioners will guarantee the company an income sufficient to afford a return of 8 per cent on the investment involved.

Indiana Commission

An inventory of the property of the Indianapolis Light & Heat Company has been filed with the Public Service Commission of Indiana. The inventory was made by engineers under the direction of Mr. Wiley J. Huddle, of Sloan, Huddle, Fuestel & Freeman, Madison, Wis. The inventory was made by order of the commission, which is considering rates of the Indianapolis companies for light and heat. The commission expects to begin the consideration of the evidence within a short time and hearings on the valuation of the plants may be held. Whether the commission will make another inventory of the plants on its own initiative has not been made public.

A complete statement of the value of the property will be filed later, according to Mr. Charles C. Perry, president of the company.

New York Commissions

Deposits made by consumers with gas companies are the subject of a special inquiry conducted by the New York Public Service Commission, First District. The hearings will be held by Commissioner Milo R. Maltbie. The purpose is to determine whether the commission shall order companies to pay interest on deposits, to keep accurate accounts thereof, and to take other steps to protect depositors. The law requires companies to pay 6 per cent interest on such deposits, but there is no provision for annual payments, and it has been the practice of companies not to pay interest until consumers stop the service or change residence. Gas companies in the First District at the close of 1913 held $3,557,173 of such deposits, exclusive of accrued interest.

Wisconsin Commission

The Neshonoc Light & Power Company has been ordered to rehabilitate its system in accordance with certain plans suggested by the commission's engineers.

The Mineral Point Public Service Company has been authorized to issue $200,000 in 6 per cent bonds. The proceeds are to be used in paying off existing indebtedness, redeeming bonds, paying reorganization expenses and in making extensions and additions to the property. The company contemplates the extension of its high-tension transmission lines so as to reach certain mines in the vicinity of Mineral Point.

Illinois Commission

If Mr. Frank H. Funk, a member of the recently created State Public Utilities Commission of Illinois, has been correctly quoted in the Chicago daily newspapers, stocks that represent honest investment will be made safe by the new commission and honest investments will be so protected as to invite new capital into the public-utility field. Mr. Funk is credited with having said that the powers of the new commission will be exercised fearlessly with the end in view of establishing justice between utilities and the users of the service. Rates will be reduced when the facts warrant, and rates will be increased when the facts warrant. An effort will be made to correct injustice, even at the cost of inconvenience and loss, but present inconvenience will be more than compensated for by ultimate benefits. There is no occasion for alarm from any source, Mr. Funk is reported to have said. The commissioner appealed to those for whom the new board acts as arbitrator to wait with patience while the commission unfolds and puts into practice the provisions of the law.

The commission has announced that it will be its policy to deny certificates of public convenience and necessity to telephone companies where the application relates to a community which is already adequately served by a telephone company. In delivering the decision Mr. Owen P. Thompson, one of the commissioners, said that the commission believes that this policy would serve the public better than an authorization of two telephone companies in one city or village.

Ohio Commission

Mr. L. B. Denning, attorney for the Bucyrus Light & Power Company, has filed with the Public Utilities Commission of Ohio a brief regarding the valuation placed on the property. The company claims a present value of $138,233. These figures are obtained by taking as a basis the finding of Mr. Linwood G. White, engineer for the commission, and adding items for which Mr. White said he would make an allowance if he were to fix a total present value for rate-making purposes, but which he did not include in his report. Mr. White's valuation was $93,181 for the present physical value, including land. To this the attorney added $3,750 for piecemeal construction, $1,417 for interest during construction, $10,000 for preliminary financing, $5,000 for working capital and $24,885 for development expense and going value. The brief quotes Mr. Milo R. Maltbie, member of the First District New York Public Service Commission, in support of the argument that these allowances should be made. The brief declares that the portion of the law relating to the reproduction cost as of a certain date means the reproduction cost under the same conditions that existed when the property was originally constructed and that any other meaning would be unfair to both company and State. If the prices are high at the present time the company will benefit and if they are low the company will suffer. The brief discusses the question of whether early losses should be amortized or capitalized, and recommends that they be capitalized.

A complaint has been filed with the commission against the Gallia Telephone Company, Gallipolis. It is declared that the company bases its present rates upon a valuation of $108,000, while the value fixed by the Tax Commission is $55,000. The complaint asserts that a more correct valuation would be $35,000. The rates charged are $45 per year for a single business telephone, $21 for a single residence telephone and $18 for a residence party line. Reduction to $30, $15 and $12, respectively, is asked.

The commission has refused to accept the appeal of the Toledo, Bowling Green & Southern Railway Company from regulations prescribed by the City Council of Findlay to prevent electrolysis. The commission decided it has no jurisdiction in such cases. The company asked the commission to lay down rules for uniform safeguards in all cities of the State.

The commission has issued an order that all public utility companies, with the exception of steam railroads, telegraph and sleeping-car companies, must furnish an itemized valuation of their properties before Aug. 1, 1914. Cost of reproduction, depreciation and net value are to be given. Such items as overhead expenses during time of theoretical construction, value of franchises or contracts, good will, going value, cost of financing and property owned but not used may be included. This step has been taken to aid the commission in fixing valuations when it is called upon to do so and to accomplish the work in the shortest time.

Current News Notes

Marconi Wireless Telephone.—News comes from Sicily that the tests in wireless telephony made in the last week between warships of the Italian fleet by Mr. William Marconi were successful. The Duke of the Abruzzi presided over the experiment and expressed his admiration of the results obtained.

* * *

Brown Telephone Ordinance in Denver Held to Be Void.—Judge Dennison has decided that the Brown telephone ordinance, which sought to reduce rates to telephone users in Denver, is ambiguous and void because of provisions which virtually make it a franchise. The court holds that the Mountain States Telephone & Telegraph Company is a trespasser in the city and that it is not entitled to do business until it has obtained a franchise. Further, the court says that the citizens of Denver may prescribe the manner in which the company may do business, even to the extent of fixing its rates for service.

* * *

Third-Rail Railroads in United States.—A recent report made by the committee on electricity of the American Railway Engineering Association shows that on Dec. 16, 1913, there were seven third-rail railroads in the United States operating 100 or more miles of track. In order these are: New York Central & Hudson River, 234 miles; Interborough Rapid Transit of New York City, 203 miles, of which 118 is elevated and 85 subway; Long Island Railroad, 203 miles; Pennsylvania, West Jersey & Seashore, 150 miles; Northern Electric Railway of Chico, Cal., 141 miles; New York State Railways, 106 miles; Michigan United Railways. 104 miles.

* * *

The Flow-Over Lamp and the Consecrated Lamp.—Central-station companies often receive queer requests from customers. The *Edison Round Table* of the Commonwealth Edison Company, Chicago, reports that a consumer called recently at the lamp-renewal department of that company and asked to have shipped to him a flow-over lamp. After some cudgeling of brains it was suggested to the inquirer that what he probably wanted was a throw-over switch, and this proved to be true. On the same day another person made inquiry about a consecrated lamp. It was thought that this man had become interested in the tungsten lamp by hearing of its superlative qualities, and he was satisfied to accept tungsten lamps as the nearest thing to consecrated lamps that the company had.

* * *

Old Employees of Philadelphia Electric Company Celebrate.—A banquet was tendered to fifty of the original employees of the Edison electric light station in Philadelphia, now chiefly officials and engineers of the Philadelphia Electric Company, on March 12 at the Continental Hotel. The banquet was given in honor of their twenty-fifth anniversary in the service of the company. Medals struck from the copper of the first switchboard in the old station at 908 Sansom Street were given to each of the fifty veteran employees. These medals were gold-plated. In addition, 300 unplated medals were distributed to 350 of the company's employees who were present. Mr. W. C. L. Eglin, one of the veterans, who is now second vice-president of the company, acted as toastmaster. An address was made by Mr. Joseph B. McCall, president of the company.

* * *

Canton (Ohio) Parents Demand Electric Cleaners for Public Schools.—A diphtheria scare in the schools at Canton, Ohio, recently awoke the public to the fact that healthful conditions did not exist in the city school buildings. One of the unsanitary practices uncovered through investigations made by local newspapers and citizens was that of sweeping while pupils were still in the school buildings. This practice, the janitor asserted, was necessary in order that the cleaners might do all work assigned to them. Two school buildings out of a total of eighteen were then equipped with electric suction cleaners of the stationary type. In these schools it was soon discovered that dust and dirt were at a minimum, and an association of parents and teachers was at once formed to force the school board to action in installing further vacuum-cleaner equipment. As the situation now stands the parents' association is demanding that the remaining schools be equipped with vacuum cleaners, but the school board has intrenched itself behind the statement that its funds are insufficient for the purchase of necessary apparatus.

* * *

SOCIETY MEETINGS

New England Section, E. V. A.—At a regular meeting of the New England Section of the Electric Vehicle Association of America scheduled for March 25 at the offices of the Lynn (Mass.) Gas & Electric Company the program included a description by Mr. Sewall Cabot, of the Electric Conversion Company, of a new mechanical rectifier for battery charging.

* * *

National District Heating Association.—The annual convention of the National District Heating Association will be held at Rochester, N. Y., May 26, 27 and 28. Among the subjects to be discussed are the operation of bleeder turbines, turbine-driven pumps versus reciprocating pumps, and the relative efficiency of intermittent and continuous heating.

* * *

New York Meeting, E. V. A.—"The Effect of Power-Wagon Operation on Terminal Freight Congestion" is the title of a paper to be given April 24 by Mr. Fred A. Hortter, car accountant Boston & Maine Railroad, before the Electric Vehicle Association of America at the United Engineering Societies Building, 29 West Thirty-ninth Street, New York City.

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New York Electrical Society.—At a meeting of the New York Electrical Society to be held on March 31 Dr. Frederick G. Keyes, of the Cooper Hewitt Electric Company, will give an outline of high-pressure mercury-arc lamps. Mr. D. McFarlan Moore will describe his latest work, illustrated with lantern slides, and will demonstrate various types of apparatus, including lamps and long tubes supplied with nitrogen and neon and carbon dioxide. The meeting hall will be lighted with a 184-ft. Moore tube lamp.

* * *

Pittsburgh Section Iron and Steel Electrical Engineers.—Seventy-two members and guests were present at the third monthly meeting of the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers, held at the Seventh Avenue Hotel, Pittsburgh, Pa., March 14. Following the usual dinner Mr. H. W. Eastwood, Cleveland, Ohio, gave an illustrated talk on "The Application of Automatic Control to Machine Tools." Messrs. O. R. Jones, W. O. Lumm, W. F. Detwiler, W. C. Kennedy and Paul Caldwell took part in the discussion.

* * *

Radio Engineers.—A meeting of the Institute of Radio Engineers will be held at Columbia University, New York City, April 1, at 8:15 p. m. Past-president

Marriott will present an original paper entitled "Specifications for Steamship Radio Equipment," relating to the proper and preferred types of main and auxiliary transmitting apparatus. In connection with this subject Mr. Marriott will also discuss the allied subject of emergency lighting of steamship passageways and lifeboats from the same auxiliary source of energy as that which is used for the emergency operation of the radio transmitters.

* * *

REJUVENATION AT ST. PAUL.—About 100 men, including candidates, attended a rejuvenation and joviation of the Jovian Order at the Hotel St. Paul, St. Paul, Minn., on the night of March 18. The meeting was held during the annual convention of the Minnesota Electrical Association, the sessions of which were held in Minneapolis. Statesman B. O. Horton presided, and Mayor Keller of St. Paul, who is a Jovian, acted as toastmaster at the dinner. Among the other speakers were Messrs. Jacob Price, insurance commissioner of the State, representing the Governor; P. T. Glidden, of St. Paul, general manager of the Consumers' Power Company, and J. O. Corbett, of Pittsburgh, statesman-at-large. A class of thirteen candidates was initiated.

* * *

CHICAGO JOVIAN LEAGUE ON A SELF-SUSTAINING BASIS.—At its meeting on March 23 the Chicago Jovian League adopted changes to its constitution and by-laws which provide for annual dues of $2, also for a class of non-Jovian members. The non-Jovian members shall have the privileges of the luncheon club for one year, but no longer, and will not be allowed to vote or to hold office. About 100 Jovians attended the meeting and practically all of them signed the application cards to become paying members of the Chicago Jovian League. After the business matters had been disposed of the meeting was turned over to the electrical contractors, Mr. C. R. Kreider presiding. Mr. Ernest Freeman, president of the National Electrical Contractors' Association, gave a talk explaining the purposes of that association. One of these purposes, he said, is to endeavor to secure the passage of laws in the various States providing for the licensing of electrical contractors.

* * *

DAYTON REJUVENATION.—Under the direction of Mr. Thomas F. Kelly, of the Dayton Power & Light Company, statesman for Ohio, a successful Jovian rejuvenation was held in Dayton on March 21. The number of candidates initiated was 51 and the total number present at the dinner was 115. Mr. Frank M. Tait, president of the Dayton Power & Light Company, was the toastmaster, and Mr. Sam A. Hobson, of Chicago, Western manager of the *Electrical World*, was the guest of honor and first speaker, detailing the history of the order and its purposes and aims. Judge E. P. Matthews, the general attorney of the Dayton Power & Light Company; Mr. W. W. Mumma, of the Robbins & Myers Company, Springfield, statesman for Ohio; Mr. J. E. Barlow, director of public service in Dayton; Mr. Chryst, chief engineer of the Dayton Engineering Laboratories, and Mr. V. G. Apple, president of the Apple Electric Company, were the remaining speakers.

* * *

JOVIANS OF SOUTHERN CALIFORNIA.—The regular weekly luncheon of the Jovian Electrical League of Southern California was held at Christopher's, Los Angeles, March 18, more than 100 members attending. Mr. R. H. Ballard, secretary and associate general manager of the Southern California Edison Company, presented an interesting address on the Los Angeles power situation. After giving a brief review of the passage of bond issues for the completion of power development at the Los Angeles aqueduct, he led up to the proposed new issue which goes before the voters in May "for the completion of power plant No. 1 and the acquisition or construction of a distributing system." This is the same issue that went before the voters in April, 1913, and was defeated. Mr. Ballard defended the position taken by the power companies and clearly showed that their policy in defending their properties was in the interests of the community as well as of the bondholders.

* * *

JOVIANS ADOPT RESOLUTIONS ON DEATH OF WESTINGHOUSE.—At the regular Jovian luncheon held in Pittsburgh on March 19 addresses were made on the life and work of George Westinghouse by Col. H. G. Prout, president of the Union Switch & Signal Company, and by Mr. R. S. Emery, secretary-treasurer of the Westinghouse Air Brake Company. Resolutions were also adopted as follows: "Whereas in the removal from the sphere of earthly activity of George Westinghouse the Jovian Order has lost an honorary member who not only was a benefactor to the human race but to whose unceasing efforts and keen foresight is due much of the wonderful advancement in the electrical industry, and whereas his removal leaves a void in the industrial world and his industrious efforts in the field of engineering stand unique in the world, therefore be it resolved by the Pittsburgh Jovians here assembled, that we feel a personal loss and that the Jovian Order at large has been deeply afflicted in the death of our honored member."

* * *

REJUVENATION AT INDIANAPOLIS.—Under the direction of Mr. Thomas A. Wynne, vice-president of the Indianapolis Light & Heat Company and Indiana statesman for the Jovian Order, a very successful Jovian rejuvenation was held in Indianapolis on March 20. There were 131 candidates initiated, and the number of Jovians who sat down to the dinner was 331. The exercises were held at the Hotel Severin and the well-trained degree team was in charge of Mr. J. H. Payne, alternate statesman. This degree team is preparing to enter the team contest at the Jovian convention to be held in St. Louis next October. Among the candidates admitted to the order were Governor S. M. Ralston of the State of Indiana and Mayor Joseph E. Bell of Indianapolis. Mr. Wynne was the toastmaster at the banquet and Mr. W. N. Matthews, of St. Louis, reigning Jupiter of the order, was the first speaker. He was followed by Mr. Sam A. Hobson, of Chicago, past-Jupiter; Mayor Bell; Mr. John B. Cockrum, attorney for the Indianapolis Light & Heat Company; Governor Ralston, and Mr. Ell C. Bennett, of St. Louis, the Mercury of the order. Governor Ralston spoke of the desirability of recognizing the rights of buyers and consumers, as well as recognizing the mutual rights of sellers and producers. The Jovian Order will live forever, he said, if its members follow the teachings of the ritual. The Governor, and indeed the other speakers, also spoke feelingly of the desire of the Indiana Jovians to elect Mr. Wynne as the next reigning Jupiter on the occasion of the next convention of the order. The chief magistrate said it was the duty of all Jovians in Indiana to increase the membership of the order in that State, and therefore to go down to the St. Louis convention with a strong claim to the Jupitership. Mr. C. C. Perry, president of the Indianapolis Light & Heat Company, was chairman of the reception committee. On the morning of March 20 the *Indianapolis Star* signalized the rejuvenation by bringing out a four-page Jovian section with portraits of well-known Jovians.

Steam and Hydroelectric Generating System

Water-power plants of the Lewiston-Clarkston Improvement Company developing irrigation flow near Clarkston, Wash., and subsequent installation of steam-turbine auxiliary stations

THE Lewiston-Clarkston Improvement Company was originally formed for the double purpose of building a dam and flume to supply water for irrigating a considerable section of fine agricultural land about Clarkston, Wash., and of selling these lands, with water rights,to settlers and others interested in the raising of high-class fruits and farm products. However, the advantages of combining this irrigation undertaking with the installation of water-power stations for furnishing electrical energy for light and industrial service in the vicinity soon became apparent. Two hydroelectric plants were therefore made a part of the initial installation and shortly afterward electrical service was inaugurated at Lewiston, Idaho, and Clarkston, Wash.

During the year 1910, however, on account of extensive sales of land, the company found itself handicapped by the lack of water to operate its hydroelectric stations and it became apparent that additional generating equipment of some kind would have to be installed to relieve the situation. The purpose of this article is therefore to outline the problem which confronted the managers of the properties and to show how the difficulty was successfully met and why an additional steam station was finally installed.

The Asotin Creek Installation

On the Clarkston side of the Snake River, a number of years ago, an irrigating scheme was placed in operation and grapes were raised extensively. The possibilities of the country were even then apparent, so that the improvement company built a dam on Asotin Creek and conveyed water from this source through an open flume 13 miles to Clarkston. The original purpose of the installation was to secure water for irrigation purposes, but about this same time the city of Lewiston had developed to such a point that it was deemed advisable to install generating equipment to furnish electric service for the two cities of Lewiston and Clarkston as well as for some of the adjacent towns.

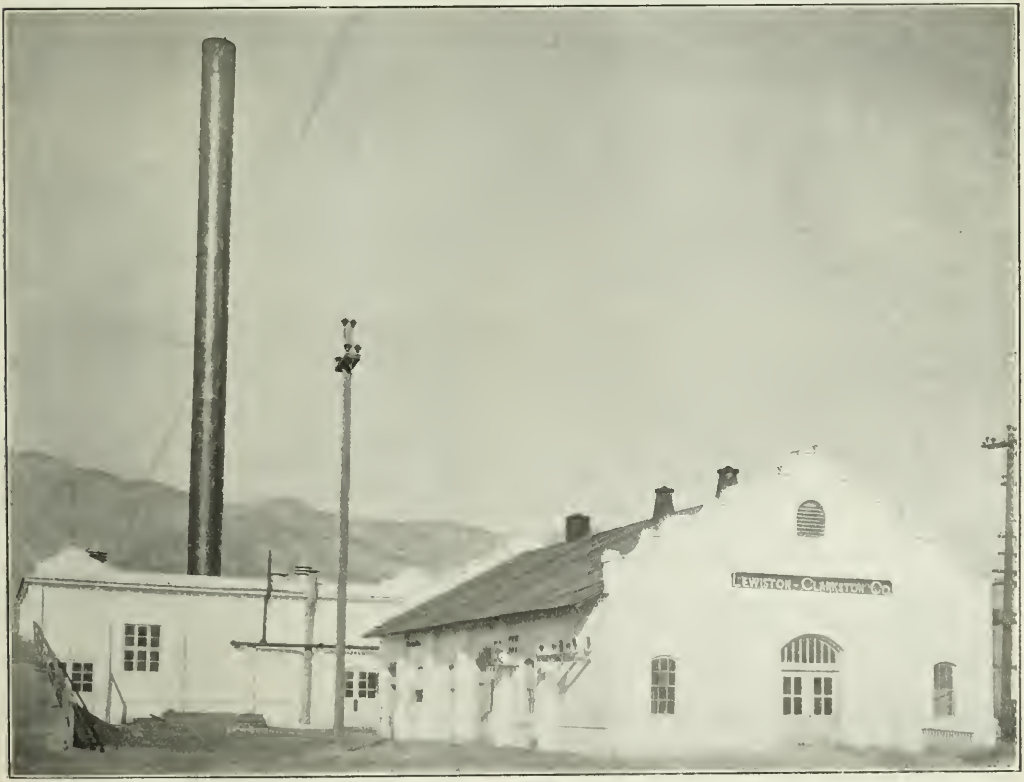


FIG. 1—STEAM PLANTS OF THE LEWISTON-CLARKSTON IMPROVEMENT COMPANY, CLARKSTON, WASH.

On Asotin Creek, a few miles above the town of Asotin, a 400-kw impulse-type waterwheel and generator were therefore installed. This wheel took water from the irrigation flume and discharged into Asotin Creek. Its operating head was about 450 ft. The flume soon proved to be insubstantial and leaked so badly that the company was compelled to tear it out and replace it with a wood-stave pipe line. This line is 48 in. in diameter as far as the Asotin Creek plant and 36 in. in diameter from there on to the Pomeroy station.

The Present Hydroelectric Development

The hydroelectric development of the company thus at present consists of two plants. The station on Asotin Creek contains two Doble impulse turbines, each direct-connected to a 750-kw, three-phase, 2200-volt, sixty-cycle, 300-r.p.m. Westinghouse generator. The wheels are designed to operate under a head of about 518 ft., although the static head on the plant is about 543 ft. Each wheel is controlled by a Lombard governor. The two 40-kw exciters are belted to the main wheels. Water is taken from the irrigation line through a steel pipe running almost directly down the side of a very steep hill.

At the Pomeroy plant situated at the lower end of the pipe line there is installed a three-runner Pelton impulse turbine with one nozzle and one needle nozzle per runner. The turbine is directly connected to a 2200-volt, three-phase, sixty-cycle generator of Westinghouse make, which has a rating of 400 kw.

The dam and irrigation line had been installed to take care of practically all of the flow in Asotin Creek, so that it was impossible to secure additional water from this source when it became apparent that the supply was running low.

The First Auxiliary Steam Plant

A steam plant was therefore built in Clarkston on the bank of the Snake River. This auxiliary plant, of 400-kw rating, contains three 72-in. by 18-ft. high-pressure return-tubular boilers and one of the first Westinghouse-Parsons steam turbines installed in this vicinity. The condensing equipment consists of a surface condenser, with rotative dry vacuum pump, and an engine-driven circulating pump. There is a 6-ft. engine-driven induced-draft fan, controlled by a steam-pressure regulator. This fan discharges through a 48-in. steel stack which extends for about 50 ft. above the boiler-room floor.

Considerable difficulty was experienced in operating this first steam plant for several reasons. There is, for example, a very great difference in elevation between the low and high water stages of the Snake River. This stream has a very long course through the State of Idaho and flows through a country sparsely covered by vegetation, so that the run-off is very rapid. During the period of high water the stream carries large quantities of suspended matter. It flows very swiftly and the suspended matter does not have an opportunity to settle. Stones, leaves, sticks and fine earth were during these periods drawn into the condenser in such great quantities that the plant could not operate for more than a few hours without shutting down. The suspended matter also entered the boilers, rendering the plant inoperative by the accumulation of mud in the feed and steam pipes. During the period of very low water the circulating pump could not raise the water from the river, and it was necessary to install a motor-driven centrifugal pump to discharge the water into the circulating pump.

Conditions Affecting New Extensions

In the summer of 1910 new interests acquired the Clarkston property and in an energetic manner started in to improve the conditions then existing. At this time the peak load on the system was between 1500 hp and 1800 hp. About half of this power was used in and about Lewiston, and the rest was sent out over a transmission line to Moscow, Pullman and the intermediate towns. The Asotin Creek plant could carry during the summer time about 400 kw from midnight to 4 a. m., and during the rest of the day about 200 kw. The remainder of the water had to be used for irrigation purposes. The Pomeroy plant carried about 175 kw continuously, there being required at the lower levels sufficient water for irrigation to use up the discharge from the wheel when operating at this load. The rest of the load had to be carried with the steam plant.

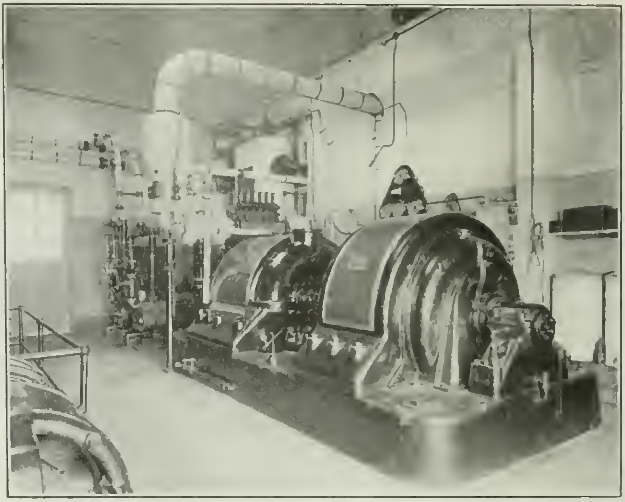


FIG. 2—MAIN TURBINE, AND FEED-WATER PUMPS AND HEATER

There were several possible methods of increasing the generating capacity of the system. The first to be considered was the replacing of the turbine on the end of the pipe line at the Pomeroy plant with a larger waterwheel, in order that more power could be secured from the water discharged through it.

Another method of augmenting the generating equipment would have been to add units to the existing steam plant. The matter was gone into very thoroughly and carefully, but after investigation it was believed that this would be inadvisable.

As a third possibility, the company had available on the Grand Round River, about 25 miles from Clarkston, a hydroelectric power site capable of developing approximately 10,000 hp, which would have been sufficient to meet its requirements for some time to come. This development seemed to be a good and feasible one to undertake, provided there could be secured a market for the power of the complete development, but in view of the facts that such a market was not available and that a partial development would entail a very heavy expenditure per unit of capacity, this scheme was also reported on adversely.

Plans for a New Oil-Burning Steam Plant

It was therefore finally decided to install an altogether new steam plant, as this seemed to offer the most satisfactory way of meeting the situation. Such a steam plant could be installed promptly and at a lower cost per kilowatt of rating than a new hydroelectric development, and for the existing conditions the cost of power production would be less with the steam plant. The cost of coal at the plant site was $6.75 per ton, but nevertheless the above conclusions were reached after a very careful analysis of the situation and have since been confirmed by the very satisfactory results secured.

A spot was therefore selected alongside the existing Clarkston steam station on the bank of the Snake River, and designs and tenders for a 1560-kw steam station were asked. Charles C. Moore & Company, engineers, Seattle, Wash., were the successful bidders, and contracted to install the plant complete, the General Electric Company furnishing the turbine set and its auxiliaries.

At the time the contract was awarded negotiations were being made with the railway company in an endeavor to have the freight rate on fuel oil from the Pacific Coast lowered sufficiently so that oil would be the most economical fuel to use in the plant. The plant contract was awarded, therefore, on the basis of an oil-burning station. There is no railroad on the Clarkston side of the Snake River, and it was intended to install a small pumping station on the Lewiston side of the stream and to run a pipe line 1700 ft. long across the bridge and over to storage tanks alongside of the power plant. Oil was to be taken directly from tank cars on the siding and pumped into the storage tanks.

As it frequently becomes very cold at Clarkston during the winter, special arrangements were considered to facilitate the handling of oil through the pipe line at low outdoor temperatures. Provision was made for the installation of a pumping plant to contain a small vertical boiler and duplex pumps, with an oil heater of sufficient size to raise the temperature of the oil to a point permitting its ready discharge through the pipe line. In order that the pipe might be cleaned out after a cargo of oil had been unloaded, it was intended to pump water through the pipe line, floating the oil up to the crown of the bridge, the highest point on the system, and, discharging the oil and water, leave the pipe empty. This would have very much facilitated the discharge of the oil through the pipe when again starting up.

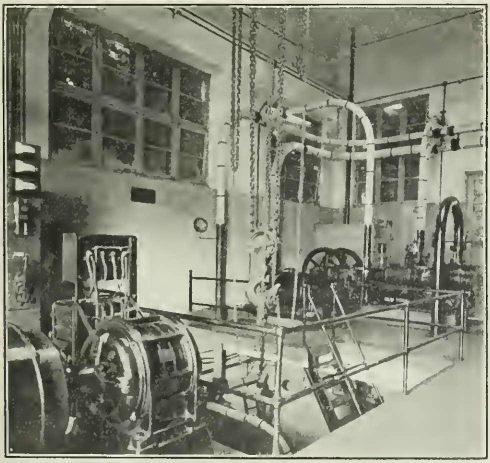


FIG. 3—CONDENSER PIT, AIR PUMP AND EXCITERS

The installation as originally proposed was to contain one 1560-kva Curtis steam-turbine set, one turbine-driven exciter, one motor-driven exciter, two Stirling 321-hp water-tube boilers with Peabody patented fuel-oil furnaces, arranged with special grates for burning bituminous coal; one Wheeler "dry-tube" surface condenser, etc. In addition to a 2000-barrel oil-storage tank, two auxiliary measuring oil tanks were to be provided. These were to be placed alongside the plant and to be filled from the main storage tank by gravity. The small tanks were expected to furnish a means of measuring the quantity of oil used daily by the plant, as one tank could be filling while oil was being used from the other.

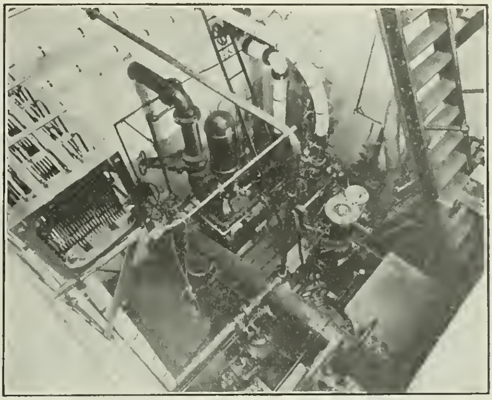


FIG. 4—VIEW LOOKING DOWN INTO CONDENSER PIT, SHOWING CIRCULATING AND FIRE PUMPS

Shortly after the contract for the plant had been let it was found that the freight rates on oil could not be sufficiently reduced to make the use of this fuel permissible, so a modification of the design was made, all of the oil-handling equipment being omitted and the boilers being arranged to be fired with coal. Next there arose the question of the use of stokers. The plant had been so designed that one operator could handle everything in the turbine room, and the boilers could be fired by two men hand-firing or by one man with automatic stokers. The interest on the additional investment for mechanical stokers would be offset by the saving of one fireman's wages and by the saving in fuel. However, on account of the first cost of the stoker equipment, it was finally decided to use hand-fired furnaces with shaking grates.

Features of the Present Installation

The plant was, of course, so designed that it could be readily extended in a down-stream direction. The wall on this side of the building was made of metal lath and plaster so that it could be easily removed. Building columns were designed for an extension and the crane supports and beams were designed so as readily to permit of extensions, reinforcing bars being left where they could facilitate tying in with an addition. The building is of reinforced concrete of simple but substantial design. The soil where the plant stands is hard-pan, sand and gravel. The plant building measures 65 ft. in length by 39 ft. in width, with a 23-ft. ceiling.

The rise and fall of the Snake River at the plant site is more than 30 ft., so that in order that the circulating pump could be within suction limit of the water at the low stage it was necessary to design a deep condenser pit. The circulating pump is installed in a well 18 in. below the turbine-room floor, which is but a little above the maximum high-water stage. The pit for the condenser itself did not have to be so deep, but in the pump pit there are, besides the circulating pump and engine, a large fire pump rated at 1000 gal. per minute and the hot-well pump. One of the problems involved was the design of this pump pit so that it would neither leak nor float. The floor was made very heavy and reinforced, and the walls were then built on this platform, the joint being made at an angle so that the pressure inward in all directions tended to close the joints and also helped prevent any tendency to caving in.

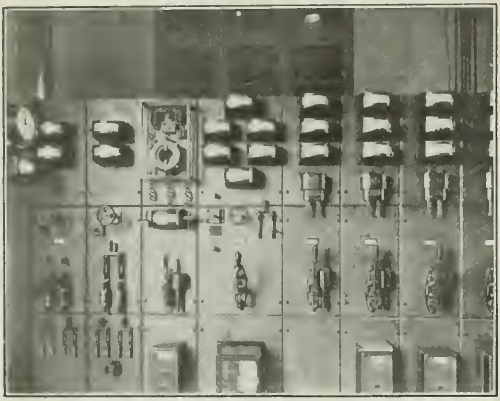


FIG. 5—PLANT SWITCHBOARD

From the circulating-pump pit a cast-iron bell and spigot-pipe line extends out to the river. Where the pipe went through the wall special rings were cast on the pipe, which, being embedded in the cement, formed a joint that has given no trouble from leakage. Considerable difficulty was, however, experienced in anchoring the suction and circulating pipes. The discharge pipe is run along just under the ground and the end of the pipe is carried down to and sealed below the water, so that the circulating system is on a closed siphon, reducing the work of the circulating pump and engine. The circulating pump is primed with a steam primer. A sump pump removes all drainage and leakage.

One condition in connection with the surface condenser installation appeared to offer a possible source of trouble, and this was the probability of the condenser tubes and tube sheets becoming fouled with débris. To overcome this difficulty a very simple and ingenious arrangement of circulating piping connections was made, so that by operating four valves it is possible to reverse the flow of water through the two-pass condenser. Sometimes the direction of flow had to be thus reversed every hour in order to wash out the accumulation, but immediately after reversing the flow, which takes but a few seconds, the vacuum comes back to normal.

From one of the illustrations shown it will be noted that the feed-water heater, which is of the open type, is mounted on a platform above the turbine-room floor. The boiler-feed pumps are installed directly underneath and are controlled by pressure governors. This arrangement places everything excepting the boilers in the turbine room, out of the way of dust and dirt and under the eye of the engineer at all times.

General Piping Layout for Plant

The piping in the plant was laid out with the idea of having all connections as short as possible. Bends were used in lieu of fittings wherever their installation was permissible. This was done not only to decrease the number of connections and the friction of the steam but also to allow for expansion and contraction. The main steam-pipe sizes employed are relatively small compared with standard practice for a plant of this size, the idea having been, however, to decrease the loss in the plant by pipe radiation. There is some pressure drop between the boilers and the turbine, amounting to almost 8 lb. at full load, but this does not interfere with the operation of the plant, and it is probable that the over-all plant economy has been best served by this design.

The reader has doubtless noted that the boiler rating of the plant is relatively small for an installation of this kind. This size of equipment was chosen, however, for the reason that the plant at certain seasons of the year is either not in use at all or carries but a very small percentage of its rated capacity, owing to the fact that sufficient water is available for operating the hydroelectric stations when irrigation is not being carried on. The smaller boiler installation, of course, cost less than a larger number of units, resulting therefore in a considerable saving in the total first cost of the plant. In addition the boilers are of Stirling design and are capable of carrying heavy overloads without injury. In order that the boilers might carry overloads a large stack was installed 125 ft. above the boiler-room floor. This stack gives ample draft so that, together with the arches which are installed in the furnaces and over the grates, a large amount of coal can be burned per square foot of grate surface, and the boilers have without difficulty been able to operate the plant at a considerable overload on the generating equipment.

Test observations were recently made on the plant covering a period of two days, during which all of the coal was weighed. Under ordinary operating conditions it was found that the plant will develop a kilowatt-hour on about 3.5 lb. of combustible or 45 lb. of coal. At the time of the test Roslyn nut coal was being fired. During the period of this run the load-factor averaged about 45 per cent.

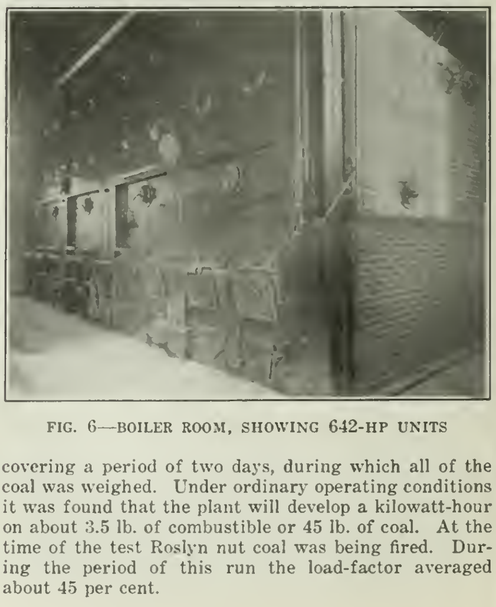


FIG. 6—BOILER ROOM, SHOWING 642-HP UNITS

Electric Arc Welding

Utilization of carbon arc and metallic arc to bring metals to be welded to melting temperature—Methods of welding and their application. By Otis Allen Kenyon

IN general two kinds of arcs are used for welding purposes, namely, the carbon arc and the metallic arc. In each case the heat of the arc is utilized to bring the metals to be welded to the melting temperature, when the joint is filled with molten metal, usually introduced in the form of a rod or pencil.

As is well known, the positive side of the direct-current arc generates heat at a rate approximately three times as great as that at which heat is generated at the negative side. Therefore, it makes a considerable difference to which side of the circuit the material to be welded is connected. As a general rule, on account of the comparatively large mass and heat conductance of the material, it is connected to the positive side.

Carbon Arc

The carbon arc generates heat energy at a higher rate than the metallic arc and is therefore best adapted to use in places where comparatively large masses of metal are to be heated, such as in the cutting of iron and steel and the filling of blowholes in castings, as well as in making some kinds of welds where temperature stresses do not play an important part.

In working with the carbon arc the operator holds the carbon electrode in one hand and a melt bar in the other, the arc supplying the heat by means of which the melt bar is worked into the space between the metals to be joined. The carbon arc requires an emf varying between 50 volts and 100 volts, and the value of the current is varied over a range between 150 amp and 700 amp, according to the nature of the work to be performed. Very high values of the current are not as frequently used now as formerly, 300 amp usually being sufficient for welding and cutting work.

With the carbon arc both hands are occupied with the welding, and a mask must be worn to protect the head and face from the powerful heat and ultra-violet rays of the arc. This mask is somewhat of a disadvantage, as the operators find it is disagreeable to wear and also because it interferes with easy inspection of the work.

The carbon arc, employing a comparatively high voltage, varies in length from 1 in. up to 6 in. and therefore it spreads over the surface somewhat as does the oxy-acetylene flame. On account of this action the heat is applied to a surface considerably larger than it is desired to raise to the melting point for welding. For this reason the total amount of heat required to melt the surfaces to be joined is greater than would otherwise be the case, and hence the temperature stresses set up in the metal to be welded are correspondingly great.

In planning the method of welding in any given instance it is of the greatest importance to take into careful consideration the possible temperature stresses and so to lay out the work as to reduce them to a minimum, otherwise the entire mass of the parts to be joined must be preheated.

FIG. 1—WELDING 15-IN., 55-LB. CHANNELS IN RONDOUT SIPHON OF CATSKILL AQUEDUCT

The carbon arc is much better adapted to cutting metals than is the metallic arc. However, the oxy-acetylene flame with the oxygen jet is very much better than the electric arc wherever the metal to be cut is steel because the oxy-acetylene process by means of the oxygen jet burns up the metal and hard steels lend themselves best to rapid oxidation. When cast iron is to be cut the oxidation method cannot be applied and the carbon arc gives the best results, as it permits the application of enormous quantities of heat necessary to melt the metal. Cuts made with the arc are always more or less ragged and must be so arranged that the freshly molten metal can run clear of the cut before hardening.

The Metallic Arc

In the metallic arc process the welding electrode or pencil is incorporated with the melt bar itself, and as this pencil is consumed in the arc the greater part of it passes over and is deposited in the joint to be welded. This process has two distinct advantages over the carbon method: First, by eliminating the carbon the possibility of carbonization of the weld is removed, and, second, by incorporating the melt bar with the welding electrode only one hand is required for welding, and therefore the operator can hold a mask or screen in the other hand while welding and lower it each time the arc is broken; thus the operator can inspect his work with the naked eye at frequent intervals.

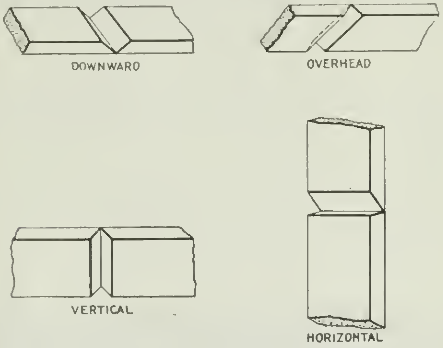


FIG. 2—WELDING POSITIONS

The metallic arc requires only a very low emf, namely, from 15 volts to 30 volts. The length of the arc is very short, usually being less than $^1/_8$ in. The voltage seems not to vary greatly with the length of the arc, because the arc vapor is a very good conductor, practically all the voltage being consumed at the surfaces of the electrodes.

The ability to use an extremely short arc is simultaneously an advantage and a disadvantage of this process. The disadvantage is that more skill is required to work with a short arc than with a long one as the long arc is more stable. The advantage lies in the extreme localization of the heat, which is of transcending importance. The extreme localization of the heat generated by the short arc permits the melting of metal immediately under the end of the welding pencil, the particles of molten metal traveling from the pencil through the arc and combining with the molten metal at the point opposite the end of the electrode.

In this arc it is not necessary to give the electrode a rotary motion. On the contrary, it is held perfectly quiet for an instant and then moved ahead one step, the metal being deposited in a series of drops which are run together as a string.

Temperature stresses with a properly manipulated metallic arc are practically negligible, and wherever they are liable to occur they can be taken care of without resorting to preheating or any complicated method of procedure except in massive and complicated castings in which large quantities of metal are deposited within a small radius. In the metallic arc process practically all the heat is utilized for welding, very little being dissipated uselessly in the mass of the metal.

Energy Supply

The welding-arc circuit should preferably have a constant-current characteristic so as to produce stability in the arc. Where only one arc is used a constant-current generator may be used. In other cases the constant-current characteristic can be obtained by connecting a rheostat in series with the arc across a constant-potential system. The series resistance gives greater voltage across the arc when the current tends to decrease and less voltage across the arc when the current tends to increase. In this way the voltage across the arc varies with the length of the arc and the current is kept approximately at a constant value. Naturally the resistance method of stabilizing the arc is extremely wasteful, according to usual practice from 40 to 60 and more volts being consumed in the rheostat as compared with about 20 volts in the welding arc. The carbon arc may be operated without a series rheostat, but means must be provided for protecting the generator from dead short-circuit when the arc is struck.

When using constant-potential machines the only limit to the number of arcs that can be connected in parallel is the current-carrying capacity of the machine. For metallic arcs with series rheostats it is usual to estimate 150 amp for each arc, the arc itself consuming 25 volts. The current for carbon arcs is usually estimated at 300 amp and the emf at 70 volts. Welding generators wound for low voltages are now manufactured by several different firms.

Operation

The joint to be welded is prepared by cutting away the edges in such a manner as to allow the insertion of the electrode or welding pencil into the innermost part of the joint for drawing an arc at that point.

The angle of bevel depends on a number of factors: the kind of metal to be joined, the composition of the joint, the direction in which the welding is to be done, and the strength required. For very high-strength joints it is desirable to have a comparatively large area of contact between the deposited metal and the original metal.

There are several different positions in which welds can be executed, namely, downward, vertically, horizontally and overhead. These various positions are shown in Fig. 2.

In downward welding full advantage can be taken of gravity. Horizontal welds can sometimes be arranged so as to be almost as easily executed as downward welds. Vertical welds require about 25 per cent longer time than downward welds, and overhead welds require about 67 per cent longer time.

Overhead welding is not practicable with the carbon arc. However, it is easily performed with the metallic arc provided that the welding electrode is coated with a refractory flux. This flux coating, which was invented by Kjellberg in Sweden, performs two functions: It supplies flux to the welds at the rate which bears a definite relation to the rate of consumption of the welding pencil, and it forms a tiny crucible which holds a small quantity of molten metal on the end of the electrode upon which the "pinch effect" of the current may act. In this way the molten metal on the end of the pencil is squeezed outward and upward onto the joint, where it sticks. Without the coating on the electrode the metal does not travel against the force of gravity but falls in a stream onto the floor.

Fig. 3 shows the time in minutes required to weld steel plates of different thicknesses and by different methods of cutting the joints. In these curves no allowance has been made for time required to change welding pencils or prepare the work. They cover simply the actual time of welding. Ten seconds is sufficient time to allow for changing a welding pencil by properly trained men.

The success of an arc weld is determined by a number of factors, as follows: First, the work must be planned by some one who understands both the welding and operating conditions to be met by the apparatus that is to be repaired. Second, the composition of the welding pencil and the flux used with the pencil must be chosen with due respect to the metal to be welded. Third, the value of the current must be determined with reference to the metal to be welded as well as the liability to temperature disturbances.

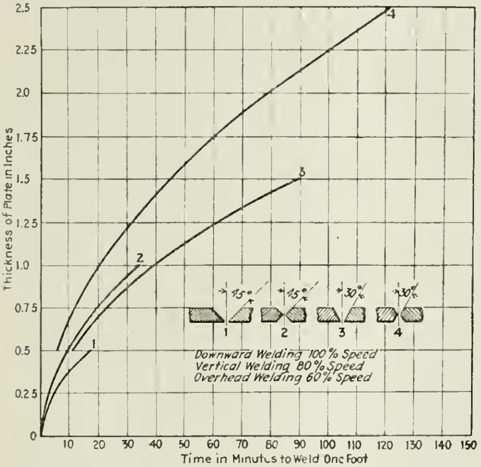


FIG. 3—RELATION OF THICKNESS OF PLATE TO TIME OF WELDING

Applications

Arc welding is one of the oldest practical applications of electrical energy, and yet only in recent years, comparatively, has it come into very extensive use. The slowness of the development of a process which offers such great possibilities is attributable entirely to a failure to consider the necessity for an enormous amount of special knowledge. Arc welding was originally supposed to be extremely simple, and this supposition resulted in many failures which greatly retarded its development.

The beginning of the present activity in arc welding dates back to only a few years ago when the metallic arc with the coated electrode was first taken up in Europe. This process greatly simplified the matter of temperature stresses as well as the control of energy and therefore met with more general success than any method previously known. At the present time it is recognized that successful arc welding can be accomplished only by skilled operators under the direction of competent superintendents. There is no longer a question as to the possibility of producing strong welds; in fact, the welds are just as strong as the original material. Nevertheless, most engineers are ready to use arc welded joints only in places where tests can be applied after the work has been finished.

In boilers, pipe lines, tanks, etc., where working pressure can be applied with little trouble, arc welding has been successfully introduced. It is also very generally used for reclaiming defective and broken castings, for filling holes and building on projections.

Lack of experience has led engineers to regard arc welding suspiciously wherever important work that cannot be tested in place is involved. At present only those trained in the art of welding are competent to pass upon the quality of a joint, and hence unless some method is devised whereby an ordinary mechanic can ascertain the quality of a welded joint by simple inspection the art of electric welding will suffer from the lack of knowledge and experience in its use by those who have to pass upon and determine the design of structures.

Notable Application

Probably the most noteworthy application of electric arc welding was that of the steel lining of the Rondout siphon of the Catskill Aqueduct, executed by The Electric Welding Company. In this instance the metallic arc process was applied to butt-weld 15-in., 55-lb. channels into the form of rings, which were then riveted together and protected from corrosion by concrete placed outside and inside. The total head of water acting upon this tunnel, which is 14 ft. 2 in. inside diameter, may be as high as 750 ft., although the external ground-water pressure will compensate for a good deal of internal pressure.

In sanctioning this application of electric welding the Board of Water Supply of the city of New York very carefully investigated the process by welding full-size specimens and subjecting them to tests. In October, 1913, the water was let into the tunnel and the job accepted as perfect.

Irrigation Pumping Losses Due to Pipe Friction

The head under which a given pump is to operate may be materially increased by installing suction and delivery pipes of too small diameter and by putting into the pipe line unnecessary bends or by having those that are necessary so abrupt as to impede the flow of water, said Mr. James E. Davidson, general manager of the Pacific Power & Light Company, Portland, Ore., in a recent paper on the subject of "Electrically Operated Pumping Plants."

Williams and Hazen's tables show that a 6-in. cast-iron pipe delivering 410 gal. of water per minute will have a friction head of approximately 2.4 ft. per 100 ft. of pipe. A 4-in. pipe, under similar conditions, would have a friction head of approximately 17 ft. per 100 ft. of pipe used, while a 3-in. pipe would have a friction head of about 68 ft. per 100 ft. of pipe. It can be readily seen that the friction head caused by small pipes is excessive and the use of such pipes must be avoided. They will cause high bills.

As an example, consider the power required to force 410 gal. of water per minute against the friction of 100 ft. of 4-in. and of 6-in. pipe. The 4-in. pipe would require 3.36 hp to overcome the friction head, whereas the 6-in. pipe would require but 0.47 hp to overcome the friction head, or a difference of 2.89 hp in favor of every 100 ft. of the 6-in. pipe. If it is assumed that a certain plant was pumping 410 gal. a minute through 100 ft. of 6-in. pipe, and instead of the 6-in. pipe a 4-in. pipe was substituted, the irrigator would be required to increase his power from 10 hp to 12.87 hp, or nearly one-third.

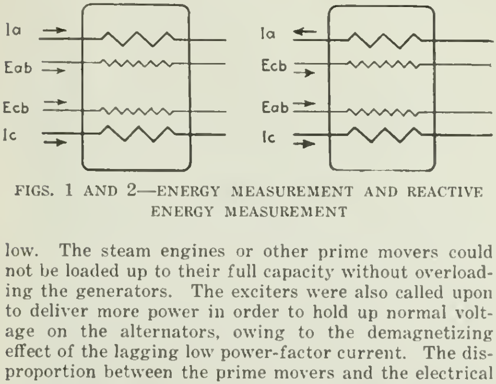
Economies of Power-Factor Adjustment

Methods of securing best power-factor conditions for both energy-supply companies and energy users—Bonus system for keeping the power-factor high. By H. B. Dwight

THE importance of power-factor in alternating-current systems is very generally realized, but the methods for securing economically the best possible power-factor conditions are not always clearly understood. Synchronous motors have long been used for the sake of their effect on the power-factor. Contrary to the rather usual practice, however, the adjustment of synchronous machinery should not be determined by any single rule, much less let go by default, but the adjustment should be made according to a careful study of the local conditions. It is the object of this article to point out principles governing the adjustment of power-factor for the best interests of the customers and of the energy supply company for all cases involving the sale of energy, including that of small central stations as well as that of large transmission systems.

The early central stations supplied energy to loads composed almost entirely of incandescent lamps, of practically 100 per cent power-factor. When induction motors came into general use the power-factor of the station loads became lower, and several distinct disadvantages were felt from this cause.

First, when the alternators were delivering their full rated output in volts and amperes, the true power in kilowatts delivered, on which the income was based, was low. The steam engines or other prime movers could not be loaded up to their full capacity without overloading the generators. The exciters were also called upon to deliver more power in order to hold up normal voltage on the alternators, owing to the demagnetizing effect of the lagging low power-factor current. The disproportion between the prime movers and the electrical machinery has been corrected in more recent installations, but the fact still remains that an 80 per cent power-factor load means a current 25 per cent greater than the same real load at unity power-factor, and accordingly there is a 25 per cent increase in cost of all the electrical apparatus, including generators, exciters, transformers, transmission lines and distribution lines.



FIGS. 1 AND 2—ENERGY MEASUREMENT AND REACTIVE ENERGY MEASUREMENT

Another disadvantage is felt in addition to the above and really distinct from it. Even for the same value of current, a low power-factor load produces a much greater voltage drop in an alternating-current line than a high power-factor load, owing to the voltage from the lagging reactive current and the reactance of the line. This is not a disadvantage so long as the energy is being sent only a relatively very short distance, because the power transmitted by the conductors is limited by their heating, and the voltage drop is not noticed. But in practically all instances the distance to which electric energy is sent is great enough to make the voltage drop very troublesome, since it produces variations in the voltage, and accordingly the limit of output of most alternating-current lines is not in their heating but in their voltage drop or regulation.

Thus low power-factor increases the cost of the lines even more than it increases the cost of the generators. In city systems the cost of lines is considerable, being proportionate to that of the generators. In long-distance transmission systems the cost of the lines is much greater than that of the generators, and this second disadvantage of low power-factor, in producing very poor line regulation and necessitating extra line construction, is of correspondingly greater importance.

The three usual forms of motor-service contracts and their effect in ameliorating the disadvantages of low power-factor will be described. These forms, while still of universal occurrence, were all planned for lighting and induction motor loads and are more suitable for them than for loads partly made up of synchronous motors.

As a first example, consider the very usual case of a customer who purchases service simply on a kilowatt-hour rate. Supposing that he is under no contract obligation to maintain a high power-factor of his load, he feels little, if any, disadvantage from the low power-factor caused by his connecting up a large number of lightly loaded induction motors. If he requires a supply of direct current, he will not be likely to install a synchronous motor-generator set, since it is rather expensive, but he will probably purchase the cheapest and most reliable piece of apparatus, such as a synchronous converter or an induction-motor-generator set.

While low power-factor does not cause any inconvenience to the above-mentioned customer, it is a great source of inconvenience and expense to the energy-supply company, as has been described in the opening paragraphs of this paper. It is a common practice, and a very reasonable one, for the supply company to offer its customers a bonus for keeping their loads at a high power-factor, and we may take as a second example the case of the above customer when a discount is given in the bill if the power-factor is always above 85 per cent, as shown by a graphic meter. It is probable that the power-factor can be kept above this figure by taking pains to choose the induction motors so that they operate at approximately full load. If a number of direct-current motors are used, the direct current can be supplied most economically by a synchronous converter. The converter will operate at approximately 100 per cent power-factor, and while it will give only a small amount of power-factor correction to the entire load, it will probably give as much as is sufficient for a customer with a contract such as that described above. It may be mentioned that synchronous converters are being used to an increasing extent, largely owing to the better operation secured in recent designs by commutating poles and to the high efficiency and low first cost characteristic of this type of apparatus. Synchronous converters are best operated with a fixed rheostat setting and are not suitable for power-factor control.

The third case is very similar to the second and is that of a customer who buys energy under a contract which gives a bonus for high power-factor, increasing until 100 per cent is reached. This bonus may be given according to the minimum readings of a graphic power-factor meter or it may be given by charging for the total kva-hours instead of the kw-hours. The total kva-hours, however, are very difficult to meter with even commercial accuracy, and it is easier and in other ways preferable to meter the reactive kva-hours, by a special method described later, and to charge for them and the kw-hours separately. The above form of contract, giving a bonus for the very highest power-factor, is used in practice, and the difference in its wording induces a customer to install synchronous motors wherever possible, since they are the only kind of apparatus which can raise the power-factor of an induction motor load up to a value approaching 100 per cent. In such a case, if direct current is required, a synchronous motor-generator set will be preferable to a synchronous converter owing to its greater ability to raise the power-factor. It may also prove economical to specify certain of the larger, steadily running motors to be of the synchronous type, and to run them with over-excited fields for power-factor correction.

Consider now the adjustment of the power-factor by the same company which generates and transmits the energy. The real benefits to the entire system must be estimated, thus making an entirely different problem from that considered above. The best rules for the adjustment of power-factor in any case will be discussed, and the contract terms will be described which will tend to enforce these rules.

It is a fact often overlooked that by attempting to hold the power-factor of a customer's load at any fixed value, as is done by the above-mentioned usual contract clauses, a large part of the benefit obtainable from synchronous motors is lost. It is often better, where there are synchronous motors, to pay less attention to the load power-factor and more to the amount of reactive power which would be desirable. Thus, for example, a synchronous motor in a factory which closes at 6 p. m. would be of considerable benefit to the power system if it were run for an hour or two longer, regardless of the local power-factor. Then, again, a customer of a transmission company may be forced by a contract which penalizes low power-factor indiscriminately to operate his synchronous motors "leading" during the night, even though he is at the same time suffering from an excess of voltage which is detrimental to his lamps, and even though the transmission company is running synchronous machines "lagging" in order to bring the voltage down to the normal value. In this way a wrong form of contract has resulted in actual instances of the synchronous motors of a customer being operated at night in direct opposition to those of the transmission company.

Where a customer's load is at a relatively short distance from the generating station the cost of feeders is negligible, and appreciable voltage variation due to line drop does not occur. Here the only disadvantage of low power-factor is that it increases the load on the electrical apparatus in the station. In any ordinary case there will not be enough synchronous motors to make the power-factor of the entire load leading, and therefore motors close to the station should be run with maximum field current throughout both night and day.

If the energy-supply company is the owner of the synchronous motors, it will make the field current as strong as the heating will allow, and no more attention will be necessary. If a customer owns the motors, the usual penalty for low power-factor will not induce him to operate at a low "leading" power-factor at times of light load. Two forms of contract may be used which will make it profitable for him to operate the motors "leading" all the time. First, as an approximate method, the kilovolt-ampere rating of motors not needed for mechanical load and hence available for power-factor correction may be estimated, and a bonus allowed of so much per kilovolt-ampere. A graphic ammeter can be used to show that the motors carry full kilovolt-ampere load all the time. This method, however, takes no account of a possible low power-factor of the rest of the same customer's load. The second method is more accurate. It consists in using a special, simple connection of a standard polyphase watt-hour meter to measure the reactive energy, and in this way the total leading kva-hours delivered by the customer to the supply system can be metered. This measurement has been made use of in an actual installation, in order to determine the amount of penalties for low power-factor according to a contract provision, by Mr. C. W. Baker, of Hamilton, Canada, and it was described by him in the *Proceedings* of the Canadian Electrical Association, June, 1912. Except for slight errors with an unbalanced load, it is as accurate as an ordinary kw-hour measurement, and it is far superior in accuracy and simplicity to the measurement of the total kva-hours. By means of this measurement the customer can be paid for net "leading" reactive kva-hours, or charged for "lagging" kva-hours, at a rate of, say, one-fourth of the kw-hour rate.

The connection of a standard three-phase watt-hour meter to measure the reactive energy, as shown in Fig. 2, is readily compared with Fig. 1, the connection for an ordinary energy measurement. The only differences from Fig. 1 are that in Fig. 2 the connections to the shunt coils of the two elements are interchanged and the connection to one of the series coils is reversed. The coil to be reversed depends on whether leading or lagging kilovolt-amperes are to be registered. In Fig. 1, as is well known, the current and voltage of each element are 30 deg. out of time-phase at unity power-factor. In Fig. 2 they are 90 deg. out of time-phase, and hence register zero at unity power-factor. The readings of the meter in Fig. 2 are to be multiplied by a constant, $\frac{\sqrt{3}}{2}$, to obtain the reactive kva-hours on the same scale as the meter in Fig. 1 shows kw-hours. The connection has been described for integrating meters so as to apply to the purchase of energy, but it may be used, if desired, for indicating or graphic instruments for showing real and reactive power.

The above method of charging for the reactive energy separately from the real energy is applicable to cases where the energy-supply company wishes a leading or a high power-factor from the customer at all times of the day, and this will be presumably only when the customer is close to the generating station. This method may also be applied where no synchronous motors are installed or are likely to be installed and where, therefore, power-factor adjustment is not possible. The disadvantage of this method for most cases is that it discourages any adjustment of the power-factor.

Where the load to be measured is situated at a distance from the generating station the cost of conductors and line construction becomes of importance. This includes not only many cases of city distribution, but all cases where loads are supplied by transmission lines. As stated in a previous paragraph, whenever the distance of transmission is great enough to make the cost of conductors an important factor in the system, the size and number of conductors which must be used for a certain load are determined, not by their heating, but by the voltage drop. Steady voltage at the load is one of the prime requisites of good electric service, and supply companies spend large sums in extra lines and feeders and in feeder regulators in order to deliver energy at steady voltage. Now, if all loads were of unity power-factor, the voltage variation due to drop in the lines and transformers would be less than at a low power-factor. However, if synchronous motors are installed, they would be very inefficiently used if they merely held the load power-factor at 100 per cent. Large savings in line costs and beneficial effects on the generators may be obtained by operating the synchronous motors strongly "leading" at heavy load and sufficiently "lagging" at light load to hold the voltage constant. In transmission-line work the savings in line costs are so large that it pays a supply company to install synchronous motors and run them without mechanical load, adjusting them either by hand or by automatic regulators to give constant voltage at all parts of the line. It is to be noted that a part of the investment in synchronous motors needed to establish a constant-voltage transmission line can be saved if the customers can be induced by the right kind of contracts to install synchronous motors and continually adjust them for as constant voltage as possible.

The question arises, What rules of power-factor adjustment and what forms of contract will enable a supply company to obtain most benefit from the synchronous machinery installed by customers at some distance from the generating station? Obviously none of the contracts mentioned so far will apply, since they all penalize "lagging" power-factor, and the company now desires "lagging" power-factor at certain times of day.

The simplest case is that of an isolated customer. It seems reasonable that a bonus should be given for each kilovolt-ampere of synchronous motors available for power-factor control, since by means of this machinery the supply company is enabled to make use of a cheap line, which would ordinarily have very poor regulation. But the adjustment of the machinery, either by hand or by automatic regulators, can be left to the customer, since poor adjustment will result in voltage variation, and he himself will be the sufferer.

Where several customers are near together, each would be expected to install synchronous machinery and would receive a bonus in proportion. As regards voltage control, they are in some degree independent, since each can utilize the reactance of his own transformers, as well as that of the supply line, to hold his own voltage constant. But poor adjustment by one might result in voltage variations which another could not overcome, and so a check would have to be kept on the adjustment by means of graphic voltmeters in each customer's station and penalties imposed for careless adjustment.

A clear realization of all the possibilities of power-factor control should result in special contracts between energy-supply companies and energy users, where synchronous motors are installed, which would be of greater fairness and profit to both parties concerned than many of the usual contracts now in force.

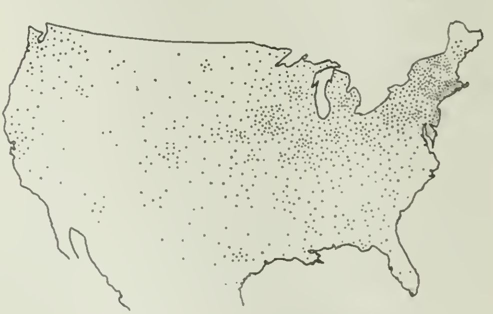
Reviewing the above outline, it may be stated that a contract bonus for keeping the power-factor above, say, 85 per cent encourages a customer to keep his induction motors fully loaded but does not induce him to install synchronous machines. A bonus for keeping the power-factor up to 100 per cent may be given directly according to power-factor readings on a graphic instrument, or it may be given by charging at a certain rate for the integrated reactive kva-hours. Such a bonus is advisable where there are no synchronous motors or where it is proper to operate the synchronous motors with a strong field current at all times without any adjustment. In most cases continual power-factor adjustment is very valuable, and a bonus should be based on the available kva rating of the synchronous motors, with penalties when they are not adjusted to give constant voltage. Lagging power-factor at times of light load should not be penalized, but encouraged.

Railroad Aspects of Conservation

One of the committees of the American Railway Engineering Association is that on conservation of natural resources. Its report to the recent Chicago convention of the association is largely devoted to a résumé of the proceedings of the fifth National Conservation Congress held in Washington, D. C., on Nov. 17-20, 1913. The committee, of which Mr. William McNab, of Montreal, Quebec, is chairman, says that the question of the control of water-power might be interesting to the railroad engineer under two aspects—first, in case the railroads contemplate electrifying their systems and handling their traffic by electrical energy; second (and this will be new to many electrical men), "when the use of electric power decreases the consumption of coal to the extent of its interfering with the revenue of the railway and the prosperity of the coal-mining communities." It may be added that this seems to be looking a long way ahead.

Company Members of the National Electric Light Association

The National Electric Light Association now has some 1,080 Class A members among the electricity-supply companies of the United States, its possessions and several foreign countries. Of this number almost exactly one thousand are contained within the borders of the forty-eight States, as shown on the accompanying map, which reveals the distribution of these member companies by the arrangement of the small dots. New York leads among the States, with ninety-nine companies; Pennsylvania comes next, with seventy-six; Iowa has fifty-six and Illinois fifty-one. Among the outlying possessions of the United States, Alaska has one member, Hawaii two, the Philippines two and Porto Rico three. The Canadian membership of fifty-eight is led by the Province of Ontario, with thirty-six companies. The list of members in foreign lands includes the following: Argentina, two; Brazil, four; Cuba, one; England, three; Germany, one; Japan, one; Mexico, one, and Venezuela, one.



DISTRIBUTION OF MEMBER COMPANIES

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Profit Sharing in a Small Plant

Mr. N. J. Brown, secretary and treasurer of the Mount Pleasant (Mich.) Light & Fuel Company, has announced that, beginning with Jan. 1, the company placed in operation a plan of sharing profits with its regular employees, who number about thirty-five. On Jan. 1, 1915, each employee will receive a certificate of deposit representing 6 per cent of the amount of his yearly wage. Mr. E. M. Jefferson is superintendent of the plant.

A Convincing Tungsten-Lamp Window Display

The Narragansett Electric Lighting Company, of Providence, R. I., is a thorough exponent of the art of window dressing, and at its showroom in the Turk's Head Building regular changes are made in this portion of its display space. Here is shown a recent window effect designed to demonstrate the important steps in the construction and the striking economy of the tungsten lamp. The novel feature of this display comprised three tungsten lamps on one pan of a set of scales balanced against a carbon lamp of the same total watts rating on the other scale pan, the comparison on the basis of light production obviously being greatly in favor of the latter. The scale pans were alternately shifted up and down by a motor-driven mechanism. The photograph was taken by the light of the window interiors derived from tungsten lamps massed in the concealed space at the top of the window above special fixtures which will be described in a future article.

DISPLAY WINDOW OF ELECTRIC SHOP

The Electric Motor and Its Users

"The Electric Motor, Its Uses and Users," is the title of an impressive list of local motor-service applications just issued by the Edison Electric Company of Lancaster, Pa., in the form of a forty-page pamphlet for distribution locally. Installations of 1 hp and over are included in the list, which embraces more than 600 names of motor users. A number of halftone illustrations of local plants employing electric drive brighten the pages of the book, and at the end there is an appendix of application pictures sure to prove suggestive to prospective customers. According to Mr. H. J. Von Nieda, superintendent of the commercial department of the Lancaster company, the connected load of motors on the Edison system has grown as follows:

	Hp		Hp		Hp
1908	2965	1911	5519	1913	9291
1909	4233	1912	6825	1914	12,154
1910	4897				

Fifteen motor-driven refrigerating plants are now connected to the lines of the company. One of these customers, who has a 5-hp outfit in his meat market, testifies as follows: "Our motor-driven refrigerating plant is not only working satisfactorily, but beyond our expectations. Our refrigeration is now not only cheaper, but cleaner and handier in all respects. During May, 1912, with ice at 30 cents a block, it cost us about $75 for ice alone. Our electricity bill for operating the refrigerating machine during May, 1913, amounted to $14.71. We are sorry we did not make the change years ago."

Storage Batteries in Central-Station Service

Mr. T. Milton, district engineer for the Electric Storage Battery Company in Chicago, gave a talk on "Storage Batteries" at the luncheon of the Chicago Jovian League recently. Mr. Milton referred to the great size and variety of applications of storage batteries. He spoke particularly about central-station installations, saying that the Commonwealth Edison Company, in particular, has batteries sufficient to take the maximum direct-current load on the system for eighteen minutes. The big central-station companies in Boston, New York, Chicago and other cities are purchasing additional batteries from year to year to keep up with the peak demand of their direct-current load. The speaker described the use of emergency or stand-by batteries, regulating or peak batteries, exciter batteries, oil-switch batteries and ignition-system batteries for large gas-engine plants. In relation to the first class he told of the comparatively modern use of thin pasted plates in large central-station cells. He spoke of some large stand-by batteries that will carry over 400 amp for ten minutes. In relation to regulating or peak batteries Mr. Milton said that the electric-railway storage battery on Plymouth Place, Chicago, is figured to save $57,000 a year by flattening out the peak of the demand of the electric-railway companies, which purchase central-station energy.

Dry-Goods Delivery by Electric Vehicles in Winter

The accompanying data show the work done during a winter month by a Detroit 1000-lb. electric delivery wagon having a sixty-cell Edison battery, which is operated by a department store at Providence, R. I. This vehicle has been in continuous service, regardless of weather conditions, since Oct. 1, 1913, and is used in a section of Providence where it must climb grades ranging from 4 per cent to 15 per cent. Four regular trips are made each day over a route on which horses could make only three trips. The illustration shows the conditions on Feb. 20 directly after the worst blizzard of the season. On this day, it is interesting to note, only 70 amp-hr. was consumed over a distance of 10 miles, during which thirty-five packages were delivered.

ELECTRIC TRUCK MAKING WINTER DELIVERIES

PACKAGE DELIVERY DURING JANUARY, 1914

Date	Packages	Miles	Amp-hr.	Kw-hr.
1	175	30	140	27
2	200	35	140	20
3	200	35	140	20
5	175	33	150	19
6	175	35	135	17
7	200	35	150	18
8	175	35	140	19
9	200	36	140	22
10	250	37	150	20
12	175	35	140	18
13	175	30	140	20
14	200	35	135	20
15	200	36	140	20
16	200	35	140	20
17	250	37	150	22
19	160	33	135	16
20	200	35	140	18
21	175	35	160	17
22	200	36	145	24
23	225	37	140	20
24	250	36	150	28
26	150	30	135	20
27	200	35	140	16
28	200	35	140	22
29	225	36	145	21
30	200	35	140	20
31	250	37	150	26
Total.......	5375	....	3850	550

COST OF OPERATING DELIVERY WAGON

550 kw-hr. at 6.5 cents per kw-hr	$35.75
Garaging	20.00
Battery maintenance	8.50
Tires (estimated life twelve months)	10.00
Miscellaneous repairs and upkeep	8.25
Painting and varnishing	4.25
Interest and depreciation	18.75
Total	$105.50
Driver and boy	90.00
Cost of delivery 5375 packages	$195.50
Delivery cost per package	3.64 cents

Complete operating records are kept by the store so that the exact cost of operation may be known. The January report reproduced herewith is of special interest, as it shows an average cost of 3.64 cents per package delivered.

Tactful Relations with Customers

In the course of a recent address to an audience of young electrical men Mr. John W. Ferguson, assistant to the general contract agent of the Commonwealth Edison Company, Chicago, said that in the commercial side of the electric-service industry the technically educated man must not look down upon the non-technical man. He declared that a technical man without business ability or training may "exist" and that a business man without technical training may "progress," but that the business man with technical knowledge is "bound to succeed." Mr. Ferguson also made the point that to the misuse or careless use of the telephone by employees is due much of the ill feeling exhibited by the public toward public-service corporations. Too much care cannot be exercised by the department manager in impressing on the minds of those under him the necessity of courteous treatment of all telephone inquirers. To school those whose duties bring them in frequent daily contact with the public over the telephone to be patient, polite and exact is a task of no small magnitude; but it is one that cannot fail to commend itself to the men in authority who study the situation with care.

All the men connected with the company should bear in mind the necessity of maintaining pleasant relations with customers. Mr. Ferguson said he had known men whose primary duty it was to cut off customers for non-payment of bills but who performed their duties in such a manner that not only was the customer not cut off, in some particular case, but he was transformed into a good friend of the company. The necessity of discussing electrical matters with customers in familiar English and not in technical terms was pointed out. To the solicitor Mr. Ferguson made the point, out of his large experience, that in the long run it is sincerity that wins business and holds it. The agent should not be arbitrary in his statements but should "use all gently." However, he should "be not too tame" either. Complaints should be carefully investigated and if justified they should be remedied quickly and cheerfully.

Setting the Example with Good Illumination in Company's Buildings

When a customer or a prospective customer of the Columbus (Ohio) Railway & Light Company signifies his intention of installing electric fixtures or increasing his present installation, the new-business department of the electric-service company furnishes him with suggested plans of an installation which it believes will be suitable and will serve his purpose. This work is handled by the solicitors of the new-business department, each of whom is capable of advising the customers in the capacity of an illuminating engineer. These specifications when drawn up give the prospective customer something concrete from which to talk and also furnish him with a set of plans which he may take to several contractors in the city to determine what the installation is going to cost. The specifications cover number and spacing of outlets, type of fixtures suitable for the particular business, height of units from the floor, type and size of lamps, reflectors, and method of

During the past year the company has been not only preaching good lighting but also practising its own doctrine, as will be noted from the accompanying night control.

LIGHTING IN METER ROOM AT COLUMBUS, OHIO

picture taken in its meter-testing department. On the extreme right is a rack for testing apparatus which is brilliantly illuminated by means of tungsten lamps suspended by drop cords and shaded by green reflectors. At the opposite side of the aisle a similar workbench, illuminated with the same type of units, is used for making small repairs. General illumination is furnished by tungsten lamps in glass reflectors suspended about 2 ft. from the ceiling.

Variation of Energy Consumption in Brick Plants with Condition of Clay

The use of clay of different consistencies affects the cost of brick-making, so that costs for the same factory may vary widely during different months of the year as the weather affects the character of the soil. The accompanying table shows how the maximum demand for common machines employed in the manufacture of bricks varies in a Utah factory where press and wire-cut brick are made. The highest maximum demands, as would be expected, were registered during the early spring months, when the clay was in a sticky state.

MOTORS IN BRICK PLANT

Application	Maximum Demand in Kw.
One 40-in. disintegrator, belt-connected to one 40-hp, three-phase motor	36.4–50.4
One pug mill belted to 50-hp motor	43.0–44.0
One wire-cutting machine, 50,000 bricks in ten hours, belted to 50-hp motor; also two belt conveyors	51.0–64.0
Two four-mold pressed-brick machines, 20,000 bricks in ten hours, belted to 30-hp motor	12.0–12.0
One 11-ft. blower and one 13-ft. blower, 222 r.p.m., belted to 35-hp motor	43.0–50.4

Energy is transmitted to the mill at 28,000 volts, being stepped down to lower pressures for motor service and lighting. Data based on the company's annual output and energy consumption show that 22 kw-hr. represents the requirement in the manufacture of every 1000 bricks.

Illumination and Wiring

Nitrogen-Filled Lamps for Moving-Picture Machines

The Seattle (Wash.) municipal lighting plant operates no 110-volt direct-current circuit, and for the use of local stereopticon and moving-picture machine operators Mr. J. D. Ross, superintendent of the Seattle Lighting Department, has had developed a special form of nitrogen-filled stereopticon lamp. One of these, for operation on a 125-volt circuit, is a 700-cp unit. Another type, rated at 400 cp, operates on a 10-volt transformer, making a very rugged filament. In both cases the filament is concentrated as far as possible at a point. The new lamp is intended to replace the direct-current arc for all stereopticon work. For this use it promises to be exceptionally good, and by eliminating the flickering of the arc it will make moving pictures appear more steady.

Mounting of the San Francisco Exposition "Jewels"

As already noted in these columns, some 10 tons of cut-glass "jewels" are to be employed in the decorative lighting of the Panama-Pacific International Exposition buildings. To support these sparkling gems of hard flint glass in the rays of the projector lamps, special holders are now being designed. A metal ring 0.125 in. wide will encompass the jewel on its outer edge, and a second holder at the back will bring a small mirror against the apex of the jewel. It is estimated that the brilliancy of reflection will be increased more than 40 per cent by the use of this mirror. Each jewel will be hung by a small handle with a 0.25-in. hole on a 0.125-in. hook. This arrangement permits of free movement in any direction and practically amounts to point suspension. The jewels measure 1.85 in. in diameter. They are molded in Austria from an exceptionally hard flint glass and are afterward hand-cut and polished by peasants who have learned to do this work.

A 951-Ft. Transmission Span Clearing Navigation

The British Columbia Electric Railway Company, of Vancouver, B. C., has just installed a new 34,600-volt transmission span over the Second Narrows of Burrard Inlet, to supply energy to North Vancouver and adjacent districts. The span measures 951 ft. between towers and at its lowest point clears the water by a height of 160 ft. in order to permit large vessels to reach industrial plants at the head of the inlet.

The new masts are of double-pole or "H" construction, each being composed of two-pole masts, placed 18 ft. apart. The north mast is 210 ft. high and the south mast 215 ft. high. On the north side the masts are guyed to a two-pole anchor tower itself 130 ft. in height, while the south mast is tied to a four-pole anchor tower 95 ft. high.

The masts carry eight wires, these consisting of two 34,600-volt, three-phase circuits, and two telephone wires. The 34,600-volt wires are of galvanized plow-steel wire, each made up of six strands of seven wires. Each wire is of 2500-circ. mil area. The core is of hemp, and the cable itself measures 0.5 in. in diameter.

The two circuits are placed side by side 6 ft. between centers, in a vertical plane. The middle wire is offset 2 ft. to increase clearance when snow or sleet may prevail. The telephone wires are placed at the ends of the cross-arms.

Complete transfer of the transmission lines from the old masts to the new construction was effected Feb. 21. As this is the only connection with the company's North Vancouver substation, which supplies energy for a railway system and for public and private light and motor-service business, it was necessary that the interruption caused by the transfer of the wires be as brief as possible and at such times as would inconvenience the company's patrons but little. The transfer was made on three Sunday mornings, the average length of interruption on each day being about two hours.

Lighting and Illumination Tests in Central-Station Offices at Ann Arbor, Mich.

The new home of the Eastern Michigan Edison Company at Ann Arbor, Mich., presents an example of carefully designed semi-indirect lighting, an interesting feature of the installation being the complete absence of desk lamps and bracket or extension fixtures in the large office and display rooms shown in the accompanying illustrations.

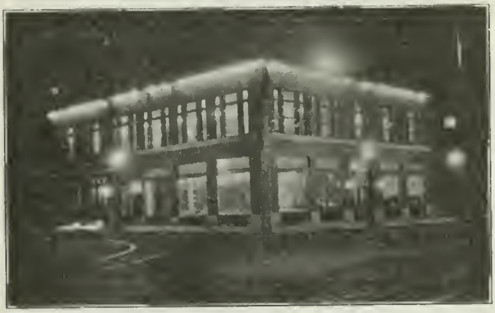


FIG. 1—EXTERIOR ILLUMINATION OF NEW OFFICE BUILDING, ANN ARBOR, MICH.

The building is a three-story structure of reinforced concrete and steel, including a basement. The first floor is occupied by the general offices, cashier's office, trouble-men's desks, display tables and salesmen's desks, and is made attractive by large display windows fronting on two streets. A large room across the hall contains the transformers and other substation equipment. The second floor is given over entirely to desks, the private office of the division manager and the private telephone exchange. Another room on this floor contains the meter-testing department and a drafting room.

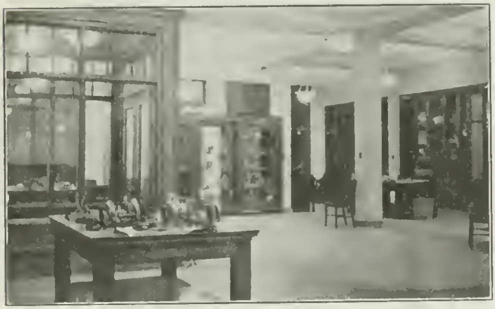


FIG. 2—ENTRANCE VESTIBULE, SHOWCASE AND DISPLAY TABLES

As indicated by the dotted lines (Figs. 4 and 5), the rooms are divided off into 12-ft squares by beams 14 in. wide and extending down 11 in. from the ceiling. The pillars are 14 in. on a side and are indicated by small squares on the drawings. All of the switches which control the fixtures are of the push-button type and are mounted in the sides of these pillars. The walls and ceilings of both floors are white in color with no trimming, except the light golden-oak finish of the woodwork, which matches the desks.

TABLE OF PHOTOMETER READINGS.

FIRST FLOOR		SECOND FLOOR	
Station No.	Illumination in Ft.-Candles	Station No.	Illumination in Ft.-Candles
1	2.04	1	2.11
2	2.48	2	2.30
3	2.50	3	2.86
4	3.19	4	1.15
5	3.47	5	2.27
6	2.05	6	3.39
7	1.13	7	3.65
8	4.55	8	4.65
9	3.39	9	2.38
10	3.51	10	3.83
11	4.25	11	3.91
12	3.65	12	3.02
13	2.63	13	2.31
14	1.08	14	3.56
15	8.47	15	4.34
16	3.58	16	4.01
17	3.86	17	3.71
18	3.94	18	2.25
19	4.22	19	2.35
20	2.71	20	3.54
21	1.16	21	4.44
22		22	3.98
23	4.09	23	3.92
24	3.82	24	2.58
25	1.54	25	1.99
26	3.41	26	2.94
27	3.45	27	3.68
28	2.95	28	3.64
29	3.39	29	3.64
30	6.90	30	2.60
31	2.19	31	1.82
32	1.81	32	1.99
33	1.95	33	2.68
34	2.53	34	2.29
35	2.08	35	2.25
		36	2.08

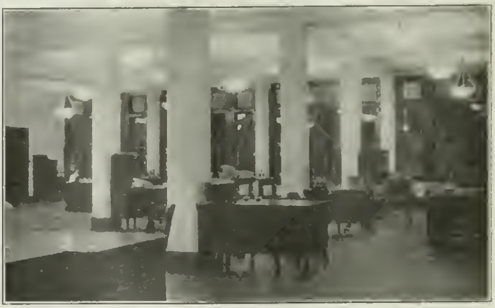


FIG. 3—OFFICE SPACE ON SECOND FLOOR

Thirteen Alba "semi-indirect" fixtures are used to light the first floor and sixteen the second. On the first floor where the ceiling is 12 ft. 9 in. high the bottoms of the bowls are 3 ft. from the ceiling, while on the second floor, although the ceiling is 11 ft. 10 in. high, the same type of fixture is used. Each bowl contains three 60-watt tungsten lamps placed horizontally, the center of the lamps being 30 in. from the ceiling and 2.5 in. from the tops of the bowls. The diameter of the bowl used is 21 in.

One 60-watt tungsten lamp in a frosted dome furnishes sufficient light for the main entrance vestibule. This entrance has a ceiling of its own and is entirely separate from the rest of the office, except for large double doors with glass. The walls are also of glass paneled in heavy woodwork.

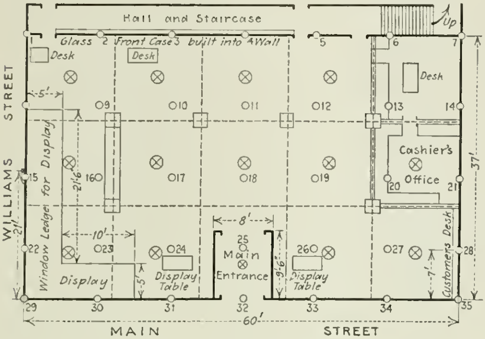


FIG. 4—FIRST-FLOOR PLAN

In the diagrams the position of each fixture is indicated by a small circle inclosing a cross, while the stations where photometer readings were taken are shown by small blank circles. The stations are 10 ft. apart each way, but those stations which are indicated as being on dividing walls are understood to be 6 in. from the wall.

The accompanying photographs were taken at night with a hand camera, using only the light from the tungsten installation. The times of exposure averaged ten minutes. The clearness with which articles on the desks and in the showcases are seen shows how well absence of glare and uniformity of illumination have been obtained.

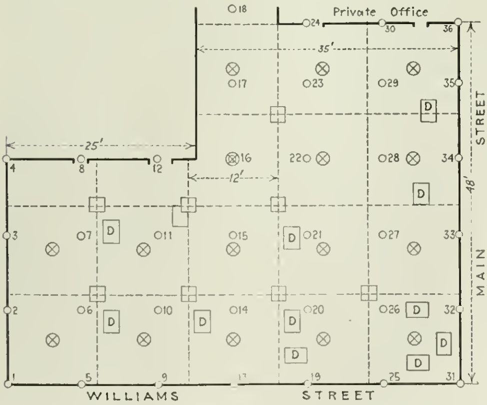


FIG. 5—SECOND-FLOOR PLAN

In Fig. 6 the illumination in foot-candles on the second floor is plotted as ordinates and station numbers as abscissas. Reference to Fig. 3 will show the location of the curves.

The window illumination has been increased by placing fourteen 40-watt tungsten units on the Williams Street side above the window ledge and seven 40-watt tungstens on the Main Street side. These lamps are equipped with Holophane metal reflectors.

The average of four readings on the cashier's desk inside the cage, which is directly under a fixture and 4 ft. above the floor, was 3.51 ft.-candles. Office employees are much pleased with the new system.

The average illumination was found to be 2.85 ft.-candles for the first floor and 3.12 ft.-candles for the second floor. The lamps were rated at 113 volts, but were burned at 112 volts. The average illumination corrected for this difference in voltage would be 2.97 ft.-candles and 3.25 ft.-candles respectively.

The total lumens emitted was determined by using the value 8.45 lumens per watt, which gave $13 \times 3 \times 60 \times 8.45 = 19{,}773$ lumens for the first floor and $16 \times 3 \times 60 \times 8.45 = 24{,}320$ lumens for the second floor.

The efficiency of the illumination was determined by using the relation:

$$\text{Efficiency per cent} = \frac{\text{floor area} \times \text{av'r'ge ft.-candles} \times 100}{\text{total lumens emitted}}$$

For the first floor this gave:

$$\frac{2144 \times 2.85}{19{,}773} = 30.8 \text{ per cent.}$$

and for the second floor,

$$\frac{2430 \times 3.12}{24{,}300} = 31.2 \text{ per cent.}$$

All readings were taken with a calibrated Sharp-Millar photometer with test-plate 30 in. above the floor.

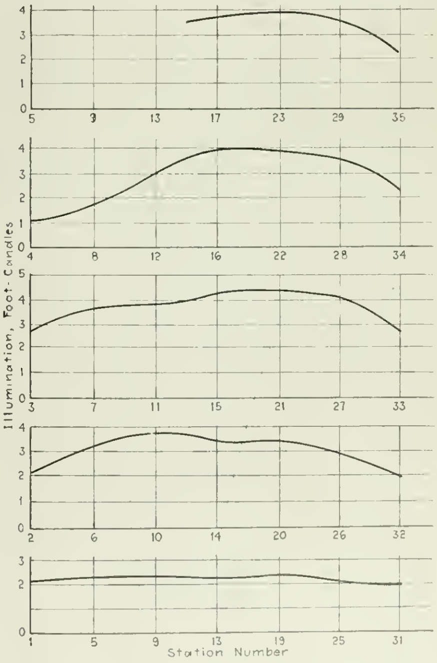


FIG. 6—INTENSITY OF ILLUMINATION ON SECOND FLOOR

The above observations were made by Messrs. W. L. Bice, E. A. Hurme and E. H. Gillette under the direction of Prof. H. H. Higbie, of the electrical engineering department of the University of Michigan, and through the courtesy of Mr. R. W. Hemphill, Jr., of the Eastern Michigan Edison Company.

Electrical Decorations at Rotary Club Banquet

At the annual banquet of the Pueblo (Col.) Rotary Club, held last month, the electrical decorations were pleasing and rather elaborate. At one end of the hall a large wheel outlined with many electric lamps rotated throughout the evening, energy being supplied by means of brush contacts on the main shaft. The tables in the hall were arranged in the form of a wheel having one large table in the center for the hub and smaller tables radiating from it to resemble the spokes. Comparable to the felloe of the wheel was a railing, in which gateways between the "spokes" provided access for guests and waiters. On this rim of the wheel were 4-cp yellow and green lamps, 8 in. apart, controlled by a twenty-four-point flasher giving the effect of a wheel turning on its axis. Mr. W. F. Raber, manager of the Arkansas Valley Railway, Light & Power Company, is a valued member of the club, and Mr. E. F. Stone, lighting and power superintendent of the same company, had charge of the electrical decorations.

Seattle's Nitrogen-Filled Street Lamps After 1000 Hours' Burning

One of the first shipments of nitrogen-filled high-efficiency tungsten lamps produced was delivered to the Seattle (Wash.) street-lighting department and immediately put into service there for a commercial test. As described on page 98 of the *Electrical World* of Jan. 10, 1914, these 6.6-amp, 56-watt units are operated from special 8-volt transformers, a separate transformer in the base of each five-lamp cluster pole supplying the corresponding five lamps in multiple.

By the first week in March, according to Mr. J. D. Ross, superintendent of lighting for the city of Seattle, forty of the cluster-pole lamps first put into service had been burning more than 1100 hours. These lamps give a beautiful white light, he adds, making the ordinary tungsten units look yellow in comparison.

Of the forty cluster-pole lamps installed, some had to be placed inverted, although this was then not supposed to be desirable. Experience has now shown, however, that the lamps seem to work equally well either way. Eight have burned out thus far, but the remainder appear to be still in excellent condition.

At the time the curb-post installation was made thirty-three lamps of the same size and having "Mogul" bases were installed on the city's arc circuits in series with the arc lamps. These have also now passed the 1100-hour mark. There have been eight replacements on account of burn-outs, but the remaining lamps show practically no signs of deterioration or blackening.

In addition to the lamps above mentioned the Seattle system has in service about 500 8-volt, 80-cp nitrogen-filled lamps fed from low-voltage transformers and about 500 others operating in series on the 6.6-amp series arc circuits. These and a smaller number of large lamps also in service have averaged to date about 800 hours' burning, but show thus far no evidences of deterioration.

The Packard lamp division of the General Electric Company, which furnished the nitrogen-filled lamps above referred to, has also developed for the use of the Seattle lighting department a large high-efficiency incandescent unit with which to replace arc lamps on the city's streets. These lamps are being placed in service as rapidly as possible and will, it is declared, double the candle-power of every street lamp in the city without increasing the consumption of energy.

Letters to the Editors

The Boundaries and Divisions of Standardization

To the Editors of the Electrical World:

SIRS:—An experience of many years in the standards committee of the American Institute of Electrical Engineers and the fact that the writer has recently become president of the Electric Power Club which has done much work in the standardization of electrical machinery have caused him to consider the proper jurisdiction of the various organizations interested in the subject.

Fundamentally there are three broad divisions of standardization—first, scientific; second, technical, and, third, industrial. True examples of scientific standards are the resistivity and temperature coefficient of copper. A proper matter for technical standardizing is the safe temperature limits of the various kinds of insulating material. As clear cases of industrial standardization may be cited the shaft diameters and speeds of different types and sizes of electric motors. A scientific problem should be handled by the United States Bureau of Standards or the American Physical Society. A technical electrical matter should be decided by the A. I. E. E., and an industrial electrical question properly belongs to the National Electric Light Association or the Electric Power Club.

The best way to solve the problems of standardization is not by conferences between a number of bodies acting jointly on the various subjects. Of course, co-operation is very desirable in some cases, but in dealing with many matters it is unnecessary. Standardization should be carried on in accordance with the following general scheme: First, each organization should have definite jurisdiction, within which it should have full authority. Second, each organization should as far as possible confine its action within its own jurisdiction. Third, when questions arise that are on the border, or when the authority and interest of two or more organizations overlap, then a conference between the interested parties should be held.

In order to determine jurisdiction, the following plan of procedure may be adopted: When any organization considers it desirable that something shall be standardized, its secretary shall communicate that fact to the secretaries of the other bodies likely to be interested in the same subject. Communications between the standards committees are not sufficient, because there may be several in one society and they may change from year to year. In most cases, from the nature of the particular matter involved, it is clear that it properly belongs to a certain organization, and the others will accordingly acquiesce. In other instances it is evident that a question is on the boundary between two bodies, and they will therefore agree to co-operate in acting upon it. Of course, failure to answer such a communication within a reasonable time would be tantamount to an abandonment of any claim to the matter involved. When there is doubt or difference of opinion as to jurisdiction that cannot be settled by correspondence between the parties interested, then the case may be referred to an arbitrator, for example, the director of the United States Bureau of Standards or the president of one of the national engineering societies not interested. The arbitrator merely decides which body or bodies shall have jurisdiction over that subject. The actual standards are determined by this body or bodies.

The first standardization of electrical apparatus and methods was the work of the A. I. E. E. several years before anything of the kind was done in other countries. In fact, it was the first comprehensive scheme of standardization generally adopted in any branch of science, technology or industry. At first the Institute was the only body competent or willing to undertake such work, and the standards were so general that they were important to almost all the branches of electrical engineering. Hence there was no question of jurisdiction at that time. Now there is much specialization with many organizations to cover the various branches. For example, the American Electrochemical Society and the Illuminating Engineering Society are strong and active in their respective fields, which are more or less included in electrical engineering. These are technical bodies of the same general character as the A. I. E. E., and there are also organizations largely industrial, such as the N. E. L. A. and the Electric Power Club, composed of manufacturers of electrical machinery, which cover much of the same ground as the A. I. E. E. but from a different standpoint.

On account of the very rapid differentiating and specializing in electrical science, technology and industry it would seem that some general plan is needed for present and future standardization. In some cases it is quite evident that a certain body should have sole authority over a certain subject. For example, the electrochemists as a body should certainly determine all standardizing in that branch in spite of the fact that hundreds of members of the A. I. E. E. are also interested in it. An organization of men who devote themselves to a particular subject should be able to determine standards for it more correctly and more quickly than the A. I. E. E. This is true even though a committee or sub-committee is selected for its special knowledge of the subject, because the Institute as a whole is not qualified or interested to act upon the report of such a committee, however good it may be. Special subjects should be dealt with by those who live with them, so to speak, devoting their thoughts and efforts to them.

In all matters affecting standards it is of the utmost importance to give them very careful consideration. It is much better to have no standard than to have an ill-advised one or to have different standards for the same thing. It is hard to rectify mistakes of this kind. In looking back over the history of electrical and other standardizations, we see that the tendency has been to standardize too quickly, too often and too much. There have been dozens of wire gages; for example, electrical books in the English language may use the American, Birmingham or the standard British gages, each materially different from the other two. Many superfluous technical terms have also been introduced. Experience, therefore, indicates that we should be conservative in establishing standards. This is another reason why each organization should limit its action to those matters which it best understands. Thus fewer mistakes and at the same time better progress are likely to be made. All standardization committees should be careful not to rush in where angels fear to tread.

It is surely a mistake for any organization to reach out and attempt to standardize in any field that does not clearly belong to it. Each organization already has far more that is unquestionably within its province than it can possibly cover, and new ground is being rapidly opened up. The standards committee and sub-committees of the A. I. E. E., for example, have been working very hard for two years on a revision of its standardization rules. The general scope is not much greater than that of the former rules, but the new ones will be much more correct and complete. Nevertheless, there are many points that it would be desirable to cover more definitely, and a number of branches of the subject could advantageously be extended and important new matter added. Certainly the duty of the Institute is to cover its own particular field thoroughly before it seeks out or wanders into other fields to which its title is even questionable.

The Electric Power Club has one general standards committee, and there are eight sub-committees, each devoted to a particular class of electrical machinery, for example, one for large alternating-current generators, another for large direct-current generators, etc. A great deal has been and will be accomplished, but there is much more ground than it is possible to cover properly even though the work is strictly confined, as it should be, to the sizes of shaft, pulley, etc., speeds, nomenclature, ratings for different service and other matters that are industrial in contradistinction to those that are technical or scientific.

A great deal of trouble is caused to manufacturers and users of machine tools owing to the varying types, sizes and speeds of electric motors employed to drive them. Hence, the standardizing of motor dimensions for machine-tool drive is very desirable. This is solely an industrial matter that should be dealt with by the Electric Power Club and the National Tool Builders' Association acting jointly. Neither the A. I. E. E. nor the American Society of Mechanical Engineers should have anything to do with it, because it is clearly outside of their jurisdiction. As a matter of fact, it has been considered by committees of both of these bodies. Little has been accomplished, however, because it was thought necessary to consult all four organizations, and everybody's business is nobody's business.

New York, N. Y. FRANCIS B. CROCKER.

Consulting Engineers and Manufacturers

To the Editors of the Electrical World:

SIRS:—Last Friday evening, at the annual "electrical night" of the New York Railroad Club, after some descriptive remarks on electrification work progressing under his supervision, Mr. George Gibbs discussed in very strong terms the relation of American electrical manufacturing companies to electrification engineering. It has been customary on these occasions to allow to those invited to speak the utmost freedom in the choice of subjects, and no manuscript is asked for in advance. They are invited to discuss whatever phase of electrical engineering is, in their opinion, important. This particular subject has been frequently and energetically discussed in the past, but always in private. Its importance is so great that it should be discussed publicly, and Mr. Gibbs doubtless desired to take advantage of a time and place where he could open the discussion on his own responsibility.

If I understood Mr. Gibbs correctly, his position is

(1) That electrical manufacturing companies in the United States have shown that they desire to sell plant and to project engineering in addition to their legitimate business of selling manufactured goods.

(2) That the excellence of their apparatus is beyond question, but that their engineering for the use of this apparatus is too frequently mere salesmen's tactics. Such engineering, of necessity, is bound to be more or less governed by commercialism, and is, therefore, likely to be unsound.

(3) That it seems to be considered good business for these companies to advocate strongly the particular system of electrification in which they have a proprietary advantage or which has, for them, some other commercial advantage.

(4) That their practice is not economically sound and should be changed for one of hearty co-operation with designing and assembling engineers outside their organization. The manufacturing companies should limit their energy to perfecting the apparatus they sell.

Mr. Gibbs is right in his first point. The manufacturing companies do sell engineering. Whether the customer pays for it directly or indirectly he pays, and, therefore, it is sold. The companies either do it voluntarily or because, from their point of view, they are forced to do so. There are many reasons for thinking that they do not do it voluntarily. In fact, it is known that they believe circumstances force them to do it. What are the circumstances?

They desire to sell apparatus for electrification. Before this apparatus can be sold a large amount of expensive engineering investigation is necessary. Moreover, the prospective purchaser is usually lukewarm and needs plenty of inducing. Now, says the manufacturing company, either the outside engineer cannot afford to, or will not, do this preliminary work unless the prospective client will pay for it all. This the railroad president or general manager is not sufficiently interested to do, except in a few cases. Therefore, say the manufacturers, we must do it or sit idly by and not apply the same salesmanship that we apply in other departments. We should like to work with the consulting engineer, but we cannot let him obstruct our business.

This is perhaps true, and if this were the place, I should like to tell some of the woes that I think will come to consulting engineering in this country unless those practising it apply some salesmanship to it. Engineering may be a profession, but consulting engineering is not. It is a business.

Mr. Gibbs is right in his second point. The manufacturing company engineer is tinged with commercialism. Would he ever recommend, for example, that something be purchased from a rival company? In nine cases out of ten he is doing free work apparently, which, however, is to be paid for when the apparatus is purchased. This has nothing to do with the engineer himself or with his integrity. He may be better informed than any consulting engineer in the country. He may be just as close to operation as any but one or two of the "electrification engineers" of the country to-day. But in all his work there is the purpose to sell apparatus for his company. He is an advocate, not a judge. He could, under other circumstances, do as well as any engineer in the world. The circumstances of his position are at fault—not he himself. There is ample analogy in the law. The lawyer pleading before the bar may know twenty times as much as a judge, but he is not allowed to pass judgment. The lawyer may cease to be a lawyer and become a judge to-morrow, but he himself is not different. He can and will render a just decision, however, because circumstances permit him to do so.

I do not believe that the companies or their engineers ever advocate something unfitted for the project merely because it would be to their commercial advantage. I have too much confidence in their integrity. The worst that I am willing to charge is an honest but warped judgment, due to circumstances. The truth is that their experimental work is successful along certain lines. The resulting enthusiasm leads them, as it would lead any one, to attribute more versatility to the child of their energy than is really possessed. This, however, is only another reason why they are incapable of deciding conservatively when the interests of others clash with their own. So far as the undue advocacy of systems is concerned, it is fair to the manufacturing engineer to say that the two foremost and vociferous advocates of rival systems to-day are not manufacturing but operating and consulting engineers. And, further, from the standpoint of knowledge, several of these outside engineers have had comparatively little experience with any system except the one which they advocate so strongly.

From every possible point of view, I agree with Mr. Gibbs in his belief that the manufacturing company and its engineers should withdraw from all electrification engineering except that necessary to design and construct properly the apparatus they sell. I do not believe this because the present policy may be against the pecuniary interests of the consulting engineer. The consulting engineer who is not able to cope with a factor of this kind had better be in some other business or practising engineering under a salary. I do believe it, however, from the standpoint of the manufacturing company itself, and more particularly from the standpoint of the purchaser or client. If the manufacturing companies want to do this work, it would be far better for them to form and finance a separate and distinct organization for the purpose. It is a mistaken policy, in my opinion, to add the very great costs of this engineering to the overhead costs of manufacturing. Moreover, they are undertaking work which a manufacturing organization is not equipped to do properly. They are assuming the responsibility of making a variety of apparatus work together properly, when, in reality, the greater part of their energy is spent on the design and construction of certain portions of the apparatus.

And what about their treatment of the purchaser? Is it fair for them to go to him and say that he can safely intrust his whole problem to them, with the assurance that he will get the very best solution, when at the outset they mean to exclude practically all other manufactured material except their own? If they knew, by any chance, that a rival interest had something to sell which would be much better for the client than that which they themselves manufacture, could they possibly offer it? In the last analysis, is there not a certain moral dereliction in carrying the usual methods of salesmanship so far and apparently offering something for nothing?

Would they honestly contend that such a method is a safe one from the standpoint of the client?

The serious question, however, is: Are the manufacturing companies compelled to do this? I know that there are weak so-called consulting engineers. I know that any consulting engineer in such an art as electrification, with its very rapid development, must lean very heavily on the engineers of manufacturing companies. Would it not be better, however, for the manufacturing company to insist, for its own protection, that a consulting engineer of sufficient ability be connected with the work, unless there is an operating engineer with time and ability to serve on the part of the client?

I think the real difficulty in this particular connection is with the consulting engineer. I doubt very much whether, in spite of what the manufacturing companies are doing to-day, they would not prefer to have a good, strong consulting engineer work up the project; but the ordinary consulting engineer is usually too much of a professional gentleman waiting for someone to retain him. He is too willing to stand by until the railroad manager decides to electrify and wants someone to tell him how to do it.

I do not mean at all that he ought to go out and, in the ordinary way of a commercial salesman, solicit work. Nevertheless, it seems almost too altruistic to ask manufacturing companies to-day to do investigation work in order to prove the advisability of further study of a certain project and then recommend that the railroad employ an independent consulting engineer who may or may not give them business. I think Mr. Gibbs, therefore, is correct in his criticism, but the discussion certainly should proceed to a recommendation as to what should be done. For my part, whatever this recommendation may be, I am convinced that the consulting engineer must do something on his own account which he has not done heretofore.

New York, N. Y. WILLIAM MCCLELLAN.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Operating Methods in Large Steam Power Plants

About 250 members and guests at the dinner meeting of the Chicago Section of the American Society of Mechanical Engineers held at the Hotel Sherman on March 18 listened to interesting discussions of large steam-power plants. The speakers of the evening, Messrs. I. E. Moulthrop of Boston, W. J. Parker of Detroit, John Hunter of St. Louis and W. L. Abbott of Chicago, are men in responsible charge of some of the largest steam-power plants in this country. Abstracts of their opinions on the subjects discussed are given in what follows.

For Greater Plant Efficiency Begin in the Boiler Room

After commenting upon the broadening influence that joint meetings of technical societies have on engineers, Mr. I. E. Moulthrop said that he thought increases in plant efficiency in the future would be obtained by giving additional attention to boiler-room operation. Although there are at present many accurate instruments for measuring and recording the operation of the electrical end of a station, instruments for boiler-room work have not as yet reached a desirable degree of accuracy. Speaking of boiler-room instruments now in use, Mr. Moulthrop said that the visual load indicator was generally the first helpful device installed. Of other instruments he said that he thought the CO_2 recorder very good as a laboratory instrument but as yet hardly practicable for boiler-room use. The steam-flow meter was characterized as a most valuable aid to the fireman when used in conjunction with draft gages and other instruments.

Discussing the subject of draft, Mr. Moulthrop said that a stack large enough to carry the gases to an unobjectionable height would in most cases supply sufficient draft for the boilers. However, the speaker said that forced draft affords better control. Ideal conditions exist where the stoker operating at normal rating of the boiler uses only natural draft but is arranged so that during the peak forced draft may be utilized, forcing the boiler to 300 per cent of its rating. One unit in the station of the Edison Electric Illuminating Company of Boston thus adjusted is ordinarily raised from 125 per cent load to 300 per cent load in five minutes when the peak comes on the station.

The High-Grade Engineer for the Boiler Room

Inasmuch as the economy of the plant is in the hands of the operating engineer, Mr. Moulthrop contended that the time is past when the high-grade engineer should be placed in the turbine room, leaving the operation of the boiler room in the hands of the fireman. Since the advent of the stoker has changed the aspect of the modern boiler room, making it a light, clean and attractive place, the speaker says there is no reason why this job should not attract better men.

Reliability of Large Boilers

Mr. J. W. Parker, of Detroit, Mich., speaking of the large boilers of the Detroit Edison Company, said that one advantage of the large unit is that the company can afford instruments for each boiler, allowing a closer watch upon the operation of each. As to the reliability of large boilers, he said that they are more to be depended upon than the turbines. The Detroit company has never lost the use of a boiler during the peak, nor has it been obliged to take a boiler from the lines when it was needed. Although the large units were rather clumsy to handle at first, the centralization of all control apparatus at one point has eliminated this disadvantage. Thus far all apparatus is hand controlled as the development of proper types has been gradual and the next step will probably be the design of an automatic machine to care for all of these operations. One change mentioned in connection with the large unit was the elimination of the small steam stoker engine and the substitution of a direct-current motor. Mr. Parker's opinion of the CO_2 machine differed from that of Mr. Moulthrop, and he said that by taking samples of the flue gas at four different points on the same horizontal plane and automatically mixing the gases he had been able to secure readings representative of the condition of the flue gases in the stack. In the Detroit company's station the readings of the CO_2 recorder vary from 10 per cent to 16 per cent, the average reading being in the neighborhood of 13.5 per cent. Mr. Parker said that he was in favor of putting college graduates in charge of boiler-room operations as he believed they not only would gain good first-hand experience there but would be able to render valuable service to the company.

Results of Six Months' Observations in St. Louis

In commenting upon the engineering problems arising as a result of the purchase of energy amounting to 60,000 hp from the hydroelectric plant at Keokuk and the consequent invention of a quick-firing method for steam boilers, Mr. John Hunter, chief engineer of steam plants Union Electric Light & Power Company, St. Louis, Mo., said that it is vital to keep dampers closed in such quick-firing boilers. Circulation of air should be prevented so that the brick settings will be kept hot. From observations it has been found in St. Louis that the firebrick suffers very little from the flames when the fires are started if these precautions are taken. Investigation has shown, however, that pitting occurs in the boiler drums near the water line. While this action is not serious, it has served to warn engineers that a danger confronts them. The pitting is of such character as to indicate that galvanic action takes place between the metal of the boilers and particles of carbonaceous matter adhering to them. Prevention of immediate further action has been accomplished by thoroughly cleaning the corroded spots, scraping and wire-brushing the entire inside of the drum, and applying two coats of graphite paint, permitting each coat to dry thoroughly. As a further preventive measure the treatment of the boiler-feed water has been changed. Previously the company used a coagulant of lime and sulphate of iron, adding a small per cent of soda ash. Believing, however, that the soda ash caused the concentration of sodium sulphate in the boilers, which served as an electrolyte for the galvanic action, barium hydrate has been substituted for the soda ash. It is hoped that this chemical will remove all the organic matter and a large percentage of the permanent hardness from the water, at the same time avoiding the presence of a strongly alkaline solution in the boilers.

Removing Iron Coils from Transformers

While speaking of pitting and deterioration of iron, said Mr. Hunter, an experience which the Union Electric Light & Power Company has been having with cooling coils of high-tension transformers on the hydroelectric system might be mentioned. Careful examination of the iron coils in these transformers showed that they were in a strong magnetic field and were highly magnetized. After being in service for six months it was found that the inside of the coil had deteriorated rapidly, giving the appearance of galvanic action. The pipes had also become heavily coated on the inside with mud deposited by the cooling water. To remedy the difficulty brass pipes have been substituted for the iron, and experience thus far shows that there is no pitting or accumulation of silt.

Mr. Abbott on Condensers

Mr. W. L. Abbott, operating engineer of the Commonwealth Edison Company, Chicago, Ill., in commenting on the growth of the Chicago central-station system during the past twenty years, said that energy is now being generated in the company's stations at a fuel consumption per kilowatt-hour one-half that required twenty years ago. Discussing ways and means for increasing station efficiency, Mr. Abbott suggested the use of shorter boilers operated at greater overloads, utilizing the material saved in boiler construction to build larger economizers. Mr. Abbott believes there is wide field for improvement in the design and construction of more efficient condensers, and in this connection he declared that during the past few years there had been less good judgment displayed in the design of condensers than in any other piece of power-station apparatus. Condenser designers have followed too closely the work of boiler designers, with the result that steam passes through the condensers at high velocities, creating high back-pressures against which the steam-generating unit must operate.

Purchase of Oil Fuel—II

By R. T. Strohm

One method of determining the percentage of water in oil is to make use of the affinity of petroleum ether for water. A weighed sample of the oil to be tested is placed in a test tube, petroleum ether is added, the two are shaken together and are then allowed to stand. The ether, with the water it has taken up from the oil, will collect on top of the oil and should be decanted into another tube. The remaining oil should again be washed with petroleum ether, the clear solution decanted and added to that in the second tube. A third washing may be performed in the same way.

The water in the oil is removed by these washings, being carried away by the ether. The second test tube is now heated to a temperature of from 100 deg. to 140 deg. Fahr., when the petroleum ether boils and passes off, leaving the water in the bottom of the test tube. The weight of this water, divided by the weight of the original sample of oil and multiplied by 100, gives the percentage of water in the oil.

Another method is to weigh the sample of oil and then to add to it a known weight of plaster of paris that has been gently ignited. The plaster of paris will take up all the water in the oil, after which it should be removed and washed with gasoline to remove all oil. It should then be dried at a gentle heat, to drive off the remaining gasoline, and weighed. The increase of weight represents the water absorbed from the oil. Thus, the weight of the original sample of oil and the weight of the moisture are known, and the percentage of moisture may readily be calculated. A good oil for fuel should not contain more than 2 per cent of water.

Oil should have a specific gravity of from 0.85 to 0.96 at a temperature of 59 deg. Fahr., and should be rejected if its specific gravity is 0.97 or more at that temperature. It should not contain any solid or semisolid bodies and should flow readily at ordinary temperatures. A good test for fluidity is that the oil shall flow easily through 10 ft. of 4-in. pipe under the pressure due to a head of 1 ft. of oil. It should not freeze or become too sluggish to flow at 32 deg. Fahr. The calorific value should not be less than 18,000 British thermal units per pound. As for cleanness there should be no more than a trace of sand, dirt or clay.

The oil should not contain more than 1 per cent of sulphur. The amount present in the oil may be determined in the following manner: A sample of 50 cc. is put in a flask and 0.5 gram of sodium bicarbonate is added. Heat is applied to the mixture and it is distilled at the rate of about 50 drops per minute until about 45 cc. has been driven off. The residue is then placed in a large porcelain dish and is washed several times with petroleum ether. The ether is collected from the several washings and evaporated. About half a gram of sodium is next added in small pieces, the whole is evaporated over a small flame until it becomes sirupy, and then is ignited. The ignition is continued until the ash is quite white, ammonium nitrate being added gradually during the operation. The residue is treated with very dilute hydrochloric acid and barium chloride is added, precipitating barium sulphate. The precipitate is separated by filtration, washed, ignited and weighed, and the amount of sulphur contained in it is calculated by multiplying its weight by 0.13733. The weight of sulphur divided by the weight of the original sample and multiplied by 100 gives the percentage of sulphur in the oil.

A test may be made with the greatest degree of accuracy, yet it will be of little value in showing the composition of an oil unless the sample that is tested represents properly the whole quantity of oil. Poor methods of taking samples or mistakes in following approved methods may result in unfair and misleading results. For this reason it is very important that the sampling be done correctly.

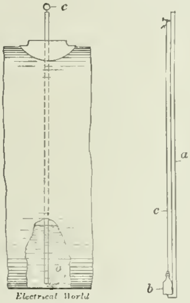
Method of Taking Sample

The manner in which samples are taken depends on the way in which the fuel is delivered. If the oil is brought by tank wagon or tank car and is allowed to flow into the storage tank in such a way that the end of the discharge pipe is accessible, sampling may be done with a dipper holding about a pint. Immediately after the oil begins to flow into the storage tank, the dipper should be filled from the stream of oil escaping at the end of the pipe. The sample thus obtained should be poured into a clean vessel. In the same way other samples should be taken at equal spaces of time during the emptying of the car or wagon. The samples should be taken often enough to give a final combined sample of at least a gallon, and this gallon sample should be thoroughly mixed before any of it is tested for water or sulphur. The dipper used for taking the samples should always be filled to the same point, so that equal amounts will be taken at equal intervals; but if the first dipperful shows water in the oil, it should be thrown away and not poured into the receiving vessel.

In case the end of the discharge pipe cannot be reached for sampling with a dipper, a hole may be tapped in the under side of the pipe and a short piece of ½-in. pipe and a valve attached. Then, during the whole time in which the oil is being discharged, the valve should be left open a fixed amount and a continuous sample of the oil thus collected. This quantity should be thoroughly mixed in a clean vessel and a sample of about a gallon should be taken from it for the tests.

In case the oil is to be sampled in a tank, a piece of 1-in. pipe somewhat longer than the depth of the tank should be used, as shown in Fig. 3. A piece of wire *a* is attached to a tapered wooden plug *b* of sufficient size to close the end of the pipe. The wire is carried through the pipe and has a loop *c* at the upper end. To take the sample, the pipe with the plug hanging below it is slowly lowered vertically into the oil. As it descends the oil rises inside it, and when it has reached the bottom it has inclosed a column of oil from the top to the bottom. The wire is now pulled up, drawing the plug into the lower end of the pipe, where it may be fixed securely by bumping the pipe against the bottom of the tank.

The pipe is now drawn out and emptied into a vessel. The oil thus obtained is a representative sample, because it contains oil from every level between the top and the bottom of the tank; thus, even if the oil has separated into layers of different specific gravities, the sample includes some of each. Particular care should be taken to lower the pipe slowly, so that the oil will not be stirred up.



FIGS. 3 AND 4—ARRANGEMENT FOR SAMPLING OIL IN TANKS AND DEVICE FOR TAKING SAMPLES OF OIL

If it is deemed advisable to take samples from various parts of a tank instead of just below the manhole, a device like that in Fig. 4 may be used to advantage. It consists of a pole *a*, long enough to reach to any part of the tank, to which is fixed a bottle *b*. To the cork is fastened a string *c* whose other end is attached to the upper end of the pole. To use the sampler, the bottle is cleaned and loosely corked. Then it is lowered by the pole to the point where the sample is to be taken and the cork is removed by a pull on the string. The bottle immediately fills with oil, is drawn out, emptied, and cleaned for the next sampling. In this way samples are taken from various points symmetrically located in the tank. These samples, when mixed thoroughly, form a representative sample.

Sand or earthy matter in oil will eventually settle to the bottom if the oil is allowed to stand for a time undisturbed. Consequently, to determine whether an oil contains dirt, a cup fixed to a long handle may be used to scrape up a sample along the bottom of the tank. If the cupful shows a considerable amount of solid matter, the oil is dirty and may prove troublesome to use.

Induction in Iron Conduit

Three 3-in. iron conduits spaced 8 in. apart are being installed, each to contain three 500,000-circ. mil conductors carrying 440-volt, sixty-cycle, three-phase energy. Will the loss due to induction in the conduit be considerable on a 200-ft. distributing circuit when the conductors are carrying their full load? A. W. L.

You will encounter no difficulty from induction in your three-phase cables if they are inserted in single, iron conduits. At each instant the negative and the positive values of the currents in a balanced three-phase system have a total sum which equals zero, and therefore there is no external inductive action. With three separate iron conduits, each containing the three leads of a three-phase system, there will be no inductive effect between the three separate conduits.

Allowable Outlets on a Branch Circuit

In wiring a factory for 10-watt tungsten lamps, how many outlets should be connected to each branch circuit? G. L. H.

It is allowable to connect a maximum of sixteen sockets (or receptacles) onto one branch circuit provided the total load of these sockets does not exceed 660 watts. By special permission from the inspection department having jurisdiction in cases where No. 14 rubber-covered wire or its equivalent is used with keyless sockets and where there is no chance of small motors, heating devices or lamp clusters being fed from any of the receptacles, it is allowable to connect thirty-two sockets (or receptacles) onto one branch circuit feeding not more than 1320 watts.

Gradual Voltage Drop of Generator When Running at Full Load

We have an old-style revolving-armature, 90-kw, 2200-volt, single-phase generator, which, when started, gives the required voltage at the secondary taps of a step-down transformer, but after operating two or three hours at full load the secondary potential drops from 120 volts to 110 volts. What is the cause of the drop and how can it be prevented? F. T. B.

The decrease in potential across the secondary taps of your transformer may be caused by an excessive temperature rise in the generator or transformer conductors (especially in the field coils), or by a gradual decrease in the power-factor of the load. In a generator of this size a rise in temperature of 60 deg. C. would cause the field current to decrease about 17 per cent. The degree to which the generated voltage will be affected by the decreased field current will depend on the proximity of the field flux density employed to the knee of the magnetization curve. If the cross-section of the armature conductors is restricted enough to produce excessive heating, their increase in resistance will also reduce the useful potential available by increasing the internal drop in the machine. To ascertain whether heating or power-factor is responsible for the voltage drop observe the secondary voltage when the generator is operated at full load first with unity power-factor and then with a low power-factor. If heating is found to be the cause, the equipment will have to be operated at lower than its rated output (unless redesigned), or else a higher rate of heat radiation must be provided. By arranging a blower with its draft directed on the parts subjected to the highest temperature rise, the electrical output may be considerably increased. If low power-factor is the cause of the drop, the potential may be maintained practically constant by floating an over-excited synchronous motor on the line or by replacing some of the inductive apparatus by equipment taking a leading current. Any decrease would be augmented by a lowering of the voltage of the exciter as it became hot.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Armature Circulating Currents in Lap-Wound Multipolars.—C. C. Hawkins.—Lulofs has shown how in a four-pole machine with lap-wound armature circulating currents partially compensate for unequal pole-strengths. His further conclusion that the same action is not present with six or eight poles is here brought in question, and it is shown that the same principle holds in all multipolar machines with lap-wound armatures. The article is profusely illustrated by diagrams. —London *Electrician,* March 6, 1914.

Lamps and Lighting

Metallic-Filament Lamp.—A description of a new metallic-filament lamp, the feature of which is the peculiar arrangement of the filament, as shown in Fig. 1, giving a horizontal illuminating surface. The lamp is especially useful for table lighting and for purposes in which the horizontal illumination should be a maximum. In Fig. 2 curve 1 gives the candle-power distribution from such a lamp, and curve 2 gives the candle-power distribution from an ordinary metallic-filament lamp.—*Elek. Zeit.,* Feb. 26, 1914.

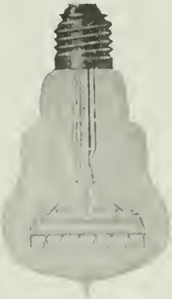


FIG. 1—METALLIC-FILAMENT LAMP

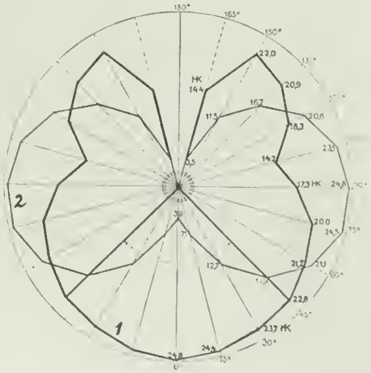


FIG. 2—DISTRIBUTION CURVE

Malleable Tungsten.—A note on a recent British patent (No. 5150, 1913) of J. Canello. The finely divided metal is mixed with a small quantity of nickel, and with glycerine to act as a binding agent. The mixture is then compressed, slowly dried, and afterward sintered in an electric furnace.—London *Elec. Eng'ing,* March 5, 1913.

"Marble Light."—W. Voege.—An illustrated article on the so-called "marble light," the characteristic feature of which is the use of translucent marble plates instead of the usual white glass in illumination fittings. It has long been known that marble in very thin layers is translucent and that very pretty light effects can be obtained especially with thin colored marble layers. But the high expense of grinding thin layers has prevented their extended use. According to a recent process of H. W. Engel, marble plates of 3 mm to 20 mm (1/8 in. to 25/32 in.) thickness can be made translucent by a special grinding and impregnating process so that they are superior in translucency to white-glass plates of normal thickness. In this process the marble plates are first ground on both sides and are then impregnated at high pressures and temperatures with oils of different kinds. This new process is much less expensive than the manufacture of thin plates of a few tenths of a millimeter in thickness. The thick marble plates are naturally also very strong. Colored marble plates of this thickness give beautiful light effects which cannot be imitated at all by means of colored glass. On some of the German transatlantic steamers skylights are used consisting of colored marble plates illuminated by electric incandescent lamps. In the present article the author deals very simply with the use of white marble in place of white glass. He first gives results of tests of the translucency and diffusion capacity of impregnated marble and white glass for rays within the visible spectrum. One of the tests was as follows: The author's laboratory is usually illuminated by three 25-cp clear-bulb tantalum lamps and six 25-cp frosted tantalum lamps. The illumination obtained thereby is on the average 25.6 lux, the maximum being 70 lux and the minimum 6 lux. The specific consumption with these tantalum lamps is 0.43 watt per lux per square meter. For nine tungsten lamps arranged in the same way the specific consumption would be 0.31 watt per lux per square meter. In a second and third test these line-distributed lamps were replaced by a single high-candle-power metallic-filament lamp, diffusion of the light being obtained by means of white glass or white marble. In both cases a 330-watt, 400-cp osram lamp was used. With white glass the illumination was 20 lux on the average, the maximum being 36 lux and the minimum 10 lux, and the specific consumption 0.43 watt per lux per sq. m. With white marble the illumination was 27.7 lux on the average, the maximum being 55 lux and the minimum 11 lux, and the specific consumption 0.34 watt per lux per sq. m. The results show that the use of a single high-candle-power metallic-filament lamp with white marble gives about the same specific consumption as nine distributed osram lamps, while the uniformity of illumination is very much better with the marble (55 to 11, against 70 to 6). With white

glass this uniformity is also satisfactory, but the specific consumption is higher. Other tests also show that marble plates are more translucent than any other absorbing media. A pure white light is obtained while any irritating effect is avoided. All observers agree that the "marble light" appeared to be particularly agreeable to the eye. The author tried to find a reason for this. No difference could be found between marble and white glass as to translucency for ultra-violet rays. The only difference between marble and white glass is that if the two media permit the same amount of light to pass through, marble absorbs the dark heat rays to a much greater degree than any other medium, and it is thought that this fact explains the beneficial physiological effect. Where indirect or semi-indirect illumination is impracticable, the author thinks that the use of white marble gives the most agreeable light at present.—*Elek. Zeit.*, Feb. 19, 1914.

"*Cathode Incandescent Lamps.*"—H. Greinacher.—When an electric discharge passes between two electrodes in a vacuum tube (Geissler tube) the cathode is strongly heated while the heating of the anode is small. In cathode tubes it is important to avoid this heating of the cathode, which is, therefore, made of large mass and surface. In the present instance, however, the author has endeavored to utilize this same effect as a source of light. For demonstration purposes the arrangement of Fig. 3 may be used. Two carbon lamps or metallic-filament lamps are connected together through a glass tube, and the whole, consisting of the two globes and the connecting glass tube, is evacuated. After the terminals of an induction apparatus are connected to the two lamps, a discharge passes from one lamp to the other lamp. It will be found that the lamp connected with the negative pole becomes incandescent while the other lamp remains dark. By using a sufficiently strong secondary current (employing an induction apparatus with Wehnelt interrupter) the lamp connected with the negative pole becomes lighted as though it were used under ordinary conditions. This arrangement is useful for producing very pretty luminescence effects, but the cathode soon disintegrates and the globe blackens so that this arrangement cannot be used for practical purposes. For practical applications the author suggests the arrangement shown in Fig. 4, the material of the Nernst-lamp filament being employed. Nernst filaments S are inserted in quartz tubes Q in a glass globe with attached tubes R which may be evacuated from A as shown in the illustration. Connection of the Nernst filaments with the outside circuit is made through platinum wires Pt. If a vacuum of a few millimeters of mercury traversed by a 1000-volt alternating current, a blue brush discharge is emitted from the filaments S. These are thereby heated until they get white hot. The starting of the lamp takes only a few seconds. The new lamps can be made in a very simple manner. A high-vacuum pump is not required. It even seems better not to push the vacuum too far. "With 820 volts between the filaments the current measured was 0.11 amp so that the power consumption was 90 watts. The lamp was at least as bright as a 50-cp incandescent lamp." The author questions whether the cathode incandescent lamp would be useful for all purposes or only for cases where direct connection to a high-voltage circuit is desirable.—*Elek. Zeit.*, March 5, 1914.

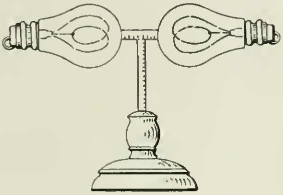


FIG. 3—ARRANGEMENT OF LAMPS

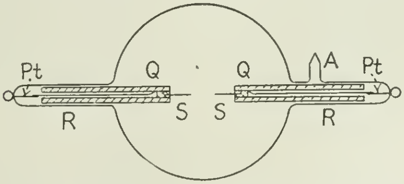


FIG. 4—ARRANGEMENT WITH NERNST-LAMP FILAMENT

Generation, Transmission and Distribution

Transmission Lines.—Ulisse del Buono.—An extensive paper read before the Italian Electrical Engineering Association on the calculation and testing of long-distance transmission lines. The author gives a very simple and rapid method for calculating the regulation, energy losses, etc., in overhead lines and gives a report of tests made on the line from Pescara to Naples which has a length of 185 km (111 miles) and is operated at 90,000 volts. These tests related to the regulation at different loads. The line capacity, inductance, corona losses, etc., were also measured. The results show a very close agreement between measurements and calculations. The paper contains numerous diagrams.—*Assoc. Elettrotecnica Italiana*, Vol. 17, Oct. 31, 1913.

Connections of Three-Phase Transformers. — R. Swyngedauw.—The magnetic flux produced by a sinusoidal current in the core of a transformer is not itself sinusoidal if the iron is saturated. The third harmonic in the flux wave is the more pronounced the higher the saturation of the iron. The author studies the influence of this harmonic on the liability of producing dangerous high voltages in three-phase lines supplied from the transformers. He concludes that the danger of such rises of voltage disappears if the third harmonics are prevented from entering into the line by means of connecting in delta the secondary winding of the transformer at the transmitting station and the primary winding at the receiving station—*Comptes Rendus*, Vol. 158, page 484; abstracted in *La Revue Elec.*, March 6, 1914.

Three-Phase Transmission.—A. Blondel.—A paper on the influence of the method of connecting the transformer windings on three-phase transformer systems. In order to protect the transmission system against the effect of the third harmonics two remedies may be employed. The first is the use of transformers or groups of transformers in the transmitting as well as receiving stations with their low-tension circuits connected in delta and their high-tension circuits connected in star. The second remedy is the use of a metallic insulated "equilibrium wire" connecting the neutral points of the high-tension windings of the transmitting and the receiving stations.—*Comptes Rendus*, Feb. 16, 1914; abstracted in *La Revue Elec.*, March 6, 1914.

Hoisting Plants.—Wilfred Sykes.—An article illustrated by diagrams on the power requirements of electric hoisting plants.—*Elec. Journal*, March, 1914.

Traction

Stockholm Suburban Road.—F. F. son Holmgren.—The conclusion of his illustrated article on the electrification of the suburban road from Stockholm to Saltsjobaden in Sweden. In the present instalment details are given of the line construction and of the motor-generator station where the three-phase currents are changed to 1350-volt direct current. Some notes are given on the results obtained since the line was opened in May, 1913, and on the way in which some initial difficulties were overcome.—*Elek. Zeit.*, March 5, 1914.

Electrification of Railways.—E. de Marchena.—A report on the present situation in the electrification of railways with special reference to France.—*La Houille Blanche*, Jan. 1, 1914.

Petrol-Electric Motor Cars.—A brief illustrated article on the use of petrol-electric motor cars on the Swedish railways.—*La Lumière Elec.*, March 7, 1914.

Installations, Systems and Appliances

Paper and Pulp Industry.—E. C. Morse.—An illustrated article on the use of electric motors in the pulp and paper industry, with tables giving the typical electric-drive equipment for different machines.—*Elec. Journal*, March, 1914.

Units, Measurements and Instruments

Measuring the Resistance of a Ground.—M. Lasalle.—Usually the resistance of a ground connection is determined by Kohlrausch's bridge method with a telephone. The method supposes that three grounds x, y and z are available. The values $x + y$, $x + z$, and $y + z$ are determined in succession so that one gets the equations from which the values of the three resistances can be calculated. The connections for determining the value of $x + y$ are shown in Fig. 5. When silence is obtained in the telephone we have $b\ (x + y) = aR$, where a and b form together the contact wire along which a contact slides. In an analogous way the values $x + z$ and $y + z$ are determined. The author points out that this method has several inconveniences and may be advantageously replaced by the following method. The value $x + y$ is determined as described above, but then the connections are changed to those of Fig. 6. All that is to be done for this purpose is to change the connection of the telephone from the ground x to the third ground z. When silence is obtained in the telephone we have $by = a\ (R + x)$. We have, therefore, two equations for the two unknown values x and y. This method is, therefore, simpler and requires less calculation than the former method. It is also more accurate.—*Assoc. des Ingen. Elec. Inst. Electrotec. Montefiore*, November, 1913.

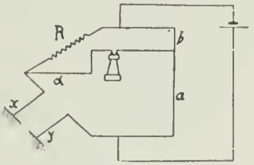


FIG. 5—DIAGRAM OF CONNECTIONS FOR DETERMINING RESISTANCE OF GROUNDS

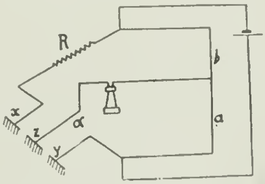


FIG. 6—DIAGRAM OF CONNECTIONS FOR DETERMINING RESISTANCE OF GROUNDS

Testing Work of a Power Company.—T. F. Whimster.—An illustrated paper on the electric testing work of a large power company. The author discusses the initial examination and adjustment and the maintenance of all electric protective apparatus, such as feeder and transformer protective gear, and the initial and routine testing and repairs of all electricity meters and all measuring instruments. He then takes up what may be called special testing work, such as efficiency and temperature tests of generators and transformers, etc., further electric tests of samples of materials such as tapes, insulators, oils, etc., and the use of the oscillograph. The paper is concluded by a chapter on standards and sub-standards. In an appendix several special problems are discussed, including a method of ascertaining the correct connection of three-phase meters, temperature tests of generators, etc.—*Transac. South African Inst. Elec. Eng.*, December, 1913.

Measuring Transformers.—E. Alberti and V. Vieweg.—An account of an investigation carried out in the Reichsanstalt on the experimental determination of the magnetizing current of a measuring transformer. Two methods were tested and compared. In the first method a determination is made of the transformation ratio and the phase difference between primary and secondary currents by means of a compensation method with the vibration galvanometer as zero instrument. In the second method the "magnetic voltage meter" (Spannungsmesser) is employed. This is the coil of uniform cross-section with uniformly distributed winding. In a magnetic alternating field the emf induced in this coil between its terminals is proportional to the magnetic tension between its terminals measured along its axis. Hence if the "magnetic voltage meter" embraces a number of windings through which the same current flows, the voltage of the magnetic meter is proportional to the embraced ampere windings, but lagging in phase by 90 deg. If the magnetic voltage meter is therefore placed simultaneously through the primary and secondary coils of a transformer, the emf of the magnetic voltage meter is proportional to the geometric difference of the primary and secondary ampere-turns. Both methods were applied to the test of a measuring transformer for 10 amp to 5 amp, and the results obtained with both methods are compared in the form of diagrams. These show certain differences which are explained by the effect of the wave-form of the magnetizing current on the measurement with the magnetic voltage meter.—*Archiv. f. Elek.*, Vol. II, 1913, No. 5.

Electrolytic Valves.—G. Schulze and R. Lindemann.—Zenneck has found that the rectifying effect of electrolytic valves decreases with increasing frequency. The present authors show that this is due to the electrostatic capacity and the critical tension of these valves. This is proved experimentally by the substitution of a mercury rectifier in parallel with a condenser for the electrolytic valve. The results of the experiments agree with the theory.—*Phys. Zeit.*, March 1, 1914.

String Electrometer.—Theo. Wulf.—An illustrated description of a string electrometer, the feature of which is the elastic method of fastening the lower end of the string whereby advantages are obtained with respect to sensitiveness and ease of transportation.—*Phys. Zeit.*, March 1, 1914.

Wires, Wiring and Conduits

Calculation of Lines.—J. Desplanques.—A mathematical article on a simple method of calculating a transmission line with respect to variation of temperature, change of wind pressure, variation of distance between poles, variation of slag, effect of a rupture on the line, etc.—*Assoc. des Ing. Elec. Inst. Electrotec. Montefiore*, November, 1913.

Insulating Conductors.—A note on a recent British patent (No. 18,517, 1913) of J. A. Heany. Fibrous insulation, such as asbestos, is applied to conductors as a smooth uniform sheath. This is effected by covering a thread or filamentary body with a coating of the fibers, using an adhesive binder, winding this on the conductor, and finally smoothing.—London *Electrical Eng'ing,* March 5, 1914.

Electrophysics and Magnetism

Natural and Artificial Electrification of the Atmosphere.—Sir Oliver Lodge.—His Kelvin lecture, in which the measurement and causes of the electrification of the atmosphere and its relation to the weather are discussed. The author then deals with artificial electrification and the application of electricity to agriculture, and makes suggestions as to researches needed in this direction and the possibilities of weather control.—London *Elec. Eng'ing,* March 6, 1914.

Effect of Electric and Magnetic Fields on Spectral Lines.—N. Bohr.—In a previous paper the author had shown that an explanation of some of the laws of line spectra may be obtained by applying Planck's theory of black radiation to Rutherford's theory of the structure of atoms. In the present paper these considerations are further developed, and it is shown that it seems possible on the theory to account for some of the characteristic features of the recent discovery by Stark of the effect of an electric field on spectral lines, as well as of the effect of a magnetic field first discovered by Zeeman. It is also shown that the theory seems to offer an explanation of the appearance of ordinary double spectral lines.—*Philos. Mag.*, March, 1914.

Book Reviews

Alternating Currents and Alternating-Current Machinery. By D. C. and J. P. Jackson. New York, N. Y.: The Macmillan Company. 968 pages, illus. Price, $5.50.

This being a new edition of a well-known work, it should not be necessary to give a summary of its contents, or to venture a judgment on its merits, except in so far as the present edition differs from previous issues. The book was first published in 1896, and the appearance of this new edition, rewritten and enlarged, suggests that it has met with a favorable reception. The additions include a more thorough treatment of transient phenomena, vectors, complex quantities and Fourier's series, hysteresis and eddy-current losses in laminated cores, and the treatment of the electrostatic capacity of transmission lines, together with the effects of distributed inductance and capacity.

The whole field of alternating currents and their application in single-phase and polyphase machinery is covered in a thorough and masterly manner. The book is written for teachers and students in engineering schools. It is primarily a textbook, but the authors believe it will also prove of service as a reference book for those engaged in practical work. This belief may be well founded, and so voluminous a record of persistent labor and clear thinking deserves to have an important place outside of the schools; but it is possible that the engineer engaged in practical alternating-current work may find other books—less comprehensive perhaps, and less thorough—that will yet more nearly satisfy his particular needs. For the practical man, who requires a clear conception of the reasons of things as the surest means of reaching the desired end, a mathematical viewpoint is not always the best. The authors claim that every effort has been made to present a full physical conception of phenomena to the reader's mind. "The mathematics used are merely logical means for accomplishing the end," but it is unfortunately a logic which can be followed only by those well versed in mathematical methods. The authors, being themselves thoroughly familiar with the uses of mathematics as a convenient means of attaining their results, tend perhaps to place too much confidence in this tool. We do not suggest that it leads them into error or perverts the facts, but merely that it keeps them out of touch with those who would prefer more natural methods of presentation. It does not seem altogether impossible that graphical or semi-graphical methods of solving alternating-current problems may come into favor with practical engineers.

The mathematical—or perhaps more properly the academic—standpoint is taken by the authors when treating of self-induction, and the definition given on page 128 seems unnecessarily involved. To many engineers the self-induction of a circuit is merely the induction due to a current in the circuit; it has no peculiar or mystic properties which it does not share with other inductions. The symbolic treatment of problems involving inductive reactance tends somewhat toward obscurity of conception in the minds of students not mathematically inclined, but if they once clearly picture the flux of self-induction linking with the turns in the electric circuit, and connect this picture with the word "inductance," the path of progress instantly becomes smoother. Many a student has the haziest ideas on the subject of self or mutual induction, and this is perhaps not always the fault of the student. From the teacher's point of view, the book has much in its favor. Its completeness renders frequent reference to other works unnecessary; but, at the risk of seeming to criticise adversely, it might be asked whether so much material should be included, and so much ground covered in so complete a manner, in a single treatise. In this connection it is only fair to state that the authors themselves consider the book as a whole too long for the courses in many engineering schools, and they recommend that certain chapters be selected to suit the requirements of individual schools.

The Resistance of the Air. Aviation experiments conducted at the Champ de Mars laboratory by G. Eiffel. New York: Houghton, Mifflin Company. Price, $10.

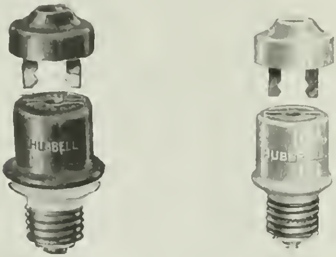
In 1891 Professor Langley published his book upon aerodynamics. This classic book showed the way to the proper development of the science of flight. Yet so slowly did the ideas and methods of Langley get recognition that twenty years passed before the science of aeronautics had any firm foundation, although the art was developed ten years after Langley's work was published. To Gustave Eiffel more than to any other man we owe the fact that to-day engineers can obtain aeronautical data based upon thorough laboratory experiments. The book before us is the complete record of laboratory experiments in three different departments of aerodynamics. It shows the four characteristics of the resultant pressure upon a great variety of supporting surfaces arranged as monoplane, biplane and tandem. These four characteristics of the resultant air pressure are direction, line of action, point of application and magnitude, and all must be known if one is not to work blindly. The resistances of struts, wires and other non-supporting surfaces are recorded, as is also the efficiency of propellers. From this book alone it is possible to construct a machine and to know beforehand just what it will do. The translation is a very good one, the press work is exceptionally fine, the graphs are very clear, and the type is large and distinct.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Cartridge-Fuse Attachment Plugs

Attachment plugs made of both porcelain and composition material for 6-amp cartridge fuses are shown herewith. The fuse used with the plug measures 13/32 in. in diameter and 1.5 in. over all. These plugs are designed particularly for use with electrically operated portable machines such as drills, grinders, etc. The composition plug is intended for installations subject to hard usage. These attachment plugs are being placed on the market by Harvey Hubbell, Inc., Bridgeport, Conn.



FIGS. 1 AND 2—ATTACHMENT PLUGS FOR CARTRIDGE FUSES

Portable Laboratory Meter

A portable laboratory meter of the D'Arsonval type is shown herewith. A single air-gap is employed, and through this swings the moving coil, which is pivoted at one edge. The moving parts can be taken out for inspection or repairs without disturbing the magnetic circuit. The light metal frame on which the moving coil is wound moves through the air-gap of the magnets and makes the reading inherently dead-beat.

LABORATORY METER

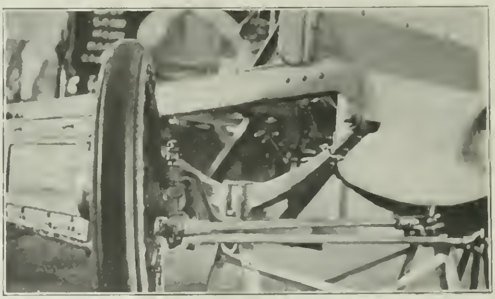
The scale, which is 11.5 in. long, subtends an arc of 100 deg., giving large open divisions which are of uniform length throughout. The scale has diagonal markings which facilitate accurate readings of fractions of divisions. A mirror extending the entire length of the scale is used to prevent parallax in reading.

For use with the millivolt meters combination laboratory portable shunts are supplied. These combination shunts include three shunts of any desired rating up to 200 amp, mounted in a single box with suitable terminals. This meter is furnished as a voltmeter or as a millivoltmeter. The millivoltmeter can be used as an ammeter when high accuracy is desired.

The instrument is mounted in a polished-walnut carrying case which is equipped with removable hinged covers. The Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., is placing this meter on the market.

Electric Trucks at Boston Commerical Motor Vehicle Show

At the third annual commercial motor-vehicle show, held last week in Boston, Mass., the Buffalo Electric Vehicle Company, Buffalo, N. Y., exhibited a 2000-lb. chassis and running gear with a new feature in the shape of a foot control by means of which the brakes cannot be applied without cutting off the supply of energy to the motor. An extra controller and resistance for operation by the chauffeur's pedal are provided under the front platform, and the manufacturers contend that a saving of from 15 to 20 per cent in energy consumption for a given ton-mileage results, giving correspondingly increased operating distances per battery charge. The advantage to the driver of being able to retain the hold of both hands on the steering wheel on rough roads is important, and the builders emphasize the tendency toward increased energy consumption in equipments in which it is necessary to let go with one hand in order to shut off the power. The machine exhibited had another new feature in the shape of a battery box equipped with a folding lid which can be used as a table in withdrawing the cells, the lid being fastened to the box proper by pull spring hooks instead of the usual troublesome wing nuts. On the truck shown the braking surface totaled 500 sq. in., and the rear tires were 5 in. wide against an average of 4 in. for



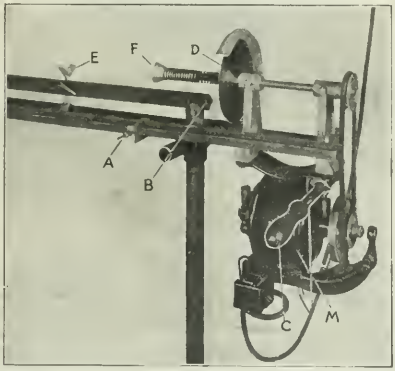
ONE-TON TRUCK WITH LONG SPRING

this size of machine. The motor was supported on trunnions without the use of a universal joint, and the springs were 42 in. long, compared with a common length of 36 in. The truck was equipped with forty-four cells of Philadelphia WT-15 battery and an 85-volt, 22-amp General Electric motor.

The General Motors Truck Company's exhibit included two electric trucks of 4000-lb. and 1000-lb. capacity. The company has recently sold a 12,000-lb. electric truck to the Roxbury (Mass.) Iron Works for heavy haulage in the Boston district. This is said to be the largest electric truck thus far sold in New England. It will be equipped with a twenty-nine-plate Philadelphia battery and a standard "C" chassis. Eight 1-ton electric delivery wagons have been sold to the Animated Advertising Company, of Boston, Mass., which is equipping these vehicles for combined delivery and animated electric-sign advertising of a well-known brand of tobacco. Other products are to be featured in the same way in both Europe and America.

Shade-Roller Measuring, Sawing and Boring Machine

A motor-driven machine which is designed to saw and bore shade rollers, and which can be set to measure for various styles of brackets, is shown herewith.



MOTOR-DRIVEN MACHINE FOR MEASURING, SAWING AND BORING SHADE ROLLERS

The saw operates on the swing-saw principle, the motor hanging below and balancing the saw. When the handle of the machine is moved, the current is automatically turned on, the motor then starts and the saw swings forward. After cutting the end of the roller a hole is drilled in the center of the roller by pressing it in the cone which surrounds the drill and which automatically centers the roller. The drill is in the center of the cone and is supported by a spring. This spring is pushed back while the drill is engaged in boring.

By referring to the illustration the detailed operation of the machine is as follows: The rollers are placed in the trough *B*, the lever *C* is turned slightly to the left, thereby starting the motor *M*, and the lever *C* is then pressed down as a result, bringing the saw *D* across the rollers and sawing them square. The sawing operation requires about one second. The rollers are now placed in the crotch *E* and the ends are inserted in the tapered cup *F*, which centers the rollers. Now on starting the motor by turning the lever *C* slightly to the left each roller is bored for the pin.

The machine occupies a space of 2 ft. by 6 ft., and it is manufactured by Messrs. Mylod & Sons, Providence, R. I. The motor used in its operation is made by the Diehl Manufacturing Company, Elizabeth, N. J.

Electric Cooking Appliances

An electric range and toaster are being placed on the market by the Rutenber Electric Company, Logansport, Ind. The range is made of heavy metal and is well finished. The oven interior is of sheet aluminum, and insulating material 2 in. thick is placed between its inner and outer walls. The switches are placed at an angle of 30 deg., thus enabling the operator to read the lettering on the indicating dials more readily.

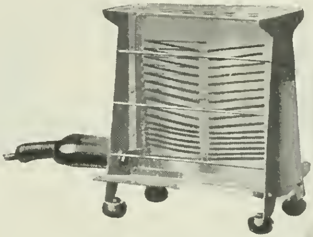


FIG. 1—ELECTRIC HEATER

The toaster is made of stamped steel and is finished with highly polished nickel. Six feet of silk heater cord and a separable attachment plug are furnished with the toaster. This attachment plug is made in the shape of a handle and may be used to carry the toaster about from place to place.

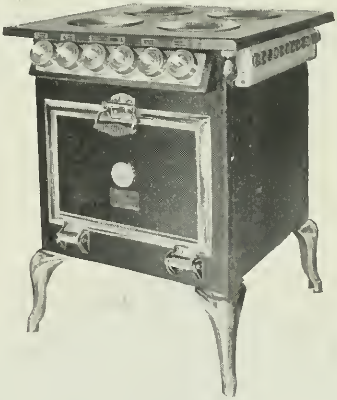


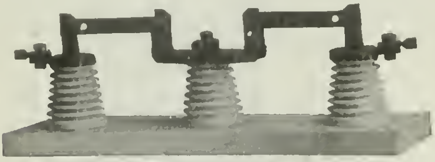
FIG. 2—ELECTRIC RANGE

In Fig. 1 is shown the electric toaster and in Fig. 2 the electric range.

Selector-Type Disconnecting Switches

The selector type of disconnecting switch is a transfer switch using a circuit which does not need be opened while a change is being made. The switch can also be used to connect two independent circuits in parallel. These devices are in effect two single-throw, single-pole disconnecting switches with the hinge jaws connected together and mounted on the same insulator. The hinge jaw is also provided with dummy jaws to hold either blade of the switch in the open position.

These switches, which are made in two types, are being placed on the market by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. The type M switch is designed for wall mounting, the live parts being carried on porcelain insulators fastened to a cast-iron yoke or base. All parts of this switch excepting the porcelain insulators are finished in black marine. The type D switch is designed for indoor mounting on marble bases or switchboard panels. It is made for either front or rear connection or for any combination of front and rear connections desired. The copper parts are dipped and lacquered.

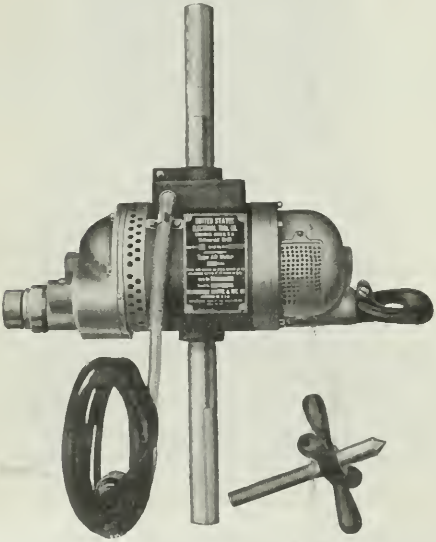


SELECTOR-TYPE DISCONNECTING SWITCH WITH BOTH SIDES CLOSED

Electric Drill

The electric drill illustrated herewith is manufactured by the United States Electrical Tool Company, Cincinnati, Ohio, and a Westinghouse motor is used to drive the device. The motor is series-wound and will operate on either 110 volts or 220 volts, direct current, or 110 or 220 volts, sixty cycles or less, alternating current.

The drills are designed for either wood boring or metal drilling. Each drill is fitted with a magnetic blow-out switch, and the casing of the motor is made entirely of aluminum. The gears are made of hardened chrome-nickel steel, and they run in grease.



ELECTRIC DRILL FOR WOOD BORING AND METAL DRILLING

The drills are manufactured in the following sizes, 3/16 in., ¼ in., 5/16 in., ⅜ in., ½ in. and ⅞ in.

Push-Button Switch

The push-button switch illustrated in Fig. 1 is made by the Connecticut Electric Manufacturing Company, Bridgeport, Conn. The switch is equipped with a positive lock and a quick-break mechanism and is inclosed in a porcelain receptacle. The box furnished with this switch is shown in Fig. 2. One of the sides of the box is removable, enabling any number of gangs to be built up. The bottom of the box is provided with four plugs which can be knocked out in case it is desired to have leads enter the box from below. One of the sides opposite the removable side also has a plug. No spacers are required with this box.

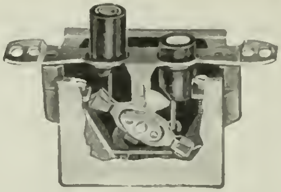


FIG. 1—PUSH-BUTTON SWITCH

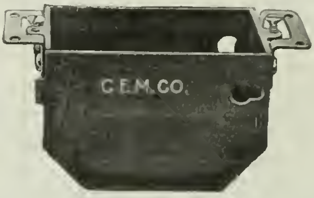
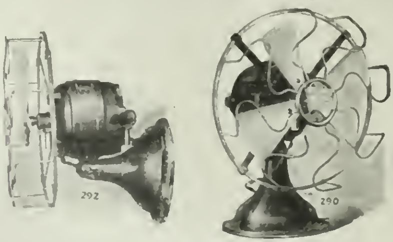


FIG. 2—SWITCHBOX

Eight-Inch Desk Fan

An 8-in. direct-current desk and bracket fan is being placed on the market by the Robbins & Myers Company, Springfield, Ohio. This fan is designed for both 110-volt and 220-volt direct-current circuits. By means of a speed-regulating coil and switch in the base, speeds of 1700 r.p.m., 1400 r.p.m. and 1000 r.p.m. can be obtained. At these speeds the motor takes 25, 20 and 15 watts respectively.

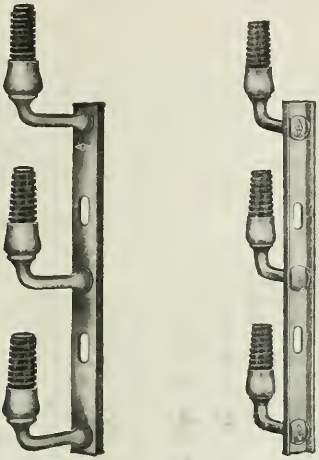
A hinge joint provides for trunnion adjustment, adapting the fan for either desk or bracket service. The blades are made of sheet brass and are riveted to a punched carrier which is formed to give a uniform pitch to all blades. A strong guard surrounds the blades and is fastened to the body by four steel supports. The frame and base of the motor are finished in baked black enamel with gilt stripes. The blades have a brushed-brass finish and are lacquered.



FIGS. 1 AND 2—DESK AND BRACKET FANS

Bracket Hardware

The impregnated locust or oak cobs used in the construction of the brackets illustrated herewith are slowly forced into the cold-drawn steel shells under a pressure of several tons. A desirable wood thimble is thus secured without the danger of the cobs splitting. The wall plates are made of pressed-steel and open-hearth channels and the brackets of hot-forged open-hearth steel. The brackets are riveted hot with electrically operated riveters. No metal portion of the bracket touches the insulator. These brackets are the product of the Barnes & Kobert Manufacturing Company, New Haven, Conn.



FIGS. 1 AND 2—FRONT AND REAR VIEWS, SHOWING METHOD OF ELECTRIC RIVETING

Electric Gear Shift for Automobiles

An electric gear shift which was formerly manufactured by the Vulcan Motor Devices Company, Philadelphia, Pa., and which is now made and marketed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., is shown in the accompanying illustration. Instead of employing a hand-operated lever to shift the gears, power for this work is supplied by a solenoid which is capable of exercising a pull of 150 lb. In the Vulcan system four such solenoids, which are mounted under the car, control respectively the high, low and intermediate forward speeds and the reverse speed. These solenoids are energized by a battery and are controlled from push-buttons mounted on the hub of the steering wheel, the forward speed buttons being marked 1, 2 and 3 (for first, second and third speed) and the reverse speed button bearing the letter R.

ELECTRIC GEAR SHIFT

When one of the speed-changing buttons is depressed the circuit to the proper gear-shifting solenoid is partly closed, but the actual closing of the circuit is not completed until the clutch pedal is thrown in. This pedal carries a small master switch which completes the circuit to the battery. Very little energy is used as none is consumed except at the instant the gear shifting solenoid is energized.

The principal advantages claimed for this electric gear shift are:

(1) Ease of operation.

(2) The device can be operated without removing the hand from the steering wheel or taking the eye from the road ahead.

(3) The gears can be shifted very quickly.

(4) The driver is enabled to anticipate speed changes without actually changing the speed until ready.

(5) The clutch is always fully disengaged and the gears are always drawn mechanically to the neutral position before a shift is made, thus rendering it impossible to strip a gear.

Changeable-Letter Electric Window Signs

Changeable-letter electric window signs of the type illustrated by the accompanying picture are made by the Brilliant Sign Company, 420 North Eighth Street, St. Louis. As shown in the illustration, three sizes are made containing respectively twenty-one, fourteen and ten letters, the blank spaces between letters being counted as letters. The frames containing the letters are of oxidized bronze, oxidized copper or polished brass. The letter panels, which are removable, are shaded blue glass, the letters themselves being in opal white. Ten-watt tungsten lamps are placed behind the letter panels, so that one lamp serves to illuminate several letters. Thus, six lamps are required for the twenty-one-letter sign, four for the fourteen-letter sign, and three for the ten-letter sign. A flasher is furnished to flash the light from the lamps. The price of these signs is moderate and includes one set of letters to fill the sign, the necessary number of lamps connected, the flasher and an attachment cord 8 ft. long with plug. Additional letters to change signs may be had.

CHANGEABLE-LETTER ELECTRIC WINDOW SIGN

Jobber, Dealer and Contractor

Electrical Section at Women's Exposition in Cleveland

Electric lamp and appliance manufacturers, contractors and dealers were liberal contributors to the success of the Women's Exposition recently held at the Central Armory, Cleveland, Ohio. The entire center row of booths, surmounted by lighting units in diffusing globes, was given over to the electrical concerns to exhibit electrical devices for the home. Booths at the sides of the electrical exhibits were occupied by general household displays. However, the fact that more than one-third of the available exhibit space was taken by electrical interests indicates what a large part electricity is beginning to play in the home life of the average family. Furthermore, as the woman is the real purchaser of household equipment, it would seem that the electrical concerns were not far wrong in spending their time and money on exhibits at such an exposition.

Legislation Affecting Electrical Contractors

The committee on legislation of the National Electrical Contractors' Association, of which Mr. Paul H. Jaehnig, of Newark, is chairman, has gathered a large quantity of data on existing and proposed legislation bearing on electric work, so as to be in a position to suggest ways and means of accomplishing results based on the experience of those who have succeeded in having satisfactory legislation enacted. It is the hope of the committee that as soon as its data are completed it can submit a model state law and city ordinance that will be applicable in all essentials to every state and city in the United States. The committee suggests that each electrical contractor take a personal interest in the subject and secure the co-operation of all the electrical interests, principally the lighting company, the labor organizations, the municipal and underwriters' inspection bureaus, manufacturers, jobbers, electrical engineers, architects and, in fact, all who are directly or indirectly interested in safe electrical work.

For the guidance of electrical contractors, the committee states that any law drawn in their interests should embody certain essential features. The law should be obviously designed to protect life and property. It should not create a monopoly for the electrical contractor but should be so framed as not to restrict the freedom of those who wish to engage in the business. A competent lawyer should be consulted in the matter so that there will be no doubt as to the constitutionality of the act after its passage. A competent examining board should be provided for and the license fee should be small. Violations of the law should be made a misdemeanor. The public and legislators should be educated on the necessity and justice of the law and the protection it affords. The electrical contracting business should be dignified by having it legally recognized, so that the term "electrical contractor" will carry with it the prestige it deserves. No provision should be made for a bond as a penalty is sufficient to safeguard the public, but licenses should be made revocable with violations. Workmen should not be licensed; the responsibility should rest entirely with the master electrician.

The committee points out that the licensing of electrical contractors is at present receiving much attention throughout the country, as it seems to be the only solution of certain abuses and weaknesses in the trade. One of the chief difficulties in obtaining uniformly good results in electrical construction work is the irresponsible contractor, who through lack of knowledge of correct principles, the use of inferior material and poor workmanship tends to create a life and fire hazard instead of a safe installation. This has a tendency to discredit the business in general, and more particularly the legitimate and well-qualified contractor who strives always to install his work in accordance with correct principles and to produce a safe and creditable installation.

A license in itself would not be an assurance of safe or honest work, according to the committee, but merely indicates that the licensee is in a degree competent. It would prevent from engaging, much less staying in the business those who do not possess the requisite knowledge of the correct principles and their practical application. The cancellation of a license for cause would be more effective than the fear of a suit under a bond. A license tends to dignify the business, gives it official recognition and places it on a higher plane in the minds of the public. It tends to fix responsibility and guarantee a compliance with the requirements of the National Electrical Code.

Laws governing electrical contracting are at present in force in Tennessee, Louisiana, Maryland, Minnesota, Ohio and the District of Columbia. In general these laws provide for a license to do electrical work, which can be secured by passing an examination before an examining board, the payment of a license fee and yearly renewal fee. In three of the states named a bond is required, the amount of the bond being $1,000 in Maryland and $2,500 in both Tennessee and Louisiana. License laws are now before the legislatures of the States of Oregon, California, Indiana and Massachusetts, and electrical contractors in these states are very actively engaged in securing their passage.

There are ordinances governing the installation of electrical work in the following cities: Moline, Rock Island, Peoria and Chicago in Illinois; Newark and Camden in New Jersey; Kansas City, Mo.; San Francisco and San Diego, Cal.; Toledo, Ohio; Minneapolis, Minn.; Louisville, Ky.; Denver, Col.; Medford, Mass.; Madison, Wis.; Indianapolis, Ind.; New Haven, Conn.; Jamestown, N. Y.; Sioux City, Ia.; Memphis, Tenn., Little Rock, Ark. Proposed ordinances are being considered in the cities of Gary, Ind.; Watertown and Buffalo, N. Y.; New Orleans, La., and Newark, N. J.

Commenting on the various laws and ordinances, Mr. Jaehnig says the Louisiana law was declared unconstitutional on the ground that it discriminated in favor of the public service companies, or was class legislation. The Maryland law is not entirely satisfactory, owing principally to lack of proper application and enforcement. The recent Chicago ordinance is not satisfactory as it does not provide for an examination and as anyone can secure a license by paying the required fee and being vouched for by two citizens.

Sioux City, Ia., reports that its ordinance is working well. Jamestown, N. Y., reports the ordinance and its provisions satisfactory, but weak in enforcement. Peoria, Ill., reports the ordinance satisfactory. Denver, Col., has a very complete ordinance which is working out satisfactorily, although there is a little trouble enforcing all its provisions. Kansas City, Mo., reports the ordinance not working to suit the contractor. It does not provide for an examining board, hence any one can secure a license by paying the fees. The fees are too high. The contractors recommend an examining board, reducing the fees and eliminating the bond required.

Camden and Newark, N. J., report their ordinances are working out satisfactorily although experience has shown where improvements can be made.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Fourth of the Series of Public Utility Lectures.—On March 30 the fourth of the series of public utility lectures will be given in the West Side Branch of the Young Men's Christian Association in New York. At that time Dr. E. P. Hyde, director of the physical laboratory of the National Lamp Works, at Cleveland, Ohio, will speak on "Progress in the Science of Lighting."

Motor-Converter Sets Ordered for Canadian Factories.—Bruce, Peebles & Company, Ltd., of Edinburgh, Scotland, have received orders for two 350-kw motor-converters for the Canadian works of Armstrong, Whitworth & Company, of Manchester, England, and for one 250-kw set for the Canada Cement Company. The converters are built under the Peebles-la Cour patents. In European electrical engineering practice this apparatus is used to a considerable extent, being favored for some services over the usual type of rotary converter or the motor-generator set.

Appearance of Ford Electric Not Imminent.—Rumors have been circulating recently to the effect that Ford electric cars have been supplied for demonstration purposes to numerous Ford agencies, but this rumor has been authentically denied. It is true that investigations are in progress, with the end in view of producing a cheap and serviceable electric car, and several test cars are in operation. Even if the desired results should be secured within the near future, it is stated authoritatively that no electric cars would be placed on the market before July, 1915.

Equipping Lamp Salesmen with Voltmeters.—The National Quality Lamp Works are preparing to equip their lamp salesmen with a new type of voltmeter, which has recently been developed by the General Electric Company. This instrument, known as the "lamp specialist's meter," is about half the size and weight of a standard portable meter and is designed to stand the hard usage that the service will entail. These meters are being provided in order to enable the salesman to see that his customers receive lamps of the proper voltage for their needs and to enable him to analyze service difficulties and find the cause for "kicks."

Chicago to Have a 1914 Electrical Show.—Preparations are under way for Chicago's 1914 electrical show, which will be held under the direction of the Electrical Trades Exposition Company at the Coliseum from Oct. 31 to Nov. 14. Manager H. E. Niesz has not sent out a formal announcement of the 1914 show to the trade, as it is his intention to give the exhibitors of the 1911 show an option until May 1 on the original space they occupied in the last show. Electrical show offices have been opened in Suite 546, Commercial National Bank Building, Clark and Adams Streets, Chicago, where diagrams and other information may be secured by prospective exhibitors.

Hydroelectric Development Planned in North Carolina.—Construction work will be started shortly on the hydroelectric plant of the Southern Power Company at Lookout Shoals on the Catawba River, near Statesville, N. C. The ultimate rating of the site is estimated to be 26,000 hp approximately. The completion of this project will give the Southern Power Company an aggregate generating capacity of 154,000 hp, of which 98,000 hp is now represented by four hydroelectric plants and 30,000 hp by three auxiliary steam generating stations. The B. H. Hardaway Contracting Company, of Columbus, Ga., is to do the construction work on the dam and power house at the Lookout Shoals development. The Parker Brooks Construction Company, of Macon, Ga., has secured the contract for building a 5-mile line of railroad from the Southern Railway to the site of the new station. The Southern Power Company is controlled by the Duke interests.

Alberger Pump Installed for Elevator Service.—The Union Electric Light & Power Company, of St. Louis, Mo., has recently installed in its Neighborhood Plant a 10-in., three-stage Alberger turbine pump of 1500 gal.-per-minute capacity, working against a discharge pressure of 135 lb. per sq. in. The pump is to be used to maintain the service for ten hydraulic elevators in the Central National Bank and the Chemical Buildings during the summer months when the steam pump will be shut down. The new pump is directly connected to a 175-hp, 230-volt direct-current motor obtained from the Sprague Electric Works. An operating speed of 1200 r.p.m. will be used with this motor, which is the largest one that the Union Electric Light & Power Company has yet installed.

A Westinghouse Lamp Factory for Milwaukee.—To supplement the output of its factories in New York City and in Bloomfield, N. J., the Westinghouse Lamp Company is now equipping a plant in Milwaukee, Wis., which will have a daily output of approximately 10,000 tungsten lamps. The building to be occupied was originally constructed for the Kissel Motor Car Company but stood idle up to the time it was taken over by the Westinghouse company. The new factory will be equipped during the summer months and it is expected will be in operation in time to supply the fall trade. Approximately 1000 employees will be put to work at the opening of the plant. A note appeared in the Jan. 24 issue of the *Electrical World* stating that the above move was contemplated, and that it was significant of a general policy of expansion.

Refrigerating Plant for Hudson Terminal.—The Carbondale Machine Company, of Carbondale, Pa., has just signed a contract with the Hudson & Manhattan Railroad Company for the installation of a Parsons "Quick Freeze" system, with 18 tons of ice daily capacity, in the Hudson Terminal Buildings, 30-50 Church Street, New York City. These buildings now contain an absorption refrigerating plant installed by the same company. The particular point of interest in this new system is that it will include three tanks, each containing twenty 300-lb. cans, which will freeze in twelve hours with 8-deg. brine. These tanks, together with the thawing system, whereby the ice is withdrawn from the stationary cans, the distilling equipment, all the necessary pumps, and an ice-storage room with a capacity of 25 tons of ice, are contained in a floor space measuring 23 ft. by 23 ft.

Panama Pacific Exposition Work Progressing.—The following extract from a recent official bulletin on the Panama Pacific Exposition work will be of interest to prospective exhibitors and visitors: "The following foreign nations have accepted the invitation of the United States to participate in the exposition: Argentina, Bolivia, Brazil, Canada, Chile, China, Costa Rica, Cuba, Denmark, Dominican Republic, Ecuador, France, Guatemala, Haiti, the Netherlands, Honduras, Italy, Japan, Liberia, Mexico, Nicaragua, New Zealand, Panama, Persia, Peru, Portugal, Salvador, Spain, Sweden, Turkey, Uruguay, Venzuela. It is now assured that practically all the states of the Union will be represented. All exhibit palaces are in process of construction under time contracts requiring completion by July 1, 1914. Machinery Hall, the largest building of the group, is complete save certain details of interior finishing, and many of the other palaces are under roof. Exhibitors in all parts of the world are therefore assured that they may soon begin shipment of their exhibits, certain that those received after July 1 of this year may be immediately installed and made ready for the completed opening Feb. 20, 1915." It is also of interest to note that the plans and specifications for the electrical work on the California Building are almost complete and that the contract for the electrical work in the Court of Palms and the Court of Flowers has already been awarded. Orders have been placed for the auxiliary equipment required for the three main generating stations supplying direct current for exhibitors and for decorative lighting. An order was placed a couple of weeks ago with the Wheeler Reflector Company, of Boston, Mass., for 2154 reflectors, varying in diameter from 7 in. to 11 in. These will be made of steel with lacquered aluminum finish and will be used in the several exhibit halls.

Operation of Electric Welding Plants by Contract.—The Electric Welding Company, 220 West Forty-second Street, New York City, has devised a plan whereby it undertakes the operation of a manufacturer's plant at a stipulated price. According to this plan it is not even necessary for a manufacturer to install a special welding plant, provided that he has a source of direct current available, as the welding company is prepared to furnish controllers suitable for any commercial voltage. However, in cases where there is a considerable amount of work to be done, it will pay in energy economy to install a special welding plant. The first company to try the plan was the Nichols Copper Company, of Laurel Hill, Long Island, which has now operated its plant for over two and one-half years in this manner, during which time various new methods have been introduced. In the Nichols plant there is a very extensive industrial railroad system and great trouble was formerly experienced with wheels coming loose from the car axles. This trouble has been entirely eliminated by welding the wheels to the axles, as described in the Oct. 11, 1913, issue of the *Electrical World*.

Manufacturer of Transmission-Line Specialties Active.—An order has been received from the Chile Exploration Company by the Clark Electric & Manufacturing Company, Singer Building, New York, for a large quantity of seamless splicing sleeves to be used on the former company's copper transmission and steel ground lines in South America. Last week, at the New York Electrical Testing Laboratories, a ⅜-in. Siemens-Martin steel cable, twisted into a standard seamless tinned copper splicing sleeve, broke outside of the sleeve before pulling out from it and developed approximately 99 per cent of its ultimate tensile strength. A sample of 000 standard copper conductor developed practically its full tensile strength. It is believed these high results are due to the use of the latest type of steel-twisting tools furnished by the company. Another large shipment of sleeves will be made to the Ebro Irrigation & Power Company, Barcelona, Spain, in the near future, on order from the Pearson Engineering Corporation, of New York. Recent orders have been received from the Connecticut River Transmission Company, the Eastern Pennsylvania Railways Company and the American Gas Company for overhead protective clamping sets for use at railroad right-of-way and telephone crossings.

Large Vacuum Cleaning Units for the Canal Zone.—In the Jan. 31 issue of the *Electrical World* note was made of the installation by the American Rotary Valve Company of six large vacuum cleaning outfits in the administration building at Balboa, Canal Zone. A recent communication from the company contains a complete description of the apparatus installed. Each machine is of the reciprocating, double-acting, positive displacement, engine type, motor-driven through a silent endless belt. The machine is entirely inclosed and is self-oiling by a combination of the splash, fountain and force-feed systems. The air cylinder measures 18 in. by 10 in., giving a displacement of approximately 650 cu. ft. per minute at 220 r.p.m. This apparatus will operate at any desired vacuum, with from one to six hose lines in use. The vacuum is automatically controlled and maintained, as the air volume varies, by means of an unloading device, which automatically adjusts itself so as to by-pass, from one end of the cylinder to the other, enough air to make up the difference between the actual displacement and the air being taken in through the cleaning appliances in operation. The machine is equipped with a rotary valve which turns continually in the same direction, with ports interchangeable at 180 degrees. This valve rotates in oil, operates without wear and is noiseless. It is driven from the main shaft through gearing and is arranged so that it can be turned through an angle of 180 degrees, thereby converting the machine into an air compressor. This is done when compressed air is desired for blowing out dust from obscure corners and when it is desired to clean out the receiving tank, which is done under pressure. Separation is effected in this machine by drawing the dirt-laden air through water. The base of the machine is a hollow casting, in one end of which there is a rotary agitator, driven by a belt from the main shaft. The refuse is drawn in at this end and blown directly against the agitator. This mixes it thoroughly with the water, which catches the dirt and allows the air to escape. The machine is driven by a 25-hp, 220-volt, twenty-five-cycle, three-phase Jenney motor.

Customs Concerning Commercial Travelers in Peru and Ecuador.—Since 1909 a government tax of about $50 has been collected for each visit of a foreign commercial traveler to Ecuador. Samples are admitted duty free into that country for periods of three, six, nine or twelve months, as arranged, on furnishing of the usual bond guaranteeing final payment or re-exportation. In Peru there is no national tax on foreign agents, but small local taxes are imposed in some towns. At present samples may be admitted duty free for various periods up to but not exceeding three months, and the following rules, formulated in 1912 by the Peruvian Minister of Finance and effective July 13, 1912, cover this privilege: Importers of samples shall present in each case, in duplicate, an itemized statement containing the following data: Marks, numbers and weight of each package; enumeration of all the articles contained in each package with the proper designation and tariff number of each article, as set forth in the customs tariff; description of each article and gross weight, legal weight, net weight or dimensions, as the case may be. Only one article of each kind may be imported unless there is a difference in quality, shape, size, weight and color. Articles which are free of duty under the customs tariff may be imported without the foregoing formalities. Articles the importation of which as samples is not permitted may remain in customs storage at the expense of the importer. The duties on articles which are admitted shall be deposited in cash or in the form of a bank draft. The cash will be refunded or the draft returned upon re-exportation of the goods and payment of such storage charges as may be incurred. In each case the customs officials will fix a period, not to exceed three months, for the re-exportation of the samples. If proof of the re-exportation within the period determined upon is not submitted, the amount of duties will not be refunded or the bank draft will be cashed, as the case may be. For the re-exportation of all or part of the samples, the importer shall present the goods in ample time at the custom house, in order that the contents of the packages may be checked up. If, on examination, any of the articles is missing, or has been altered in weight or measure, or has been replaced by another, twice the amount of the duty on the article will be collected and the article substituted will be confiscated.

NEW YORK METAL MARKET PRICES

	Mar. 17		Mar. 24	
Copper.	Bid	Asked	Bid	Asked
Standard spot*	13.60	14.25	13.87½	14.37½
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	63 16 3		65 7 6	
Prime Lake	14.50	to 14.75	14.75	to 14.87½
Electrolytic	14.12½	to 14.25	14.40	to 14.50
Casting	14.00	to 14.12½	14.20	to 14.30
Copper wire base	15.50	....	15.50	to 15.75
Lead	4.00		4.00	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.35	....	5.32½	
Tin, spot	38.10	to 38.50	38.70	to 38.80
Aluminum:				
Prompt delivery	18.00	to 18.25	18.00	to 18.25
Future	18.00	to 18.25	18.00	to 18.25

*OLD METALS

Heavy copper and wire	13.62½	13.62½
Brass, heavy	8.62½	8.62½
Brass, light	7.62½	7.62½
Lead, heavy	4.00	4.00
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to March 24	34,065

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*From daily transactions on the New York Metal Exchange

Corporate and Financial

Missouri Utility to Issue Bonds.—Permission has been received from the Missouri Public Service Commission by the St. Joseph Railway, Light, Heat & Power Company for the issue of $162,000 of 5 per cent bonds, the proceeds of which are required for financing extensions and improvements. This company is a subsidiary of the Cities Service Company.

Postponement in Negotiations to Combine Telephone Properties in Chicago.—The Chicago City Council committee on gas, oil and electric light has deferred action until the early part of May (after the April election) in relation to the matter of sanctioning the sale of the telephone properties of the Chicago Tunnel Company (the automatic system) to the American Telephone & Telegraph Company for the Chicago Telephone Company.

Western Electric Company of Ohio to Be Dissolved.—The Western Electric Company of Ohio, a subsidiary of the Western Electric Company, which is an Illinois corporation, is to be dissolved as an Ohio corporation, and a meeting will be held in Cincinnati on March 28 to take the necessary action. The dissolution is merely a matter of change in form since the Western Electric Company of Illinois has been authorized to do business in Ohio.

Cities Service Company Planning Stock Increase.—At the annual meeting of the stockholders of the Cities Service Company in Dover, Del., on April 7, consideration will be given to the question of increasing the authorized capital stock of the company from $50,000,000, divided into $30,000,000 preferred and $20,000,000 common stock, to $65,000,000, divided into $40,000,000 preferred and $25,000,000 common stock. It is officially stated that no immediate plans are held for the sale of any of this extra stock, but that a margin is desired, so that this can be done at short notice any time in the future when it seems desirable.

Massachusetts Instrument Companies Merged.—The Foxboro Company, recently organized under the laws of the Commonwealth of Massachusetts, has taken over all assets and liabilities of the Industrial Instrument Company of Connecticut and of the Standard Gauge Manufacturing Company of Connecticut, with factory at Foxboro, Mass. The first-mentioned company manufactures the Foxboro improved recording gages, thermometers, tachometers and pyrometers sold by the Industrial Instrument Company, which has its main office at Foxboro with branch offices at 50 Church Street, New York; 1363 Monadnock Building, Chicago; 1984 Railway Exchange Building, St. Louis; 461 Market Street, San Francisco, and 832 Brown-Marx Building, Birmingham, Ala. E. H. Bristol and B. B. Bristol continue as president and treasurer respectively of the Foxboro Company, and there are no other changes in the personnel or policies of the merged companies, the consolidation being effected merely to concentrate and simplify the organization.

United States Light & Heating Company Plans Bond Issue.—A special meeting of the stockholders of the United States Light & Heating Company has been called for April 9, at Portland, Me., for the purpose of authorizing an issue of $1,500,000 first mortgage fifteen-year bonds, the proceeds of which will relieve the present shortage of working capital. Following the work of the investigating committee recently appointed to look into the company's production and distribution systems, with an idea of increasing their efficiency, announcement has been made of the determination to move the main office of the company from New York to Niagara Falls, where the factory is situated. This change will take effect on May 1, and thereafter only a sales office and distributing station will be maintained at New York. This step is expected to produce a large saving of expense, and, if the bond issue is authorized, the combined effect will be very favorable to the company. The recent business of this company has been normal, with shipments averaging $200,000 a month, although its railroad car lighting and heating business has not been very active lately. A. H. Ackerman, general manager of the company, stated to an *Electrical World* representative that the contemplated changes have no significance, aside from the greater economy that is expected from them.

Allis-Chalmers Company Matters.—The balance sheet of the Allis-Chalmers Manufacturing Company, as of Dec. 31, 1913, was recently made public, together with a statement of the condition of that concern's business. The company had on that date capital assets of $32,043,305 and current assets amounting to $13,260,275. Its capital stock consisted of $16,500,000 preferred and $26,000,000 common stock, and it had current liabilities of $1,042,501, reserves amounting to $241,490 and a surplus of $755,124, which represented the profits from the commencement of business of the Allis-Chalmers Manufacturing Company on April 16, 1913, to Dec. 31 of that year. J. H. McClement, chairman of the board of directors, stated that there was a decided falling off in business from early in August up to the end of the year, in sympathy with the general slackening of business throughout the country, and that this reduction was reflected in a decrease of the company's profits. At a meeting of the board of directors on March 6 it was decided not to pay a dividend on preferred stock out of the surplus, action being deferred until such time as the profits and business prospects of the company will justify the expectation that dividends can be declared and maintained at a specified rate.

Annual Report of the Electric Storage Battery Company.—The annual report of the Electric Storage Battery Company, of Philadelphia, Pa., recently issued, showed a net income from sales of $1,035,917 and a net surplus amounting to $558,791 for the year ended Dec. 31, 1913. The total surplus on the above date was $3,312,523. The company had $1,885,920 invested in its plants and its total fixed assets amounted to $18,892,764. The total current assets came to $3,341,151. The company is capitalized at $18,000,000, of which $155,000 is preferred and the remainder common stock. Current liabilities on the above date amounted to $164,758. The year 1913 was an active one for this company. Its product was sold extensively for automobile lighting and starting service, for street-railway work, for constant voltage axle lighting in connection with steam railroads, and for power-plant installations. Among the larger individual orders placed for its batteries were that for forty-three sets by the New York Railways Company, for operating storage-battery cars on one of its cross-town lines; that for sixty-two axle lighting sets by the Atchison, Topeka & Santa Fé Railway Company, and that for a 156-cell battery by the Indianapolis (Ind.) Light & Heat Company for excitation and emergency service in its generating station. During the year this company has been working on the development of an improved method of end-cell switch control, and these switches are now being built for continuous service on currents up to 10,000 amp. On Dec. 1 the company celebrated its twenty-fifth anniversary.

Western Electric Company Has Successful Year in 1913.—The report of the Western Electric Company for the year ended Dec. 31, 1913, gives information concerning the remarkable business of that corporation during the past year. Gross sales for that period amounted to $77,532,860, and manufacturing expenses totaled $71,689,555. Net earnings came to a total of $6,563,861 and after deducting $1,500,000 paid out in dividends during the year and $2,500,000 reserve, the surplus for the year amounted to $1,671,695. The balance sheet as of Dec. 31 showed total assets of $74,068,318, of which $18,703,823 represented investment in plants and $16,966,856 covered the value of raw materials and finished stock on hand. The company has an outstanding stock of $15,000,000 and a bonded debt of the same amount in first mortgage 5 per cent gold bonds maturing Dec. 31, 1922. Its current liabilities amounted to $5,660,517 at the close of 1913, and its total surplus at that time amounted to $22,840,459. A statement by H. B. Thayer, president of the company, accompanied the report and read, in part, as follows: "In view of the prospect of a smaller business in our own products in 1914, and some changes in types, it has seemed advisable to apply more than the usual depreciation to our valuation of completed merchandise. A large part of our manufacturing plant is of recent construction and therefore the standard rates of depreciation have not sufficed to produce a net valuation as low as conservative accounting would dictate, on a highly specialized plant. We have therefore applied this year an extra depreciation to our plant accounts."

Business Notes

The Western Lamp & Brass Company, Chicago, Ill., will move shortly into new quarters at 156 West Lake Street.

The Cooper Hewitt Electric Company will shortly move its Chicago office, in charge of G. C. Keech, to 506 Fisher Building, that city.

The Julius Andrae & Sons Company, Milwaukee, Wis., has secured the services of W. A. De Forest as its Minneapolis representative.

The Adams-Bagnall Electric Company, Cleveland, Ohio, has appointed V. N. Marker as manager for the Northwest, with headquarters at 639 Andrus Building, Minneapolis, Minn.

The United Ice Improvement Company has moved its office to 50 Church Street, New York, and will use the refrigerating system to be installed by it in that building for demonstration purposes.

The J. P. Hall-Smith Company has been formed to take over the electrical contracting business established by J. P. Hall in 1891. The offices of the company will be at 320 Fifth Avenue, New York.

The Ferley Electric Company has recently been formed with offices at 51 North Fifty-seventh Street, Philadelphia, Pa., to carry on an electrical contracting business in Philadelphia and vicinity. G. D. Fernandez and D. G. Daley are partners in the company, which is not incorporated.

The Meister Engineering Company, electrical engineer, with offices at 500 Reliance Building, Kansas City, Mo., has been organized by J. F. Meister to do general engineering work and to act as selling agent for Crocker-Wheeler electrical machinery and for Ward-Leonard control apparatus.

The Monitor Controller Company, Baltimore, Md., has announced the removal of its Philadelphia office to 1533 Chestnut Street. Walker Brothers & Haviland are in charge of this office. Arnold Erlanger has been appointed assistant to J. F. Frese, district manager for New York City, with office at 30 Church Street.

The L. G. Schoepflin Company, of Buffalo, N. Y., has entered the field as a maker of electric commercial vehicles. Mr. Schoepflin has had a wide experience as a wagon manufacturer and more recently has turned his attention to the manufacture of trucks. Mr. J. H. Thompson has opened a Chicago office for the new company at 20 East Jackson Boulevard.

New Industrial Companies

The Bodine Electric Company, of Chicago, Ill., has been incorporated with a capital stock of $50,000 by C. D. Bodine, J. F. Bodine and P. J. Bodine. The company proposes to manufacture and deal in electrical apparatus and machinery.

The Van Curve Light Company, of Green Island, N. Y., has been incorporated with a capital stock of $10,000 to manufacture mechanical devices by W. H. Babbitt, T. E. Vanderwerker and Robert Caldwell. Green Island has not a post office.

The Moore Automatic Fire Escape Company, of Passaic, N. J., has been incorporated with a capital stock of $25,000 by P. Simon, E. T. Moore and S. J. Moore, of Passaic, N. J. The company is capitalized at $25,000 and proposes to do a general mechanical and electrical engineering business.

The E. W. Ham Electric Company, of Worcester, Mass., has been chartered with a capital stock of $99,000 to do a general electrical contracting business and to deal in electrical devices. The officers are: J. Brinton Bailey, president; Edwin W. Ham, treasurer, and Paul Fielden, clerk.

The South Electric Manufacturing Company, of New York, N. Y., has been incorporated by W. S. Lison, C. R. Peddle and L. C. Randolph, of New York, N. Y. The company is capitalized at $25,000 and proposes to manufacture and deal in machinery and mechanical devices and to do a general contracting electrical and mechanical engineering business.

Trade Publications

Battery-Charging Sets.—The Lincoln Electric Company, Cleveland, Ohio, has just issued a pamphlet of directions for setting up, operating and adjusting its rotary battery-charging sets.

Metal Signs.—The Electric Service Supplies Company, Philadelphia, Pa., has just put out a poster describing its electrically illuminated metal signs for use in connection with the "safety first" movement.

Electric Trucks.—A three-page folder put out recently by the L. G. Schoepflin Company, Buffalo, N. Y., gives information on that concern's new line of electric delivery wagons of 500-lb. to 1500-lb. capacity.

Meters.—Folder No. 272, issued by the Esterline Company, Indianapolis, Ind., refers to its graphic meters. An illustrated description is given of the design and operation of various types of Esterline graphics.

Live Material.—Section DS 842 of the Westinghouse Company is a trolley line material catalogue. It describes bracket arms for direct and catenary construction. Complete informatiŏn, together with illustrations, is given about various types.

Transformers.—A leaflet has been issued by the Wagner Electric Manufacturing Company, St. Louis, Mo., bearing the title "The Proof of the Pudding." It refers to nine Wagner transformers, installed in 1898, which have shown 98.4 per cent efficiency after sixteen years' continuous service.

Governor Air Compressor.—The General Electric Company recently issued Bulletin 44590, describing its type ML governor for automatically controlling the operation of either stationary or railway motor-driven air compressors in order to maintain air pressure in a storage reservoir between predetermined limits.

Electric Vehicles.—A large folder has been issued by the Buffalo Electric Vehicle Company, Buffalo, N. Y., referring to its light-duty trucks. These trucks are built in two sizes, 1500-lb. and 2000-lb. capacity. The principal specifications of the 1500-lb.-capacity chassis are given, as well as a picture showing the operating mechanism of the shaft drive.

Poles.—A leaflet referring to its chestnut poles has been issued recently by the Chattanooga Pole Company, Chattanooga, Tenn. This company has specialized in chestnut poles for fourteen years and carries a large stock of sizes varying from 20 ft. to 90 ft. An illustration of the 66,000-volt transmission line of the Tennessee Power Company is given showing poles which were furnished by the Chattanooga Pole Company.

Aluminum Lightning Arresters.—The General Electric Company recently issued a bulletin describing its aluminum lightning arresters for alternating-current circuits. The bulletin consists of thirty-two pages, filled with detailed information relative to these arresters and choke coils for use with them, with notes on the charging operation, installation and ground connections. There are also diagrams and tables of dimensions of both arrester and choke coils.

Small Motors.—Small Moters, No. 18, published by the Westinghouse Electric & Manufacturing Company, covers the application of small alternating-current and direct-current motors. A detailed description is given of the construction of these motors, accompanied by photographs of the various parts. There is also given the application of these two motors to various devices, such as washing machines, vacuum cleaners, piano players, pumps, sign flashers and ironing machines.

Condensers and Auxiliaries.—The C. H. Wheeler Manufacturing Company, Philadelphia, Pa., has brought out a creditable little volume on the subject of its condensers and auxiliaries. Interesting chapters on the economy of high vacuum and the thermodynamics of condensers are followed by sections devoted to condensers, displacement vacuum pumps, centrifugal circulating pumps, feed-water heaters, engines, water-cooling towers and other apparatus manufactured by the Wheeler company. The descriptive matter is of a practical nature and is well illustrated.

Personal Mention

Mr. H. A. Mohr has been appointed superintendent of distribution of the Lehigh Navigation Electric Company, with headquarters at Siegfried, Pa.

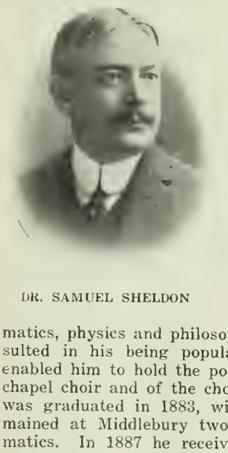
Mr. S. R. Blakemore, of Senatobia, Miss., has been appointed superintendent of the city water and electric plant at Dyersburg, Tenn. Mr. Blakemore has had charge of the Senatobia plant for the past four years.

Mr. J. M. Atkinson, Jr., formerly assistant manager of the Missouri Valley Light & Power Company of Eldorado Springs, Mo., has accepted the position of manager of the La Plata (Mo.) Light, Heat & Ice Company.

Mr. William P. Bear, formerly sales engineer of the Sprague Electric Works of the General Electric Company, has accepted a position as representative of the Trumbull Electric Manufacturing Company, with headquarters in Chicago.

Mr. P. T. Davies, of the Montreal (Que.) Light, Heat & Power Company, has been appointed alternate statesman of the Jovian Order for the Province of Quebec. The Montreal members are holding a weekly series of dinners, lectures and entertainments at the Commercial Travelers' Club.

Mr. S. R. Blakeman, who for the past four years has been connected with the Senatobia (Miss.) lighting and water plant as superintendent, has been appointed superintendent of the Dyersburg (Tenn.) water and lighting plant. Mr. Blakeman is a graduate of Purdue University, class of 1909.



DR. SAMUEL SHELDON

Dr. Samuel Sheldon, to whom the alumni and undergraduates of the Polytechnic Institute of Brooklyn, his friends and professional associates tendered a dinner on March 21 in commemoration of twenty-five years of service as a professor in electrical engineering, is well known in engineering circles. Through honesty of purpose and by persistent industry and enthusiastic aggressiveness he has attained success as an experimental physicist, electrical engineer and scientific writer. Born in Middlebury, Vt., in 1862, he received such education as the public schools afforded and entered Middlebury College in 1879, supporting himself while there by an endowment prize scholarship which he won and retained throughout the four years. As a student he excelled in mathematics, physics and philosophy. His natural versatility resulted in his being popular with his college mates and enabled him to hold the position of organist of the college chapel choir and of the choir in St. Stephen's Church. He was graduated in 1883, with the degree of A.B., and remained at Middlebury two years as instructor in mathematics. In 1887 he received the degree of A.M. In the fall of 1885 he entered the University of Würzburg, Germany. During his first year he was selected by Professor Kohlrausch to assist in special investigations, among which was the classic determination of the ohm for the Bavarian government. During his last year he held the position of assistant in laboratory physics and was graduated in 1888 with the degree of Doctor of Philosophy. Returning to America, he was at once made first assistant in physics under Prof. John Trowbridge at Harvard University, where, in collaboration with that eminent physicist, he conducted many original investigations in magnetism, the results of which were embodied in papers presented before the American Academy of Arts and Sciences. The next step in Dr. Sheldon's advancement was his call to the Polytechnic Institute of Brooklyn as professor of physics and as professor in the newly organized department of electrical engineering. These positions he has filled for a quarter of a century, with increasing credit to himself not only as a teacher but also as an administrator in organizing and managing the departments in his charge. Under his supervision the shops, mechanical engineering, physical and electrical engineering laboratories were installed. Dr. Sheldon has frequently been called to give testimony in both the state and federal courts, and since 1903 he has been an expert of the Swiss Department of Justice and Police. He has also carried on an extensive consulting engineering practice embracing all branches of electrical engineering. His reports of experimental investigations to the Electro-Therapeutic Association constitute a valuable contribution to science and to the art relating to electrostatic machines. His textbook contributions have received well-merited recognition. He revised the fourth edition of Olmsted's College Philosophy, entitled "An Introduction to Natural Philosophy," in 1891, and since 1900 he has acted as critic for the D. Van Nostrand Company. He is the revising editor of, and contributor to, several sections of Foster's Electrical Engineers' Pocketbook. He is also editor of definitions pertaining to electricity in the new Standard Dictionary. Dr. Sheldon is also the senior author of "Dynamo-Electric Machinery," "Alternating-Current Machines" and "Electric Traction and Transmission Engineering." He is a fellow of the American Institute of Electrical Engineers and served on the board of managers for six years, as vice-president for two years, and as president for the year 1906-1907. He was chairman of the papers committee, 1902-1906; chairman of the standards committee, 1908; chairman of the library committee since 1910, besides co-operating on various other committees. He is also a fellow of the American Association for the Advancement of Science, a fellow of the Brooklyn Institute of Arts and Sciences and president of its department of electricity, a fellow of the American Electro-Therapeutic Association, a member and past-president of the New York Electrical Society, and is a member of the American Physical Society, the Society for the Promotion of Engineering Education, the American Electrochemical Society and the American Electric Railway Association. The University of Pennsylvania and Middlebury College honored Dr. Sheldon with the degree of Doctor of Science in 1906 and in 1911, respectively.

Mr. James D. Mortimer has been elected president of the North American Company to succeed Mr. James Campbell, who became chairman of the board of directors. Mr. Mortimer came to New York in March, 1905, to take the position of engineer for the Electric Bond & Share Company. Previously he had been engineer for the Puget Sound Power Company. Later he was made manager of the operating department and vice-president of the Electric Bond & Share Company. He resigned from the latter position in October, 1909, to become vice-president of the North American Company and continued in that office until his accession to the presidency last week. Mr. Mortimer is now president and director of the following companies: North American Company, Wisconsin Edison Company, Inc., Milwaukee Electric Railway & Light Company, Milwaukee Light, Heat & Traction Company, Wisconsin Gas & Electric Company, Watertown Gas & Electric Company, Union Electric Light & Power Company, Electric Company of Missouri and St. Louis County Gas Company. Mr. Mortimer is also vice-president and director of the West Kentucky Coal Company and director of the Allis-Chalmers Manufacturing Company and Utah Securities Corporation.

Obituary

James S. Cummins, senior member of the law firm of Cummins, Stearns & Milkewitch and vice-president, director, senior counsel and one of the founders of H. M. Byllesby & Company, died on March 23 at his home in Chicago. Mr. Cummins was born in Pennsylvania in 1857. He was a graduate of Swarthmore College and was admitted to the bar in his native state in 1882. In 1889 he was married to Alice Charlotte Byllesby. Two years later he came to Chicago and became counsel for the Thomson-Houston Electric Company, and he also served as counsel for the General Electric Company in Chicago when the latter company was organized in 1892. Ten years later he helped to found H. M. Byllesby & Company, and he was closely connected with that extensive public utility organization until his death.

Construction

New England

SANFORD, MAINE.—At the annual town meeting it was voted to improve the street-lighting system in the business section of the town. It is proposed to erect 50 two-lamp clusters on Washington Street and Main Street, from Hotel to Windor Street. The ornamental posts are to be furnished by private subscription.

MONTPELIER, VT.—A committee, consisting of W. C. Colton, George Blanchard and Benjamin Gates, has been appointed by the Board of Trade to negotiate with the Consol. Ltg. Co., of Montpelier, in regard to the installation of a better lighting system in the business district of the city. H. D. Larrabee is manager of the company.

RICHFORD, VT.—Preparations are being made to enlarge and improve the furniture plant of the Richford Mfg. Co. An addition 48 ft. by 51 ft., three stories high, will be built, equipped with electrically driven machinery. Orders have been placed for a 225-kw to 250-kw generator, motors and other accessories necessary. Construction work will be started about April 1.

EASTHAMPTON, MASS.—The Public Service Commission has granted the Easthampton El. Lt. Co. permission to issue $10,500 in bonds, the proceeds to be used for improvements to its lighting system.

MELROSE, MASS.—Plans are being considered by the city officials for the installation of an ornamental street-lighting system for the business section, including larger lamps from Wyoming Avenue to Porter Street through the center of the city.

PLYMOUTH, MASS.—The Plymouth El. Lt. Co. is planning to extend its cable lines to the Marconi station at Marion and along the northernly banks of the Cape Cod Canal. The company, in addition to furnishing electricity for the Marconi station, will furnish electrical service in several of the adjoining towns.

SHELBURNE FALLS, MASS.—The New England Pwr. Co. is planning to expend about $1,000,000 this year to finish the construction of its No. 5 plant on the Deerfield River. This development will furnish a water-head of 245 ft., and will generate approximately 30,000 additional hp for the transmission lines of the system. The main office of the company is at 50 Congress Street, Boston, Mass. George S. Smith, of Boston, is president of the company and E. L. Wise, of Worcester, manager.

WORCESTER, MASS.—Contracts have been awarded by the Worcester Pressed Steel Co. for the erection of a new cold roll mill. The plant will be equipped for electrical operation; the equipment will include one 500-hp, 550-volt alternating-current roll-mill motor with reversing self-starter, two new switchboard panels and three 300-kva transformers; also several smaller motors, totaling about 100 hp. J. E. McClaren is chief electrician.

WOONSOCKET, R. I.—The Blackstone Valley Gas & El. Co., of Woonsocket, has submitted a proposition to the Town Council of North Smithfield, offering to furnish electricity for lighting that town.

WOONSOCKET, R. I.—Resolutions have been signed authorizing Mayor Daignault and the joint standing committee on street lights to enter into a contract with the Blackstone Valley Gas & El. Co., of Woonsocket, to install 28 new ornamental arc lamps of the inverted luminous type on Main Street and adjacent squares.

Middle Atlantic

ALBANY, N. Y.—Bids will be received by the trustees of public buildings, Executive Chamber, Capitol, Albany, until April 8 for electric wiring the west wing of the State Capitol, Albany, in accordance with specification No. 17. Drawings and specifications may be consulted and blank form of proposal obtained at the office of Lewis F. Pilcher, state architect, Capitol, Albany.

BUFFALO, N. Y.—The Niagara, Lockport & Ontario Pwr. Co., of Buffalo, it is reported, is contemplating building a subsidiary plant on Salmon River, near Pulaski, to supplement the amount of Niagara power in this State by 30,000 hp. S. Piek, of Buffalo, is assistant general manager.

CHERRY CREEK, N. Y.—At the annual election held March 17 the proposition to purchase electricity from the village of Randolph for street-lighting purposes in Cherry Creek was carried.

CROTON FALLS, N. Y.—George Juengst & Sons, owners of the local electric-light plant, expect to purchase within the next four months wire and other material for line construction. George Juengst, Jr., is manager.

DEPOSIT, N. Y.—The Deposit El. Co. has recently purchased and expects to have installed by May 15 a new 250-kw, three-phase, 2300-volt, 60-cycle, 200 r.p.m. General Electric generator, exciter and switchboard. John D. Mickle is manager.

ELLENVILLE, N. Y.—Within the next two months the Ulster Lake Co., of Ellenville, expects to install a 48-in steel flume (900 ft. long), build an addition to concrete dam, install gates, waterwheel, governors, etc. Contracts have already been placed for equipment and material. C. D. Divine is secretary.

GROTON, N. Y.—Within the next ten months the Board of Water and Light Commissioners expects to purchase a boiler for the municipal electric-light plant. Charles O. Rhodes is clerk.

HAMILTON, N. Y.—Within the next two months the Board of Water and Light Commissioners expects to purchase a boiler with a rating from 80 hp to 100 hp. E. L. Kingsbury is superintendent.

HERMON, N. Y.—Within the next three months the Hermon El. Lt. Co. expects to purchase four vacuum cleaners and one washing machine. W. G. Popple is manager.

NEW YORK, N. Y.—The New York Tel. Co. has filed plans with the Building Department for enlarging its present building at No. 24 Walker Street. It is proposed to build an addition of seven stories (increasing it to twenty-four) at a cost of $500,000. McKenzie, Voorhees & Guelin, of New York, N. Y., are architects.

ONEONTA, N. Y.—The City Council has entered into a contract with the Oneonta Lt. & Pwr. Co. for lighting the streets of the city for a period of five years from March 1, 1914. Under the terms of the contract the company is to furnish arc lamps of the present type at $72.50 per lamp per year. In addition, the city has the option of using cluster lamps in the business sections, consisting of four 60-cp lamps and one 100-cp lamp, at $80 per year for each cluster; also to use incandescent lamps wherever the committee may desire.

SONYEA, N. Y.—Bids will be received by Percy L. Lang, president of board of managers of Craig Colony for Epileptics, Sonyea, until April 14 for construction, plumbing and electric wiring and refrigerating equipment for cold-storage plant; construction of new carhouse; erection of chimney for power plant; furnishing and installing boilers, steam apparatus and piping, engines, generators, electric work and plumbing for central power plant at Craig Colony for Epileptics. Separate bids must be submitted on each division of the work and no combination of bids will be considered. Drawings and specifications may be consulted and blank forms of proposals obtained at the Craig Colony for Epileptics at Sonyea, and at the office of Lewis F. Pilcher, architect, Capitol, Albany.

SPENCERPORT, N. Y.—At an election held March 17 the proposal to appropriate $16,000 for the installation of an electric-light plant to furnish electricity for street-lighting and general purposes was carried.

STAMFORD, N. Y.—The West Branch Lt. & Pwr. Co., of Stamford, expects to purchase a few transformers, meters, some wire, insulators and lightning arresters. Leslie P. Grant is manager.

UNION SPRINGS, N. Y.—Within the next three months the Union Springs Lt. & Pwr. Co. expects to erect a small addition to its power house, also to purchase one 150-kw generator, switchboard panel for generator, 2 miles of wire for distribution line, poles, cross-arms, lightning arresters, etc., and two 40-kva transformers. F. L. Egleston is general manager.

HASTINGS, PA.—A petition has been presented to the Borough Council asking that steps be taken for improving the street-lighting system in Hastings.

CAMDEN, N. J.—Bids will be received by the Board of Chosen Freeholders until April 8 for the construction of power plant and installation of electrical equipment at the County Tuberculosis Hospital, at Ancora. Thomas Stephen, Masonic Temple, Camden, is architect. F. W. George is clerk of board.

CLAYTON, N. J.—We are informed that the contract awarded Moore Brothers Glass Co., of Clayton, for lighting the streets of the borough is a renewal of a previous contract. Reported in the issue of March 21 to have been awarded contract for street-lighting.

JERSEY CITY, N. J.—The Central R. R. of New Jersey, it is reported, is considering replacing the wooden poles for telegraph line with poles of steel or concrete construction.

MULLICA HILL, N. J.—Within the next two months the Harrison Heights Improvement Co. expects to install an extra panel to its switchboard with full equipment to handle alternating current in addition to its direct-current equipment. Clinton Iredell is secretary and engineer.

RIDGEFIELD, N. J.—Bids will be received by the Mayor and Borough Council until April 8 for furnishing street-lighting service to the borough of Ridgefield for a period of five years, consisting of two or more arc lamps of 1200 cp and 114 or more incandescent lamps of 32 cp, with all-night service. C. B. Wilson is borough clerk.

SPRING LAKE, N. J.—Bids will be received by the street lighting committee of the borough of Spring Lake until March 30 for furnishing electricity for lighting the streets and public places of the borough for a period of five years, beginning May 15, in accordance with specifications on file in the office of the borough clerk. The specifications provide for not less than 16 fixtures on the ocean front along the boardwark, and not less than 20 fixtures on Third Avenue, to be maintained through underground conduits. E. V. Patterson is borough clerk.

BALTIMORE, MD.—The contract for the erection of a power house at Homewood for the Johns Hopkins University is reported to have been awarded to Charles L. Stockhausen, Marine Bank Building, Baltimore. The building will be 70 ft. by 123 ft., two stories high, and will cost about $50,000. Plans were prepared by Parker, Thomas & Rice, architects, 712 North Howard Street, Baltimore.

EASTON, MD.—We are informed that as yet no definite action has been taken by the city of Easton upon the installation of a municipal electric-light plant. An item stating that the Legislature has passed the bill authorizing the municipality of Easton to establish a municipal plant was published in the issue of March 21.

WASHINGTON, D. C.—Bids will be received by the purchasing agent of the Post Office Department, Washington, D. C., until April 22 for furnishing miscellaneous supplies, including electrical supplies (motors, carbons, fuses, tape), stationery, computing, baling, addressing, canceling, opening, adding and perforating machines; also motor vehicle supplies, etc., as they may be ordered for use of the postal service from time to time during the fiscal year beginning July 1, 1914, and ending June 30, 1915. Blanks for proposals, with specifications to bidders, will be furnished upon application to the purchasing agent. A. S. Burleson is Postmaster-General.

WASHINGTON, D. C.—Bids will be received at Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 21 for furnishing at the various navy yards and naval stations the following electrical supplies: Brooklyn, N. Y., Schedule 6434—one six-drop water-tight annunciator, miscellaneous electric fixtures, 100 portable hooks, six portable voltmeters. Brooklyn, N. Y., and Philadelphia, Pa., Schedule 6434—miscellaneous non-water-tight bells and buzzers. Brooklyn, N. Y., and Mare Island, Cal., Schedule 6434—300 non-water-tight push-buttons. Brooklyn, N. Y., and Norfolk, Va., Schedule 6434—miscellaneous shade holders. Norfolk, Va., and Mare Island, Cal., Schedule 6434—miscellaneous junction branch boxes, etc. Mare Island, Cal., Schedule 6434—four 25-amp, 250-volt circuit-breakers, miscellaneous plate carbon, 175 lb. hard sheet rubber. East and West, Schedule 6434—3200 hard rubber bushings, miscellaneous pear push-buttons, miscellaneous sheet and rod fiber, miscellaneous interior fittings, miscellaneous interior fittings for switches, 85,000 3-amp glass-tube fuses, miscellaneous inclosed fuses (cartridge type), miscellaneous link and plug fuses, renewable fuses and elements for renewal, 3600 miscellaneous globes, insulators, electric soldering irons, mica and pressed mica plate, non-water-tight attachment plugs, etc., 20 portable ventilating sets, miscellaneous magnet wire. East, Schedule 6434—1975 portable non-water-tight guards, 31 120-volt electric flatirons. Philadelphia, Pa., and Mare Island, Cal., Schedule 6434—12 120-volt disk electric heaters. Puget Sound, Wash., Schedule 6434—120 keyless sockets, cat. 59954. Boston, Mass., and Norfolk, Va., Schedule 6434—45,000 two-hole wire terminals. Norfolk, Va., Schedule 6434—Miscellaneous terminal and stuffing tubes. Bids will also be received until April 28 for furnishing 20 testing motor-generating sets, to be delivered East and West as per Schedule 6570. Bids will also be received until May 5 for furnishing two turbo-generator sets to be delivered at Mare Island, Cal., as per Schedule 6564. Applications for proposals should designate the schedule desired by number. T. J. Cowie is paymaster-general U. S. N.

North Central

CADILLAC, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 27 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Cadillac, Mich. Drawings and specifications may be obtained from the above office or from the custodian of site at Cadillac. O. Wenderoth is supervising architect.

DETROIT, MICH.—The Council committee an public lighting has approved an appropriation of $10,842 for the installation of arc lamps on the Boston Boulevard. The lighting commission has asked for funds to erect 1000 new lamps this year.

MUNSING, MICH.—Within the next two months the El. Lt. & Pwr. Co., of Munsing, expects to erect 3 miles of transmission lines to furnish electricity to do the city pumping; also to purchase a 150-hp engine, one 200-kw, three-phase, 2300-volt generator, poles for two miles of transmission line, cross-arms, insulators, lightning arresters, etc., for a complete insulation. James Hosking is manager.

SAULT STE. MARIE, MICH.—Bids will be received by the Edison Sault El. Co., of Sault Ste. Marie, until April 15 for furnishing material and constructing an extension to its power house. Specifications and blueprints may be obtained upon application to the company for which a deposit of $10 will be required, to be refunded upon return of plans.

ASHTABULA, OHIO.—Plans are being prepared by business men on Bridge Street for the installation of ornamental street lamps similar to those erected on Main Street.

BARBERTON, OHIO.—Bids will be received at the office of O. D. Everhard, director of public service, Moore Block, Barberton, until April 4 for furnishing f.o.b. Barberton two 15-hp, three-phase, 60-cycle, 220-volt motors, automatic pressure regulator control to be included. Bids will also be received at the same time for two electrically driven deep-well pumps, directly connected.

CINCINNATI, OHIO.—T. C. Powell, vice-president of the Alabama Great Southern R. R. Co., has announced that the telephone will be substituted for the telegraph for dispatching trains and handling messages on the entire line between Chattanooga and Meridian, a distance of 296 miles.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 513, City Hall, Cleveland, until April 1, for one hydraulic plunger freight elevator for the municipal electric-light plant. Specifications may be obtained at the office of the commissioner of the light and heat division, at 1443 East Third Street.

COLUMBUS, OHIO.—Bids will be received by B. L. Bargar, director of public safety, City Hall, Columbus, until April 1, for furnishing materials for the fire and police telegraph system of the city of Columbus as follows: For 375 B.T. chloride accumulator couples, 30 B.T. positive end plates, 30 B.T. negative end plates, 40 B.T. bolt connectors, 300 B.T. glass jars with grooved bottoms, electrolyte necessary for 300 cells for B.T. storage battery, 7000 lb. No. 10 D.T.B.W.P. copper wire, 1200 Hemingray long-distance glass insulators. Each bid must contain specifications of the wire proposed to be furnished with the name of the manufacturer of same. A sample of glass insulator must accompany each bid J. R. Smith is secretary.

KENTON, OHIO.—The Hardin-Wyandotte Ltg. Co., which supplies electricity in Forest, Dunkirk and Upper Sandusky from its central station in Kenton, is planning to install a new 500-kw turbine with entire new condensing outfit. The company has recently installed new equipment and magnetite street lamps in the city of Kenton, and is also preparing to make further improvements and additions to its high-tension transmission lines. E. W. Lothrop is vice-president and general manager.

MANSFIELD, OHIO.—Bids will be received by the board of education until April 21 for furnishing material and erecting an eight-room addition to the Bowman School, including repairs to the old building; erecting a four-room addition to Newman School and also to the East Fourth Street School, including repairs to old buildings; repairs to Prospect Street, West Fourth Street and Marion Avenue school; work to include electrical fixtures and electric wiring, vacuum cleaner and heating apparatus. John H. Bristow is clerk.

NORWOOD, OHIO.—The Boss Washing Machine Co., of Norwood, it is reported, will soon open bids for material and equipment for a power plant for its factory. Plans are now being prepared for a new reinforced-concrete factory building by E. H. Dornette, Pickering Building, Cincinnati, Ohio.

SPRINGFIELD, OHIO.—A committee has been appointed by the Industrial Bureau of the city of Springfield to investigate the project of building a modern power building to meet the needs of small manufacturing plants to which power and light will be furnished.

DANVILLE, KY.—The new hotel which is to be built by Malcolm Weisiger, of Danville, will be equipped with electric elevators.

FRANKFORT, KY.—The Kentucky Pub. Ser. Co., it is reported, is contemplating utilizing energy generated at its Lexington plant to operate the local system, and proposes partly to dismantle the Frankfort plant. The Lexington plant, it is said, will require additional transmission equipment.

HARLAN, KY.—Plans are being prepared by the Harlan Coal Mining Co. for the erection of a large central electric power plant to supply electricity to its mines in Harlan County and adjacent fields.

LEXINGTON, KY.—The Kentucky Pub. Ser. Co., of Lexington, which has acquired and is operating a number of plants in Kentucky, has purchased a 20-year franchise to operate an electric light and power system in Christian County outside of incorporated towns, of which Hopkinsville is the largest. The franchise was purchased for the purpose of covering an extension of a transmission line from the company's plant in Hopkinsville to Pembroke to furnish electricity to the last-named town, and other extensions which may be made later.

LOUISVILLE, KY.—Improvements are contemplated to the Jefferson County Fiscal Court House in Louisville, including the installation of two additional elevators.

OAKDALE, KY.—Bids will be received by the city of Oakdale until May 1 for a franchise to furnish electricity for street and domestic lighting in Oakdale. For further information address J. A. Hagan, Mayor, 3830 Grand Boulevard, Louisville, Ky.

PADUCAH, KY.—The Illinois Central R. R. Co., it is reported, is planning to establish locomotive and steel car repair shops in this city, which will be equipped with electrically driven machinery. The main office of the company is in Chicago, Ill.

PADUCAH, KY. — Announcement has been made by the Kentucky Southwestern Interurban Ry. Co. that contract has been awarded for construction of its proposed electric railway from Henderson to Hickman, taking in many of the important towns in western Kentucky. The headquarters and main power station will be in Paducah.

WHITESBURG, KY.—The Letcher County El. Lt. & Pwr. Co., it is reported, will purchase a 500-kw, three-phase, 60-cycle, 2400-volt generating unit, with complete condensing outfit. For further information address Samuel Collins, of Whitesburg.

GOSHEN, IND.—The Hawks El. Co., of Goshen, has petitioned the Public Service Commission for permission to extend its transmission lines to Waterford and New Paris. The cost of the proposed extension is estimated at $4,000.

INDIANAPOLIS, IND.—It is reported that Robert S. Fletcher, of Indianapolis, is contemplating the construction of a hotel and coliseum, to cost about $1,000,000. The building will be 12 stories high and will have its own electric plant.

INDIANAPOLIS, IND. — Specifications for street-lighting prepared by the city engineer are in the Mayor's hands and will soon be presented to the Board of Public Works. The contract for street-lighting does not expire until next year, and preparing specifications at this time will give any new company that may be a successful bidder an opportunity to install equipment to furnish the service.

LAWRENCEBURG, IND.—The W. P. Squibb Distilling Co., of Lawrenceburg, has awarded a contract to the J. R. Stevens Co., of Cincinnati, Ohio, for the construction of a distillery and grain elevator, for which electric power and lighting equipment will be required.

NEW ALBANY, IND.—The Mill City Cotton Mills, which have been organized by J. E. Wiley, will be equipped for electrical operation. It is understood that a generating set capable of developing 200 hp will be purchased.

WEST BADEN, IND.—The West Baden Wtr., Lt., Ht. & Pwr. Co. has applied to the Public Service Commission for permission to purchase the property of the French Lick Lt. & Wtr. Co., of French Lick, which is owned by Thomas Taggart, and a water franchise and plant in West Baden, owned by Edward Ballard. The West Baden company proposes to consolidate all the public utilities in West Baden and French Lick and neighboring towns and resorts.

CHICAGO, ILL.—Plans are being prepared by Chatten & Hammond, architects, 64 East Van Buren Street, Chicago, for the erection of a new six-story building, 84 ft. by 150 ft., to be erected on St. Clair Street, for the Merchants' Syndicate Catalogue Co., at a cost of about $150,000. The proposed building will be equipped with two low-pressure boilers, two electric passenger elevators and two electric freight elevators Bids for construction of the building will be received from April 1 to April 15.

CHICAGO, ILL.—Within the next ten months the city of Chicago expects to erect one power station and install three 250-kw, 12,000-volt transformers and 20 induction regulators (5000 volt, 10 amp); also to purchase lightning arresters, oil switches, ammeters (0-50 amp), 5000-volt voltmeters, No. 6 single-conductor, lead-covered cable, also eight-conductor cable (12,000 volts), 2000 arc lamps, 1000 tungsten lamps (4 amp, 20 volts) and 500 lamp-posts. M Ferry, 614 City Hall, Chicago, is engineer in charge.

CISSNA PARK, ILL.—Within the next five months the El. Ser. Co., of Cissna Park, expects to erect new distribution lines and change its system to three-phase, 60 cycles E. Lindnor is manager.

CLAYTON, ILL.—Within the next few months the Central Illinois Pub. Ser. Co., of Mattoon, expects to erect a substation in Clayton. As yet no definite arrangements have been made. J. Clarence Maguire is local superintendent.

EASTON, ILL.—The local electric-light plant and machine shop, owned by E. W Fuller, is reported to have been destroyed by fire recently.

LOCKPORT, ILL.—The Public Ser. Co. is reported to have offered the City Council $10,000 for the municipal electric-lighting system.

FALL RIVER, WIS.—The site where the Lashier Mill formerly stood, which was destroyed by fire recently, has been purchased by Julius Frederick, who, it is understood. will rebuild the mill. It is probable that a stock company will be formed to operate the lighting plant, which is to secure energy from the mill.

KENOSHA, WIS.—Bids will be received by George W. Harrington, city clerk, until April 6 for the installation of inverted magnetite-arc lamps and furnishing electricity for same. The arc lamps are to be erected on ornamental cast-iron standards.

ADRIAN, MINN.—The city of Adrian has recently purchased a 50-kw, 250-volt Triumph generator, one 72-in. by 18-ft Brownell boiler and one 4-in. plunger pump belted to a 5-hp Triumph motor. This equipment will be installed by T. W. Newell, superintendent of light and water station.

FARMINGTON, MINN.—Within the next three months the Farmington El. Lt. & Pwr. Co. expects to erect 12 miles of 13,200 volt, three-phase, 60-cycle pole transmission lines and to install an underground steam-heating system; also to purchase a 50-kw to 75-kw, three-phase, 60-cycle, 2300-volt generator, with engines, boilers and necessary auxiliaries; also switchboard and transformers. F. H. Eddy is manager.

MINNEAPOLIS, MINN.—The recent decision of the Minnesota Supreme Court upholding the right of the University of Minnesota to build an electric railway from the main campus to the Agricultural College has cleared the way for the construction of the line, for which steps will be taken at once.

MOORHEAD, MINN.—Within the next three or four months the Water and Light Commissioners expect to purchase one 500-kw generator and turbine. R. G. Price is city clerk.

NEW PRAGUE, MINN.—Within the next two months the board of electric-light commissioners expects to install a 66-in. by 18-ft. high-pressure tubular boiler and to purchase one 6-in. non-returning boiler stop valve. Joseph T. Rynda is superintendent

WAUBUN, MINN.—Chandonnet & Son, it it is reported, have been granted a franchise to install and operate an electric-light system in Waubun.

ODEBOLT, IA.—The Odebolt Gas Co., it is reported, contemplates the installation of an electric-lighting system.

WILLIAMS, IA.—The Williams El. Lt. & Pwr. Co. is reported to be contemplating erecting a transmission line to Blairsburg to furnish electricity for lamps and motors in that town. F. R. Payne, of Williams, is manager.

WINTERSET, IA.—Bids will be received by H. S. Ely, city clerk, Winterset, until April 6 for furnishing the following supplies: 25 electric meters, 1000 electric lamps, 500 lb. insulated wire, 500 lb. copper wire, 100 cross-arms, 400 pins and 250 insulators.

HAMILTON, MO.—C. A. Martin and T. D. Parr, it is reported, are contemplating the installation of an electric-light plant in Hamilton.

KING CITY, MO.—The King City El. & Mfg. Co. expects to purchase within the next 30 days two double-throw or triple-throw pole oil switches, 2300-volt, hand-operated (second-hand preferred). The company expects to establish a day service May 1. Harry V. Forest is manager.

WILLOW SPRINGS, MO.—J. B. Quigley, who built the short-line railroad connecting Mansfield and Ava, is promoting a hydroelectric power plant on North Fork, a tributary of Current River. If sufficient capital is secured, he proposes to construct a plant to supply electricity in Willow Springs, Mountain View, Cabool and other towns in this part of the State.

RHAME, N. D.—A movement has been started to establish an electric-light plant in Rhame.

WILLOW CITY, N. D.—Application has been made to the Council by Robert Hunt for a franchise to construct and operate an electric-light plant in Willow City.

GARY, S. D.—The Citizens' El. Co. expects to purchase within the next two months one 50-hp compound engine and one 100-hp boiler. Hans Nordley is manager.

EDGAR, NEB.—The Edgar Commercial Club is reported to be interested in a project to secure development of the water-power on the Blue River near Edgar.

MADISON, NEB.—Within the next 30 days the managers of the municipal electric-light plant expect to purchase a 100-hp Corliss engine (probably Bates) to replace the present engine. The municipal plant will be rebuilt this spring. The cost of enlarging the power house is estimated at $3,000. A. E. Kernick, manager, will have charge of the work.

MINDEN, NEB.—The Almo Engine & Supply Co., of Omaha, is reported to have been awarded the contract for the construction of an electric power station at $12,571 and for two engines to the Merkle-Hines Machinery Co. The sub-contract for construction of power house has been awarded to Jens Kundsen, of Minden.

NORTH LOUP, NEB.—Bonds to the amount of $20,000, it is reported, have been voted for the installation of an electric-light plant and water-works system in North Loup.

OMAHA, NEB.—The Illinois Trac. Co. (McKinley system), owner of the Omaha & Lincoln Ry. & Lt. Co., has filed mortgages for $2,225,000 covering all the property in Nebraska, to secure an issue in bonds. The proceeds are to be used in extending its electric lines from Omaha to Lincoln. At present 17 miles of the road is in operation. The McKinley syndicate also furnishes electricity for lamps and motors in several Nebraska towns.

ORD, NEB.—The City Council contemplates calling an election to vote on the proposition to issue bonds for the construction of an electric-light plant, extension to water-works system and erection of a new city hall building. The plans provide for an expenditure of $5,000 for electric plant, $18,000 for water-works extensions and $7,000 for city hall.

OVERTON, NEB.—The town of Overton is contemplating the purchase of the local electric-light plant, owned by W. H Hill, and will probably take over the system April 1.

TALMAGE, NEB.—The local electric-light plant is reported to have been purchased by William J. Ritter, who, it is said, contemplates making extensions and improvements to same.

UNIVERSITY PLACE, NEB.—Within the next six months the Water and Light Commission expects to erect several line extensions; also to purchase a pump, underground conduit, several transformers, lamp-posts and some household labor-saving devices. F. Harbican is water commissioner.

ATCHISON, KAN—The Council has passed an ordinance authorizing the Mayor to enter into a contract with the Thayer Foundry Co. for the installation of an ornamental lighting system on Commercial Street between the east line and Fifth Avenue. For further information address C. C. Finney, Mayor.

GARDEN CITY, KAN.—Announcement is made by the officials of the United States Sugar & Land Co., of Garden City, that it will build an electric interurban railway to connect its numerous irrigated ranches in this section. The company is now installing a large electric power plant at Garden City, details of which were published in the issue of Feb. 21.

Southern States

BOONE, N. C.—Plans and specifications are being prepared for a 200-hp hydroelectric development on the New River for the Appalachian Training School, of Boone. A three-phase transmission line will supply electricity for lamps and motors for the school and the town of Boone. Bids will be asked for construction of plants as soon as specifications are completed. The cost of the plant is estimated at about $6,000. D. R. Shearer, of Knoxville, Tenn., is consulting engineer.

BURLINGTON, N. C.—The Piedmont Ry. & El. Co., of Burlington, has completed its new electric generating station. The present output of the plant is 3000 hp, which, it is understood, will be increased by 3000 hp, making a total of 6000 hp. The transmission lines of the company supply electricity in Graham, Haw River, Mebane and Burlington.

HIGH POINT, N. C.—A committee has been appointed by the Mayor to make investigations relative to the purchase of a new arc-lamp lighting-system, to cost about $25,000. F. N. Tate is Mayor.

ROCKY MOUNT, N. C.—The Board of Public Works is now installing a 500-kw General Electric turbine and additional switchboard panel in the municipal electric-light plant. A. S. Lyon is superintendent.

CHARLESTON, S. C.—The capital stock of the Charleston Consol. Ry., Gas & El. Co., which is operated by the Charleston Ry. & Ltg. Co., has been increased by $500,000.

BALL GROUND, GA.—The city of Ball Ground is contemplating the installation of an electric-light plant and water-works system. For further information address J. B. Roberts.

GRIFFIN, GA.—The Towaliga Pwr. Co., of Griffin, has recently purchased a 1600-kva, three-phase General Electric generator (waterwheel type) and one 1800-hp Leffel waterwheel, with auxiliary equipment. F. Mayes is superintendent.

PELHAM, GA.—At an election to be held April 15 the proposal to issue $4,000 in bonds for extensions to the municipal electric-light plant and water-works system will be submitted to the voters.

ROME, GA.—The Rome Ry. & Lt. Co has filed a petition with the Secretary of State asking for permission to increase its capital stock from $500,000 to $1,000,000. S. S. Bush is vice-president and general manager.

SYCAMORE, GA.—The City Council has granted the J. B. McCrary Co., Third National Bank Building, Atlanta, a franchise to furnish electricity in Sycamore. Energy for operating the system will be supplied by the municipal electric plant in Ashburn.

DYERSBURG, TENN.—The city of Dyersburg is contemplating making extensions to the ornamental street-lighting system. S. R. Blakeman is superintendent.

MEMPHIS, TENN.—C. P. Cooper, general agent for the Southern Railway in Memphis, is reported to be interested in a movement to extend the ornamental street-lighting system on Madison Avenue from the Lyric Theatre east to the new viaduct to be built by the company. Ornamental standards carrying lamp clusters will be erected on the viaduct.

SHELBYVILLE, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 4 for construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Shelbyville. For details see proposal columns. O. Wenderoth is susupervising architect.

ARKADELPHIA, ARK.—The Arkansas Railroad Commission has granted a charter to H. C Couch, State National Bank Building, Little Rock, president of the Arkansas Pwr. Co., to construct a hydroelectric power plant on the Caddo River, 5 miles north of Arkadelphia, to cost about $235,000. Under the provisions of the charter work must begin on the plant within two years and be completed within four years.

ALEXANDRIA, LA.—Plans are being considered for enlarging the power house of the municipal electric-light plant; also for the installation of additional machinery. J. C. Raxdale is superintendent.

ALEXANDRIA, LA.—A stock company, it is reported, is being organized in Alexandria by J. Marion Stukes, of San Antonia, Tex., and N. Jeffers, of Browndell, Tex., for the purpose of installing an electric power plant to be operated by the Stukes water motor, a new invention. It is proposed to build a plant on boats in the river to generate electricity by power furnished by the waterwheel that is submerged in the stream.

EUNICE, LA.—Bids will be received at the office of the Mayor until April 16 for building, foundations, machinery and pole lines for a municipal electric-light plant. Plans and specifications may be obtained from E. M. Kursheedt, consulting engineer, Whitney-Central Building, New Orleans, La., upon deposit of $5, which will be refunded upon return of same. ....

NEW IBERIA, LA.—Plans are being considered for extending the electric-lighting plant and the water-works system, for which $4,000 is available.

BROWNWOOD, TEX.—The Texas Pwr. & Lt. Co. is contemplating the installation of a new street-lighting system in Brownwood, to cost about $15,000.

BRYAN, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 30 for the construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Bryan, Tex. Drawings and specifications may be obtained from the custodian of site at Bryan or at the above office O. Wenderoth is supervising architect.

CORPUS CHRISTI, TEX.—The controlling interest of the Corpus Christi Street & Interurban Ry. Co., consisting of new power plant and 8 miles of car lines, is reported to have been purchased by Newburger, Henderson & Loeb, of Philadelphia, Pa. The new owners, it is understood, will make further improvements. The same interests have an option on the property of the Corpus Christi Ice & El. Co.

FORT WORTH, TEX.—Arrangements have been completed by the Fort Worth Pwr. & Lt. Co. whereby it will furnish energy to the counties of Dallas, Denton, Wise, Jack, Palo, Pinto and Parker. It is proposed to furnish electricity to towns and farms from the local plant.

HOWARD, TEX.—The installation of an electric-light plant in Howard is under consideration. Alexander Brothers are reported interested.

Pacific States

CHELAN, WASH—Plans are being considered by the City Councils of Chelan and Lakeside for the installation of an electric-light plant and water-works system, for which it is understood that bids will soon be called. Mayor Emerson of Chelan is chairman of the investigating committee.

GLACIER, WASH.—The Washington Anthracite Coal Co., which operates a coal mine, located in the Government Reserve, 4 miles south of Glacier, has applied to the United States Forestry Department, Portland, Ore., for a permit to erect a transmission line from the main line of the Puget Sound Trac., Lt. & Pwr. Co. to the mine. The company also contemplates the construction of an aerial electric tramway for handling products of the mine. Some electrical machinery, including motors, generators, etc., it is understood, will be installed when the line is completed.

MOUNT VERNON WASH—The Pacific Northwest Trac. Co., of Mount Vernon, has applied to the County Commissioners of Skagit County for permission to extend its transmission lines over any and all roads of the county to furnish electricity for lamps and motors. This company, which is a subsidiary of the Stone & Webster Engineering Corpn., of Boston, Mass., contemplates making extensive additions and improvements to its system in this section during the coming summer.

SOUTH BEND, WASH.—Application has been made to the City Council by Frank McKean for a franchise to supply heat, power and water in South Bend.

TOLEDO, WASH.—The Washington-Oregon Corpn., it is reported, will begin work immediately on the construction of a new transmission line between Winlock and Toledo. The main office of the company is at 1311 Yeon Building, Portland, Ore. F M Housh is construction engineer

NEWBERG, ORE.—The Portland Ry., Lt. & Pwr. Co., of Portland, has purchased the property of the Yamhill El. Co., which operates in Newberg, Charlton, Dayton, and other towns in Yamhill County. The system of the Yamhill company has been connected with the high-tension line of the Portland company.

PORTLAND, ORE.—The Northwestern El. Co., of Portland, has submitted a bid for furnishing electricity for lighting the five bridges and the county hospital at 2 cents per kw-hr. The Portland Ry., Lt. & Pwr. Co. is now furnishing the service.

PORTLAND, ORE.—C. B. Hegart, chief engineer of the port of Portland, has been authorized to advertise for bids for furnishing five electrically operated winches, to cost about $2,100 each, a rotary converter, to cost about $2,500, and equipment for power circuit and other equipment necessary in handling cargoes. The Portland Ry., Lt. & Pwr. Co. has been awarded the contract by the port of Portland to furnish electricity to Public Dock No. 1 at 2½ cents per kw-hr., for a period of three years.

SANDY, ORE.—The Portland Ry., Lt. & Pwr. Co. is contemplating extending its electric transmission line from Bull Run to Sandy, at a cost of about $5,000.

BAKERSFIELD, CAL.—The Board of Supervisors, it is reported, has decided to use electricity to operate the county's rock-crushing plant to be established at Keene. A transmission line will be erected by the county from the power plant at Big Creek, the cost of which is estimated at about $22,000. The work will be done under the supervision of the county highway commission, of which C. E. Getchell is chairman. P. H. Everett is engineer.

CHINO, CAL.—At a meeting of the alfalfa growers of this section held recently it was decided to accept the offer of the Edison El. Co. for electrical service and an agreement for one year is to be signed at once.

GLENDORA, CAL.—The Pacific Lt. & Pwr. Corpn. has been granted a franchise to construct and operate transmission lines for the distribution of electricity for lamps, heaters and motors for a period of 40 years in Glendora.

HUNTINGTON BEACH, CAL. — The Huntington Beach Lt .& Pwr. Co. has applied to the State Railroad Commission for permission to sell its distributing system to the Pacific Lt. & Pwr. Corpn., of Los Angeles, for $21,691. The Pacific company has completed its transmission line into this city and has also been granted a franchise by the board of trustees to furnish electricity for lamps and motors here. It is understood that the Pacific company will improve and extend the system in the near future.

LOS ANGELES, CAL.—Preparations are being made by the Home Telephone & Telegraph Co. for extending its service in the southeastern part of the city, which will involve an expenditure of more than $50,000 for equipment. The company is also making preparations to extend its service between southeast Los Angeles and Long Beach.

LOS ANGELES, CAL.—Bids will be received by the Board of Supervisors of the county of Los Angeles, Los Angeles, until April 6 for the construction of a girls' hospital at the Juvenile Detention Home. Steam heating and electric wiring will not be included in the above contract. H. J. LeLande is county clerk and ex-officio clerk of beard.

LOS ANGELES, CAL.—The City Council will soon submit at a special election a proposition to issue $6,500,000 in bonds for power development purposes. The State Railroad Commission will be asked to condemn the private electrical distributing system or such parts as may be necessary for the distribution of power by the city. Of the proceeds of the bond issue, if carried, $1,250,000 is to be used for construction of a generating station and transmission lines and $5,250,000 in the condemnation and acquisition of the private distribution system. The city does not propose to build a new distribution system. In case the bond issue carries, it is understood that the city will seek to condemn the distribution system of the Southern California Edison Co. within the city limits.

NEWPORT BEACH, CAL.—Plans are being prepared for the installation of an ornamental street-lighting system in Newport Beach, consisting of 149 concrete or bronze standards and fixtures and underground conduits.

NEWPORT BEACH, CAL.—The Pacific Lt. & Pwr. Corpn., of Los Angeles, is reported to be negotiating for the property of the Newport Beach El. Lt. & Pwr. Co. The Pacific company has already erected a distributing system and is furnishing electricity here. C. H. L. Ghriest is owner of the local system.

PASADENA, CAL.—An ordinance has been passed by the city commissioners providing for the installation of ornamental street lamps on Madaline Drive and Colorado Street.

REDONDO BEACH, CAL.—The Pacific Lt. & Pwr. Corpn. has been granted a permit to erect a building in the Ocean Beach subdivision which will be used as an addition to power plant. The building will be 21 ft. by 53 ft. and will cost about $3,300.

SAN FRANCISCO, CAL.—The Pacific Gas & El. Co., of San Francisco, it is reported, will soon authorize an issue of $12,000,000 in capital stock, the proceeds to be used for improvements and additions to property.

VICTORVILLE, CAL.—An agreement has been reached between the residents of Victorville and the Southern Sierras Pwr. Co., of San Bernardino, whereby the latter will furnish electricity for lamps and motors here. It is understood that a substation will be erected and a distributing system installed.

BOISE, IDAHO.—The sale of the property of the Idaho-Oregon Lt. & Pwr. Co., of Boise, which was to have been made March 16, under the order of the court in receivership proceedings, has been deferred, and no date fixed for future sale. The property will continue to be operated by a receiver, and the court will be asked to authorize the issue of receiver's certificates for approximately $250,000, the proceeds of which will be used to install equipment to increase the output of the Ox Bow hydroelectric plant by 4000 hp.

TUCSON, ARIZ.—The Tucson Gas, Lt. & Pwr. Co. is reported to be contemplating making improvements to its plant, extending its street-car line to outlying districts and erecting transmission lines to furnish electrical service through the Rillito and Santa Cruz valleys. The cost of the work is estimated at about $200,000.

HELENA, MONT.—The property owners of the east side are contemplating establishing an east side lighting district, plans for which are being prepared by William Jordan, Jr., city engineer. It is estimated that at least 220 posts will be required.

ROUNDUP, MONT.—Within the next six months the Roundup Coal Mining Co. hopes to erect a new power house and a 250-volt transmission line; also to purchase two or three 72-in. by 18-ft. tubular boilers, one 200-kw, 250-volt generator with turbine, boiler feed pump and possibly a condenser, some rubber-covered transmission cable and weather-proof wire. J. E. Woodward is president and E. L. Rousseau purchasing agent.

RYEGATE, MONT.—A movement has been started by residents of Ryegate to establish an electric-light plant here.

WILSALL, MONT.—C. S. Hefferlin is reported to have been granted a franchise to establish an electric-light plant in Wilsall.

SPARKS, NEV.—Work has begun on the construction of an electric plant at the Sparks shops of the Southern Pacific R. R. Co., which when completed will furnish electricity to operate the block signal system of the Salt Lake division from Imlay to Blue Canyon. The building will be 60 ft. by 40 ft. and will cost about $40,000. Power houses are being erected at two other points along the division.

Canada

EDMONTON, ALTA.—Representatives of the firm of Smith, Kerry & Chase, of Toronto, Ont., are investigating the water-power in Athabasca at Grand Rapids with a view of building a hydroelectric power plant, to cost from $5,000,000 to $10,000,000. J. S. Kerry, a member of the firm, states that it will be possible to transmit energy generated at the plant to Edmonton, a distance of 175 miles. He expects to submit a proposition to the Department of Public Works to furnish energy at the city limits, to be distributed by the municipal system.

FERNIE, B. C.—Within the next two months the city of Fernie expects to erect 3 miles of service lines, material for which has already been purchased, also to purchase within the next six weeks material for a complete tungsten street-lighting system, covering a circuit of 9 miles, consisting of 100 lamps of 100 cp, 100 street brackets with reflectors, 500 locust pins (1½ in. by 9 in.), 500 glass insulators, 100 strain insulators, 47,000 ft. No. 6 weather-proof wire, one 10-kw or 12-kw tungsten regulator; switchboard with instruments and switches for control of this system. Tenders for this complete equipment will be received by the city of Fernie until May 7. James E. Finn is superintendent of light and power.

PRINCE RUPERT, B. C.—Within the next eight months the municipal electric light department expects to erect a power house with an output of 1800 hp and to erect 6 miles of transmission lines; also to purchase waterwheel, generator and exciter, switching equipment, 60 kw in transformers, poles for 10 miles of line, insulators and wire for same, and one 50-lamp rectifier outfit complete with lamps. T. C. Duncan is manager.

BATHURST, N. B.—The Bathurst Pulp & Paper Co., recently incorporated with a capital stock of $3,000,000, contemplates the construction of a large pulp and paper mill within the next year. The plans provide for the development of an extensive water-power on the Nepsisiquit River and the transmission of electricity to the plant at Bathurst.

MONCTON, N. B.—Plans are being prepared for the installation of a new street-lighting system in Moncton.

BLENHEIM, ONT.—The Town Council has passed a resolution requesting the Hydro-Electric Power Commission to submit an estimate as soon as possible of the cost of delivering energy to the municipality.

CORNWALL, ONT.—The Minister of Railways of the Canadian government has approved of the route for the proposed transmission line of the Cedar Rapids Mfg. & Pwr. Co., from Cedar Rapids to the transformer station in Cornwall, a distance of 44 miles. The company is building a large hydroelectric power plant at Coteau Landing, about 30 miles from Montreal.

ENGLEHART, ONT.—The installation of a street-lighting system in Englehart is reported to be under consideration.

KINCARDINE, ONT.—The installation of underground conduits for the new street-lighting system is under consideration. It is understood that the posts are to be of augmented cement or cast iron. For further information address Andrew Ingram, Kincardine.

OTTAWA, ONT.—Bids will be received by the chairman of the Municipal Electric Department, City Hall, Ottawa, until March 30, for electric meters, transformers, copper wire and sundry supplies. Specifications may be seen or obtained at the office of the Municipal Electric Department, 75 Laurier Avenue West. J. E. Brown is general manager.

ST. MARY'S, ONT.—The Hydro-Electric Power Commission has recommended that the arc lamps now in use be replaced by tungsten lamps at a cost of about $10,000.

WINDSOR, ONT.—A company has been organized by Harry Lee, C. H. Dollins, of Detroit, Mich.; B. Y. Fox, J. A. Straith, of Windsor, and Orville E. Reeves, of Toledo, Ohio, to erect a large power building, to be located at the corner of Carron and West Sandwich Streets, at a cost of about $80,000. The building will be rented out to a number of concerns for light manufacturing purposes.

MONTREAL WEST, QUE.—The Town Council is considering the installation of a street-lighting system.

MONTREAL, QUE.—Provision is made in this year's expenditure on the Montreal Harbor for equipping the railway system for electrical operation; the cost is estimated at $282,674, with $300,000 for equipment. The ultimate terminus of the railway system is Bout de l'Ile, which it is expected will be reached next year. On the south shore, where extensive improvements will be made, 8 miles of electric railway will be built.

OUTREMONT, QUE.—Tenders will be received by E. T. Sampson, secretary and treasurer, Town Hall, Outremont, until April 1, for furnishing 450 street-lighting standards, with globes, reflectors, insulators, sockets and accessories complete. Specifications and drawing can be obtained from the office of the town engineer, Town Hall.

WESTMOUNT, QUE.—The City Council has passed a by-law appropriating $250,000 for improving the municipal electric-lighting system and for placing all wires in underground conduits. The amount appropriated will provide for lamps on all residential streets and placing all wires underground.

CARLYLE, SASK.—Extensions and improvements involving an expenditure of $30,000, it is reported, are contemplated to the electric-lighting system. For further information address E. Holmes.

New Incorporations

SUGAR CREEK, OHIO.—The Sugar Creek Lt. & Pwr. Co. has been chartered with a capital stock of $25,000 to furnish light, heat and power. The incorporators are C. C. Sauser, W. H. Schweitzer, V. B. Halue, A. M. Mast and A. H. Hyler.

McALLEN, TEX.—The McAllen Ice, Lt. & Wtr. Co. has been granted a charter with a capital stock of $10,000. The incorporators are F. E. Osborne, R. E. Horn and J. T. Cardwell.

BLAINE, WASH.—The Blaine-Lynden El. Ry. Co. has been incorporated with a capital stock of $250,000 by John Pinckney, Lester Livingston and J. A. Willison.

POUND, WIS.—The Coleman-Pound Lt. & Pwr. Co. has been organized with a capital stock of $10,000 by the business men of Coleman and Pound to furnish electrical service in both towns. The company proposes to secure electricity from the High Falls plant of the Wisconsin Pub. Ser. Co.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 17, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,090,159. Brush Holder; J. C. Lincoln, Cleveland, Ohio. App. filed July 19, 1911. Screw in engagement with worm places brush spring under requisite tension.

1,090,188. Railway Switch or the Like; W. A. Austin, Omaha, Neb. App. filed Jan. 31, 1910. Electric motor operated.

1,090,190. Electrically Connecting Device; R. J. Bell, Harvey, Ill. App. filed July 19, 1913. For clamping electric conductor to the base flange of a railway rail.

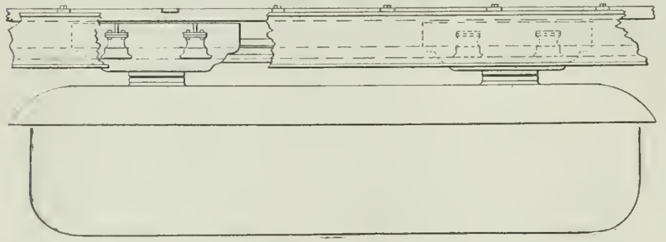
1,090,201. Charging Switch for Storage Batteries; C. W. Coleman (deceased), Westfield, N. J. App. filed Jan. 18, 1911. Particularly designed for the duplicate battery sets used in railway signaling service.

1,090,213. High-Speed Railway; T. L. Johnson (deceased), Cleveland, Ohio. App. filed April 6, 1906. A magnetic field sustains and propels the car.

1,090,215. Mechanism for Electrically Controlling and Operating Fare Registers; E. J. Kennedy, New York, N. Y. App. filed April 10, 1913. Electrically operated fare register, push-button control.

1,090,234. Insulating and Supporting Mechanism; J. W. Rogers, Woodbury, N. J. App. filed May 12, 1913. The insulating support for the third-rail fits over the base of the support for the protecting board.

1,090,238. Electric Curler and the Like; E. Schwartz, Chicago, Ill. App. filed April 1, 1913. Has rotatable plug terminals to prevent twisting of the cord.



1,090,213—High-Speed Railway

1,090,301. Control of Signal Lamps; L. A. Hawkins, Schenectady, N. Y. App. filed Nov. 20, 1911. Controls the signal lamp from a central point by the alternating-current transmission system.

1,090,302. Vehicle Signal; J. B. Hawks and H. R. Kennedy, Los Angeles, Cal. App. filed July 17, 1912. Semaphore-type auto rear signal.

1,090,309. Electric Railway Signal; J. B. Howell, Leavenworth, Kan. App. filed Aug. 30, 1910. For switches operated by the trolley of a car at a turn-out or station.

1,090,328. Single-Phase Motor; C. B. Mills, East McKeesport, Pa. App. filed May 27, 1912. Starting characteristics of series motor and operating characteristics of squirrel-cage induction motor.

1,090,339. Electrically Heated Stove; T. S. Perkins and E. E. Rose, Pittsburgh, Pa., and Swissvale, Pa. App. filed July 24, 1911. Unitary structure with switching device permanently mounted beneath it and operated from the side of the stove.

1,090,354. Socket for Incandescent Electric Lamps; W. C. Tregoning, Cleveland, Ohio. App. filed May 13, 1912. Regular socket with special spindle frame and sheet-metal cam.

1,090,357. Electric Signal System for Railways; H. J. Warthen, Washington, D. C. App. filed June 16, 1910. Devices operate by gravity when circuits are broken to apply the air-brakes.

1,090,362. Electric Signal for Railways; H. J. Warthen, Washington, D. C. App. filed March 24, 1909. Rails-in-circuit system.

1,090,363. Trolley for Electric Signals for Railways; W. H. Warthen, Washington, D. C. App. filed June 16, 1910. For making contact with short ramp rails.

1,090,372. Dry Battery; J. A. E. Achenbach, Hamburg, Germany. App. filed Jan. 7, 1913. Negative electrode consists of layers of corrugated, finely perforated zinc.

1,090,378. Railway Signal-Operating Mechanism; J. Blackburn, Kirkwood, Mo. App. filed May 15, 1911. Mechanically operated and electrically controlled.

1,090,391. Apparatus for Manufacturing Nitrogen Compounds; T. Fujiyama, Tokyo, Japan. App. filed April 12, 1913. Supplies carbide to a roller in a heated nitrogen chamber.

1,090,394. Coil-Insulating Machine; E. Haefely, Basel, Switzerland. App. filed April 20, 1911. Wraps insulating material with pressure.

1,090,419. Calibrating Device; S. D. Sprong, Brooklyn, N. Y. App. filed Feb. 10, 1913. Provides a second and fixed coil which incloses the movable coil and is disposed at an angle thereto.

1,090,427. Electric Zinc Furnace with Integral Condenser; J. Thomson, New York, N. Y. App. filed Jan. 2, 1913. Grate supports a bed-of-carbon resistor.

1,090,428. Electric Zinc Furnace with Integral Condenser; J. Thomson, New York, N. Y. App. filed April 14, 1913. Has compound parallel porous resistors.

1,090,429. Universal Electric Furnace Combined with Means for Condensing Zinc; J. Thomson, New York, N. Y. App. filed June 7, 1913. Resistor of trapezoidal form and an underlying sump.

1,090,435. Harmonic Signaling System; H. G Webster, Chicago, Ill. App. filed March 11, 1912. Employs alternating currents of different frequencies and selectively operated reed bells.

1,090,436. Call Bell; H. G. Webster, Chicago, Ill. App. filed March 11, 1912. Applies magnetic stresses corresponding in direction and frequency to the impressed current impulses to a tuned reed striker.

1,090,445. Cartridge Fuse; L. D. Blackman, Battle Creek, Mich. App. filed March 29, 1913. Has screw-threaded-ferrule end members which clamp the fuse strip.

1,090,455. Railway Signaling Apparatus; W. J. Cook, Denver, Col. App. filed March 4, 1911. Green light in cab changes to red when approaching a track signal.

1,090,456. Process of Forming Joints; W. A. Darrah, Brooklyn, N. Y. App. filed July 22, 1911. Electrolytically produced joint between a conductor and glass or porcelain.

1,090,489. Meter-Testing Cut-Out; T. E. Murray, New York, N. Y. App. filed Feb. 7, 1912. Two series of circuit terminals on opposite sides of the cut-out block may be connected interchangeably to the load and service leads.

1,090,527. Cap and Shell Fastening for Lamp-Socket Casings; E. H. Freeman, Trenton, N. J. App. filed April 11, 1912. Admitting of practically universal circular adjustment.

1,090,528. Electrical Border-Light Receptacle; E. H. Freeman, Trenton, N. J. App. filed Aug. 22, 1913. Wiring extends in substantially continuous shape throughout the wiring conduit contained in the trough.

1,090,551. Manufacture of Superheater Units; C. K. Lassiter, Richmond, Va. App. filed June 5, 1913. Forms return bend body and return bend cap in separate forged sections and electrically welds them together

1,090,557. Transmitter; R. S. M. Mitchell, Syracuse, N. Y. App. filed May 10, 1913. Vibrating diaphragm for three-way transmitter.

1,090,568. Means for Collectively Actuating and Controlling Alternating-Current Motors; J. L. Routin, Paris, France. App. filed Dec. 16, 1912. For controlling gun mechanism on warships.

1,090,579. Electric Hair Drier; J. T. Stapleton, Jersey City, N. J. App. filed June 28, 1913. Made in the style of a comb

1,090,618. Process and Machine for Making Switch Parts; W. F. Hosford, Chicago, Ill. App. filed Oct. 12, 1912. For welding platinum-disk contacts to springs

1,090,619. Process and Machine for Forming and Affixing Switch Contacts; W. F. Hosford, Chicago, Ill. App filed Oct. 12, 1912. End of platinum wire pressed against surface of the work is welded thereto by passage of electric current and wire is then cut.

1,090,624. Casing for Electric Cells I. Kaempfer, New York, N. Y. App. filed Dec. 18, 1912. Sealed paper carton with flush terminals for testing.

1,090,627. Signaling Device for Party-Line Telephones; T. Kernan, East St Cloud, Minn. App. filed Aug. 8, 1912 Name of eavesdropping party is made known to the parties talking.

1,090,629. Electric Socket; G. C. Knauff, Chicago, Ill. App. filed April 7, 1913. For axially disposed endward contacts such as used in auto head and tail lamps.

1,090,630. Socket for Electric Lamps, G. C. Knauff, Chicago, Ill. App. filed May 26, 1913. Has spring-contact fingers engaging lamp base and holding it in place.

1,090,657. Trolley; H. Shaffert, East Pittsburgh, Pa. App. filed Feb. 19, 1913. Retaining members pulled apart by cords

1,090,669. Indicating Device for Drains and the Like; J. H. Woodington and E. H. Coles, Clevedon, England. App. filed Nov. 7, 1913. Indicates whether intercepting traps in a drainage system are free.

1,090,672. Electric Curling-Iron Heater; C. H. Austin, Palmyra, N. Y. App. filed Oct. 21, 1912. Screws into socket like ordinary lamp.

1,090,682. Electric Shoe; K. H. Brown, Chicago, Ill. App. filed March 26, 1909. Has foot-engaging electrodes and a cell in the heel of the shoe.

1,090,686. Insulator Clamp; W. A. Cook, Shinnston, W. Va. App. filed April 9, 1913. Adjustable and releasable clamp locks conductor to insulator.

1,090,726. Carbon Holder for Electric-Arc Lamps; B. B. Lacy, Houston, Tex. App. filed July 24, 1911. Positive acting carbon clutch.

1,090,749. Recording Mechanism; H. W Payne, Rochester, N. Y. App. filed April 24, 1913. The action with respect to the galvanometer is practically frictionless.

1,090,763. Electric-Battery Cell; H. A Thomas, Springfield, Ill. App. filed May 17, 1912. Two-fluid type.

1,090,794. Automatic Circuit-Closing Device for Elevators; C. W. Sauer, Jr., Elizabeth, N. J. App. filed Sept. 16, 1912 Door switch.

1,090,805. Junction Box; J. F. Wagner, South Bend, Ind. App. filed Aug. 28, 1911. Obviates necessity for placing cross-bars between joists for the support of the box.

1,090,806. Automatic Air-Brake Control for Railways; H. J Warthen, Washington, D. C App. filed June 16, 1910 Applies brakes when electric signal circuit is broken.

1,090,816. Signaling Device; C. Henschel, New York. App. filed April 18, 1910. For transmitting signals to those operating the ships or the guns on shipboard.

1,090,821. Telephone System; F. R. Parkerm, Chicago, Ill. App. filed June 20, 1904. Prevents operator from "listening in."

1,090,825. Railway Signaling System; M. H. Collins, West Hoboken, N. J. App filed March 5, 1913. Dispenses with insulated joints, reactance bonds, impedance coils, etc.

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Deliberation Before Legislation

Regarding the proposed anti-trust legislation now pending before Congress, to which reference was made in these columns last week, the most important feature of the week has been the receipt at Washington of various expressions to the effect that whatever be done should be done slowly. It is obvious that the body of business opinion in the country is becoming articulate, and it is certainly matter for congratulation that the prevailing sentiment of at least some of the commercial interests is finding expression. It is also gratifying to note that the general tenor of the resolutions which have been handed to the President from such bodies as the New York Chamber of Commerce, the Merchants' Association and the American Manufacturers' Export Association is eminently sane and reasonable, and that these bodies are entering the debate in no spirit of partisanship and passion. In effect, Congress is now being advised that, since the proposed legislation is concerned with the conduct and regulation of business, both big and little, an attentive ear ought to be lent to the voice of business. Protests as to specific proposals may or may not become necessary later. The point for us to note is that at present the business interests are making a reasonable plea for deliberation and mature judgment—a time of deliberation during which the party that is to be regulated may be heard before decision is made concerning the method of regulation.

The New York Commissioners

The Public Service Commission appointments of Governor Glynn of New York are greatly to be regretted. This is not a reflection upon the appointees, who may be estimable incumbents of other offices and of wide usefulness in other spheres of life. It is a criticism of the Governor for his choice of men to fill positions in which there is special need of aptitude for the duties to be performed. The salary of $15,000 a year written into the law for the New York commissioners was not designed as a political plum; it was intended to secure men of adequate experience and ability. If it is not to be used for the original intended purpose, it should be reduced. No reasonable price that the State pays for commissioners of ability equal to the needs of the position is too high if the desired men are obtained. Any price paid is too high if the State gets less than it ought to have. Efforts were made by engineering societies to impress upon Governor Glynn the engineering nature and importance of the problems of the commissions, and there was a general hope that they would result in the recognition of engineers in the appointments. The selection of engineers would have tended to restore the original complexion of the commissions and to produce the harmony which should prevail in their deliberations and is now conspicuous by its absence. The appointments are of as much concern and regret from the corporation standpoint as from the public standpoint. Anything that lessens the efficiency of regulation discredits the whole policy of state regulation. It is the policy of state regulation on which the companies must depend for a fair settlement of their serious problems. If state regulation is a failure, the alternative will be public ownership and operation, with even greater failure.

Minimizing "Moving-Day" Peaks

In many American cities leases are written to expire on April 30 or Sept. 30, so that, by long-established custom, May 1 and Oct. 1 have come to be regarded as "moving day." A large proportion of the population of the cities is transitory, and it follows that a great burden of making changes, disconnections and connections falls on the public utility companies by reason of the moving-day custom. An effort is being made in Chicago under the auspices of the Chicago Real Estate Board to cause renting agents to co-operate with the board in an endeavor to have leases terminate at various times during the year rather than almost entirely on the two dates mentioned. The movement is one that deserves general encouragement in all cities. In Chicago representatives of the electric-service company, the gas company, the telephone company and of the van and warehouse interests have joined with the real-estate men in an effort to bring about the proposed reform, which, by general consent, is believed to be to the advantage of all the business interests concerned as well as of the general public.

Some Impressive Truck Figures

If other than mere technical arguments are needed to present an effective case for the electric truck as the logical means of parcel-post delivery, we believe that a practical business administration cannot fail to be impressed by the hard-cash totals which private industry has seen fit to invest in this form of conveyance. The department stores and express companies, for example, are confronted with the identical delivery problems which are before the parcel-post officials—long runs, numerous stops and small-package deliveries. Proof of the solution which the department stores have found is the $6,000,000 worth of electric trucks already in their service, and most of this amount, it may be added, represents repeat orders. The express and transfer companies have about $3,000,000 invested in trucks and are among the most enthusiastic in their praise of the practical service of these vehicles. Next to the department stores, curiously enough, comes the brewing industry with over $5,000,000 in battery-driven wagons—substantial evidence of the confidence placed in the electric vehicle by a most conservative class of manufacturers. The public-service companies appropriately use $3,000,000 worth of trucks in their own business, and the various government departments both in this country and its insular possessions already have a half million invested in electric wagons, exclusive of the rented vehicles used in post office haulage and parcel-post delivery. Such figures as the foregoing, which are based on authoritative information, are perhaps even more significant and satisfying to the prospective purchaser than several columns of ton-mile data, for whatever the courage of one's convictions, he cannot but feel more comfortable when in goodly company. Surely a fair start has been made in the putting of $20,000,000 worth of electric trucks in service. The days of the up-hill struggle are over, and the movement already begun may now be expected to gather impetus until the promised "all-electric" truck era has been attained.

The Practical Use of Color Effects

The article by Mr. M. Luckiesh in this issue brings to the front possibilities in the use of colored lighting which heretofore have had scant consideration. One of the first suggestions in this line came from Prof. R. W. Wood, of Baltimore, who pointed out the wonderful results that could be obtained in illuminating paintings by projecting upon them light from a suitably colored stencil. Mr. Luckiesh has gone very much further in this line, showing the admirable effects which may be obtained not only by varying the illumination upon pictures in color and direction, but in producing shifting scenes and flashing signs by the suitable use of colored lights. The possibilities of color in illumination have been appreciated only in very recent times. In fact, it is only with high-efficiency illuminants that selective color absorption becomes economically possible, and with it the production of brilliant color effects in connection with the objects illuminated.

"Artificial daylight" has already been produced in several forms, all useful although not by any means concordant. We have pointed out before that it is quite as necessary to settle upon what shall be considered standard daylight as to be able to furnish it when required. Apart from all this, however, comes the possibility so admirably set out by Mr. Luckiesh of using colored illumination to produce effects which can hardly be duplicated in any other way. Perhaps the first applications of such methods will be in stagecraft, which already depends in so great measure on skilful and artistic lighting. The stage electrician has already grasped the possibilities of colored illumination in itself, but the thing here considered—adaptation of colored illumination to the colors of the things illuminated—opens a still broader field for ingenuity. The coming of the nitrogen-filled tungsten lamp with its excellent intrinsic color and very high efficiency puts in the hands of the illuminating engineer at last a source which can be freely used in these ways, particularly since it is not difficult to manufacture such lamps with concentrated filaments which lend themselves particularly well to projection. It is a most interesting field of investigation which we hope Mr. Luckiesh will continue to till.

Economy in Station Operation

The great improvement in station economy possible by the use of modern apparatus and methods is in no wise better shown than in the brief account of the new station of the Savannah Electric Company in another column. In this instance the replacement of an obsolescent station has shown more than usually excellent results. It is no small thing to have reduced the working staff of a generating plant from fifty-four to twenty-two men all told, including substation attendants, particularly when in the change the automatic stoking of cheap coal has been provided for. In nothing is the new plant more notable than in its improvement of boiler equipment. We have been advocating large boilers in season and out, and the excellent effect of the change made in this instance from units averaging only 260 nominal hp to those of 665 hp emphasizes the lesson in economy. Then, too, the passage from comparatively small reciprocating engines to large turbines showing a low steam consumption is a great gain in itself. The whole design of the new plant tends toward that simplification which is necessary to the production of electrical energy at a low cost.

Roughly, one may say that there are in existence two types of large stations, one that has grown by accretion of units of small size, the other in which the fundamental principle has been realized that the best station design calls for the installation of as few units as give due security in reserve. The first-mentioned type shows practically no better economy than that of a small group of the individual units. The latter makes possible gains which can come only through the added efficiency of and lessened labor with large units. In the earlier stages of electric work dozens of small belted machines furnished the output. That day of complication and high costs has passed, and improvements now take the direction of replacing the older equipment of the succeeding stage in station development with apparatus suitable for the loads and load-factors now encountered. One of the best features of the present situation is the lessened depreciation shown by the more modern equipment. Estimates of depreciation made ten or fifteen years ago must be entirely revised at the present time. While no change can be considered a permanent one, yet each modification brings lessened likelihood of rapid depreciation due to change in the art.

Wet Filtration of Cooling Air

Reference is made in the Digest of this issue to an article by Mr. D. A. Hackett upon a method of wet filtration of cooling air supplied to electrical machinery. It is long since dynamo machines depended entirely upon mere contact of their hot surfaces with the external air to carry off the air-convected heat. In all large rotating machinery the rotors are constructed with channels and ducts in such a manner that the air lying in these passages is urged forward by centrifugal force and rejected from the machine after it has become heated to some extent by contact with the hot walls of the passages. In this way the forced convection of heat from the machine during its operation is greatly increased. It is true that a certain amount of power is consumed mechanically in wind production by such procedure, but this disadvantage is far outweighed by the advantage secured in increased output without exceeding the temperature limit and often with increased efficiency.

The cooler the air which can be introduced into the ducts of the rotor the greater will be the quantity of heat which this air can carry off in its passage through the machine. If the air is merely discharged into the room and recaptured from the same source, the air temperature in the room tends to be raised, unless ample room ventilation is provided.

The process described by Mr. Hackett's article consists in bringing the incoming air which is to be passed through the machine into intimate contact with water in the form of a finely divided spray. This must have three effects. First, it will remove some impurities from the intaken air, either mechanical impurities like dust or chemical impurities such as acid or alkaline fumes. Whether such impurities as ordinarily exist in city intake air are prejudicial to electrical machinery is debatable, but at least it is likely to be admitted that impurities do not do any good, and that their removal by filtration is more likely to be beneficial than otherwise. Second, the intake air is likely to be cooled, because the cooling water is rarely as warm as the intake air. This cooling of the air is likely to increase the cooling effect of the air blast on the machinery, and thus to make the filtration worth while. Third, the water content of the incoming air is sure to be increased, not only in the form of gaseous water-vapor, but also in the form of entrained drops or liquid particles. If baffle plates are used, as suggested in the article, the entrained drops are likely to be discharged, and only the aqueous vapor needs to be considered. That is, the air, after wet filtration, is likely to be humid almost to saturation. As soon as it enters the machine, however, or even before it reaches the machine, the advancing air rises in temperature and falls below saturation, so that with the machinery in regular operation there seems to be little likelihood of moisture being deposited in it. The extra moisture contents will tend slightly to increase the absorption of heat from the machine during its passage. The benefit of this absorption due to aqueous vapor is, however, probably small by comparison with that due to the cooling of the intake air.

There can be no doubt that this water filtration acts in the right direction for further progress, namely, in increasing the effect of forced ventilation. The only question is as to the extent of the gain compared with the effort required to filter the air. It is to be hoped, however, that means may be found to utilize either the latent heat of steam or the thermal capacity of water in the cooling machinery. If water spray could be safely introduced into the passages and then evaporated, the increase in cooling effect would be very marked over that due merely to raising the temperature of the incoming moist air. Of course, such water channels would have to be kept separate from the insulated electric conductors.

Properties of Selenium Blocks

Selenium, as is well known, is a very imperfect electric conductor. It stands on that somewhat disreputable neutral ground which divides non-conductors from conductors. It has been classified with each group by different classifiers at different times. It compensates, however, for its indefiniteness as a conductor by its remarkable property of changing its conducting power under the influence of changes in intensity of incident light. In general, it conducts better in the light than in the dark, a phenomenon accidentally brought to light in attempts to make a simple high-resistance block out of a selenium lump. The action has been shown to be very complicated, both chemically and physically.

In a paper in the February number of the *Philosophical Magazine*, on "The Properties of Selenium Blocks," Mr. G. W. White describes some measurements tending to show that the effect of light on the resistance in selenium is largely developed at the contact surface or surfaces of the electrode. That is, the effect is held to be developed largely at the metal-selenium contact, and to a lesser degree in the substance of the illuminated selenium.

It would seem, at first thought, an easy matter to put such a proposition to experimental test by placing a prism of selenium between a pair of terminal electrodes and exposing only a short length of the prism at a time to incident light, so as to determine the relative change in resistance when the light shines on the middle and on the end of the prism. Yet the experimental difficulties in the test are considerable, if only owing to the high resistivity of the selenium and to the expansion of the prism under incident light.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

United Gas Improvement Company Under Government Investigation

Attorney-General McReynolds has acted on complaints filed with the Department of Justice against the United Gas Improvement Company of Philadelphia charging it with violations of the Sherman anti-trust law, and the case has been placed in the hands of Assistant Attorney-General Todd. According to President S. T. Bodine of the United Gas Improvement Company, which controls a number of electric properties throughout the country, he had an interview with the Attorney-General some time ago on this subject and at that time offered the Department of Justice every facility to make the investigation thorough and complete. Subsequently a special representative of the Department of Justice visited Philadelphia and every detail of the company's business was submitted to him. The view of the Department of Justice has not yet been learned.

Electrical Development Campaign Prizes Awarded

The Society for Electrical Development has mailed checks in payment of the prizes awarded in the campaign for membership carried on in its behalf by the Jovian Order. The first prize of $500 for the Jovian League securing the greatest number of subscribers was awarded to the Cleveland Jovian League. The first prize of $250 to the individual securing the greatest number of subscriptions was awarded to Mr. J. C. Bartlett, of Philadelphia. The second prize of $150 for the individual securing the next greatest number of subscriptions was awarded to Mr. H. F. Viot, Omaha, Neb. The third prize of $100 for the individual securing the third greatest number of subscribers was divided equally between Mr. W. J. Trott, Fostoria, Ohio, and Mr. C. A. Taylor, Youngstown, Ohio.

Each of these checks was accompanied by a letter from the society expressing its thanks to the prize winners for their co-operation and assistance.

New York Chamber of Commerce Would Postpone Trust Legislation

A special committee appointed by the Chamber of Commerce of New York City has made a report urging that action on trust legislation be deferred to another session of Congress. The committee says that the spirit of the bills is opposed to the utterances of President Wilson on the subject of business legislation. The committee believes that "what business men generally desire, what industry most needs, is the certainty of a period of rest for the peaceful readjustment of all enterprise that is inconsistent with the accepted principles of law and ethics and for the energetic advancement of all individual endeavor free of any sense of repression, secure in a sense of liberty of action, and guarded from the danger that the disclosure of personal prerogatives and private achievements would entail."

Dr. Pupin on the Electromagnetic Theory

Under the auspices of the committee on technical lectures of the American Institute of Electrical Engineers, Dr. Michael I. Pupin, professor of electro-mechanics at Columbia University, New York City, is to deliver two lectures on "The Electromagnetic Theory." The first lecture will be given at the Engineering Societies Building, New York City, Wednesday evening, April 29, and the date of the second will be announced later. Dr. Pupin will treat the subject from the points of view of the physicist and the electrical engineer, and will endeavor to differentiate these points of view.

Bell Telephone Litigation with Government Settled

The combination by which the Bell system dominated the telephone lines of Washington, Oregon and Idaho was dissolved on March 26, when a decree, accepted by the Pacific Telephone & Telegraph Company and conceding the government's demands, was entered in the federal court at Portland, Ore. In a statement the Department of Justice said:

"The decree adjudges that the defendants combined to monopolize the means of telephonic communication in and among the States named in violation of the anti-trust act and forbids them to form any like combination in the future. The Bell companies are ordered to dispose of their holdings in the Northwestern and Interstate companies—the two long-distance companies—and are prohibited from acquiring hereafter any interests in those companies.

"The decree further orders the Bell companies to sell their holdings of the stock and bonds of the Home Company of Spokane, but it is provided that if the city of Spokane within three months shall determine it to be in the interest of the people of that city to consolidate the exchanges of the Home Company and of the Bell companies under the control of the latter, application may be made to the court so to modify the decree as to permit that to be done.

"The decree condemns as unlawful all contracts by which local companies agree to give their long-distance business to the Bell companies exclusively, and prohibits the latter from accepting any benefits thereunder."

Mr. Theodore N. Vail, president of the American Telephone & Telegraph Company, at the annual meeting of the stockholders in New York on March 31 said that never before in the history of the company to the best of his knowledge had the business been so free from vital questions of policy of procedure. There is not a single suit pending against the company in any state or federal court charging any violation in any anti-trust law.

Regarding future financing Mr. Vail said: "Arrangements have been made by some of our associated companies to finance themselves for the immediate future and to repay some of the money advanced to them by this company to such an extent that it is not expected that it will be necessary for this company to issue stock or any new securities at least before the first half of the year 1916."

Electric Heating of Water Pipes to Prevent Freezing

By keeping currents of several hundred amperes flowing continuously through water pipes which otherwise would have been in danger of freezing, it was possible to continue construction work on the hydroelectric development of the Cedar Rapids Manufacturing Power Company near Cedars, Quebec, without interruption during even the coldest days of the past winter. The 1-in. pipes thus protected supplied water for the steam shovels and were laid above ground, as continuous shifting prevented them from being buried.

Current for the pipe circuits was obtained from a bank of transformers stepping down from 2300 volts to 220 volts and 110 volts. The pipe connections consisted of copper wires wound around the ends of the pipes and buried several feet in the earth to prevent the pipes from freezing back of the connections. When the temperature was below zero, and even as low as — 27 deg. Fahr., it was found that 40 kw at 220 volts would keep 1500 ft. of 1-in. pipe from freezing, even with water standing in it. A 1000-ft. pipe required 20 kw at 110 volts. Energy for construction purposes about the site, as well as for this novel electric-heating application, was furnished by the 10,000-hp water-power plant of the Provincial Light & Power Company near by.

On the pipes supplying compressed air to the various drills it was noticed that when the temperature dropped below 5 deg. Fahr. no trouble was experienced from the moisture in the air. For temperatures from 5 deg. to 40 deg. there was difficulty when the air was not reheated. That no reheating was necessary for the lower temperatures is explained by the theory that the air was so cold that the moisture was frozen out of it before entering the machine. The work is carried out under contract by Frazer, Brace & Company, of New York City.

Alabama Power Company and Public Interest

In order to place before the people of Alabama the position in which the Alabama Power Company stands with regard to public interest, the company has distributed a pamphlet relating to its water-power developments. The pamphlet is signed by Mr. James Mitchell, vice-president.

The belief is expressed that no natural resource in Alabama promises so much for the development of the State at this time as does the development of the Coosa. Tallapoosa and Tennessee Rivers proposed by the company. When in 1907 an act of Congress for the construction of a dam at Lock 12 on the Coosa River was approved, the Alabama Power Company was a domestic company with a small capital, and it has maintained its status as a domestic company to this date. The original stockholders, citizens of the State who resided at Gadsden, interested other citizens of the State in the purchase of land at other sites along the Coosa River, and they also organized domestic companies and purchased sites. Jointly and separately the stockholders of the companies then endeavored over a period of years to finance the developments. Local capital was manifestly inadequate. Northern capital fought shy of the project. Governmental aid had been invoked repeatedly. Under such circumstances foreign capital was the only remaining hope, and in 1911 the owners induced Sperling & Company, London, to undertake developments.

Mr. Mitchell emphasizes the points that such development as the company contemplates has for its purpose utilization and not waste of water-power, introduction of new industries, industrial development of the State, conservation of millions of tons of coal annually and improvement of navigation of a region involving several states.

The circular discusses the wisdom of the law exempting from taxation for a period of years the structures and other property of power companies, including their franchises, except the lands which the companies may acquire. Water-power companies have found many difficulties in working out developments in Alabama and other states. Developments are seldom made within original estimates. Unexpected conditions arise which it is not possible to foresee, and as a result the single development of the Alabama Power Company at Lock 12, on the Coosa River, will scarcely pay interest on the funded debt for the first ten years.

Progress in the Science of Lighting

Dr. Edward P. Hyde, director of the physical laboratory of the National Lamp Division of the General Electric Company, Cleveland, Ohio, gave a lecture before the Finance Forum at the West Side Branch of the Young Men's Christian Association, New York, March 30, covering in an intensely interesting way some of the more spectacular phases of artificial illumination. His lecture opened with a short discussion of the advantages of private ownership of public utilities, showing what immediate bearing this has on the subject of lighting. He then spoke of the changed methods under which scientific investigation is carried on at the present time, particularly in connection with large industrial enterprises. Formerly, he said, such work was largely a matter of individual effort, but under the present industrial system the purely scientific work necessary to the progress of an industry is directed toward the interests of the industry. The result, according to Dr. Hyde, is a more complete differentiation of function in research laboratories and a further integration of results.

The growth of the profession of illuminating engineering was then described. The speaker explained how the tools of that art were discovered and perfected long before the real engineering phases of their proper application were thought of, and he said that the important branches of the art are those which involve matters of the physiological and psychological effects of light, rather than simply the measurement of intensities. The most interesting and instructive part of Dr. Hyde's talk was that in which he covered, with the aid of experimental demonstrations, the bearing on illumination problems of the three factors of intensity, position and color of the light source. Using various examples of sculpture, exterior and interior architecture, paintings, advertising signs and samples of cloth, he showed in a most convincing manner that the variation of either or all of the above factors means an entire change in the appearance of the subject illumined. Taking, for example, the head of the father in the Laocoön group, he showed that, by simply varying the direction from which the light struck the figure, its expression could be changed from one of calm dignity through a number of phases to one of intense agony. By changing the color of the light on a painting he showed how the detail can be brought out and also how the impression of depth can be produced. A specially interesting and mystifying effect was brought out by Mr. Hyde in connection with the illumination of signs or pictures by monochromatic light. Under such conditions parts of a sign or picture which are entirely invisible with red light are brought out strongly by blue or yellow light, or vice versa.

American Water Works & Guarantee Company Reorganization

The stockholders of the American Water Works & Guarantee Company of Pittsburgh, Pa., recently received from the protective committee additional details of the reorganization plan, containing the statement that Mr. H. Hobart Porter, of Messrs. Sanderson & Porter, of New York and San Francisco, would accept the presidency of the reorganized company, to be known as the American Water Works & Electric Company. The new company will have $10,000,000 of 7 per cent cumulative first preferred stock, of which $5,000,000 will be issued at once; $20,000,000 of 6 per cent participating preferred stock, of which $10,000,000 will be issued at once; $10,000,000 of common stock, of which $7,000,000 will be issued at present, and $20,000,000 of collateral trust 5 per cent twenty-year bonds, of which $6,250,000 will be issued now and $3,700,000 will be available as collateral. Of the collateral trust bonds to be issued at once, $5,733,300 are to be reserved for exchange, par for par, against the first mortgage bonds of the California-Idaho Company and $516,700 are to be used to pay indebtedness of subsidiary companies. The amount of the bonds reserved as collateral is to cover the indebtedness of subsidiary companies to bank creditors.

An interesting discussion of the situation that confronted the protective committee is given by that body. After stating that the company, which was organized in 1891, had for many years conducted a successful business in the ownership and operation of water plants and also had a controlling interest in the West Penn Traction properties, the value and earning power of which had been demonstrated, the committee says:

"The company had, however, during a period of some six years prior to the receivership engaged in irrigation projects in the Far West to an extent and in a manner disproportionate to its resources. It was liable as a guarantor upon approximately $20,000,000 in mortgage bonds of such irrigation companies, all of them maturing serially year by year. It had been anticipated that the heavy requirements for principal and interest upon these obligations and for the operation and development of the irrigation properties would be met by deferred payments by settlers upon the lands. The payments collected, however, fell far short of these requirements and the deficiency had reached large proportions. The company had thus invested in these projects, in addition to the outstanding bonds, upward of $10,000,000, represented by the floating debt of the irrigation companies held by the American Water Works & Guarantee Company. In addition thereto, the American Water Works & Guarantee Company had indorsed and rediscounted with third parties large amounts of paper of those companies for payment of which it was liable. Not only had the American Water Works & Guarantee Company invested in the properties substantially all the cash received from the sale of its entire issue of preferred stock, but it had used in these enterprises funds which could otherwise have been applied to the current needs of its profitable public service properties, with the result that at the time of the receivership each of its subsidiary companies was stripped of working capital and was indebted to banking institutions upon notes which the American Water Works & Guarantee Company had indorsed to the total net amount of approximately $3,050,000. In addition to these entanglements, the American Water Works & Guarantee Company had pledged, as collateral to its guarantee of irrigation bonds of the California-Idaho Company, the major portion in value of its assets."

By the terms of the reorganization plan, the California-Idaho bondholders are to exchange their present bonds for new 5 per cent twenty-year collateral trust bonds of the reorganized company, par for par against present holdings. The holders of the other four irrigation issues, aggregating $14,097,800 in principal amount, are to be paid $1,000,000 for the release of their guarantee. The bondholders will receive 51 per cent interest in the equities remaining in these properties after the payment of principal and interest on their bonds, the new company receiving 49 per cent interest therein. Under the reorganization plan there have been no changes in the capitalization of the subsidiary companies. All of the assets will be taken over by the new company, but there will be no guarantee by the new company on any subsidiary issues, all the guarantees of the old company being canceled and released.

Bank creditors, whose paper to the amount of $3,050,000 has matured, have agreed to accept for a portion of that paper twenty-year 5 per cent collateral trust bonds of the reorganized company at 87½, the remainder being renewed and extended over a total period of six years.

The reorganized company expects to raise $4,500,000 through present stockholders by subscriptions to new stock and by assessments on stockholders who do not subscribe. All assessments must be paid in full on or before April 27, 1914, and in case of default present stockholders will forfeit all interest in the reorganization. Subscriptions to new stock may be paid in full on or before April 27, 1914, or in instalments ending Oct. 27, 1914, and any stockholders failing to subscribe or pay the first instalment of their subscriptions on or before April 27, 1914, will forfeit all interest in the reorganization.

The committee has caused an underwriting syndicate to be formed, which has underwritten the $4,500,000 to be provided and has agreed to take and pay for all stock not subscribed for by the stockholders. This underwriting, however, has not been carried on by a strictly banking syndicate but has been participated in generally by banking firms and individuals, both here and abroad.

Upon the full consummation of the reorganized plan, it is anticipated that the new company will possess, among others, assets consisting of $2,000,000 of cash and $6,233,300 of first mortgage bonds of the California-Idaho Company, which bonds are a prior lien upon 33,000 acres of land in California. The $2,000,000 of cash is the amount estimated to be left from the working capital subscribed after acquiring the properties, paying creditors and all organization and reorganization expenses. Through its ownership of the capital stock of the United Water & Light Company, the reorganized company will own directly or indirectly $42,011,500 of the outstanding stock of thirty-five electric-light, water-works and traction companies and one coal company. These companies together have $59,585,000 of capital stock outstanding, $1,385,000 of which is pledged under the mortgage of the United Water & Light Company.

Messrs. Sanderson & Porter estimate the earnings of the new company for the first full year's operation and income from securities held as follows: Earnings received and accrued are placed at $1,500,953, and $500,000 is allowed for amounts to be left with subsidiary companies and for general expenses of the new company. Interest on the $6,250,000 of collateral trust bonds of the new company, amounting to $312,500, is then deducted, leaving $688,453. From this is deducted $350,000 for the first preferred dividend, leaving a balance of $338,453 for the participating preferred and common stocks.

The president of the reorganized company, as noted above, will be Mr. H. Hobart Porter, and the following directors have been chosen: Messrs. E. C. Converse, A. H. Wiggin, Samuel Insull, Guy E. Tripp, James D. Mortimer, William Nelson Cromwell, H. Hobart Porter, J. B. Finley, W. B. Schiller, Charles R. Scott, H. J. Delanoy Meijer, Theodore Revillon, H. C. Huffer, Jr., Andrew V. Stout, Charles H. Payson, Henry Russell Platt and Henry H. Pierce. It will be noticed that the above list does not contain the names of any in the old board of directors of the American Water Works & Guarantee Company. No information is as yet available in regard to the other officers of the new company or the personnel of the voting trust to be chosen by the reorganization committee.

According to a decree entered in the United States Circuit Court in Pittsburgh on March 16, the receivership will be closed by the sale of the assets of the company on April 15, 1914. The upset price is $1,000,000, and the stockholders' protective committee proposes to buy in the property in accordance with the reorganization plan.

Halt in the Anti-Trust Legislation Program

President Wilson's fight for the repeal of the tolls exemption clause of the Panama Canal law, which was settled last week so far as the House of Representatives is concerned by the passage of the Sims bill, caused a halt in the consideration of the administration's proposed anti-trust legislation among committees of Congress and at the White House.

Just what effect the canal tolls fight in the Senate will have on the prospect of passage of anti-trust legislation at this session of Congress it is said to be too early to state, but in Washington it is realized as a fact that the proposed canal legislation is certain to act as a drag among the legislative program ambitiously mapped out not long ago, which included early passage of the anti-trust laws and an adjournment in June.

The House, having passed the Sims repeal bill, is in better shape for consideration of anti-trust legislation than the Senate. The trade commission bill has been introduced in the House, by order of the committee on commerce, and Representative Covington, of Maryland, chairman of the committee in charge of it, stated to a representative of the *Electrical World* in Washington that he intends to introduce in the House the middle of next week, probably Wednesday or Thursday, a printed argument which has been prepared by his subcommittee outlining the legal effect of the provisions of the bill and elaborating upon them.

In the House judiciary committee there are four measures, one amending the Sherman law, one defining the Sherman law, one regulating holding companies, and one prohibiting interlocking directorates. That committee has ended the hearings which have been held on these measures. They have never reached any stage beyond being submitted to the committee as "committee prints." An agreement has been reached not to hold any more hearings.

At the office of the judiciary committee it is stated that the members are considering these measures right along, but that when a report is to be made on them Chairman Clayton does not know, nor do the members of the committee. It will be necessary, it is stated, for the President to hold conferences with the members of the committee before any attempt is made to draft new bills in the place of the "committee prints" which have been used as a working basis.

One other committee, the Senate committee on interstate commerce, has before it proposed anti-trust legislation. This committee, of which Senator Newlands is chairman, has appointed a sub-committee of seven to draft one entirely new short bill which will deal with all the proposed anti-trust legislation. Senator Newlands is chairman of this sub-committee, and he states that the new bill will be ready for submission in about a week.

Under this bill will be consolidated all that Senator Newlands' committee purposes to do as to anti-trust legislation. The proposed measure will contain a paragraph on interlocking directorates and one on holding companies, but it will not contain, it is stated for the purpose of this article, any paragraph attempting to define the Sherman law or amending that law. It will be a short measure, one brief paragraph being devoted to each subject.

In view of the fact that the Senate has no rules committee, such as that of the House, which can limit debate on any subject, and in view of the fact that Republican Senators state they desire full and free debate on any proposed anti-trust legislation at this session of Congress, when the legislative and political situation with respect to the Senate's consideration of the tolls repeal bill is considered, it is, all in all, quite possible that the anti-trust legislation may go over to the next session. This possibility receives additional weight from the fact that such bills as do come from the House to the Senate will probably contain amendments to or definitions of the Sherman law the necessity for which many Senators doubt.

Tube Lighting

Mr. D. McFarlan Moore read an interesting paper on tube lighting at a meeting of the New York Electrical Society on March 31. The speaker outlined briefly the progress and the development in the last twenty-one years of lamps using gaseous conductors for obtaining light, and he gave some interesting figures telling of high efficiencies attained. Mr. Moore interspersed his remarks with a number of lantern slides which illustrated the various steps in the development of the Moore tube lamp. Various types of apparatus were also used to demonstrate the applicability of gaseous-lighting units to modern industrial conditions. Neon, nitrogen and carbon-dioxide lamps were used. The comparison of varicolored textiles and woolen goods first under a carbon-dioxide lamp and then under an ordinary tungsten lamp was of interest and showed how, with the former, colors could be selected under average daylight conditions. Mr. Moore showed also how one can easily be deceived in the selecting of meats or in determining the degree of inflammation of any diseased part of the body by depending on the usual artificial light.

Dr. Frederick G. Keyes, of the Cooper Hewitt Electric Company, discussed briefly high-pressure mercury-arc lamps. He first outlined the history of fused quartz and its use in connection with mercury-vapor arc lamps. The speaker then spoke of the ultra-violet rays emitted by the quartz tube lamp and described the ability of these rays to destroy injurious micro-organisms.

New York Meeting of American Electrochemical Society

The twenty-fifth general meeting of the American Electrochemical Society will be held in New York City April 16 to 18, 1914, with headquarters at the Chemists' Club, 52 East Forty-first Street. There will be technical sessions Thursday morning and afternoon and on Saturday morning and afternoon. Friday will be given over to an all-day excursion by steamboat around New York Harbor and Staten Island, combined with visits to the plants of the American Smelting & Refining Company, the United Lead Company and the Waclark Wire Company. The arrangements for the meeting are in the hands of the New York Section of the society, and the smoker scheduled for Thursday night and the steamer party on Friday are complimentary affairs tendered by the section. On Saturday evening a dinner dance will be held in the Chemists' Building.

Following is the program of the technical sessions:

Thursday, April 16, 9 a. m.—Rumford Hall, Chemists' Building: Annual business meeting, followed by symposium on power problems in electrochemistry. Dr. C. P. Steinmetz, "Characteristics of Electrical Energy as Affecting Chemical Industries"; Mr. P. Sothman, "Efficiency of Power Transmission Versus Utilization in Local Electrochemical Industries"; Mr. F. A. J. FitzGerald, "Economies in Electric-Furnace Operation"; Mr. W. S. Horry, "Power Supply to Electric Furnaces"; Mr. Lawrence Addicks, "The Power Problem in the Electrolytic Deposition of Metals"; Mr. H. E. Longwell, "Mechanical Aspects of the Power Problem in the Electrolytic Deposition of Metals"; Mr. F. D. Newbury, "Sources of Direct Current for Electrochemical Processes."

Thursday, 2 p. m.—Rumford Hall, Chemists' Building: Mr. Wilder D. Bancroft, "Electrolytic Flames" (an experimental lecture); Mr. C. A. Hansen, "Electric Steel Castings"; Mr. Eugene B. Clark, "Electric Furnaces for Steel Making"; Mr. G. C. Stone, "Improvements in the Metallurgy of Zinc"; Mr. W. R. Ingalls, "Electric Zinc Smelting"; Mr. W. P. Lass, "Advantages of Southeastern Alaska for Hydroelectrochemical Industries."

Thursday, 8 p. m.—Rumford Hall, Chemists' Building: Dr. E. F. Roeber, "Some Economic and Esthetic Aspects of Electrochemistry" (presidential address).

Thursday, 8:45 p. m.—Smoker, the delegates to be the guests of New York Section.

Saturday, 9 a. m.—Earl Hall Columbia University: Mr. E. A. C. Smith, "Progress in Leaching and Electrolytic Treatment of Copper Ores in South America"; Mr. Robert R. Goodrich, "Hydro-Electrometallurgy of Copper"; Mr. Rudolph Gahl, "Leaching of Copper Tailings"; Mr. Ralph W. Deacon, "Metal Inventory in an Electrolytic Copper Refinery"; Dr. Joseph W. Richards, "Electrolytic Zinc"; Messrs. O. P. Watts and A. C. Shape, "Addition Agents in the Deposition of Zinc from a Solution of Zinc Sulphate"; Messrs. Frank C. Mathers and O. Ralph Overman, "The Effect of Addition Substances in Lead-Plating Baths"; Messrs. Frank C. Mathers and Hugh M. Marble, "Electrodeposition of Cadmium"; Messrs. C. W. Bennett, H. C. Kenny and R. P. Dugliss, "Electrodeposition of Nickel"; Messrs. C. W. Bennett and A. W. Davison, "Electrolytic Deposition of Brass on a Rotating Cathode"; Mr. Gustave E. F. Lundell, "A New Method for the Determination of Free Cyanide in Electroplating Solutions."

Saturday, 2 p. m.—Earl Hall, Columbia University: Dr. E. F. Northrup, "Electric Conduction at High Temperatures and Methods of Measurement" (experimental lecture); Mr. F. A. J. FitzGerald, "Laboratory Notes on Some Electrical Properties of Silver Sulphide"; Mr. Claude N. Hitchcock, "Polarization Single Potentials"; Mr. Reinhard Beutner, "New Cell Arrangements for Direct Determination of the Free Energy"; Mr. R. Stuart Owens, "Experiments on White Lead"; Mr. Oliver W. Storey, "A Microscopic Study of Electrolytic Iron"; Messrs. O. P. Watts and M. H. Li, "The Effect of Addition Agents in the Electrodeposition of Iron"; Mr. O. L. Kowalke, "The Permanency of Base-Metal Thermocouples as Affected by Their Microstructure."

Saturday, 7 p. m.—Dinner-dance, the Chemists' Building.

Joint National Committee on Electrolysis

The joint national committee on electrolysis, which held its preliminary meeting in New York on May 27, 1913, is now made up as follows:

American Electric Railway Association—Mr. R. P. Stevens, president Mahoning & Shenango Railway & Light Company, Youngstown, Ohio; Prof. A. S. Richey, consulting engineer and professor of electrical engineering Worcester Polytechnic Institute, Worcester, Mass.; Mr. Calvert Townley, assistant to the president Westinghouse Electric & Manufacturing Company, New York.

American Railway Enginering Association—Mr. E. B. Katté, chief engineer electric traction New York Central & Hudson River Railroad Company, New York; Mr. D. J. Brumley, engineer of maintenance of way Illinois Central Railroad Company, Chicago; Mr. W. I. Trench, division engineer Baltimore & Ohio Railroad Company, Baltimore.

National Electric Light Association—Mr. Philip Torchio, chief electrical engineer New York Edison Company, New York; Mr. L. L. Elden, electrical engineer Edison Electric Illuminating Company, Boston, Mass.; Mr. D. W. Roper, assistant to chief operating engineer Commonwealth Edison Company, Chicago.

American Telephone & Telegraph Company—Mr. H. S. Warren, electrical engineer, New York; Mr. F. L. Rhodes, outside plant engineer, New York; Mr. A. P. Boeri, protection engineer, New York.

American Institute of Electrical Engineers—Mr. B. J. Arnold, consulting electrical engineer, Chicago; Mr. F. N. Waterman, consulting engineer, New York; Mr. Paul Winsor, chief engineer motive power and rolling stock Boston Elevated Railway Company, Boston.

National Bureau of Standards—Dr. E. B. Rosa, chief physicist, Washington, D. C.

Natural Gas Association—Mr. C. B. Olyphant, Iroquois Natural Gas Company, Buffalo; Mr. W. J. Broder, Columbus, Ohio; Mr. Forest Towle, New York.

American Gas Institute—Prof. Albert F. Ganz, consulting engineer and professor of electrical engineering Stevens Institute of Technology, Hoboken, N. J.; Mr. J. A. Gould, engineer of distribution Boston Consolidated Gas Company, Boston; Mr. Jacob D. von Maur, superintendent of distribution Laclede Gas Light Company, St. Louis.

Mr. Bion J. Arnold is the chairman of the joint committee. The second and third meetings of the committee were held in New York at the rooms of the American Institute of Electrical Engineers on Feb. 25 and 26. Messrs. Townley, Katté, Warren, Roper, Waterman, Ganz and Broder were confirmed as members of the committee on plan and scope of the investigation. Mr. Townley, addressing the gentlemen present, gave a general idea of the questions which it is proposed that the committee shall consider broadly. It is not proposed that the joint committee shall come to definite conclusions upon the questions at issue, but rather report back to the respective organizations represented on the joint committee, so that in time the committee would come to be recognized as a neutral body whose decisions would be authoritative. It is not proposed that the joint committee shall act as a board of arbitration in controversies.

At the meeting of Feb. 26 it was voted that Dr. E. B. Rosa, the representative of the National Bureau of Standards, be appointed secretary of the joint committee and a member of the plan and scope sub-committee. The sub-committee on plan and scope presented a preliminary report and a resolution, which was adopted, providing that the chairman appoint subcommittees to collect information and that the committee on plan and scope be continued. Chairman Arnold thereupon announced the appointment of the following sub-committees:

Principles and Definitions—Messrs. Rosa (chairman), Brumley, Stevens and Boeri.

Methods and Analyses of Surveys—Messrs. von Maur (chairman), Olyphant, Elden, Rhodes and Winsor.

Foreign Practice—Messrs. Torchio (chairman), Towles, Trench, Townley and Gould.

Domestic Practice—Messrs. Waterman (chairman), Broder, Ganz, Roper, Richey, Katté and Warren.

Minnesota Electrical Association at Minneapolis

In the *Electrical World* of March 28 was given a brief account of the seventh annual convention of the Minnesota Electrical Association, held in Minneapolis, March 18, 19 and 20. Further details of this convention, together with abstracts of papers read and addresses delivered, are given below.

Motor Applications

Mr. C. W. Drake, of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., gave a paper on "Motor Applications." He mentioned the fact that new-business departments are maintained by few electric-service companies in cities of less than 50,000 population. In Minnesota about 400,000 hp is used in manufacturing industries; possibly 25 per cent of this is supplied by electric-service companies, although this is rather a rough estimate. Discussing various classes of industries, Mr. Drake said that small planing mills make excellent "prospects" for central-station business. Paper mills are not so good. Miscellaneous industries present, perhaps, the best opportunity. Over 90 per cent of the industrial applications of the electric motor may be met by the use of standard-slip, constant-speed squirrel-cage alternating-current motors. However, direct-current motors are required where adjustable speed is needed, and the use of direct-current motors for this purpose is increasing. Electric motors used to drive machinery should be large enough; they may not show distress but still be too small. The speaker exhibited a large number of interesting lantern-slide pictures illustrating motor applications. He mentioned the fact that usually, but not always, flour mills are driven by one motor. He illustrated one such mill operated by a 1000-hp motor wound for 13,200 volts. Another promising and interesting use of the electric motor is in supplanting steam pumping engines in city water-works. Brick and tile works and paper mills furnish promising prospects. The speaker illustrated a large number of electrically driven machine tools.

Relations with the Public

Mr. R. F. Pack, general manager of the Minneapolis General Electric Company, read a thoughtful paper on "The Public and Public Service Corporations." It was a condensation of a previous paper on the same subject read before the Minnesota Section of the American Institute of Electrical Engineers. The speaker noted that as a rule the customers of a public utility corporation are more friendly to it than are the remainder of the citizens. This proves that closer relations with the corporation result in a greater appreciation of the service rendered. To illustrate that private ownership makes for progress, Mr. Pack quoted from Mr. Samuel Insull, president of the Commonwealth Edison Company of Chicago, giving a comparison between the results of the Chicago company and the combined results of three hundred electric-service plants operating in Great Britain. The accompanying table shows these results tabulated, the figures being for 1912:

COMPARATIVE DATA FOR COMMONWEALTH EDISON COMPANY AND 300 BRITISH PLANTS

	Great Britain	Chicago
Population served	24,259,261	2,185,283
Investment.....	$310,013,189	$68,284,495
Income.... .	$40,585,860	$15,361,649
Income per capita.	$1.67	$7.03
Kilowatt-hours sold. .	1,127,499,742	712,193,636
Kilowatt-hours sold per capita	46.47	325.90
Income per kilowatt-hours, cents	3.60	2.16
Operating expense per kilowatt-hour, cents	1.76	1.17
Number of years required to turn over capital.	8	4½
Nature of business	Mainly lighting	Mainly motor service

Mr. Pack said that the electric-service companies must be frank in the conduct of their business and appeal to the people. He made a strong plea for the allowance of intangible values in the valuation of plants and declared that intelligent and fair regulation should be welcomed, but that regulation should not restrict the necessary flow of capital into the business. Taxes can more justly be assessed on the basis of gross income than on the value of the property. Mr. Pack quoted Mr. Arthur S. Huey, vice-president of H. M. Byllesby & Company, to show what should be the obligations of the company and what should be expected from the public. He closed by earnestly recommending the raising of the load-factor. There is more money, he said, in selling electricity at 2 cents per kw-hr. for twenty-four hours a day than at 15 cents or 20 cents per kw-hr. for one hour.

Electrical Extension Work of the University of Minnesota

Prof. W. T. Ryan, of the University of Minnesota, described the extension work of the university in relation to electrical activities. Four lectures have been prepared for delivery throughout the State. Three of these, by Prof. George D. Shepardson, have the following subjects: "Use of Electricity in the Home," "Transmission of Intelligence" and "Use and Abuse of Light." The fourth, by Professor Ryan, is on "Methods of Charging for Electricity and the Economic Use of Electricity." Professor Ryan gave a synopsis of this lecture, which has not yet been delivered in the extension course. It is prepared for non-technical audiences, but is a carefully considered explanation of the various methods of charging used in the sale of electricity.

Mr. Pack praised warmly the extension work of the University of Minnesota. Professor Shepardson said that the department of electrical engineering in the university wants to be of the greatest possible value to the electrical interests in the State. The four lectures available should be of decided value partly because the hearers will have more confidence, perhaps, in what a university professor says than in the statements of one interested in the sale of electricity. Professor Shepardson recommended the appointment of a committee on education by the Minnesota association, following the plan of the National Electric Light Association. On motion of Mr. M. A. Pocock, of St. Paul, the association voted that such a committee be appointed.

Modern Developments in Electric Lighting

Mr. S. E. Doane, of Cleveland, chief engineer of the National Electric Lamp Association, gave an interesting and instructive talk on four recent developments in electric lighting. The first of these was the advent of the high-candle-power, high-efficiency tungsten-filament lamp. Roughly, the efficiency of the lamps will vary as the amperes consumed. The question whether the lamps should be used with transformers or compensators must be settled in each individual case. The lamp presents an advance in efficiency which is greater than the figures of watts per candle would indicate, because the relation between horizontal and spherical candle-power approaches unity. The outdoor applications of this lamp are most interesting. The lamp will probably displace all other high-candle-power illuminants.

The second topic treated by Mr. Doane had to do with European practice in relation to the cultivation of very small lighting customers by electric-service companies. A very interesting description was given of the methods used to supply the meterless, flat-rate customers in Milan, Italy, who are connected to the number of perhaps 50 kw or 60 per kw of demand. The inexpensive wiring used was also described. This is cheap in price but apparently perfectly safe. The Milan company finds it advisable to get the small customers first and then go after bigger ones. Mr. Doane said that it is not uncommon for servants to induce their mistresses to use electric light by saying that they, the maids, have it in their own homes.

As his third subject, Mr. Doane touched briefly but emphatically upon the necessity of maintaining constant voltage on customers' circuits. He pointed out what it means quantitatively in loss of net revenue to permit the line potential to drop 3 volts or 4 volts.

The fourth subject of the address was the proposal that roads between cities and towns be electrically lighted where pole lines exist. There are many pole lines on country highways, and with the present low cost of electricity and the high efficiency of the high-candle-power lamps, the speaker does not see why their roads should not be electrically lighted in some sections. This, at any rate, is a prospect of the future.

Speaking generally, Mr. Doane said that the cost of making electricity in Europe is perhaps higher than in the United States. Americans are disposed to think of European labor as cheap, but it is constantly increasing in price and is, perhaps, not so effective as American labor. In their overhead construction it is to be remembered that the Europeans in many countries do not have to contend with the climatic conditions, such as sleet storms, encountered in many parts of the United States. It is to be borne in mind also that the principal cost in the making of electricity is the interest on the investment. In Europe the company generating the electricity is often distinct from the company distributing and selling it.

Discussion

In the discussion Professor Shepardson, Messrs. T. D. Crocker of Minneapolis, F. E. Brown of Mankato, B. M. Howard of Winona, A. H. Dickerson of Windom, P. T. Glidden of St. Paul, B. W. Lynch of Minneapolis, W. R. Haney of Warren and others took part. In answer to questions Mr. Doane explained that the very small flat-rate lighting customers in European cities are "feeders" for meter customers. He told of electric cooking in London restaurants, the cost being equivalent to gas at 50 cents per 1000 cu. ft. In some sections of London electricity for heating is charged for by a fixed annual charge, paid in advance, and at very low measured rate for the energy consumed. English central-station men say that the flatiron and the electric stove are the most valuable of the electric-heating devices in bringing in revenue.

The amount paid by the very small customers in Milan, said Mr. Doane, amounts to perhaps 6 cents or 7 cents per kw-hr. The limiting device causes flickering if the limit is exceeded; by turning off a lamp satisfactory service is re-established. Mr. Doane announced that a limiting device such as that used in Italy and costing perhaps $1.50 is being brought out by the National Electric Lamp Association, but the speaker expressed the hope that other manufacturers would do the same, for the good of the industry. In answer to another question, the speaker said that the central-station companies in Europe financed small customers for a long term of years, that is, spread the initial cost over a long term, receiving perhaps 10 per cent for their money. In Italy the central-station companies think they make money from the very small customer if they receive from him over 30 cents a month. In Strassburg, Germany, this limit is placed at $4.50 a year.

Mr. Doane described the methods of wiring used for these very small customers. Different plans are employed, but all cluster about the one central idea of helping the customer. Mr. Crocker dwelt upon the importance of getting electric service to the masses of the people. He thinks, however, that customers should pay for the wiring and get a fairly low rate for service. Mr. Howard told of the plan he is adopting for "intensive cultivation" in Winona. The city is divided into districts and a solicitor assigned to each. These men are instructed not to overlook anybody. The political effect of a large number of very small customers is important, as the company has very little trouble with its own customers. Mr. Dickerson wanted further light and wished to know if the limiting devices would discourage the use of flatirons and other current-consuming devices. Perhaps, he said, it would be better to reduce the minimum rates. Mr. Glidden said that perhaps all central-station men are apt to lay too much stress on the return per kilowatt-hour.

Co-operation

Mr. W. C. Beckjord, of St. Paul, read the paper of Mr. M. J. Wolf, of the Chicago office of the Hot Point Electric Heating Company, in the absence of the author. Mr. Wolf said that co-operation should be a vital, active force; it should be constructive and conducted on a personal basis. All interested in the electrical business should co-operate with the central-station company.

Visit to the University

One of the pleasant features of the convention was an excursion on the afternoon of March 19. Under the guidance of Professor Shepardson, who is professor of electrical engineering of the University of Minnesota, the convention visitors made a visit to the university. By a coincidence a rather unusual spectacle was staged for the benefit of the electrical men. In tearing down an old heating plant on the campus it was necessary to demolish a brick smokestack 9 ft. square at the base and 85 ft. high. This was done by taking out part of the brickwork in the base and filling it with timbers. These timbers were set on fire in the presence of the visitors, and at length, with a great crash, the stack toppled over to the ground. The visitors were then conducted to the Hall of Mechanic Arts, where Dr. George E. Vincent, president of the University, gave a brief address. Dr. Vincent requested his hearers not to fail to remember the value of what is sometimes termed mere theory. He urged fair treatment and a fair regard for the man who pursues truth because he loves truth. Every "practical" man, too, can follow intellectual curiosity. Indeed, anything that is "practical" is based on some intelligent theory. The president of the university explained how the school desires to enter into the life of the State.

Professor Shepardson, speaking of the electrical features of the university, said that part of the electrical energy used was produced in the university generating plant (designed also to be of educational value to engineering students) and part was purchased from the Minneapolis General Electric Company. There is practically no difference in the cost of the purchased and home-made energy. The visitors were escorted through the new heating plant, shown the rock tunnels for underground utilities, and taken to the electrical and mechanical engineering laboratories.

Twin Cities Men Entertain at Dinner

On the night of March 19 the electrical manufacturers and dealers of Minneapolis and St. Paul gave a complimentary dinner at the Hotel Radisson, where the convention was held, for the active members of the Minnesota Electrical Association. About 250 men sat at the tables, which were ingeniously decorated with a miniature pole line, energized, apparently, by a small generating plant on the speakers' table. Miniature street-lighting standards on the tables added to the effect. Mr. C. D. Wilkinson, chairman of the committee in charge, presided, and Mr. R. M. Laird read a prospectus of the Society for Electrical Development. Messrs. J. L. Barnard and Leo Cooper were the other members of the committee. A vaudeville entertainment followed the dinner.

Accounting

A carefully prepared paper on accounting was read on March 20 by Mr. F. C. Hoffman, of the St. Paul Gas Light Company. The speaker pointed out that analysis of accounts is particularly valuable when rate investigations come up, as they are pretty sure to do, sooner or later. He gave considerable attention to the distribution of expenses. Mr. Hoffman made the point that the public is quick to blame and slow to praise the utility company. This, he contended, is a good thing, because it keeps the utility man on the alert.

Safety First

Mr. John P. Gardiner, assistant commissioner of the Minnesota Department of Labor and Industries, read a paper on the "safety first" movement in Minnesota. The safety law in that State is a drastic one, according to the speaker. Employers are responding cheerfully and employees are co-operating fairly well, but not to to extent desired. The department prides itself on getting results without invoking the law. Mr. Gardiner dwelt earnestly on the need of personal caution; thinking must supplement mechanical devices. The speaker gave particular attention to accidents due to emery wheels, set screws for shafting and protruding nails in boards.

Concluding Business

Mr. A. G. Munson, of St. Paul, brought up the subject of the theft of electricity and asked the association to lend its influence to the enforcement of existing laws to prevent this crime or the adoption of a new law if necessary.

Public Service Commission News

New York Commissions

Governor Glynn of New York has filled three vacancies in the Public Service Commissions of the State. Mr. George M. Schulz was nominated for appointment to the Public Service Commission of the First District of New York to succeed Mr. John E. Eustis, whose term of office has expired. He is forty-five years old and a native of New York City. He was educated in the public schools and was graduated from the College of the City of New York in 1892 and from the New York Law School two years later. He was admitted to the bar at once. Mr. Schulz was elected surrogate of Bronx County on the Democratic ticket last year. Before that he was a city magistrate, having been appointed by the late Mayor Gaynor. He had represented the district in which he lives in the Assembly and in the Senate. Mr. Frank Ervine, professor of law at Cornell University, and Mr. William Temple Emmet were nominated for appointment to the Public Service Commission of the Second District of New York.

Maryland Commission

The Maryland Public Service Commission has authorized the Consolidated Gas, Electric Light & Power Company to issue $1,106,800 additional consolidated mortgage debenture stock bearing 5 per cent interest with the privilege of conversion at the option of the holder into common stock on the basis of par for the debenture stock and 121½ for the common stock. The commission also authorized the company to issue "when and as needed for the conversion of the debenture stock" $909,800 additional common stock. Because of a question raised by the commission's counsel the decision in the case was delayed in order that the point raised might be thoroughly sifted. This point related to the authority of the commission to sanction the conversion feature of the debenture stock at a fixed price three years hence, but after a study of various authorities this doubt was removed.

Indiana Commission

It is reported in Indianapolis that the Public Service Commission of Indiana will not interfere with certain electrical utilities in Indiana that are operating under particular forms of franchises giving contractual rights that members of the commission believe cannot be abridged under the law. Such cases exist at Lafayette, Gary and several other of the larger cities of the State. The commission, one member declared, would hold, in these instances, that it has no power to set aside a specific contract regarding rates.

The Lafayette case has attracted much attention. The large consumers of power at Lafayette are attempting to make a settlement of the rate issue, and it appears that an agreement will be made that will keep the case out of the commission's jurisdiction. A decision in the Lafayette case had been written by the commission but not made public. When it became known that an agreement was being considered between the company and consumers the commission withheld its decision.

The commission has authorized the execution of a new mortgage for $500,000 by the Indiana Fuel & Light Company, which operates plants at Kendallville, Auburn and Garrett. Of this amount $200,000 bonds are to be used to retire outstanding bonds and $75,000 are for construction and extensions. The $75,000 bonds may not be disposed of at less than 85.

Ohio Commission

The Public Utilities Commission of Ohio has issued a supplemental order on the application of the Dayton

Power & Light Company for authority to issue preferred stock. The company asked for authority to issue preferred stock to pay for the partial cost of the reconstruction of its plants and property and for the extraordinary expenditures, beyond the normal, made necessary to operate its property during and subsequent to the flood of March, 1913.

After consideration of the testimony, it appeared that the money to be secured by the sale of the stock was to be used for the payment of the partial cost of reconstruction and the rehabilitation of service and that these were necessary for maintenance of the service. The commission therefore was satisfied that so much of the petition as sought its consent to the issue and disposition of preferred stock of the further sum of $271,500 should be granted.

The company was therefore authorized to issue this amount of stock, in addition to the amount authorized on Feb. 17, 1914. The commission stipulated that the stock should be sold for not less than 80. It was also ordered that upon issue of this stock the company reduce its outstanding common stock by retiring $200,000 thereof.

Georgia Commission

In its decision on the application of the Macon Railway & Light Company to restore rates in Macon to a proper basis, they having been demoralized by competition in the past two years, the Georgia Railroad Commission asserts its belief that where there is governmental regulation and control of public service corporations it is the duty of the government to protect such corporations in the exercise of their rights and franchises.

After permitting the restoration of rates to an equitable basis the commission said:

"We do not believe competition can ever be a consistent and proper regulator of rates and other conditions in the public utility field. Real competition in such a field means duplication of plants, which when once built are generally useless for other purposes. In our opinion, the government, which properly assumes to prescribe reasonable rates and compel adequate service by public utilities, should also protect such utilities and the public from unwise or useless competition and the wasteful investment of money in plants which are unnecessary.

"There is need, as there are opportunities, for great industrial developments in Georgia. To meet fully this need and to improve these opportunities, capital other than our own must be attracted. There is no surer way of doing this than at all times treating it and its owners fairly. There are risks and hazards in public utility investments not always carried by private enterprises. There should be recognition of this in prescribing rates; they should allow compensation therefor.

"Investors in public utility enterprises unquestionably surrender, or rather have to yield, to governmental agencies in the regulation and control of their rates and services. They are not free to do as they will with their property or to get what they can out of it. They are subject to the will of the people whom they serve, and having such powers, it seems to us that there should be recognition at all times of corresponding obligations for at least fair treatment."

California Commission

The Railroad Commission of California has given authority to the Pacific Gas & Electric Company to issue $7,000,000 of one-year 5 per cent notes, the notes to be secured by $5,000,000 of the company's general lien bonds and $5,000,000 of the company's general and refunding bonds. The notes will mature on March 25, 1915.

Current News Notes

ALLIANCE ELECTRIC SHOW.—An electric show will be held at Alliance, Ohio, from April 14 to April 18. The present indications are that it will be a very successful affair. Much effort is being spent in this direction by the Alliance Gas & Power Company, of which Mr. W. J. Rose is manager and superintendent.

* * *

GREEN WIRE FOR DECORATIVE LAMPS IN TREES.—To render inconspicuous the wires used in connecting up lamps mounted in the foliage of trees at the Panama-Pacific International Exposition, San Francisco, 1915, special colored insulation will be used, making the festoons practically invisible both day and night.

* * *

AN ELECTRIC-TRUCK OPPORTUNITY.—Each year horses worth $1,100,000 die in New York City, according to figures collected by the New York Edison Company. Had these animals been sold the money received would have bought 1000 electric trucks, each having a useful life of ten years as against the four-year life of the horse.

* * *

PANAMA-CALIFORNIA EXPOSITION BUILDINGS READY JULY 1.—Director-General H. O. Davis of the San Diego (Cal) exposition declares that all buildings for exhibits or concessions must be ready for installation by July 1, 1914. A reinforced viaduct over the Cabrello Canyon at the west entrance to the grounds will be completed shortly, giving easy access to the exposition buildings.

* * *

EXAMINATION FOR ELECTRICIAN.—An open competitive examination for electrician will take place on May 6 at the usual places, as designated in the government circular. Applicants must be twenty years of age or over. Experience in the care, maintenance, repair and operation of station storage batteries is desirable. From the registers of successful candidates vacancies in the departmental service at Washington will be filled. The usual entrance salary for electricians is $4 a day. Those desiring to take this examination should write for Form 304 to the United States Civil Service Commission, Washington, D. C.

* * *

UNITED STATES COMMISSION ON INDUSTRIAL RELATIONS.—Public hearings in thirty-five important industrial centers from New York to San Francisco will be held during the spring and early summer by the United States Commission on Industrial Relations, according to an announcement by Mr. Frank P. Walsh, chairman of the commission. Through the examination of witnesses competent to speak for employers, trades unions, other labor organizations, unorganized employees and the general public, the commission hopes to obtain information concerning the industrial situation that will lead to constructive recommendations.

* * *

ELECTRICAL MACHINIST.—The United States Civil Service Commission will hold an examination for electrical machinist on April 27. At present there are two vacancies for machinist to be filled, one in the Signal Service-at-Large, Fort Wood, New York, and one in the same service at Fort Mason, Cal. Each position pays $1,000 per annum. Applicants for these positions should be practical electrical machinists more than twenty years of age, with three years' or more experience, should have a knowledge of electricity, and must be competent to repair telephone and telegraph instruments, radio apparatus, etc. Persons desiring to take this examination should write to the United States Civil Service Commission, Washington, D. C., for Form 1800.

Minneapolis to Have Electrical and Household Show.—Minneapolis is to have an electrical and household-appliance exhibition during the entire week commencing May 18. Mr. Charles E. Hansing, who is managing the undertaking, plans to make the electrical section one of the leading features of the show and desires to have every local electrical firm represented. Both the main Armory building and the annex will be used, thus affording ample space for elaborate electrical exhibits.

* * *

Noon-Time Recreation for Central-Station Employees.—A feature of the new hundred-thousand-dollar building of the Penn Central Light & Power Company, Altoona, Pa., is its fine assembly room which occupies one-half of the third floor. Seats are provided for 400 persons and at frequent meetings of employees topics of courtesy, public relations, welfare work, etc., will be discussed. The room is also equipped with a pianola and highly polished dance floor and the employees are privileged to listen to the music and to dance there daily between 12 noon and 1:30 p. m.

* * *

A Great Central-Station Load.—On Dec. 31, 1913, the total connected load on the system of the Commonwealth Edison Company of Chicago was 908,204 hp. Of this amount 536,239 hp was motor load or industrial load, and 371,965 hp lighting load. The industrial load includes 255,629 hp, representing the load of the surface and elevated railways. During the year the power division of the contract department of the company closed power contracts amounting to 43,496 hp. The street-railway load was increased by 78,955 hp, and the increase in the lighting load was 54,877 hp. The total increase, therefore, was 107,328 hp.

* * *

Cost of Hydroelectic Energy in the Northwest.—Statistics compiled by Chief Engineer F. S. Burroughs of the Public Service Commission of Washington show that the Washington Water Power Company at Spokane produces electricity at a lower cost than any other company in the State. The figures refer only to the costs incurred at the manufacturing stations. The cost per killowatt-hour generated at the switchboard of the Washington Water Power Company is 2.1 mills. The cost at other hydraulic plants is given as follows: Seattle-Tacoma Power Company, 3.1 mills; Lewiston-Clarkston Manufacturing Company, 3.7 mills; Wenatchee Valley Gas & Electric Company, 2.7 mills.

* * *

The Efficacious Electric Iron.—A demonstrator for the United Electric Light & Power Company, New York City, who called at a customer's home to explain the proper method of using an electric iron, was met at the door by the maid and to her described the purpose of her visit. The maid replied that she herself knew well enough how to operate the iron, but she said she did not favor its use as it worked "so fast" and did the ironing in such a short time that her mistress afterward always found extra work for her to do. She hoped therefore that her mistress would not buy the iron. Not daunted, however, the demonstrator made the sale and has since been using the story in gaining other orders.

* * *

Exhibit of Physical Apparatus.—An exhibit of physical apparatus will be held at the Bureau of Standards, Washington, D. C., under the auspices of the American Physical Society on the occasion of the first joint meeting of the Physical Society with the American Institute of Electrical Engineers on April 24 and 25. At the same time the new electrical building of the Bureau of Standards will be informally dedicated. The exhibit, which will be similar to the eminently successful annual exhibits of the London and French physical societies, will be limited to recently developed lecture, laboratory and research apparatus, together with illustrative photographs, charts, etc. Dr. F. A. Wolff, of the Bureau of Standards, is secretary of the exhibit committee.

* * *

International Engineering Congress, 1915.—Rapid progress is being made in working out the final program of papers for the International Engineering Congress to be held at San Francisco in 1915. The first volume of the publication of the Congress will consist of a series of twenty-two articles descriptive of the various technical features of the design and construction of the Panama Canal. Colonel Goethals will write the general introductory chapter and also the article on dry excavation for the locks. Another chapter will treat of the electrical and mechanical installations at Panama.

* * *

Decrease in Meter Losses.—At a recent meeting of the Commonwealth Edison Company Section of the National Electric Light Association Messrs. J. H. Perry and A. G. Turnbull read interesting papers on meters. The company has about 229,000 meters in service on customers' premises, and 323 employees are required in the meter department. A consumer of the size of Marshall Field & Company's retail store requires an installation of twenty printometers, which register half-hour dial readings on tapes. For a thirty-day period the coincident maximum from 28,800 readings on these instruments is calculated. Ten or twelve years ago shunt losses on alternating-current meters ran as high as 6 or 8 watt-hours, while on those purchased to-day the losses run from 1.5 to 2 watt-hours only.

* * *

Only One-Tenth of Oregon's Available Water-Power Used.—According to data compiled jointly by the engineering department of the University of Washington and Engineer Burroughs, of the Public Service Commission, only 10 per cent of the water-power of the State of Oregon available for practical use has thus far been developed. Engineer Burroughs gives the total amount of hydraulic electric power now developed at 265,000 hp, of which 227,000 hp is developed by public service corporations and 38,000 hp for private commercial purposes. The engineering department of the University of Washington puts the theoretical average for the entire year that could be developed by utilizing all possible power at 13,125,000 hp. The practical figure given for the amount of power that could be developed all the year around at a cost not to exceed $1.50 per hp was 2,566,000 hp.

* * *

Funeral Service Heard by Quarantined Daughter.—A distressed husband and father, burying his wife, called on the Chicago Telephone Company and asked its aid in effecting a telephone connection from the church to the bedside of his quarantined daughter. Request for service was made at 10.30 a. m. and the funeral was to be held at 2 p. m. on the same day. Concealing a so-called "acousticon" or loud-speaking transmitter in the flowers before the pulpit and connecting it to the telephone line of the church, direct means of communication was established between the church and the central office. Here the subscriber's line and the church line were disconnected from the switchboards and tied in solid. The quarantined daughter was thus able to listen to her mother's funeral service as it was conducted in the church many blocks from her home. One of the features of this unusual feat in telephony was the quick work involved.

SOCIETY MEETINGS

Next Chicago Rejuvenation.—Mr. Homer E. Niesz, statesman for Illinois, announces that the next rejuvenation of the Jovian Order in Chicago will be held on May 11, probably at the Hotel Sherman.

* * *

Chattanooga Jovians Initiate Big Class of Novices.—The Jovians of Chattanooga, Tenn., now meet weekly at luncheon at the Commercial Club. At a recent rejuvenation the fifteen active members of the league who happened to be in town initiated a class of forty-six candidates. Mr. Paul J. Kruesi acted as toastmaster at the banquet which followed the ceremonies, and addresses were made by Messrs. Byron T. Burt, F. H. Cantrell, C. S. Steward, J. S. Kirkpatrick and E. D. Reed. The initiation was in charge of Messrs. J. L. Wilheite, F. H. Cantrell, P. W. Curtis, R. W. Dugger, Jesse Dugger, J. N. Slaughter, Carl Rigdon, N. C. Blanchard, I. L. Faucette and W. J. Hill.

* * *

New York Illuminating Engineering Society Activities.—A meeting of the New York Section of the Illuminating Engineering Society jointly with the American Museum of Safety is to be held on April 9. A program that has been arranged includes papers on "Glasses for Protecting the Eyes in Industrial Processes," by Mr. M. Luckiesh, Cleveland, Ohio; "Illumination as a Factor of Safety in Industrial Plants," by Mr. R. E. Simpson, engineer Travelers' Insurance Company, Hartford, Conn.; "Railway Yard Lighting as a Factor of Safety," by Mr. J. W. Ensign, illuminating engineer New York Central Railroad, and "Some Reasons Why Red Is Not a Proper Color for Danger Signals," by Dr. William Churchill, of the Corning Glass Works. The committee for the prevention of blindness has been invited to discuss these papers.

* * *

Boiler Manufacturers' Convention.—The American Boiler Manufacturers' Association will hold its twenty-sixth annual convention in New York City, Sept. 1 to 4, 1914, with headquarters at the Waldorf-Astoria Hotel. All boiler, tank and stack manufacturers, fabricators of steel plate and manufacturers and representatives of materials and supplies used by boiler manufacturers are invited to attend the convention. The Supplymen's Association of the American Boiler Manufacturers' Association has completed a list of boiler, tank and stack manufacturers of the United States and Canada which is compiled in neat booklet form and contains names and addresses of more than 900 manufacturers. These books are offered to interested parties, such as tool and material manufacturers, at $3 per copy. The secretary of the association is Mr. F. B. Slocum, West and Calyer Streets, Brooklyn, N. Y.

* * *

Banquet of the Chicago Central Station Institute.—After being in existence one year the Chicago Central Station Institute gave a banquet on March 27 to the eleven men who had completed the course. Mr. E. W. Lloyd, the president of the school, spoke on the opportunities in the commercial field of the central-station business for young men. Mr. John F. Gilchrist, one of the directors, spoke on the development of the central-station industry, mentioning that first the engineer was the most valuable man but later the services of the commercial man became most desirable. Now, however, the speaker said, a man with a technical training and commercial ability is necessary to handle the central-station commercial problems. The future of the institute was outlined by Mr. Fred R. Jenkins, its secretary and manager, and Mr. H. L. Lincoln, chief instructor, spoke on personal power and load factors.

Ohio Electric Light Association.—The 1914 convention of the Ohio Electric Light Association has been set for Cedar Point, Ohio, July 21 to 24. Among the papers to be presented are those on "Welfare Work in Industry," by Dr. Thomas Darlington, Iron and Steel Institute, New York, and "Electric Power—Its Advantages, Service and the Best Methods of Obtaining It," by Mr. J. H. Mitchell, Columbus Railway & Light Company, Columbus, Ohio. The following committee reports will also be given: Illumination, Mr. S. E. Doane, Cleveland; meters, Mr. A. H. Bryant, Cleveland; transmission, Mr. M. H. Wagner, Dayton, and new-business co-operation, Mr. M. E. Turner, Cleveland. The usual elaborate entertainment program has been outlined, but the executive committee has decided that no exhibits shall be permitted under the sanction of the association, either at the hotel or at the convention hall. Mr. J. C. Martin, of Wilmington, Ohio, is president of the association, and Mr. D. L. Gaskill, of Greenville, is secretary. The chairman of the committee of arrangements for the 1914 convention is Mr. E. A. Bechstein, of Sandusky.

* * *

Electricity and the Fourth Dimension.—Prof. Philip B. Woodworth, dean and professor of electrical engineering, Lewis Institute, Chicago, speaking before the Chicago Jovian League luncheon on March 30, compared the action of the forces of gravitation, magnetism and electricity with the conception of the fourth dimension as expounded by Sir Oliver Lodge. Using a blackboard to demonstrate, Professor Woodworth explained the characteristics of the line, the square and the cube as applying to the first, second and third dimensions, and showed how man, a creature of the third dimension, is able to see nothing more concrete than squares. Just as a square, having no thickness, offers no resistance to the passage of a cube, so would a body of the third dimension offer no resistance to a body of the fourth dimension, declared Professor Woodworth. From this premise he showed further that gravity, magnetism and electricity found no barrier in certain substances of the third dimension. Contending, the speaker pointed out how these three phenomena, of which we see only the actions, might be substances of the fourth dimension.

* * *

Electrical Conference in Philadelphia.—The March meeting of the Electrical Conference was held March 26 at the meter department building of the Philadelphia Electric Company. Chairman Washington Devereux presded, and the speaker of the evening was Mr. D. Brookfield Wilson, of the General Electric Company, who gave an illustrated talk on the mercury-arc rectifier. The various economies to be effected by an intelligent investigation of the proposed installation, together with the installation of the proper number and size of rectifiers, were demonstrated by Mr. Wilson. Mr. Samuel Seata, chairman of the committee on fittings and devices, spoke of the failure of some fittings after use in the field, and about twelve fittings were shown that had failed in service. Among the number were porcelain pull-chain sockets, porcelain tubes, snap switches, molding fittings, etc. This talk and the discussion following brought out the fact that the contractor should consider well the character of material supplied by the manufacturer and jobber, as the loss due to defective material usually falls upon the contractor. The next meeting of the conference will be held April 23. The speaker will be Mr. R. Maitland Nesbitt, of the Philadelphia Fire Underwriters' Association, and the subject will be "Iron Conduit, Its Manufacture and Use."

Savannah Electric Company's Turbine Station

Features of 11,000-kw Riverside plant built for economical operation in the South—Condensers, boiler-feed pumps and auxiliary units on turbine-room floor—Steam header on boiler-room floor

THE Riverside station of the Savannah (Ga.) Electric Company, which has now been in successful operation for over a year, embodies features which distinguish it from all other steam-turbine stations of the South and which contribute greatly to the economical generation of electricity. Its design both within and without is pleasing to the eye, and means are provided for keeping a close check on operations from the coal pile to the outgoing lines with a view to getting maximum efficiency at every step in the manufacturing process. It is only necessary to note the change in the force required to operate the new station as compared with that employed in the old Indian Street station to get a comprehension of the economies effected. The Indian Street station contained eleven water-tube and return tubular boilers having an aggregate rating of 2850 hp. There were six engines rated at 3220 hp, two 1000-kw turbines and three railway generators rated at 1300 kw. Besides there was 850 kw of engine-driven and motor-driven Edison apparatus, the main generators in the station being either directly connected or belt-driven. To handle this equipment required three station engineers, one chief and one assistant chief engineer, six oilers, six switchboard attendants and electricians, ten coal passers, twenty firemen and seven men who did repair and other miscellaneous work. In the new station are one chief and one assistant chief engineer, one clerk, three shift engineers, three switchboard attendants, three stokers, three oilers, one machinist and three coal and ash men. To these should be added three attendants in the Bay Street substation. The old firemen were, moreover, negroes, whereas under the better conditions obtaining in the new station white firemen are employed, with very much better results.

Features which add greatly to the easy operation of

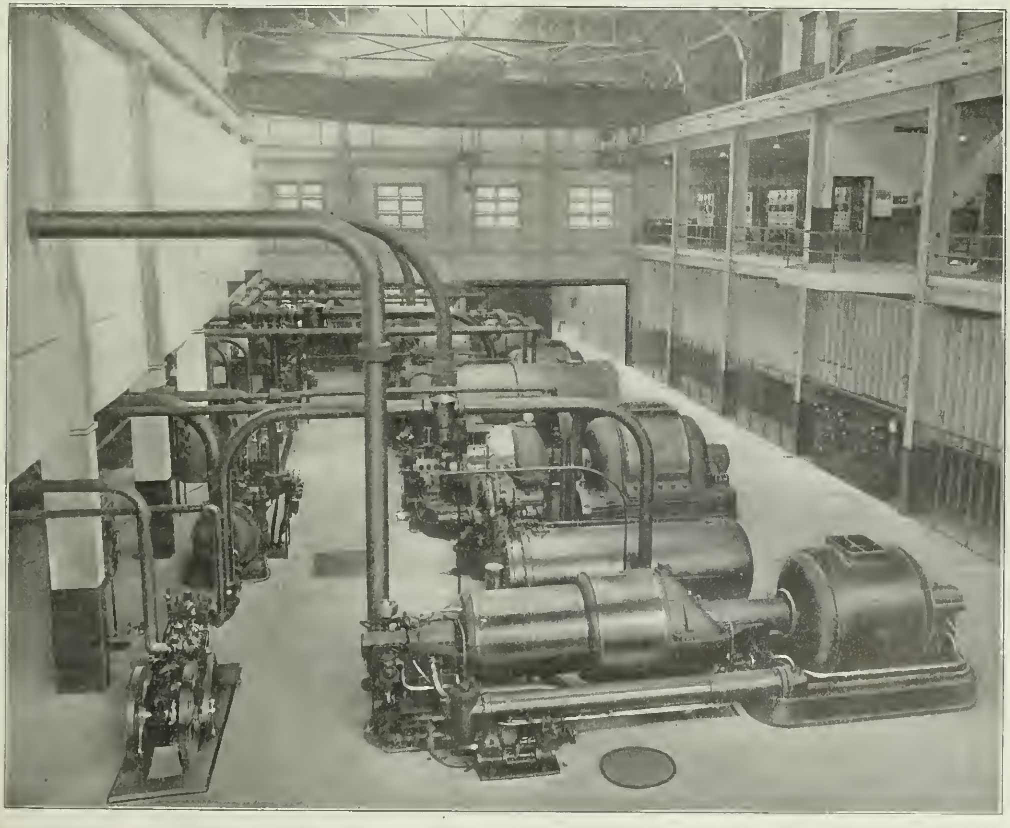

FIG. 1—RIVERSIDE GENERATING STATION OF THE SAVANNAH ELECTRIC COMPANY

the station and to its cleanly appearance are, first of all, an abundance of natural light. The condensers and all auxiliary units, including the boiler feed-water pumps, are on the same level and floor as the steam turbines; the boiler room is elevated above the turbine room, the tops of the boilers themselves being lagged and covered with a smooth cement walkway, and the main steam header is arranged about 3 ft. above the floor at the rear of the boilers, where it is easy of access without climbing. There is a high and light basement beneath the boiler room through which a railroad spur track runs and on which ash cars enter the station and are loaded from a gravity ashpit, the ashes being used for filling-in purposes and for track ballast on the suburban electric railway lines of the company.

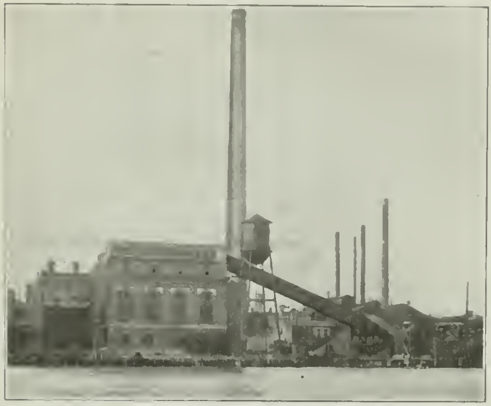

FIG. 2—RIVERSIDE STATION, SHOWING COALING FACILITIES

There are two electric-light plants operating in competition in Savannah, that of the Savannah Electric Company and that of the Savannah Lighting Company. The general manager of the former company, which also supplies electrical energy for the operation of the street railways of Savannah, is the Stone & Webster Management Association. The station of the latter company has equipment with a total rating of 4000 kw. For a while competition between the two companies was rather keen, but of late the Savannah Electric Company has greatly outdistanced its competitor.

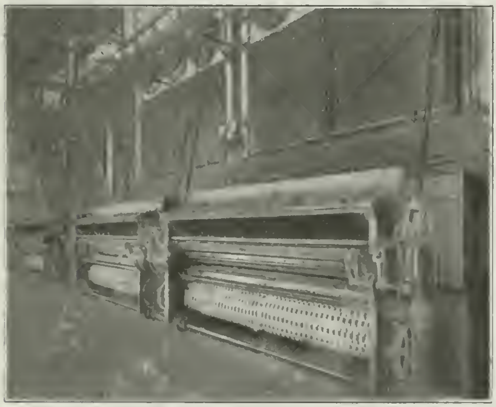

FIG. 3—BOILER ROOM OF RIVERSIDE STATION

The new station of the Savannah Electric Company is at the corner of River and West Broad Streets, on the Savannah River. The city is 18 miles from the sea, and the water of the river, although muddy and brackish, is suitable for condensing purposes and, after treatment, for feed water also. Coal is brought from Norfolk by boat or can be received by rail, and abundant storage facilities are provided on a plot adjoining the station. The station itself is a fireproof structure with steel framework and brick walls. Its general appearance is shown in one of the engravings, and a cross-sectional elevation shows the disposition of the apparatus within.

Boiler-Room Equipment

The boiler room contains four 665-hp Babcock & Wilcox water-tube boilers the furnaces for which are fitted with Green Engineering Company chain-grate stokers equipped with Foster superheaters. The type of stoker chosen will permit of using a cheaper grade of coal from the Alabama fields if desirable. Two Wachs engines are belt-connected to the stoker shafts, only one, however, being necessary to drive the present stoker installation. Provision has been made for extending the station when necessary, a temporary wall being provided at one end of the station with that in view. The boiler breeching connects with a reinforced-concrete stack 10 ft. in diameter and 254 ft. high. As shown in Fig. 6, the tops of the boilers are covered in such a manner that a smooth walkway is provided and if necessary the space can be used advantageously for storage purposes. The boilers were first lagged with asbestos, over which was spread a pillow of cinder concrete. This was finished off with 2 in. of monolithic concrete. The maximum thickness of the covering is 2 ft. and the minimum thickness (over the drums) is 3 in. The arrangement not only serves to conserve the heat of the boilers but it also makes for cleanliness, for, as operating men well know, the top of boilers is about the most uninviting place in a power house. The simplicity of the piping above the boilers also contrasts greatly with that found in most boiler rooms.

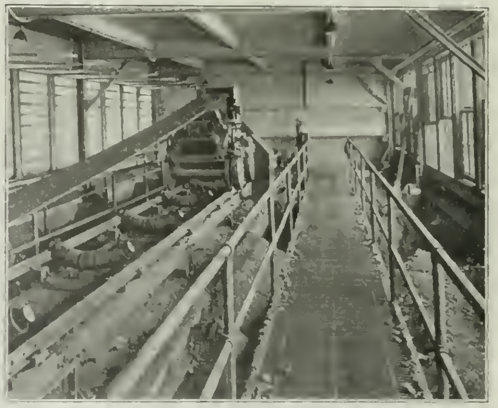

FIG. 4—COAL-CONVEYING EQUIPMENT IN RIVERSIDE STATION

Coal and Ash Handling Equipment

Coal is usually brought to the station in deep-sea barges and deposited on the storage lot across the road from the station. Suitable apparatus, comprising a crusher outfit, a Browning locomotive crane and a Robbins belt conveyor, is employed to deliver the coal to the hoppers over the boiler room. In its passage from the storage pile to the bunkers the coal is weighed by an automatic weighing device. The bunker directly over the firing aisle in the boiler room has a storage capacity of 300 tons, sufficient for about five days' supply. A chute on which is installed an automatic weighing machine travels on a track beneath the bunker and delivers coal from the bunkers to the hoppers of the stokers. In this way a record can be made of the coal used per shift or per diem and a check obtained on the conveyor scales. The coal crusher is driven by a 25-hp motor and the conveyor by a 7.5-hp motor. Steam-flow meters form part of the instrument equipment of each boiler. As indicated in the cross-sectional elevation of the station, the ashes drop from the stoker into an ash hopper, whence they are taken away in cars.

Feed-Water and Condensing Equipment

Water for boiler purposes is taken from the Savannah River through the intake tunnels and pumped thence to a concrete sedimentation tank 27 ft. by 27 ft. and 10 ft. deep. In addition, there is a 50,000-gal. tank 80 ft. above ground. The water is treated with an alum coagulant. An Organ feed-water heater built by the Exeter Machine Works, of Pittston, Pa., and rated at 5000 hp, is also installed to raise the feed water to 210 deg. The steam for the heater is taken from the auxiliaries, which are installed on the turbine-room floor, in a bay under the boilers. There are two duplex and one turbine-driven centrifugal feed-water pumps installed, in addition to an Underwriters' fire pump, a low-service pump and a centrifugal pump for pumping water to the elevated tank. The latter is driven by a 15-hp, two-phase, 220-volt induction motor.

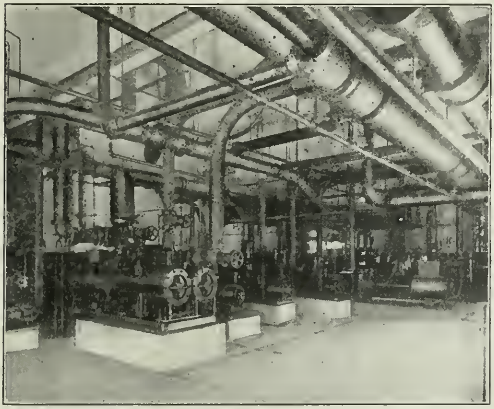

FIG. 5—FEED-WATER PUMP EQUIPMENT IN TURBINE ROOM

The condensers are of the Worthington surface type and are installed beside the turbines. The condensers for the two large turbines have a cooling surface of 13,000 sq. ft., and that for the small turbine 4000 sq. ft. Circulating water is taken from the river and supplied to the condensing units by steam-engine-driven volute pumps. The hot-well pumps are of the vertical Worthington type driven by Terry steam turbines. The dry-vacuum pumps are of the horizontal rotative type.

There are pipe and air tunnels running the length of the turbine room. The former contains all the exhaust, hot and cold well piping, atmospheric relief, etc. Under it are the condensing water intake and discharge tunnels. The latter are built of brick and are 5.5 ft. inside diameter. Horizontal screens protect the intake, and a diverting bulkhead directs the discharged water away and down stream from the intake. The screens are installed in duplicate to permit of raising and cleaning one while the other is in service. The turbine room is spanned by a 45-ton Case crane.

Main Generating Units

The generating equipment at present installed consists of two 5000-kw General Electric horizontal turbo-generators and one 1000-kw Allis-Chalmers unit moved from the Indian Street station. The generators are two-phase, 2300-volt, sixty-cycle machines. Steam is taken from the boilers through 6-in. feeders to a 12-in. header mounted slightly above the floor in the rear of the boilers. Long radius 8-in. and 6-in. pipes pass from the header through the wall to the turbines. The steam pressure is 180 lb. Excitation energy is supplied to the main generators by two 125-kw General Electric turbine-driven exciter units.

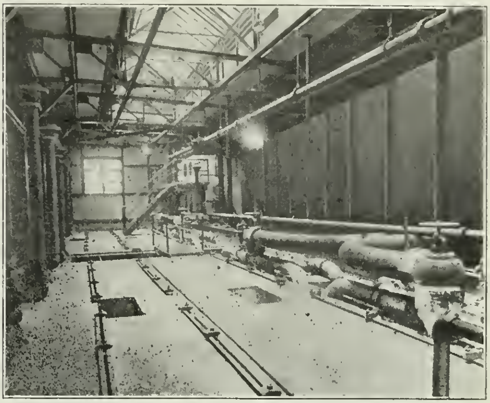

FIG. 6—VIEW OF BOILER TOPS, SAVANNAH ELECTRIC COMPANY

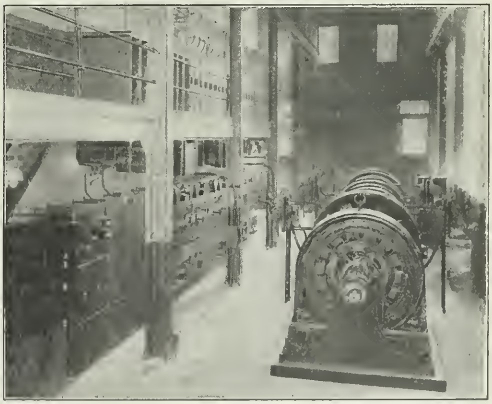

FIG. 7—BAY STREET SUBSTATION, SAVANNAH ELECTRIC COMPANY

In the turbine room is also installed a 1000-kw motor-generator set for railway load. The generator is a 600-volt machine and the motor is a 2300-volt synchronous type. Space is provided for three more sets of the same type. Future plans also contemplate the installation of two 7500-kw and two 10,000-kw, three-phase, sixty-cycle, 13,200-volt turbo-generators.

The switchboard gallery extends along the south side of the turbine room some 18 ft. above the floor. The machine board is of the benchboard type, and from it the entire turbine room can be seen. The station lamps and motors are controlled from a switchboard on the turbine-room floor. There is nothing unusual about the switchboard equipment, which follows standard General Electric practice.

To the left of the switchboard room are fifteen fifty-light mercury rectifier sets. These are equipped with a mechanical water-cooling outfit for cooling the oil in the tube tanks. A closed system for circulating the water for the rectifiers is used. Compressed air from a Westinghouse compressor is first cooled with ordinary river water by coming in contact with water tubes. It is then expanded in a large tank into which water trickles through a perforated baffle plate. This water is used in the rectifier tube tanks.

Under the switchboard gallery are installed the switch cells and bus compartments. To the west of this section is a fireproof room containing the transformers for the station load and the compensators for starting the motor-generator set. In the gallery above the main switchboard are the lightning arresters, rheostats and storage battery for operating the remote-control apparatus. A fireproof transformer house adjoins the station, in which are installed two 1250-kw, 13,200-volt water-cooled transformers feeding a line to the Mill Haven factory district where a step-down distributing transformer house is installed.

The Bay Street substation is equipped with three motor-generator sets, rated at 750 kw, 500 kw and 300 kw respectively, for the underground direct-current three-wire system in the business district of Savannah. There is room for a 4000-kw machine, and the smaller machine can be displaced by 1000-kw machines if necessary. There are two feeder lines conecting the Riverside station with the Bay Street substation. The latter supplies at present twelve outgoing three-wire feeders. The station was designed and built by the Stone & Webster Engineering Corporation, of Boston, Mass.

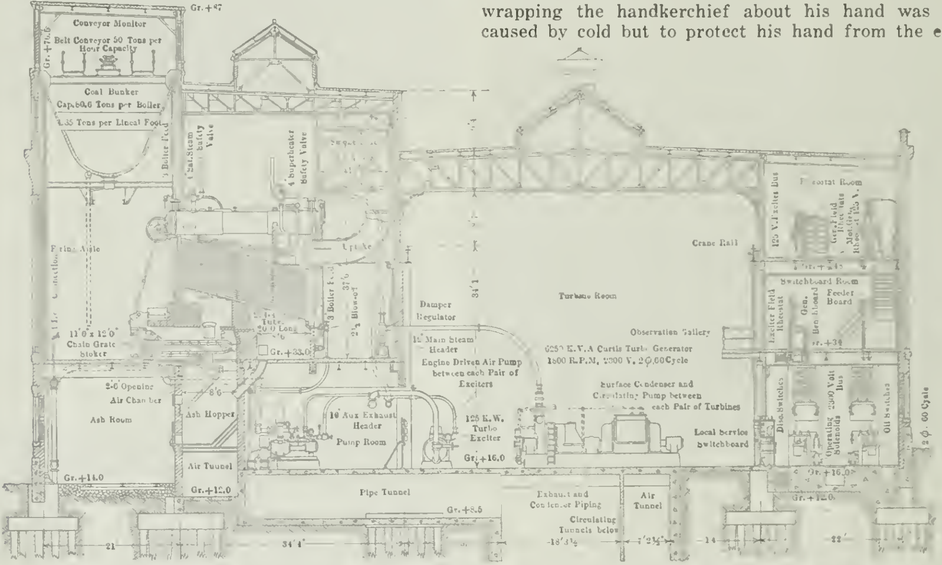

FIG. 8—CROSS-SECTIONAL ELEVATION OF RIVERSIDE STATION OF SAVANNH ELECTRIC COMPANY

Grasping Suspended Wire Held to Be Contributory Negligence

In a recent decision handed down by the Appellate Division, Supreme Court, Second Department, New York (145 N. Y. S., 981), it was held that a man who had seen a horse apparently killed by contact with a wire was guilty of contributory negligence in grasping the wire with his hand, wrapped in a handkerchief, even though the wire was not then sputtering or emitting flashes. In this case a horse attached to a vehicle had become entangled with a fallen wire, and the man while endeavoring to get the animal clear had seen the effect of the contact upon it. After the wire had been disconnected part of it hung some 3 ft. or 4 ft. behind the vehicle. The man took hold of this wire and as he approached the sidewalk, walking backward, received a fatal shock. In his hand grasping the wire was found a cotton handkerchief partly burned. The court held that, as the dangerous current was shown by the prostrate horse, the man had knowledge of his risk in touching this wire. The weather being warm, his wrapping the handkerchief about his hand was not caused by cold but to protect his hand from the electricity. As the man must have realized his danger, his grasping the live wire with no protection but a handkerchief was a plain disregard of common care and caution. Hence, even if the wire was not then sputtering or emitting flashes, he was guilty of contributory negligence.

A Storage Battery's Adventure with a Wire Bed-Spring

A fire which might have been accompanied by disastrous results was recently caused in a curious way by wire bed-springs short-circuiting a storage battery which had been temporarily placed beneath the bed. The occupant of the bedroom in sitting on the bed caused the springs to sag, short-circuit the battery terminals, and fuse, thereby burning a hole in the mattress and setting fire to the bedding. The battery had been removed from an automobile and was being stored for the rest of the winter beneath the bed.

Color Effects for Advertising and the Stage

Use of varicolored light to bring out the striking and bizarre in advertising and stage displays—Application to flashing signs. By M. Luckiesh

THE appearance of colored objects depends largely upon the quality of the light which illuminates them. That is, the color of an object is not wholly inherent in the object itself. Things are visible only by virtue of the light which passes from them to the eye. For instance, a red fabric appears red only when red rays are present in the light which illuminates it. The fabric is designated as red because it has the property of reflecting only red light. Obviously, if red rays are not present in the light under which it is viewed it will appear black. The ghastly appearance of the human face in the light of the mercury-vapor lamp is a familiar example of the distortion of color produced by a light deficient in red rays. The difficulty in distinguishing dark-blue fabrics under many of the artificial illuminants arises from the scarcity of blue rays in those illuminants. To overcome the latter difficulty and others, artificial daylight* can be produced. The effects of the color of the illuminant upon the appearance of colored objects are found on every hand. In the matching of colored fabrics instances are found where a color match obtained under one illuminant will be unbalanced under another illuminant. The same is true of colors employed by artists. In fact, the appearance of colors in paintings when illuminated by artificial light is so different from that under daylight that it is highly desirable to correct the artificial light in order to give the pictures daylight appearance. This has already been done in the lighting of a large art exhibit† by mixing colored light with the ordinary tungsten light, treating each picture in such a manner as to give it a desired appearance. The specific treatment of each painting is also desirable from the standpoint of control of distribution and intensity of the light for each picture. The ease in controlling the quality of artificial light by injecting colored light proves a ready means of giving to valuable paintings their desired appearance. Even the ravages of time upon pigments and other limitations can be overcome, and dimmed, old canvases can be freshened into luminous masterpieces.

The applied science of color can be carried further and new applications to stage effects, displays and advertising signs can be produced. In doing this it must be borne in mind that any color can be defined by three factors, hue, saturation and luminosity. For the purpose of producing disappearing effects even a simpler analysis can be made. That is, it is only necessary to consider the color of the light which a pigment reflects quite apart from the amount of light that it reflects. The first involves hue and saturation, while the reflecting power of the pigment determines its luminosity or brightness, which in the artist's terminology is defined as value. A group of colored patches can be made to disappear—that is, to become indistinguishable from each other when they are illuminated by light of such a color that they reflect rays of exactly the same character and in equal amounts. This condition will not hold in general for other illuminants; therefore, some of the colored patches at least will be distinguishable under another illuminant. The success of the experiment, of course, involves the choice of pigments properly related to each other and to the colored lights to be employed. Pure, luminous pigments are highly preferable to the ordinary oil paints. It is practically impossible to describe accurately in words any single experiment owing to the undeveloped and unsatisfactory state of color notation. The effects described in this article involve merely the science of color and can be readily produced.

The modern tendencies toward the use of color and color effects point to great future possibilities in the application of the science of color. Already in some European theaters the stage scenery is being revolutionized and lighting effects are playing an even greater

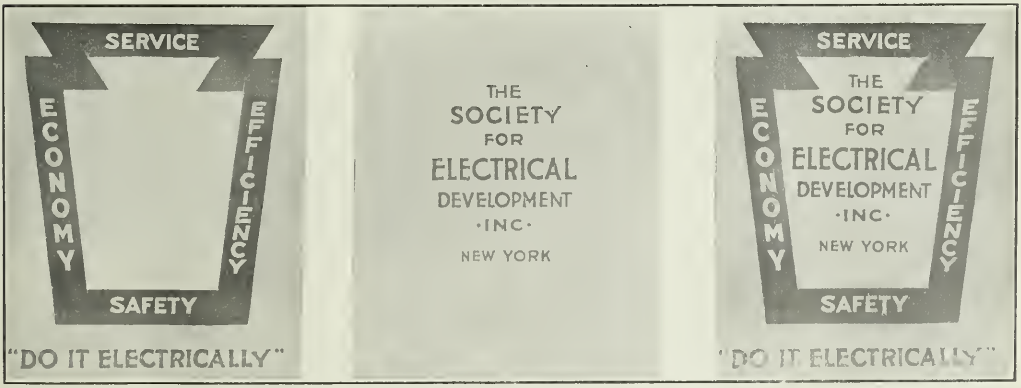
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FIG. 1—DISAPPEARING AND CHANGING EFFECTS PRODUCED IN SIGN BY MEANS OF VARICOLORED LIGHT

part in the drama than heretofore. The writer's experiments suggest the possibility that rays of light, swift and noiseless, might take the place of some of the present-day cumbersome methods of scene-shifting. Possibilities are also suggested for representing the supernatural heretofore unrealized. In Fig. 3 are shown, as well as can be illustrated in black and white, several appearances of a specially designed painting illuminated by colored lights. The first view shows nothing but a Japanesque group of branches. By varying the quality of the light falling upon the painting a figure is made gradually to appear, undergoing various transformations in its evolution, as will be noted, for instance, by the appearance of the flowing robe. Unfortunately the illustrations reproduced in black and white are robbed of all the beauty of color, but the possibilities of such a scheme can be readily imagined. A stage scene can be operated in the same manner. For the painting just mentioned only red and clear tungsten lamps were used to produce the appearance and disappearance of the figure. Various other colored lights, of course, multiply the changes that are possible. The colors used in the figure and background of this painting are so related in regard to their characteristics of reflection that under one lighting the background is perfectly uniform, the figure having disappeared, and the picture appears to be a Japanesque group of branches. Various physiological and psychological phenomena also work toward the success of the scheme. For instance, in many cases even when the color of the light falling upon a painted scene is very saturated or pure it appears to be very unsaturated. This, of course, is due to the absence of any other color which might furnish contrast. This phenomena is desirable because it softens the effect. The colors involved in the picture illustrated in Fig. 3 are white, gray, purple, green, yellow, orange, red and several intermediate ones. It is thus seen that elaborate effects are possible with only two differently colored illuminants.

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* "The Subtractive Production of Artificial Daylight," *Electrical World*, May 4, 1911.

† "Lighting of the Cleveland Art-Loan Exposition," *Electrical World*, Dec. 27, 1913.

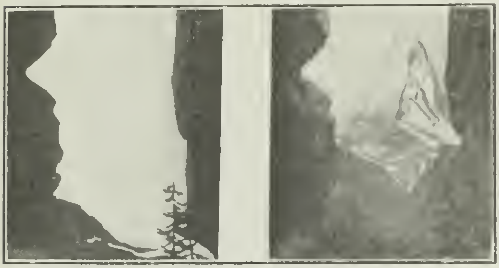


FIG. 2—MOUNTAIN PEAK MADE TO DISAPPEAR OR APPEAR BY MEANS OF VARIATION OF COLORED LIGHT

In Fig. 2 is represented a mountain peak which is made to disappear or appear at will by means of colored rays of light. Here, again, the effect is obtained by the use of only one colored light besides that of the clear tungsten lamp, although the use of other colored lights adds greatly to the attractiveness of the effects. Lightning effects can be produced by flashing light that is reflected only from the proper place. Of course, this selectivity is readily obtained by placing the proper pigment in the right place. Non-uniform distribution of light across the scene also has striking effects.

In Fig. 1 is represented a possibility outrivaling the ordinary illuminated sign, for actual disappearing and changing effects are produced. The copy shown in the second view is in black and designed to be permanent, while that shown in the first view appears and disappears. The complete sign is shown in the third view. The flashing of a portion of the sign is very effective and compels attention. This is a very simple sign requiring a most simple wiring scheme. The flashing lettered sign can be effectively combined with a scenic painting. Practically an endless variety of effects can be produced with the additional advantage that the copy can be changed as rapidly as desired.

This scheme has already been applied to displays. Even the haphazard play of colored lights upon colored patterns not designedly chosen is productive of catchy attractiveness. However, the actual disappearing effects are more desirable. For window displays the copy is placed in a darkened recess and protected as much as possible from extraneous light. The colored lights are operated by flashers designed to bring about the proper sequence of appearances. For outdoor displays the sign must be placed in such position that the plans of the designer are not disturbed by light from other sources. Of course, where colored light is necessary in illuminating signs, as in this scheme, considerable electrical power is necessary. This scheme has not been placed in practice on large out-door signs, but calculations show that the power required is not prohibitive. High-efficiency tungsten lamps in large sizes are especially applicable here. These can be combined with colored glasses and motor-driven flashers to produce effective displays.

Several advantages are found in the scheme illustrated here. Apparent motion is obtained without elaborate wiring or mechanical devices except the usual flasher. Copy can be changed continually if desired, or the sign can be repainted often. The only expense involved in the change of copy is in the painting of it, for the color scheme can always be retained in proper relationship to the colored lights. The effects are obtained more simply by reflection than by transmission as in the ordinary transparent sign. A flashing sign of this character is very simple and the possibilities of scenic effects are greater than in any other method, simplicity being taken into consideration. The scheme adds to the possibilities of stage effects where it can be carried out with ease and sometimes employed to supplant the jarring interruption due to shifting scenery. Of course, the necessity of screening extraneous light if present will be a disadvantage in the application of this scheme. There are, however, many conditions where this is unnecessary.

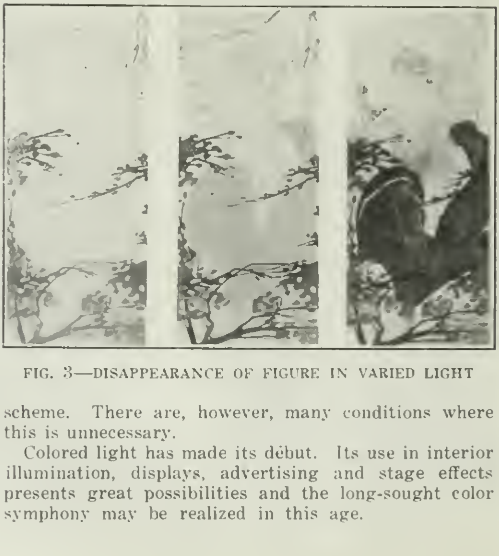


FIG. 3—DISAPPEARANCE OF FIGURE IN VARIED LIGHT

Colored light has made its début. Its use in interior illumination, displays, advertising and stage effects presents great possibilities and the long-sought color symphony may be realized in this age.

Classification and Characterization of Molded Insulations—I

Grouping based on predominating constituents electrical and mechanical — Properties of various types of insulation and method of manufacture. By Emile Hemming

THE progress made in the construction of electrical machinery and appliances has created a wide demand for molded insulations. As these newer materials are rapidly coming into extensive use, it is important that they be properly classified and their characteristics understood by electrical engineers and designers.

Molded insulations may be broadly grouped as follows:

Class A—Organic Hot-Molded Materials. Obtained by mechanically mixing natural organic binders in the plastic state with organic or inorganic fillers, molding the mixtures in heated dies, cooling and removing the pieces from the molds in a finished condition.

Class B—Organic Cold-Molded Materials. Obtained by mixing organic binders in a dissolved condition with organic or inorganic fillers, molding in a cold state and hardening after removal from the dies.

Class C—Inorganic Cold-Molded Materials. Obtained by mixing inorganic binders, chiefly with inorganic fillers, molding in a cold state and solidifying after removal from the dies.

Class D—Ceramics. Known generally under the name of porcelain—made from a mixture of china-clay, silica and water, molded in a cold state and heated to a fusing point after removal from the dies.

Class E—Rubber Compounds. Mixtures of gutta percha; generally adulterated with asphalts, oils and other substitutes, mixed with inorganic fillers and vulcanized.

Class F—Organic Plastics. Made from organic substances chemically treated to render them plastic and molded into the desired forms. This class embraces a wide range.

Class G—Synthetic Resinous Products. Obtained by mixing synthetic organic binders with organic or inorganic fillers and molding the mixtures in heated dies.

Class H—Hardened Fiber Materials. Made from paper treated to render it extremely hard. The molding of this class of material is practically limited to the production of sheet, rods and tubes.

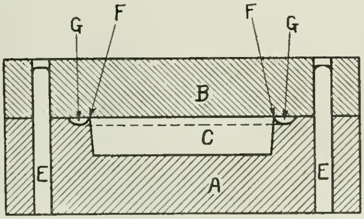


FIG. 1—TWO-PART OPEN DIE FOR TAPERED WORK

Class I—Molded Mica. Flakes or laminas of mica cemented together with resinous binders.

Hot-molded organic insulations consist of binders like shellac, damar gum, rosin, asphalt or pitch combined with fillers, such as wood pulp, cotton waste, finely ground mineral materials and asbestos. Sometimes metallic or earth pigments, lampblack or organic dye stuffs are included for coloring.

Two methods are commonly employed to combine these materials. One is to melt the organic binders, mix in the fillers and then roll the mass into sheets while it is in a hot plastic condition. The sheets are then broken, softened on steam tables and placed in heated open dies, which are pressed and cooled, and the product is removed in the finished condition. The second method of manufacture is to dissolve the binders in proper solvents and mix with the filler with or without the application of heat. On exposure to the air the solvent evaporates, leaving an intimate, uniform mixture which is afterward ground into a powder. The pulverized material is placed under pressure in heated closed dies until melted, when it is allowed to cool, leaving the finished product.

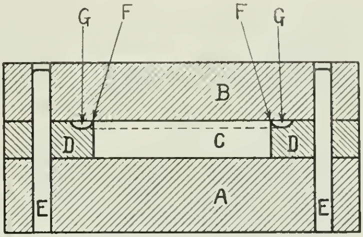


FIG. 2—THREE-PART OPEN DIE FOR CLASS A, E, F AND G INSULATIONS

Insulations produced by either method have about the same properties, but more filling material may be incorporated by employing the second method. The higher the proportion of binding material and the more finely divided the filler, the more plastic will be the mix and the cleaner will be the appearance of the finished piece. On the other hand, a higher percentage of filler (especially when inorganic) will produce a less plastic mix and a less attractive finish. It will not be as subject to the softening influence of heat, however. If the binder is entirely free of rosin and cheap gums, this class of insulation will be very stable. Rosin, because of its low cost and adaptability to molding, however, is being often used as a binder in Class A insulation, but it causes the compound to deteriorate rapidly under climatic exposure.

Bitumens or asphalts melt very easily, hence insulations containing them as binders do not withstand high temperatures. Even the sun's rays have been known to soften products containing these materials. Class A insulation is practically non-hygroscopic, unless it contains an excess of a filler like asbestos fiber. Even then it may be used to insulate ordinary voltages under normal weather conditions unless rosin is contained in the insulation. Organic hot-molded insulation will soften at about 80 deg. C. if the binder is shellac and at a lower temperature with a rosin content. It has been found that the higher the percentage of organic binder the better will be the insulating properties, while the opposite is true if the filler predominates in quantity. The dielectric strength and density are improved by using an intimate mixture of the constituents and subjecting them to an extremely high pressure and proper heat when molding.

These conditions of dielectric, water-proof and heat-proof qualities, due to variations in the percentage of fillers and binders, also apply to the insulating products of Classes B, E and G.

Cold-molded organic insulation is similar in finished appearance to the Class A type. The binders ordinarily used in the cold-molded product are the asphalts, while the fillers are asbestos, silica or other mineral substance. The binder is dissolved and mixed with the filler in a cold condition. The resulting semi-plastic mass is molded in cold dies and the contents are allowed to dry after removal, leaving a hard, durable substance. Because of the method of manufacturing, these molded articles cannot be made as accurate in dimensions as those of Class A. The shrinkage, however, due to the drying or heating is only about one-eighth that of ceramic products, such as porcelain. Heat and moisture have practically no effect on Class B insulations. The binder is the important part in this insulation, as it performs the function of waterproofing and cementing the material.

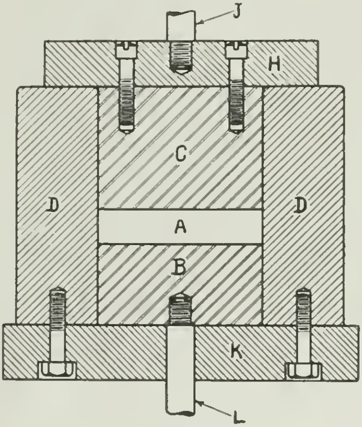


FIG. 3—COLD MOLD FOR USE WITH CLASS B, C AND D INSULATIONS

The cold-molded inorganic insulations contain asbestos, silica, alumina, lime, magnesia and hydraulic cement. The mixture is made with the aid of water, which is later removed during molding by heavy pressure. Owing to the inorganic properties of both binders and fillers, insulation of this class is unaffected by the electric arc and after special treatment is rendered non-absorbent to moisture. This insulation possesses the peculiar advantage of improving with age.

Ceramic products, of which porcelain, lavite, glass, etc., are the most important, are the least susceptible to chemical action of all molded insulations. Hard porcelain contains a large percentage of china-clay mixed with feldspar or other flux and sometimes with gypsum, chalk, etc. The quality of the clay is of first importance, for on it depends the plasticity of the mix, the ability to mold properly, the final hardness, strength and heat resistivity. It is important that the ingredients be finely divided and that the clay be free from impurities. In some manufacturing plants the plastic mix is molded directly in dies, while in others it is dried, reground, moistened and molded. Owing to the considerable shrinkage of porcelain during firing, the behavior of various shapes in the kilns should be studied.

Lava composition, another ceramic product, consists of powdered soapstone mixed with a solution of sodium silicate which is afterward dried, powdered, moistened and molded in dies under pressure. The molded articles are fired at a high temperature and after cooling are treated with the alkaline silicate solution and fired again. The operation is repeated until absorption of the silicate ceases. The finished products are very hard and tough and somewhat similar to porcelain. They resist sudden changes in heat better and for some insulating purposes are more desirable than porcelain. Shrinkage is the principal objection to lava composition insulation.

In the second instalment will be included several tables and illustrations of articles made of molded insulation. The data will give results of tests on the ohmic resistance and dielectric and tensile strengths of the various classes of insulation. Each class will also be characterized and a table given of the different varieties of molded articles with the class of insulation best adapted to their manufacture indicated.

Lighting and Electrically Driven Refrigerating Equipment of a Large Indoor Ice-Skating Rink

The increasing popular interest in indoor ice skating has resulted in the construction of rinks in many cities of North America. In Canada hockey is played extensively in such rinks by professional teams, and as the games occur at night proper lighting becomes an important requirement. Considerable interest, therefore, attaches to the lighting installation of the Arena Ice Rink at Vancouver, B. C., the refrigerating and pumping equipment of which is also electrically operated. Electrical service has in this case been supplied long enough to afford an accurate estimate of the energy consumption and the resultant load-factors.

The main ice sheet measures 85 ft. wide by 210 ft. long and is surrounded by three tiers of seats. The only supports which could be used for the main-floor lighting system were the roof trusses, 60 ft. above the ice. It was therefore decided to use 100-watt clear tungsten lamps with Holophane concentrating reflectors set in sockets about 5 ft. apart on the lower chords of the roof trusses. The trusses are 14 ft. apart so this arrangement places one lamp for every 75 sq. ft. of roof area. The entire system comprises sixteen rows of twenty-two lamps each, making a total of 352 100-watt units. The circuits are so arranged that alternate lamps in each row can be turned off separately, and the conduits are run along the under side of the bottom chords to the mains on the south side of the building.

A secondary lighting system which can be used to give a very pleasing "moonlight effect" consists of 234 25-watt tungsten lamps placed at 2-ft. intervals under the first-balcony girders and entirely surrounding the ice area. These lamps are colored a light blue and have no reflectors.

Lighting service in other parts of the building, including the locker rooms, engine room, curling alleys, etc., requires a total of 323 60-watt lamps, 153 100-watt lamps, thirty-eight 40-watt lamps, and eight 250-watt lamps, besides four arc lamps. That portion of this lighting equipment used under ordinary conditions constitutes a 66-kw load.

Refrigerating Equipment

The total ice area on the main floor and the four 14-ft. by 130-ft. curling alleys is 15,130 sq. ft. To maintain effectively the refrigeration of this area an equipment was installed capable of making 50 tons to 55 tons of ice per twenty-four hours, and rated at "115 tons of refrigeration" per twenty-four hours. The Vilter compressor units are installed in duplicate. Each has 14-in. by 28-in. cylinders and operates at 76 r.p.m. The motors run at 360 r.p.m. and drive the machines through 1-in. manila ropes connecting with the 18-ft. flywheels. These ropes, which have no metal cores and which are maintained at a constant tension of 150 lb. by a jockey-type tightener, have been in service for three years without any repairs whatever.

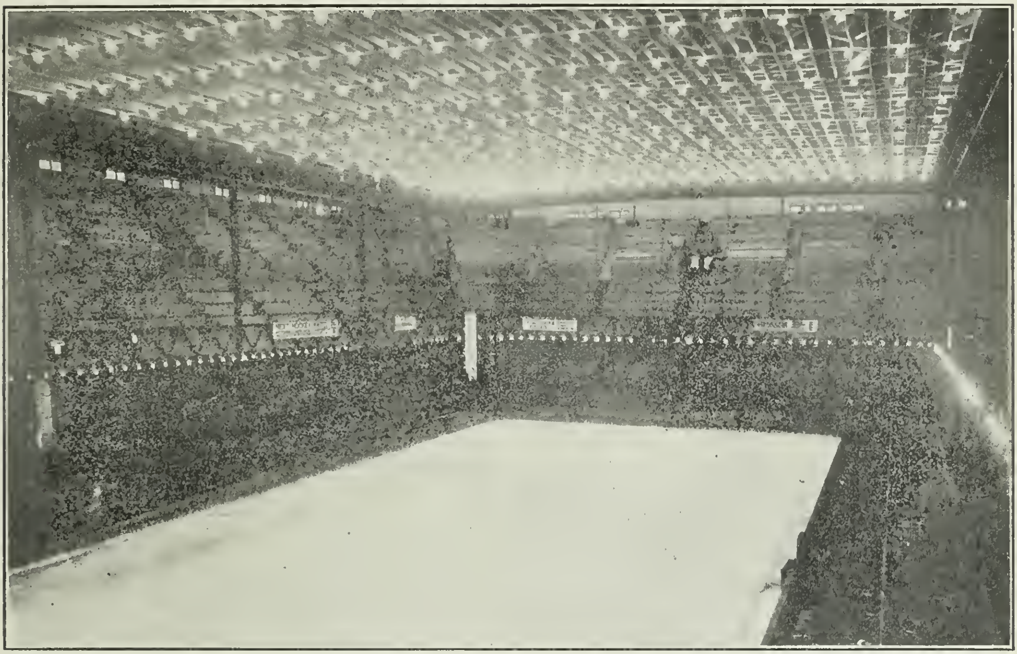
The brine system begins at the centrifugal pump in the basement, which delivers the brine to the 8-ft. by 85-ft. by 8-ft. cooling tank on the third floor. From this tank a 10-in. siphon discharge is led downward to a header just below the end of the ice floor, and from here about 250 1.25-in. pipes lead out across the length of the ice area and discharge into an open flume below floor level. This flume runs the length of the building, returning the brine to its starting point in an open wooden tank close to the centrifugal pump. The curling alleys are supplied in a similar manner by a branch of the same header, and the brine is returned in a gravity trough to the same open tank for re-pumping. The length of 1.25-in. piping in the main floor and curling alleys totals about 13 miles.

Three distinct pumping systems are therefore involved, one for the brine, a second for ammonia, and a third to supply the water from the bay which serves the condenser. The last-mentioned utilizes a Gould 3-in. centrifugal pump operated by a 25-hp motor against a variable suction and a constant 35-ft. head. The 10-in. centrifugal pump in the brine system is belt-connected to a 75-hp motor. This large motor was installed partly because six 90-deg. elbows were required in the 10-in. pipe between the pump and discharge. Each of the Vilter pumps is operated by a 125-hp, 2300-volt General Electric motor, one of these being set on either side of the switchboard which is the central point of control for all the motor units.

All four motors are installed in the basement and are fed through underground conduits from a completely inclosed concrete transformer room. This room can be reached only through a door opening on the outside of the building to which only the electric company has access. Energy enters this room over the 2200-volt, three-phase primary service lines of the company, and is here stepped down to 220/110-volts.

During the skating season this 350 hp in motor equipment operates at a load-factor of 25 per cent, which becomes 12 per cent when distributed over a full year. While this is much better than the annual load-factor for the lighting—about 3 per cent—it should be borne in mind that the skating season runs from October to March, during which time the electric company has to meet its maximum peak load. In this instance, however, rink patrons come and go on the street cars also operated by the same company. Although the rate charged for electrical energy should make it desirable to use the rink equipment during the summer months for the manufacture of ice, the plant has thus far remained closed except during the skating season.

The Arena Ice Rink was built for the Vancouver Arena Company, Ltd., of which Mr. Frank Patrick is managing director. The structure cost about $225,000 and the plant and equipment about $25,000. Mr. K. A. Auty, chief illuminating and motor-service engineer for the British Columbia Electric Railway Company, designed the lighting system and supervised its installation.



INTERIOR VIEW ARENA ICE-SKATING RINK, VANCOUVER, B. C.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

A New-Business Record at St Joseph, Mo.

The six-month period from July 1 to Dec. 31, 1913, marked an era of unusual growth for the St. Joseph (Mo.) Railway, Light, Heat & Power Company. During that time the new-business department secured contracts for more than 1600 hp in motor load among industries which formerly operated steam and gasoline engines. Among the residence patrons 1400 electric flatirons, 250 vacuum cleaners and 19 electric ranges were sold. Street lighting of any other type than electric may almost be said to have become unpopular, and in consequence 175 gas lamps have been taken out and replaced by electric standards. In addition, ten blocks of new "white way" lighting have been placed in operation.

Calculating the Size of a Refrigerating Outfit

By Sydney F. Walker

In calculating the power required for a given refrigerating plant, an estimate should first be made of the quantity of heat to be abstracted. When, for instance, meat has to be frozen, its latent heat must not be overlooked. In addition, what is termed the animal heat has to be taken out, or allowed to pass off, and the temperature of the meat has then to be lowered to the latter's freezing point, which again is below that of water. Where meat has only to be chilled it is but a question of lowering the temperature from that after the animal heat has passed off to about 34 deg. Fahr., and this may be calculated by its specific heat, weight and the number of degrees through which it has to be cooled. The same reasoning also applies to any kind of produce to be cooled. Where meat has to be frozen, the weight and the latent heat per pound multiplied together give the additional heat to be abstracted over and above that for chilling. In calculating the power required to hold a cold-storage room at a given temperature it is usual to take for calculation a standard rate of 2 lb.-Fahr. heat units per hour per square foot of area of the walls, floor and ceiling, per degree difference of temperature between the outside and the inside. Thus, if the temperature is 90 deg. Fahr. on the outside, and the air on the inside is to be held at 30 deg. Fahr., and there is a total surface of 1000 sq. ft., about 120,000 lb.-Fahr. heat units will have to be abstracted per hour. This means the use of about a 10-ton machine, requiring from 10 hp to 15 hp, according to the temperature of the cooling water available for the condenser.

Activity in Louisville

Under the direction of Mr. E. L. Callahan the reorganized commercial department of the Louisville Gas & Electric Company secured contracts for 6467 hp of new electrical business during the six months ended Feb. 1, 1914. The new lighting business contracted for amounted to 3034 hp, and the additional motor business to 3433 hp. The number of new electrical customers secured was 2159. Of the total new business, 1833 hp will replace isolated plants. As the result of a house-wiring campaign begun in December the commercial department has closed contracts for the wiring of about 350 dwellings. This campaign has also resulted in inducing independent electrical contractors to make special efforts to secure the wiring of old houses. The efforts of the contractors have been at least as successful as those of the lighting company. The gas department of the company has also been active. Natural gas from the West Virginia fields was turned into the Louisville mains on March 14.

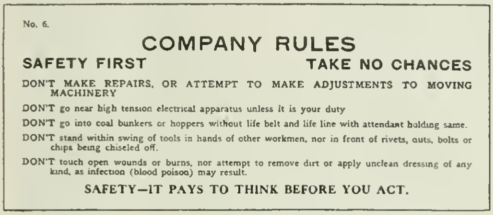
Electric Trucks of the Vienna Post Office

ELECTRIC TRUCKS OF THE VIENNA POST OFFICE

The accompanying illustration shows about one-third of the fleet of thirty 2.5-ton Daimler electric trucks used by the Austrian post office department for carrying mail matter in the city of Vienna. The trucks are owned by a local omnibus firm and are rented to the government on the basis of a fixed mileage charge. The first of these electric trucks entered the Vienna post office service about two years ago, and during the following twelve months this one car was driven over 10,000 miles. Comparative study of the haulage costs with gasoline trucks and animal traction have shown that these Vienna electric vehicles effect a saving of about 20 per cent in operating cost, in addition to their self-evident advantages of safety, cleanliness, simplicity, noiselessness and absence of odor.

"Safety First" Reminders in Pay Envelopes

In line with the "safety first" movement which is sweeping the country, the United Electric Light & Power Company, New York, has recently adopted the practice of inclosing in its employees' weekly pay envelopes printed suggestions warning against forms of carelessness which may cause accidents. The company has a series of twelve of these slips, similar to the one shown herewith. A slip will be placed in each employee's envelope only once a month, as the company believes that such practice will bring better results than if inclosures were made at shorter intervals. They are printed in different colors and each presents five suggestions for preventing accidents. One reminder, reading "Don't make repairs or attempt to make adjustments on moving machinery," is printed on all of them in bold-faced type to attract special attention.



No. 6.

COMPANY RULES

SAFETY FIRST TAKE NO CHANCES

DON'T MAKE REPAIRS, OR ATTEMPT TO MAKE ADJUSTMENTS TO MOVING MACHINERY

DON'T go near high tension electrical apparatus unless it is your duty

DON'T go into coal bunkers or hoppers without life belt and life line with attendant holding same.

DON'T stand within swing of tools in hands of other workmen, nor in front of rivets, nuts, bolts or chips being chiseled off.

DON'T touch open wounds or burns, nor attempt to remove dirt or apply unclean dressing of any kind, as infection (blood poison) may result.

SAFETY—IT PAYS TO THINK BEFORE YOU ACT.

"SAFETY FIRST" SLIP FOR INSERTING IN PAY ENVELOPE

Among the suggestions appearing on these slips are the following:

"Don't use unsafe ladders or ladders not fastened, held or provided with proper safety attachments."

"Replace all guards and safety devices when through making repairs and before starting machinery."

"It is your duty to report unsafe conditions to your foreman or superintendent."

"Warn a man when danger is near. He may know all about it; if so, no harm is done; if not, you may prevent accident."

"Don't drink intoxicating liquors while on duty."

"Don't go into dangerous places until you are absolutely sure they are safeguarded; also prevent anyone from going until this is shown to be a fact."

"Don't rely on someone else to protect you; do it yourself."

"Don't disregard warning signs and notices."

"Don't leave tools, rubbish, etc., where someone can stumble over them."

"Don't walk into dark places you do not know well; get a light."

"Don't pile bricks or other material so that it will fall over easily."

"Don't do what you know you shouldn't."

"Don't go into coal bunkers or hoppers without life belt and life line with attendant holding same."

"Don't stand within swing of tools in hands of other workmen nor in front of rivets, nuts, bolts or chips being chiseled off."

"Don't handle hot babbitt, solder or lead without using goggles."

"Don't use tools in bad condition."

"Don't handle dangling wires unless it is your special business and you understand what you are doing. If absolutely necessary, use two dry sticks or boards."

"Don't have on loose clothing or gloves around moving machinery."

"Don't carry material up ladders; use both hands and pull material up with rope."

"Don't put dressing on moving belts unless it is done on the side of the belt leaving the nearest pulley."

"Don't touch open wounds or burns nor attempt to remove dirt or apply unclean dressing of any kind as infection (blood-poisoning) may result."

Across the bottom of each slip are such additional suggestions as "Read and heed: You are paid to comply with all company rules," "In case of doubt adopt a safe course," "Be sure before you do it," "It is the chance-takers who get hurt," "Safety—It pays to think before you act," "Don't gamble with chance. Play safe."

On the Assumption that the Customer Is Always Right

In the co-operative store of the Columbus Railway & Light Company salesmen are instructed that they must work on the assumption that the customer is right, first, last and always. A dissatisfied appliance customer returning a device and asking for a settlement is first reimbursed with the price of the appliance and later questioned as to the cause of its failure to operate satisfactorily. In this way the customers are taught that the company has faith in the goods it is selling, and immediately the faith of the consumer again returns, the result very often being that the money is returned to the company and a new appliance substituted, or the old one is repaired and returned to the customer's residence. Mr. W. A. Wolls, manager of the new-business department, loses no opportunity to instil the "customer-be-pleased" spirit into the salesmen of the appliance department.

CO-OPERATIVE STORE OF COLUMBUS RAILWAY & LIGHT COMPANY

All electrical appliances handled in the co-operative store are purchased from the local dealers in the city, the company paying the dealers the cost price plus 10 per cent. These devices are then sold to the public at the retail price, in order that no hardship may be inflicted upon any of the local supply and appliance dealers. As will be noted from the accompanying illustration, there are no showcases in the co-operative store, all devices being displayed as tastily as possible out in the open where prospective customers may examine and operate them with the help of the woman demonstrator who is on duty during office hours.

Motor Drive in Malleable-Iron Foundry

Producing 25,000 tons of malleable-iron castings annually, the Missouri Malleable Iron Company, East St. Louis, Ill., ranks among the largest in its output of this product, and especially notable is the fact that the plant takes energy from the mains of the local central-station company for its 370 hp in motor equipment. Three-phase Wagner induction motors with squirrel-cage windings have been used in all of the various applications, energy being supplied from the mains of the East St. Louis Light & Power Company.

ELECTRICALLY OPERATED FOUNDRY AT EAST ST. LOUIS, ILL.

MOTOR APPLICATIONS

Number of Motors	Hp	R.p.m.	
5	10	1700	Directly connected to five No. 7 Buffalo blowers.
1	30	1140	Belted through jackshaft to slag mill 6 ft. long by 5 ft. in diameter.
1	10	1140	Belted to countershaft driving one small resin grinder, one sand mixer (6 ft. by 20 ft.) and one bucket conveyor (18 in. wide and 30 ft. long).
1	20	1140	Belted to line shaft driving one cut-off saw, one 18-in. rip saw, one "Dade" machine, one 18-in. drill press, one 12-in. lathe, one speed lathe, one wood-turning lathe and one 13-in. shaper.
1	50	1140	Belted to line shaft driving five batteries of ten tumbler mills each 4 ft. long and 2 ft. wide; also one No. 8 Buffalo blower.
1	20	1140	Belted to short line shaft driving one 1800-lb. drop-hammer, one 800-lb. drop-hammer and three 10-in. emery wheels.
1	50	1140	Belted to line shaft driving ten 26-in. emery wheels, ten 18-in. emery wheels and one No. 8 Buffalo blower.
1	50	1140	Belt-connected to eight tumbler mills 5 ft. long by 3 ft. in diameter.
1	50	1140	Belt-connected to 40 tumbler mills 4 ft. long by 2 ft. in diameter and one No. 8 Buffalo blower.
1	20	1140	Belted to line shaft in a machine shop driving two No. 5 National bolt cutters, one six-spindle 2-in. nut tapper, one 20-in. American shaper, two Lodge & Davis lathes, one 18-in. and one 26-in.; two planers, one 30-in. and one 24-in.; two 16-in. drill presses, one 30,000-lb. iron tester, one 26-in. drill press, one 45-ton hydraulic press, one grindstone 40 in. in diameter by 5 in. wide, one speed lathe and one two-spindle 0.5-in. bolt cutter.
1	10	1140	Belted to line shaft driving one 5-kw, 220-volt direct-current generator, one 26-in. drill press, one No. 2 Champion forge blower and one No. 30 Modern power hammer.
1	10	1140	Belted to one Buffalo heater.

Concerning the foundry company's product it may be pointed out that practically all of the castings are small and light in weight, necessitating the handling of a large number of pieces. The accompanying table of motor applications indicates the character of machinery used in making these castings ready for the market.

By grouping the machines the total connected load of the foundry, 370 hp, has been belted to sixteen motors. Records from these machines show that the average monthly energy consumption is 37,830 kw-hr. and that the average energy consumption per month per connected horse-power is 102.2 kw-hr. The maximum demand of the foundry is 155 kw, and the load-factor resulting has averaged 33.5 per cent.

Toledo's Electrical Residential Suburb

The value of having progressive realty companies co-operate with the local central station has already begun to be recognized in many communities, but a recent suburban development at Toledo, Ohio, points out a degree of electrical co-operation which bids fair to eclipse any achieved in the past. The Wiltsie Realty Company, operating in the suburb of Wildwood, twelve minutes' ride from Toledo's business center, is building there an exclusively electrical residence district. Twenty-six houses have so far been erected in this addition with the idea of having exclusive electric service prevail. Electric stoves, irons, toasters and percolators are being sold as part of the equipment of the houses. No gas or coal need be used in these residences, as electricity and hot water from the central-station service supply all the needs of the householders for lighting, cooking and heating purposes.

The houses are of the semi-bungalow type and are situated in a picturesquely wooded village, the streets of which are lighted by ornamental concrete lighting standards. Each house according to its size is wired with from twenty-four to thirty outlets on three separate circuits, the electric stove being wired on a circuit by itself. Energy is distributed over a three-wire system at 110 volts and 220 volts, and on account of the relatively heavy demand of the stoves some of the heating elements are connected across the two sides of the circuit. It is interesting to note the relative sizes of the rooms of these houses. The living room is as a rule as large as 20 ft. by 36 ft., while the kitchen occupies a space of only 8 ft. by 10 ft. These miniature kitchens are furnished in white enamel, the effort hav-

FIG. 1—HOMES IN WILDWOOD, ELECTRICAL SUBURB OF TOLEDO

ing been made to design the room so that the diminutive size will be a help rather than a detriment to the housewife. A woman demonstrator in the employ of the realty company aids new arrivals to the electric suburbs by teaching them the uses of the electric stove and applications of other appliances which will effect savings in the monthly electricity bill.

The stoves used in these houses were manufactured by the Copeman Electric Stove Company, of Flint, Mich., and are provided with compartments for boiling, baking and grilling. The maximum demand of the stove, 2.7 kw, is distributed as follows: a boiling compartment, 0.6 kw; baking compartment, 0.9 kw; grilling compartment, two units, 0.6 kw each. The stoves are equipped with an alarm-clock time switch for placing the heaters in operation at a predetermined hour. In conjunction with this switching arrangement contact-making thermostat levers automatically switch the heating element out of the circuit when the compartment has reached the proper temperature.

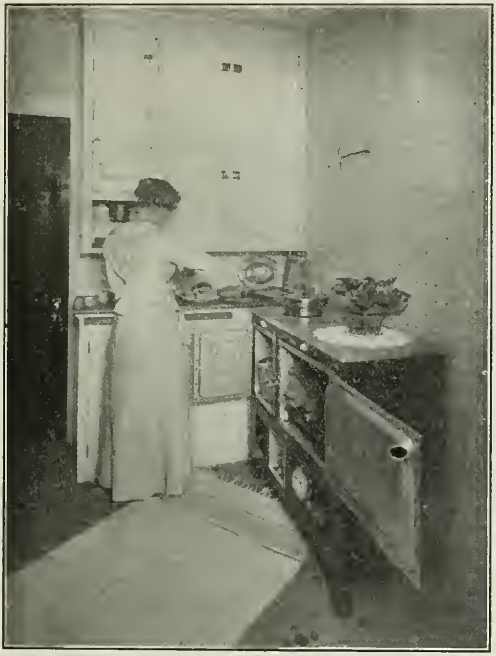


FIG. 2—ELECTRICAL KITCHEN IN AN ELECTRICAL SUBURB

VARIATION OF TYPICAL CUSTOMERS' BILLS

Period	Customer No. 1, Kw-hr.	Customer No. 2, Kw-hr.	Customer No. 3, Kw-hr.
First month	201	166	88
Second month	153	83	99
Third month	90	96	90

Energy for lighting and cooking in these houses is purchased by the Wiltsie Realty Company from the Maumee Valley Light & Power Company at 2300 volts, and is sold in turn to the householders. The rates at which this energy is retailed are quite unusual. Under the terms of the company's minimum contract a consumer pays $3.50 per month and has the privilege of using 100 kw-hr. All energy over this amount is paid for at the rate of 7 cents per kw-hr. In case, however, the customer wishes to take a higher minimum, he may do so, paying for the contracted minimum number of kilowatt-hours at 3.5 cents per kw-hr. and the remainder at 7 cents per kw-hr. Energy for lighting and cooking is measured upon the same meter.

Experience has shown that at first the customer's bill will be above his minimum, but as the housewife learns the economic method of operating the stove the bills will be greatly reduced. Mr. R. B. Wiltsie, president of the Wiltsie Realty Company, declares that the secret of economic operation of this stove lies in performing as many operations as possible at one time. This operation, he says, not only effects economy in the operation of the stove but also teaches a woman to conserve her own time. The accompanying table shows how the bills of some of the families have ranged during three months' operation. One family of three which has lived in this suburb for twelve months found that its average monthly energy consumption is 84 kw-hr. for both cooking and lighting.

A "kink" resorted to for heating water for household purposes saves much in energy consumption. In brief, this device consists of an arrangement of pipes such that the hot water of the heating system passes in an outside compartment while the water for household use circulates in the interior. This scheme makes it unnecessary to heat water electrically and so eliminates one of the most expensive energy-consuming processes from the work of the electric stove.

Allied Gas and Electric Companies of New York Occupy New Building Together

The New York Edison Company, the United Electric Light & Power Company, the New Amsterdam Gas Company, the Standard Gas Light Company and the holding corporation, the Consolidated Gas Company of New York, are now occupying the latter's new seventeen-story building at 130 East Fifteenth Street, New York.

The New York Edison Company occupies a large portion of the new building, eight floors of which are devoted to its executive and department offices. This company has equipped a very complete electric kitchen where meals will be prepared for the officials of the organization. An elaborate electric appliance showroom is being furnished on the main floor, with an entrance on Irving Place. The main offices of this company were formerly at 55 Duane Street.

The United Electric Light & Power Company, which had its offices at 1170 Broadway for about ten years, had only about thirty office employees and three rooms, with a total area of about 2200 sq. ft., when it first occupied the Broadway quarters. Since then the office force has increased about 300 per cent, and the floor area of the new quarters is approximately 450 per cent larger than that of the original offices and 60 per cent larger than the offices which have just been vacated.

It is obvious that the grouping of the allied companies under one roof will prove decidedly advantageous for economic reasons, and the officials of the individual concerns are well pleased with the new quarters and expect to realize much advantage in every way from their occupancy.

There is an auditorium in the building, where lectures and discussions will be held, classes in public safety service betterment will be conducted, and the various company commercial and technical sessions will meet.

Illumination and Wiring

Nitrogen-Filled Tungsten-Lamp Illumination of the Filene Store, Boston

One of the first comprehensive applications of nitrogen-filled tungsten lamps to department-store service was recently placed in commission at the Filene store, Boston, Mass. The electrical equipment of this establishment, it will be remembered, was described in detail in the *Electrical World* of Sept. 20, 1913. The new high-efficiency lighting installation is the outcome of a desire on the part of the Filene company to avail itself of the most modern progress in interior and display lighting and represents a large amount of experimental study on the part of the management. The local applications of the new lamps include the general illumination of the main selling area on the street floor of the establishment, the adoption of nitrogen-filled units for window lighting, and the adaptation of similar lamps of high power and efficiency to a roof-sign program of unique characteristics.

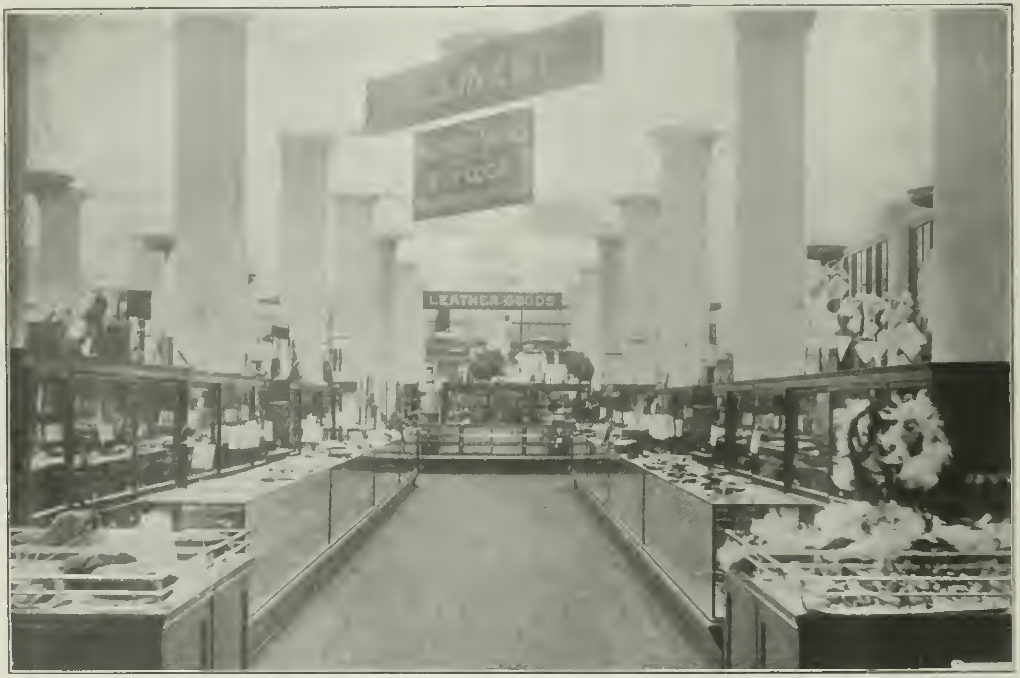


FIG. 1—MAIN FLOOR, FILENE STORE, BOSTON, LIGHTED BY 750-WATT NITROGEN-FILLED TUNGSTEN LAMPS

Use of New Units with Indirect Reflectors

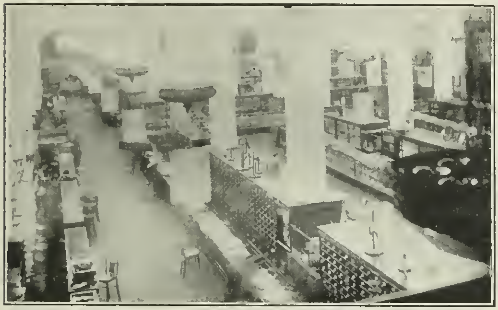
The selling floors of the store are equipped with indirect lighting, and the first floor, in which the pioneer installation has been made, was previously lighted by fifty-three indirect reflectors, each containing six 150-watt clear-bulb tungsten lamps placed with tips up. On the first floor are fifty-three bays, each 20 ft. by 22 ft. in dimensions, the ceiling being 20 ft. high. The illumination formerly secured was thoroughly effective, but of a yellowish quality in comparison with the present results. The scheme of lighting now adopted consists of the replacement of the six tungsten lamps in each reflector by one 750-watt nitrogen lamp, burned with the tip downward, the lamp being hung from a ceiling outlet by flexible cord. The Filene company is experimenting with reflectors of various types, and the best results up to the present, in the opinion of its management, are obtained by the use of white-enameled or porcelain reflectors.

The quality of illumination secured by the use of nitrogen lamps in conjunction with indirect reflectors surpasses anything thus far known in the department-store world. The distribution is even throughout the entire selling floor, and the whiteness of the light pervading the establishment forms a marked contrast to the results previously obtained, attractive as they were. With an energy expenditure in the general lighting of the street floor of but 83 per cent of the former requirements, the store is far better illuminated, although the installation must be seen to have its full attractiveness appreciated. It is also noteworthy that the heating of the switchboard feeders supplying the street floor has been materially cut down by the substitution of the nitrogen-filled lamps. Again, since the new units have been used for general illumination it is no longer found necessary to operate the lamps in the special reflectors placed immediately above the showcases. The company has had the co-operation of various lamp manufacturers in conducting its experiments.

Lessons Learned with 750-Watt Lamps

Lamps of the 750-watt size were used from the first in the general floor lighting, but it was found necessary to place them with the tips downward in order to avoid excessive blackening. The Filene company's experience has clearly demonstrated the superiority of cement instead of wax in binding the skirts to the necks of the lamps. An early improvement was the lengthening of the necks by about 4 in. to facilitate the disposition of heat and to provide additional space for blackening, besides giving a lamp length better adapted to the focus of the reflectors used. With the short-neck lamps it was difficult to secure a life in excess of 75 to 100 hours without loosening the wax by the heat developed at the base. With the long-necked lamp suspended tip downward, the convection currents carry the blackening up to the neck and better radiation of heat occurs. It is noteworthy, however, that the total heating effect in the store from the lamps is less than with the former tungsten groups which have been replaced.

It has been found that dust settling on the mirror reflectors used in the former installation has a tendency to cut down the flux of light more than an equal layer of dust on the white porcelain or enameled reflector. A number of types of reflectors are on trial, but the standard unit as at present considered and used for indirect lighting has a total diameter of 20 in., a working depth of 7 in. and contains a central plate-glass mirror 4 in. in diameter which is very effective in throwing rays upward from the region of the lamp tip. Sockets are not required in connection with the indirect reflectors, but where the lamps are placed near a mezzanine gallery used by customers as a waiting room a shade consisting of two 250-mesh screens has been placed between the observer's eye and the lamp filament and is entirely effective in cutting down the glare. The colors of goods displayed in the store can be much better examined by the light of the nitrogen-filled lamps than with the former units.



EIG. 2—STREET FLOOR SEEN FROM MEZZANINE BALCONY

Several installations of nitrogen-filled lamps have also been made in the firm's business offices, the 250-watt, 500-watt and 750-watt sizes having been tried. With the indirect-lighting service in general use in the store, the 750-watt size has been found best. An example of the lighting rendered by a 750-watt unit in a single office is shown in the accompanying photograph (Fig. 5), the office being about 11 ft. by 16 ft. by 15 ft. in dimensions and finished in dark mahogany. The lamp is hung about 9 ft. above the floor in the reflector, tip downward. Another illustration (Fig. 4) shows the difference between the nitrogen-filled tungsten and ordinary tungsten lighting on the seventh floor of the store, where adjoining areas are equipped with the two types. With the older lamps the shadows on the ceiling are prominent, despite the use of indirect reflectors, while around the nitrogen units the ceilings are uniformly white.

Nitrogen-Filled Lamps for Window Illumination

A view is also shown of the window lighting furnished by a typical 750-watt unit, which floods the entire show space with a clear, soft white light. Direct lighting is used here, but the details of the reflectors are not yet fully available for illustration. The contrast with the former style of lighting is evidenced by the attention given to the window displays by passing crowds, as the store is situated in the most crowded part of the Boston business district. In order to cut down the heating of the fixtures a galvanized-iron extension piece has been fitted to some of the lamps used for direct lighting, holes being punched in the sleeve to improve the circulation.

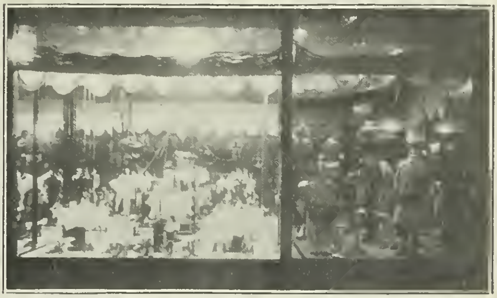


FIG. 3—CONTRAST IN WINDOW LIGHTED BY NEW-TYPE AND OLD-TYPE TUNGSTEN LAMPS

In the window shown in Fig. 3 the display at the left is illuminated by a single central nitrogen-filled lamp set flush with the ceiling, the window being about 9 ft. wide, 8 ft. deep and the lamp roughly 9 ft. above the bottom of the display area. At the right is a window lighted by eleven 60-watt, half-frosted tungsten lamps, the display space being about 6 ft. long and 6 ft. wide and of the same height as the left-hand section. The difference in the illumination is striking, although the expenditure of energy is only very slightly greater in the larger space.

Regarding the use of 750-watt nitrogen-filled lamps for show-window lighting, the Boston Board of Fire Underwriters has stated that there "is no objection to the proper installation of these lamps provided that the lamps and their attachments are properly insulated from the woodwork and other combustible material, that the sockets used do not contain sealing compound which melts below 300 deg. Fahr., and that the leads to

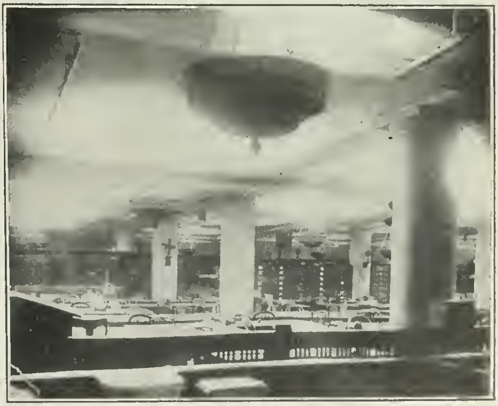


FIG. 4—ACCOUNTING DEPARTMENT, NITROGEN UNITS IN FOREGROUND, ORDINARY TUNGSTEN UNITS IN REAR

the lamp receptacle are of slow-burning wire or its equivalent."

A Roof Sign of 1000-Cp. Lamps

The Filene company recently installed a sign consisting of a letter "F" 7 ft. high and 5 ft. wide on the side of a wireless-telegraph tower on the roof of the store and 200 ft. above the street. Fourteen 750-watt lamps are used in this letter, which is of the box type, burning from dusk until midnight. The single letter has attracted much attention throughout the business district on account of the brilliancy of its outline against the winter sky. Plans are now being completed for the installation of four signs reading "Filene's" on the two wireless towers on the roof. One hundred and twenty 750-watt lamps will probably be required per sign. These are to be placed approximately 8.5 in. apart on centers, and will be protected against the weather by wired-glass windows and equipped with Mogul receptacles. They will be served by conductors run in lead-covered cables and will be ventilated at the top by galvanized-iron caps. The lamps are to be mounted tip downward and the circuits will be appropriately subdivided. Elongated bases will be required. The lamps are all to be operated on a 118-volt direct-current multiple service.

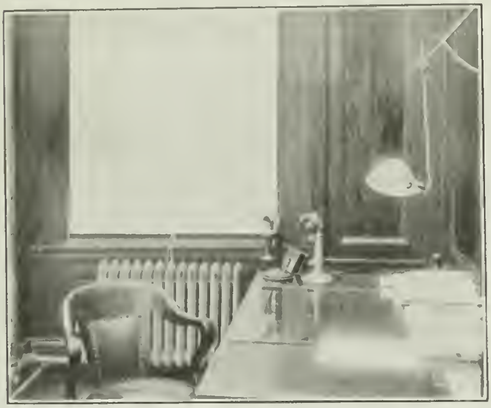


FIG. 5—MANAGER'S OFFICE PHOTOGRAPHED BY ONE 750-WATT NITROGEN LAMP WITH INDIRECT REFLECTOR

With the completion of the signs and the standardization of indirect lighting by nitrogen-filled lamps on its principal selling floors, the Filene installation promises to yield a return in illumination for the energy required which will set a new mark in progressive department-store engineering.

Electrical Inspection Discussed from Different Angles

At a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers on March 26 Mr. B. H. Glover, assistant electrical engineer of the Underwriters' Laboratories, delivered a short paper entitled "Electrical Inspection." In his discourse Mr. Glover confined his remarks to electrical inspection from the view of the laboratory man, the discussion later being taken up by Mr. Victor H. Tousley and Mr. H. B. Gear from the points of view of the municipal inspector and the electric-service company. After sketching the origin and history of the National Electrical Code, Mr. Glover said that the popular notion that the present code was prepared by the insurance companies was erroneous, for all changes in the code are passed upon by a committee, on which nearly all the prominent national electrical societies are represented.

To show how the number of approved fittings had increased, Mr. Glover said that the semi-annual booklet containing a list of these devices had grown from a short list to a pamphlet of 125 pages of condensed information. The inspector in the field was characterized as the purchasing agent of the public—one who renders the people a really expert service. Speaking of the good work which has been accomplished by the Underwriters' Laboratories, instances were pointed out showing how certain classes of devices have been standardized, eliminating faults which might prove hazardous to life or property.

On an appropriation of $123,860 for the year 1914, the Bureau of Electrical Inspection in Chicago, said Mr. Victor H. Tousley, chief electrical inspector of the city government, employs seventy-one men and will inspect all electrical wiring installed in Chicago from installations requiring but one lamp up to the largest, where thousands of lamps and many motors are installed. Mr. Tousley also commented upon the change in attitude of the public and the contractor toward the electrical inspector. People are now co-operating with the inspectors and doing work in compliance with the rules and regulations of the department of electricity of the city of Chicago.

One thing which is occupying the attention of the bureau at present is an attempt to secure control over the sale of electrical appliances. As has been demonstrated from recent accidents, some of these devices are unsafe and should no more be offered for sale without inspection than should food or firearms.

Speaking as a central-station man, Mr. H. B. Gear, engineer of distribution for the Commonwealth Edison Company, made the statement that the company maintains a bureau of inspection employing fifty men. He said that the company relies to a large extent upon the municipal inspectors to see that the work of wiring is done according to the city rules. In the past ten years central-station companies have been the gainers on account of rigid inspection, as hazards have been decreased and the confidence of the public has increased correspondingly.

Mr. F. J. Postel, chairman of the meeting, declared that, in his opinion, insurance companies could induce better wiring by offering lower rates to buildings with high-grade installations.

During the discussion of the paper which followed, the question of allowable fuse rating on branch circuits was brought up. In answer to questions, Mr. Tousley said that a new ruling effective April 1 would allow 10-amp fuses on branch circuits where formerly 6-amp fuses have been installed. This change has been made necessary on account of the many 660-volt devices now sold. Among those taking part in the discussion were Messrs. B. H. Peck, R. A. Huey, S. S. Wendt, F. A. Watkins, C. W. Naylor and P. B. Woodworth.

Intermittent Line Trouble Traced to Flaw in Insulator

The Marlborough Electric Company has a 6900-volt transmission line between Shrewsbury and Marlborough, Mass., a distance of about 10 miles, and although the right-of-way traverses a thickly wooded country the line itself has been very thoroughly cleared of all obstructing trees and limbs. On the night of a recent severe rainstorm, according to Mr. O. W. Halladay, local manager at Marlborough, the circuit-breaker on this Shrewsbury line was opened by some intermittent trouble no less than sixteen times an hour. The fault could not be located during the storm, but on the second day afterward, following a thorough inspection of the lines, a porcelain insulator was found with a crack which evidently was a flaw in the original construction as it had been nearly glazed over.

The trouble experienced during the rainstorm is explained by Mr. Halladay in the following way: Water would get into the crack in the insulator and carry current to the pole through an iron pin. The circuit-breaker would then immediately open the circuit. As soon as the water had again soaked down through the insulator another flash of current would occur and the same operation would repeat itself. This happened regularly about every four minutes and continued throughout the duration of the severe rain, stopping after the rain had ceased.

The probable cause of the trouble—the cracked insulator—was found only after the theory that some such cause of trouble existed had been evolved.

Letters to the Editors

Rates for Electric Service

To the Editors of the Electrical World:

SIRS:—I have read with interest Mr. H. S. Cooper's comments in the *Electrical World* dated Feb. 7, 1914, on my letter on "Apportionment of Off-Peak Load Costs," published in the *Electrical World* of Dec. 20, 1913. In that short letter I attempted to make two points—first, that the timeworn argument concerning the unprofitableness of the small consumer at the highest rates is merely a matter of bookkeeping, and, in so far as one company is concerned, the argument is of no force whatever, as it is contrary to fact. The second point I tried to make is that the methods of bookkeeping used by public utilities—in this case electric lighting companies—were based on erroneous assumption concerning their relations to the public.

The first point Mr. Cooper does not attempt to gainsay, and hence it need not again be discussed. The second point seems to have aroused considerable opposition, and yet it seems to me that the opposition is based on a misunderstanding of the letter.

If I understand Mr. Cooper's argument, he does not reject the principle that the relation between the public utility and the public is that of agent and principal because the theory is wrong, but because in the present state of enlightenment the working out of such a principle, or the practical application of the principle, would lead to injustice to the service corporations, and to municipal ownership, than which, as he says, "in the present state of municipal governmental affairs no greater calamity could happen to the country," and furthermore that there is no clear line of demarcation between a public utility and a private company.

It is undoubtedly true that what is at present considered a private company may at some later date be considered a public service company. This trend is disclosed by the discussion now going on concerning the relation between the federal government and large corporations commonly called trusts. The lack of a clear definition or distinguishing mark between a private concern and a public service company does not seem to me necessarily to vitiate the fundamental principle as stated by Mr. Thelen and quoted by me.

Although the distinguishing mark may not be clear in every case, and although some public utility commission may exaggerate its authority, as seems to have been the case in Oklahoma, neverthelesss in most cases the line of demarcation is clear enough for practical purposes. A public utility invariably secures its right to do business from the State, and thus indirectly from the public. That is, it performs a function which the public could perform for itself, but which it has delegated to an agent. In delegating some of its powers the public has endowed the public service company with some of the powers of government, such as the right to exclusive use of streets for its kind of traffic, and in some cases the right of eminent domain, that is, the right to take private property for public use. These are plainly public powers and can be exercised by a company only because so much of the authority of the state has been delegated to the corporation. As Justice Van Fleet says, "The public may be said to be the real owner and the company only the agent of the public." It seems to me that this is a clear enough distinction for practical purposes between a public service corporation and a private business. The individuals conducting a private business do not secure their right to do business from the government and perform no function of government.

If this principle is sound, I can see no reason why the public utility should be "run on principles and practices that violate absolutely every proper principle of private business," as Mr. Cooper seems to infer that it would be. The business should be conducted just as efficiently and in as complete accordance with good, honest commercial practice in the one case as in the other. The fundamental relation between the public and public utility should in no sense determine the manner in which the business is to be conducted. It is perhaps true, however, that a clear understanding of the relation that a public utility bears to the public might put a stop to certain practices that at present are by some considered as "proper principles and practices of private business," but which nevertheless are immoral—such, for instance, as those commonly known as stock watering.

I am unable to follow Mr. Cooper's logic when he argues that the recognition of the fundamental relation between the public and the public service corporation as mentioned will "instantly" result in municipal ownership, a calamity greater than any other that could happen to the country, as he says. I am urging the recognition of this principle because in the present condition of governmental affairs its acceptance will retard, if not prevent, municipal ownership of public utilities. When the public realizes that it is paying only a reasonable return upon the investment and service of the public utility, and that that service is efficient, the clamor for municipal ownership will cease. On the other hand, the public will not indefinitely continue to pay a high rate of return upon watered stock and capitalized franchises, even if at present such a charge may be considered as a "proper principle of practice of private business."

Mr. Cooper infers that I believe the management of a public utility should receive no reward for efficiency. I am unable to see wherein my former letter is subject to such interpretation. I am just as anxious as Mr. Cooper that justice shall be done public service companies, but at the same time the public is entitled to considerate treatment and justice. I am also well aware of the fact that opinions may and will differ in regard to what justice is in every case. For example, the people—that is, the public—no longer recognize the principle or view enunciated by a prominent public utility promoter and capitalist when he said, referring to capitalists, "we should be very deficient in mental ability if we were willing to invest $1,000,000 in a plant which might be worth $1,000,000 and no more. We certainly should be foolish to put money into it unless we had the possibility of making it worth $2,000,000." If I understand this man's methods of making the plant worth twice the amount invested, he means capitalizing it at twice the investment and fixing the rates so that dividends may be declared on the capitalization. It seems to me that the public is beginning to realize that it certainly would be foolish to subscribe to any such doctrine. If I am any judge of public opinion, I may say that it—the public—is perfectly willing to pay a reasonable return on the investment plus the risk, but is unwilling to mortgage the earnings of generations yet unborn to pay dividends upon values a great part of which society itself creates.

Such practices as these create the demand for public ownership of public utilities, and not the doctrine that a public utility is entitled to a reasonable return. This reasonable return may justly and properly include a share in the "extra profit caused by the efforts of those owning or operating the privately owned public utilities." The word "reasonable" is just as elastic as the definition of a public utility. The unreasonable charges are arousing public opposition. In this regard the regulation of the public utilities has not become definitely settled, as is pointed out by the editor of the *Electrical World* when he says: "Indeed, it is now weighed in the balance, and if it is found wanting, municipal ownership and operation is the logical outcome." This outcome will be considerably delayed if the utility commissions and courts recognize that the public service corporation is an agent of the public.

It seems that Mr. Cooper is almost persuaded to believe that the fundamental proposition concerning the relationship of the public and the public utilities is correct, for he says: "Mr. Thelen's and Professor Jansky's theories may possibly come to full fruition later on," etc. This is a recognition of the soundness of the theories, and they will come to full fruition when the public utilities cease to discriminate unfairly between large and small consumers and when the promoters of public utilities cease exploiting the public. When they do come to full fruition the public will cheerfully pay a "reasonable return."

Madison, Wis. C. M. Jansky.

"Longitudinal" and "Transverse" Induction Phenomena

To the Editors of the Electrical World:

Sirs:—Language is not fixed, and in electrical engineering it may frequently be desirable to make use of new words or old words with new meanings. Not infrequently, however, the new expressions become established without any real necessity and without careful selection. Possibly due consideration has been given to the use of the terms "longitudinal induction," "transverse induction," "longitudinal voltage," etc., in the article on "California Investigations of Inductive Interference," which appeared on page 300 of the *Electrical World*, Feb. 7, but in the opinion of the writer these terms carry no new or distinctive meaning. In fact, they appear to give some erroneous impressions, so that it seems quite in order to submit them to some scrutiny before making use of the terms ourselves or considering that we know just what is intended when others use them. Quoting from the article:

"For the purpose of clearness it is convenient to classify induction phenomena as longitudinal or as transverse, referring to their manifestations on a metallic circuit. Longitudinal induced voltage refers to the voltage induced between the circuit and ground in the case of electrostatic induction and along the circuit between the two ends of the exposure in the case of electromagnetic induction. The transverse induced voltage of a circuit is the difference between the longitudinal induced voltage of the sides of the circuit. In the case of electrostatic induction this voltage acts between the two sides of the circuit, and in the case of electromagnetic induction it acts around the metallic circuit."

Now, it would appear that the meaning intended by the originator of the terms is that longitudinal induction is that which tends to establish a current in a circuit with earth return, and that transverse induction is that tending to establish a current in a metallic circuit. Or, coming down to more concrete cases, longitudinal voltage gives rise to telegraph-disturbing currents and transverse voltage to telephone-disturbing currents. In a practical case, of course, we must bear in mind that a metallic circuit may at any moment, through design or accident, become part of a ground-return circuit even though the grounds do not appear on the wiring diagrams, and that the wires forming metallic telephone circuits are frequently at the same time forming telegraph circuits with earth return. What has been described in the paragraph quoted as transverse induced voltage would appear to be nothing more than the difference of two longitudinal factors, which, according to the common usage of the words, would not result in any component in a transverse direction but merely in some differential or component in the same longitudinal direction.

It appears that only confusion results from the introduction of such terms as "longitudinal" and "transverse" into electrical circuits, but if they are to be used it would appear that the ideas which they are most likely to carry to the reader are not unlike those already well understood from "electromagnetic" and "electrostatic." For example, assume constant voltage at all points of a power-distributing circuit and a uniform separation from a telephone or telegraph line throughout its length. If there is no connection with the earth, the voltage between the telephone or telegraph wire and earth will be the same at all points and furthermore independent of the length of the line. This voltage might be termed "transverse" more properly than the differential voltage in a metallic circuit.

The writer realizes quite well the difficulty many energy transmission engineers who are unfamiliar with telephone and telegraph circuits and connections have in appreciating the fact that electromagnetic and electrostatic induction effects are quite distinct in their nature, as are also the results of these two forms of induction on typical telephone apparatus and on typical telegraph apparatus. Difficulties in making matters clear and discussions at cross purposes may have been responsible for the suggestion and use of the new terms to which exceptions are now taken.

It is suggested, therefore, that the needs of the case can be better covered by retaining the use of such terms as "electromagnetic induction" and "electrostatic induction," "grounded-circuit voltage (or current)" and "metallic-circuit voltage (or current)," "telegraph-disturbing voltage (or current)" and "telephone-disturbing voltage (or current)," and "voltage between wires" and "voltage to earth."

The various pairs of terms are by no means synonymous, and it does not appear that "longitudinal" and "transverse," or any other pair of terms which might be suggested, will meet all the needs of the case.

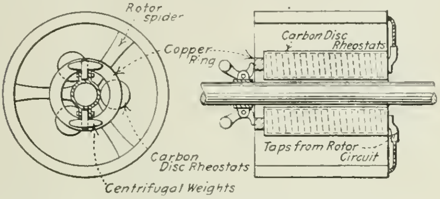
New York, N. Y. John B. Taylor.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Automatic Control of Starting Resistance for Wound-Rotor Motors

Illustrated herewith is a method of automatically controlling the resistance in the rotor circuit of a polyphase induction motor for starting purposes which eliminates the need of slip-rings. Three carbon-disk rheostat tubes are rigidly fastened to the rotor spider with their axes parallel to the shaft. A copper ring is attached to the movable disk on each rheostat, while the opposite-end terminals are connected to the three taps of the secondary circuit. Around the shaft of the motor is a collar carrying two weighted movable arms which press against the copper ring as the rotor speeds up, thereby compressing the carbon disks and reducing the secondary resistance. When the rotor has attained full-load speed the copper ring short-circuits the secondary terminals and no energy is lost in the rheostats. By using this auxiliary device a high-starting torque may be obtained without the use of slip-ring connections.



AUTOMATICALLY CONTROLLED CARBON-DISK RHEOSTATS IN ROTOR CIRCUIT

Relays and Service Continuity

In a paper recently read before the Boston Section of the American Institute of Electrical Engineers, Mr. George A. Burnham, chief engineer of the Condit Electric Manufacturing Company, Boston, Mass., discussed the relation of modern relay design to continuity of service on electrical distribution systems. The author pointed out that a purely lighting load can be handled satisfactorily by instantaneous relays, but with a feeder circuit subject to fluctuations, as on lines carrying motor loads, especially of the induction type, some time-limit feature must be resorted to to prevent continual openings of the breaker due to momentary excessive currents. He then described the application of inverse-definite time-limit relays to systems in which feeders radiate from both generating plants and substations. Properly designed installations provide for the automatic segregation of local troubles without interrupting service on trunk feeders. The inverse-definite curve is produced by designing the magnetic circuit of the relay so that the saturation point occurs at the intersection of the inverse and definite portions of the curve, the speed and time remaining constant beyond the point of saturation. In conclusion, the author discussed reverse energy relays in generator troubles.

An Alternating-Current Bakery Power Plant

Electric drive has been used throughout in the new bakery of the Acme Tea Company, Philadelphia, which has an output of 150,000 loaves of bread each ten-hour working shift. A 220-volt, two-phase, sixty-cycle, four-wire system of distribution is employed, the selection of the power-plant equipment having been made to conform to the character of "break-down" service available from the mains of the Philadelphia Electric Company, on which reliance is placed as an alternative source of power. Energy from the distribution system is furnished directly to the motors and lamps without the losses due to converting apparatus. The selection of alternating-current distribution, it will also be noted, permits the use of squirrel-cage motors which by reason of their simple construction are particularly suited to service under the conditions of flour dust prevailing in such a bakery establishment.

The building power plant is in the basement and is carefully isolated from the rest of the building in such a manner as to prevent any possible dust from coal or ashes reaching the bakery workrooms. In designing the plant one of the primary objects kept in mind was to provide against the possibility of interruption of the bread-making processes owing to failure of the energy supply. Duplicate boilers, engines and generators were therefore installed in the station, in addition to the emergency-service connection with the overhead mains of the local central-station company.

The boiler equipment comprises a pair of Parker 270-hp down-flow water-tube boilers, each equipped with McClave shaking grates. The flue gases are led aloft through a 54-in. Heinicke radial-brick chimney, 128 ft. in height. The two Skinner tandem-compound engines operate at 225 r.p.m. and develop 202 hp when running non-condensing at 125 lb. pressure. Direct-connected to each engine is a 150-kva, 240-volt, sixty-cycle, two-

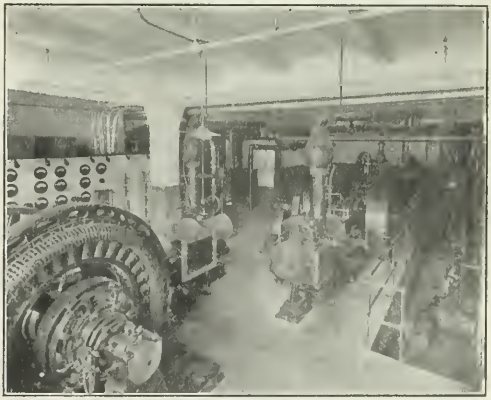


FIG. 1—ENGINE-DRIVEN ALTERNATORS IN BAKERY POWER PLANT

phase revolving-field alternator provided with a self-contained 10-kw exciter.

The high-pressure piping system, which is designed for 125 lb. working pressure, is insulated with an 85 per cent magnesia covering. A 10-in. header connects the boilers with the engine room, 6-in. lines being provided between each boiler and the header. Safety non-return angle valves are inserted at the boilers and gate valves are placed at the connections to the header. In the engine room separate connections, valved at the header, are made to each of the two high-speed engines and to the Corliss engine operating the ammonia compressor for the refrigerating system.

FIG. 2—MOTOR-DRIVEN MIXERS IN ACME BAKERY

Both the lighting and motor-service panels carry five four-pole switches, each controlling one of their respective feeders. All of these switches are of the double-throw type and are connected to separate busbars in the rear of the board so that either isolated-plant or central-station energy can be supplied interchangeably to any feeder without interfering with the energy furnished to any of the other feeders. This flexible arrangement makes it possible to supplement the output of the local plant with purchased energy at any time if desired, or to use either class of service exclusively if necessary.

The lighting system consists of five four-wire, 220-volt feeders carried to centers of distribution throughout the building. At these points four-wire lighting panelboards are provided, with a four-pole switch at each panelboard to control all the lighting on that board. The lighting units are wire-drawn tungsten lamps, those for the bake room being 250-watt units and those for the cooling and wagon rooms being 150-watt units. In all cases the large units are provided with bowl-shaped white-enameled steel reflectors. The walls and ceilings throughout the building are also white, and thus very efficient and satisfactory illumination is obtained.

Rapid Erection of a 12,500-Kva Turbine

Within twelve days from the time the Toledo (Ohio) Railways & Light Company's new 12,500-kva turbine was set on the side track at Toledo it was erected in the station and running under its own power. Load was applied to the machine two days later, establishing a remarkable erection record. The turbine, which is of the General Electric horizontal type, required nine cars for shipment from the factory The largest of its castings weighs 126,500 lb.

Transferring a Motor from One Source of Energy to Another While Operating

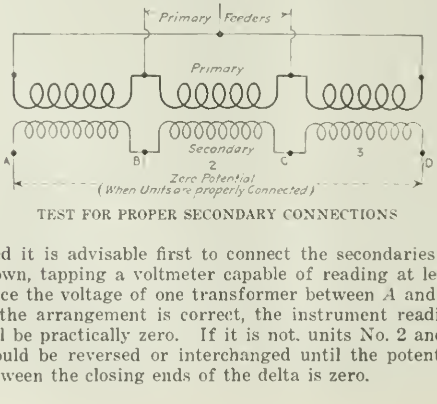
We have an exciter directly connected to a 100-hp, 550-volt, three-phase, sixty-cycle synchronous motor which is operated during the day by energy generated in our own plant. A three-phase service connection with the central-station company is available which supplies the same voltage and frequency as our plant and is capable of carrying a 100-hp load. Would it be feasible to use central-station energy to start the motor and then throw it while operating at synchronous speed and half load over onto our own generating system? G. A. N

If your generating system is synchronized with that of the central station, a motor can be started on the latter and then thrown over onto your own energy supply without affecting the operation of the motor. When the two systems are disconnected, however, the entire load will be suddenly thrown on your generators, which will result in a slight momentary disturbance if the rating of your plant is small. After starting the motor on the outside service it will be necessary, before interchanging the sources of supply, to connect some air-core synchronizing reactors between your generator bus and the central-station service to bring the two systems into step. Messrs. Morgan Brooks and M. K. Akers, in a paper presented before the A. I. E. E. in 1906, pointed out that a 7.5-kw generator can be pulled into step with another generator quickly and without subjecting either to dangerous cross-currents if air-core reactors are connected between them limiting the synchronizing current to one-half the full-load rating of the smaller machine. Taking this ratio of synchronizing current to full-load current as a guide, you will probably be able to design reactors which will give satisfactory results. When the two systems are synchronized the reactors may be short-circuited and the central-station service switch opened, allowing the motor to operate on the energy generated in your plant. It is doubtful, however, whether you will be able to obtain reasonable rates for the starting current, as the electric service company would be justified in charging for the service rendered at a rate out of all proportion to the amount of energy actually delivered.

Connection of Transformer Secondaries

After the primary windings of three single-phase transformers are connected in delta to the source of energy, how can the proper connections of the secondary terminals be predetermined? J. D. Z.

If the transformers are of the same type as regards internal and external design, the general rule in connecting the secondaries is to follow the order of connections made in the primary circuits. When in doubt or when units made by different manufacturers are used it is advisable first to connect the secondaries as shown, tapping a voltmeter capable of reading at least twice the voltage of one transformer between *A* and *D*. If the arrangement is correct, the instrument reading will be practically zero. If it is not. units No. 2 and 3 should be reversed or interchanged until the potential between the closing ends of the delta is zero.



TEST FOR PROPER SECONDARY CONNECTIONS

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Wet Filtration of Cooling Air for Electrical Machinery.—D. A. Hackett.—A discussion of the method of cooling electrical machinery by means of air cleaned by wet filtration, that is, by intimate contact with water in the form of a very finely divided spray. The author concludes that there is a fairly good case for the installation of wet air-filtration apparatus from the purely technical aspect. It undoubtedly produces clean air, and while the reduction in temperature may not, generally, be great, the air is certainly cooler after filtration. With regard to the danger of breakdown, the author suggests that it would be of interest if some experiments were carried out under actual conditions to discover whether any material alteration in insulation resistance does occur. In this connection experience might be gained at first on low-voltage machines, where the risk of break-down is less. —London *Elec. Review,* March 13, 1914.

Cascade Induction Motor.—L. J. Hunt.—A very long paper, profusely illustrated by diagrams, in which the author discusses the principle of the cascade induction motor and gives the history of the development of the windings used in it, describing step by step the development of this type of motor.—*Journal* (British) *Inst. Elec. Eng.,* March 16, 1914.

Lamps and Lighting

Intermittent Tungsten Lighting.—A method devised by the French engineer Dussaud consists in lighting tungsten lamps for very short-time intervals with a much larger current than normal, thus obtaining, it is declared, improved efficiency. It is claimed that the life of the lamps does not suffer because they are connected to the circuit for short intervals only. For practical illumination purposes several lamps are mounted on the circumference of a rotating disk and are lighted one after the other successively at certain moments. Although the lamps are lighted in succession, it is claimed that there is no flicker. The system is intended especially for moving-picture projection lamps, because the lamp globes remain quite cool as the lamps are connected to the circuit only for short intervals. In this case the successive lighting of the lamps is carried out in synchronism with the change of the pictures, that is, sixteen times in a second. From the scarce information obtainable this would seem to be an interesting physical experiment rather than an illuminating engineering accomplishment.—*Licht und Lampe,* 1913, pages 489 and 729; briefly abstracted in *Elek. Zeit.,* March 12, 1914.

Electric Train Lighting.—An account of the discussion which followed the recent paper by T. Ferguson before the (British) Institution of Electrical Engineers. Rosenberg described at some length the Woodbridge constant-voltage system. McKinnon called attention to the great care taken in Germany and Scandinavia in keeping the storage batteries in good condition.—London *Elec. Review,* March 13, 1914.

Generation, Transmission and Distribution

Reactance Coils in Power Circuits.—E. P. Hollis.—An abstract of a paper read before the (British) Institution of Electrical Engineers on the use of reactance coils in power circuits for protection against transient excessive currents. The construction of current-limiting reactance coils entails a number of difficulties. In addition to the severe mechanical stresses incidental to a short-circuit, there are electrical stresses due to transient voltages, and the reactance coils may have to carry the current for many minutes. Iron must be avoided in the construction, and in view of the strong leakage field, any solid metal work in the coil will be the seat of eddy currents and may become unduly heated and cause a fire. Steel bolts, for instance, must not be used. In practice the coil takes several forms. In one, copper cable is wound under tension upon special wood supports which are bolted to a cylindrical concrete core. Another form of reactance coil is the porcelain-clad coil, the chief characteristics of which are that the pancake instead of the drum winding is adopted. The cable is inclosed in a porcelain case, with the result that the coil is smaller than one with air insulation. The reactors are built up of horizontally wound spirals (Fig. 1) supported in recesses formed in the porcelain arms. These arms radiate from a central core of alberene stone to an outer inclosing well built up of porcelain segments. The segments consist of two heavy concrete headers, one at either end, and these are fastened to the wall by a number of mica-insulated brass rods passing through the headers and porcelain segments. The conductors are insulated, and the arrangement of the interior of the coil gives a cellular construction which permits adequate self-ventilation. A typical coil constructed on this principle is as follows: Number of turns, 34; reactance, 4.2 per cent (20,000 kw, 6600 volts, twenty-five cycles); ohmic resistance, 0.00195 ohm; I^2R loss, 6.05 kw; eddy-current loss, 0.186 kw; total losses, 6.236 kw per coil; temperature rise, 33 deg. C.—London *Elec. Review.* March 13. 1914.

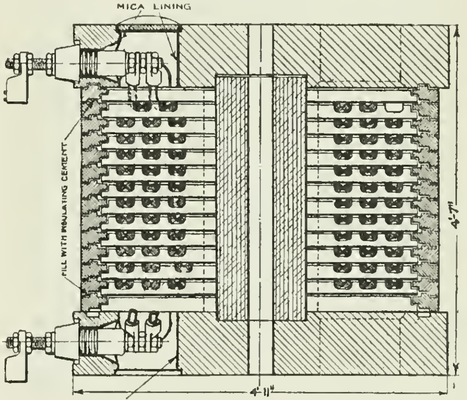


FIG. 1—SECTION OF PORCELAIN-CLAD, HORIZONTALLY WOUND REACTANCE COIL

Single-Phase from Three-Phase Currents.—An illustrated description of three simple methods for obtaining single-phase supply from a three-phase system. The first employs two single-phase transformers, the second one transformer, and the third method three transformers. In all three cases the primary side of the system becomes unbalanced. If that is not desired, some method such as the one using three separate transformers giving three separate two-wire, single-phase circuits must be adopted.—London *Elec. Review*, March 13, 1914.

Traction

Rolling Stock.—H. E. O'BRIEN.—An illustrated paper read before the (British) Institution of Electrical Engineers in which the author discusses the factors affecting the design of electric railway rolling stock and then considers particular parts where it is economical to save weight, although the first cost may be much greater.—London *Electrician*, March 13, 1914.

1200-*Volt Direct-Current Traction.*—HERMANN J. MULDER.—An English translation in abstract of his recent German article on working experience with 1200-volt direct-current electric traction which has been already noted in the Digest.—London *Electrician*, March 13, 1914.

Installations, Systems and Appliances

Austrian Central-Station Statistics.—There are now in Austria 933 central stations, against 854 in 1913. Out of the seventy-nine new stations erected last year, twenty-four supply direct current using storage batteries, twenty-six direct current without storage batteries, and twenty-nine three-phase energy. The total rating of these seventy-nine stations is 39,341 kw. The total rating of all the 933 stations is 540,386 kw. Of these 933 stations 333 supply direct current and are equipped with storage batteries, 208 direct current without storage batteries, seventeen single-phase energy, four two-phase energy, 314 three-phase energy, and fifty-seven both three-phase and direct-current energy. Of the total number 418 stations are driven by water-power 144 by steam, 116 by internal-combustion engines, 102 by water and steam, seventy-seven by water and internal-combustion engines, thirteen by steam, water and internal-combustion engines, and fifty-three buy electricity in bulk. The aggregate rating of the water-driven prime movers is 274,445 hp, of the steam engines 446,280 hp, and of the internal-combustion engines 38,600 hp. Fifteen new electric railway lines have been opened during the year or are in course of erection, with an aggregate length of 321 km (193 miles), while eight electric roads, with a total of 49 km (29 miles), are being extended or rebuilt. The total length of all electric roads in Austria is 1408.6 km (845 miles), against 1039.4 km (623 miles) in the preceding year. Seventy-three roads (1166 km of track) are operated by direct current, and six lines (243 km of track) are operated by single-phase energy.—*Elek. Zeit.*, March 12, 1914.

Central-Station Statistics of Denmark.—R. J. JENSEN.—A review of the status of central-station statistics in Denmark. For 1913 the total number of stations was 346, with an aggregate rating of 57,000 kw. Two stations alone—those at Copenhagen and Fredericksburg—have an aggregate capacity of 29,000 kw, that is, more than all the other 344 stations together. Some data are given on the rates charged by the two principal stations.—*Elec. Zeit.*, March 12, 1914.

Gas Versus Electricity.—J. G. NEWBIGGING.—Extracts from his presidential address before the Manchester District Institution of Gas Engineers. The author is the engineer of the municipal gas department of Manchester. He discusses the competition of gas with electricity, differential prices for gas, and the relation between municipal gas and electricity departments. In Manchester the most active expansion of the gas supply is in the direction of gas cookers and gas heaters. In the electricity department of Manchester there has been a marked expansion in the direction of motor service. The author suggests the possibility of municipal gas and electric departments being operated together instead of in competition with each other.—London *Electrician*, March 13, 1914.

Sheffield.—The first part of an article in which a historical sketch is given of the gradual development of the electric power supply system of Sheffield. The new station at Neepsend, from which two and three-phase alternating current is supplied, is also described.—London *Electrician*, March 13, 1914.

Electric Power in British Woolen Mills.—An illustrated article on a typical electrically driven woolen mill in Oxfordshire. Individual drives are employed wherever possible.—London *Elec. Review*, March 13, 1914.

Automatic Motor Starter.—BRUNO THIEME.—An illustrated description of an automatic motor starter based on the use of a strip of two metals welded together so as to form one strip. If these two metals have different coefficients of expansion, they form a spring which in a change of temperature contracts or expands. The arrangement is shown in Fig. 2. There is a series of bimetallic strips *Z* which on heating bend and thereby make contact with the contact pieces *B*. Each pair of bimetallic strips *Z* and contact pieces *B* is provided with a resistance *W*. The current passes through the first metallic strip *Z*, then through resistance W_1 and resistance W_2 into the next two bimetallic strips, then through the next two resistance coils into the fourth bimetallic strip, etc., as shown in the illustration. When the switch is closed the current may be 3 amp. The first bimetallic strip *Z* is dimensioned in such a way that a current of 2 amp heats it so as to make contact with *B*. When *Z* makes contact with *B*, W_1 is disconnected and the current enters directly into the second resistance coil W_2. If the current is now 4 amp, the next bimetallic strip is so designed that a current of 3 amp will be sufficient to make contact with its contact piece and so on. The time in which all the coils are disconnected may be varied by adjusting the radiation surface of the bimetallic strips. When the motor is disconnected, all the bimetallic strips go back into their original position —*Elek. Zeit.*, March 12, 1914.

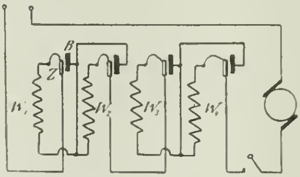


FIG. 2—CONNECTIONS FOR AUTOMATIC MOTOR STARTER

Electrophysics and Magnetism

Electric Ignition of Gaseous Mixtures.—W. M. THORNTON.—A note on a (British) Royal Society paper in which the author gave an account of an experimental examination of the mechanism of ignition of gaseous mixtures by electric sparks. It was found that there are two distinct types of curves connecting the percentage of gas in air and the least current which, when broken, causes ignition by the break-spark. In one curve, characteristic of continuous currents, the current required is proportional to the percentage of gas present; in the other, representing alternating current, it is a quadratic function of the percentage, having a minimum at the mixture giving combustion midway between CO and CO_2. In the paraffin series the minimum continuous current is the same for all the gases, but with alternating current the gases with more complex molecules require larger igniting currents. The slope of the one type and the minimum current of the other are both proportional to the number of atoms in a molecule of combustible gas. It is inferred from the observations that ignition by continuous-current break-sparks is largely ionic or electronic, but that by alternating currents is more nearly a simple thermal process. The gases examined were hydrogen, carbon disulphide, benzine, alcohol and the paraffin series up to pentane.—London *Electrician*, March 13, 1914.

Photoelectric Action.—O. W. RICHARDSON.—A highly mathematical paper on the theory of photoelectric and photochemical action. The author calculates the amount of energy which is abstracted from the radiation when one electron is liberated.—*Philos. Mag.*, March, 1914.

Electric Conductivity of Metals.—W. F. G. SWAN.—A highly mathematical paper giving an expression for the electric conductivity of metals as deduced from the electron theory.—*Philos. Mag.*, March, 1914.

Electrochemistry and Batteries

Ionic Dissociation.—F. P. WORLEY.—An article on the decline of the hypothesis of ionic dissociation. In the author's opinion, the hydrolytic activity of acids, and indeed the chemical activity of electrolytes generally, does not support the hypothesis of ionic dissociation, though it most emphatically shows the close connection between chemical and electrolytic activity, irrespective of any theory of the nature of electrolyte activation. Chemists have greatly neglected the distinction between these two issues and have advanced as evidence in favor of the Arrhenius hypothesis what really is evidence only of the close connection between electrolytic activity and chemical activity. This is especially true of hydrolytic phenomena.—*Philos. Mag.*, March, 1914.

Telegraphy, Telephony and Signals

Vibrating Relay.—W. JUDD.—A paper on the vibrating relay invented by K. Gulstad. This relay, while several times as sensitive as the ordinary polarized relay, is at the same time much more stable in the presence of disturbances from neighboring lines or from a defective duplex balance. It is applicable only to double-current Morse signaling and is efficient on all land lines and on submarine cables having a *KR* of from 0.5 to 0.75 second. The somewhat remarkable combination of increased sensibility to signals and increased stability against disturbances is explained by a consideration of the vibratory circuits. A diagram of the relay is shown in Fig. 3. Premising that no line current is present, it will be seen that when the tongue of the relay comes in contact with one or the other stop a condenser is charged through one relay auxiliary winding, pressing the tongue momentarily on this stop. Then, the condenser being charged, the current rises in the opposite auxiliary winding, through an external resistance, and pulls the tongue off, when the discharge current from the condenser flowing through both auxiliary windings throws it vigorously over on to the other stop. The same cycle of operations is then repeated with opposite polarity of the battery. In this manner a continuous and regular vibration of the armature and tongue is set up, with contacts firmly made and cleanly broken. The speed of these vibrations must be made equal (or nearly equal) to the prearranged speed of dot signals from the line to which the relay is applied, by suitable adjustment of the values of capacity and resistance in the local circuit, and the rate of rise of the local current must also be made to correspond with that of the cable current. When these conditions are fulfilled, the only duty left for the cable current is to control the vibrations. This control is obtained by furnishing the electromagnets of the relay with a separate winding through which the signals received from the cable pass. The heavier currents in this "main" winding—i.e., the cable "dash" or "space" signals—overpower the local vibrations and hold the tongue on one or the other stop, according to their polarity, until such time as, the dash or space being completed at the distant end of the line, the strength of the cable current at the receiving end falls below that of the local current by an amount giving a preponderance to the latter. The armature is then surrendered to the local forces, is pulled off and is driven vigorously over to the opposite contact by the discharge from the condenser. When "dots" are received from the cable their current amplitude is so small that only a very slight control, and in some cases practically none at all, is exerted over the tongue. Briefly stated, the resultant effect of the controlling cable currents and the local currents in the relay is this: Where dots received from the cable are to be reproduced the vibrations are allowed to continue, and where dashes or spaces occur the vibrations are damped out. The short and long contacts of the tongue thus obtained are registered on the local recording instrument with all the increased firmness and definition supplied by the local forces.—*Journal* (British) *Inst. Elec. Eng.*, March 16, 1914.

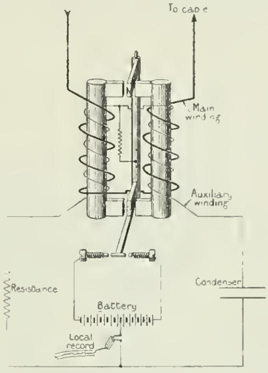


FIG. 3—DIAGRAM OF VIBRATING RELAY

Characteristics of Telephone Lines.—L. CAHEN.—A mathematical article illustrated by diagrams on the measurement of the characteristic constants of a telephone line. The author describes two methods. The first is a zero method in which the apparent impedance is measured by a compensation apparatus like the Wheatstone bridge when the wires at the other terminal of the line are insulated and when they are connected together. The second or deflection method consists in measuring at the same time the intensity of the current at the two ends of the line.—*La Lumière Elec.*, March 7, 1914.

Wireless Telegraphy.—PAUL LUDEWIG.—The first part of an illustrated article on the influence of meteorological factors on wireless telegraphy. The author discusses the propagation of electric waves, difference in the reception of waves during night and day, effect of the eclipse of the sun on April 17, 1912, and the effects of the season, the moon and the aurora borealis. The paper will be concluded.—*Elek. u. Masch.* (Vienna), March 1, 1914.

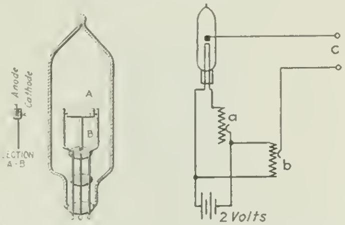
Wireless Telegraphy and Telephony.—W. H. ECCLES.—The first part of an illustrated article reviewing and analyzing recent patents in wireless telegraphy and telephony.—London *Electrician*, March 13, 1914.

Wireless Telegraphy.—J. HETTINGER.—An article, illustrated by diagrams, on resonance in high-frequency circuits in its special relation to wireless telegraphy.—*La Revue Elec.*, Feb. 20, 1914.

Relay.—LEE DE FOREST.—A letter claiming that the Lieben-Reisz gas relay is identical in every essential, except in its large size, with the audion amplifier.—London *Electrician*, March 13, 1914.

Telewriter.—C. BECKMANN.—An illustrated article giving a brief historical review of the development of the electric telewriter with special reference to the instrument of Gray. The modern form of the Gray instrument is described in detail and its various applications and its introduction into Germany are discussed.—*Elek. Zeit.*, March 12, 1914.

Cathodic Detectors.—An illustrated description of the Holweck valve which is based on the emission of negative electrons from incandescent bodies. This emission creates unilateral conductivity between the two electrodes. The emission of electrons from the cathode is rendered very strong by the means indicated in Fig. 4. The cathode has a very large surface of emission, ten times larger than that of filaments formerly employed for this purpose. The cathode surface is covered with a special oxide which has a higher emissivity than the filaments formerly used. Instead of making the distance between the anode and cathode greater than 4 mm or 5 mm, it is reduced in the present apparatus to 0.1 mm. Under these conditions the emission is extremely intense so that it is practically impossible for the valve to get out of order. Fig 5 shows the connection of the Holweck valve. *a* is the heating rheostat, *b* is the slide wire potentiometer and *c* the receiver. It is necessary to be able to regulate the temperature of the cathode and to introduce an additional emf in series with the anode.—*La Revue Elec.*, March 6, 1914.



FIGS. 4 AND 5—CATHODIC DETECTOR AND DIAGRAM OF CONNECTIONS

Miscellaneous

German Electrical Industry.—The first part of a series of articles on the status of the different branches of German electrical industries in 1913. W. Kübler deals with central stations and agricultural transmission systems, Karl Czeija with the design and construction of electrical machinery, Beckmann with storage batteries and primary batteries, Heinrich Probst with switches and switchboards. The series is to be continued.—*Elek. Zeit.*, March 12, 1914.

Contracting.—L. DOLKART.—A paper on cost systems in electrical contracting.—*Jour. Western Soc. of Eng.*, December, 1913.

Mathematics and Engineering.—W. S. BUTTON.—A paper on the relations of mathematical theory applied to engineering.—*Proc. Eng. Club of Philadelphia*, January, 1914.

Book Reviews

ELEKTRIZITÄT UND VOLKSWOHLFAHRT. By Prof. A. Raps. Berlin, Germany: Georg Stilke. 138 pages, 55 illus. Price, 2.5 marks.

A book intended for the use of the general public, giving a brief review of the progress in modern civilization due to electrical applications. The subjects dealt with are telegraphy, telephony, telegraph and telephone cables, radio-telegraphy, electric generating stations, energy transmission, motor service in manufactures and agriculture, electric lighting, traction, electrotherapy and electrochemistry. The illustrations in the book are nearly all carefully prepared photo-lithographs and of better quality than are usually presented in a book for general distribution. The book will serve the non-technical reader who is interested in the modern applications of electricity and familiar with the German language. Such publications deserve to have a wide circulation, for the great contribution made by electricity to the public welfare cannot be pointed out too often or too emphatically.

HYDRAULIC TURBINES. By R. L. Daugherty. New York: McGraw-Hill Book Company, Inc. 156 pages, illus. Price, $2.

The principles and practice governing the design of hydraulic turbines cannot be treated exhaustively in a book of 156 pages, and the man who wishes to specialize in this particular branch of engineering will not be carried very far in his subject by a study of this book. The author's purpose, however, has not been to write a treatise on the design of water turbines, but rather to present the subject in such a form as to give the reader a general idea of water-power development and conditions affecting turbine operation, and also to assist him in the selection of a turbine suitable for various conditions likely to be encountered in practical work. Such items as stream gaging and stream flow as affected by rainfall, etc., although of the greatest importance in the development of water-power at any given site, are only briefly referred to, the principal features of the book being the description of the various types of waterwheels and turbines, the factors governing the selection of the most suitable type and size, and the cost not only of the turbine proper but also of the horsepower-hour, thus allowing comparison with other sources of power, such as steam. This chapter on costs is one of the most valuable in the book. Three clearly written chapters are devoted to the theory of the various types of waterwheels and turbines, while one chapter is given to the methods of testing and determining the efficiency of turbines. Chapter XIV—the last—deals with centrifugal pumps. The author rigidly excludes all ornaments of language and confines himself to terse expressions of fact in sentences that cannot be involved or obscure because of the extreme economy of words used in their construction. The result is that a very great amount of instructive and useful matter has been compressed into a comparatively small number of pages. The illustrations, whether line drawings or reproductions of photographs, are good and clear. These include such up-to-date photographs as the 10,000-hp turbines at Keokuk and the 22,500-hp turbine built by the Allis-Chalmers Company for the Pacific Coast Power Company. Professor Daugherty has produced a book for which there is an undoubted demand. He has done his work well and kept within the limits set for himself. All those interested in the development of water-power, whether on a large or small scale, including electrical engineers and operators on hydroelectric schemes, should welcome this book.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Portable Electrical Grinders and Drills

The portable electrical tool-post grinder and drill shown in the accompanying illustrations operate both on direct current and on alternating current of any frequency up to sixty cycles. The motors used are form-wound and are impregnated with bakelite. They are kept cool by means of small fans.

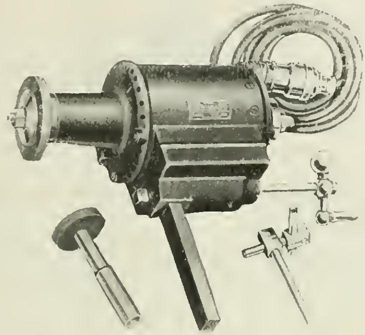


FIG. 1—PORTABLE TOOL-POST GRINDER

The grinders are equipped with ball bearings, which are incased in dustproof chambers packed in grease. These tools are manufactured in sizes of 1/6 hp and 1/4 hp and run at speeds of approximately 6000 r.p.m., thus making them effectual for internal grinding.

The drills are made in 5/8-in. and 1-in. sizes and are similar to those described in the *Electrical World* for Jan. 11, 1913, page 112, and March 8, 1913, page 535. Ball bearings are used throughout. The gears are of case-hardened steel and are incased in grease.

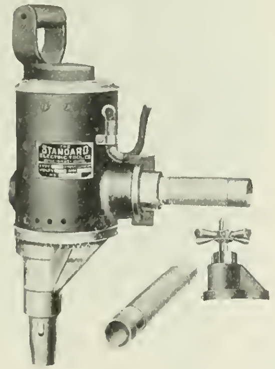


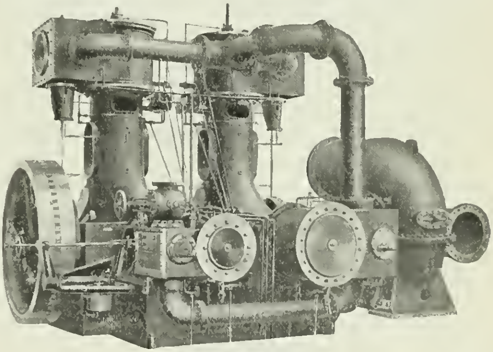
FIG. 2—PORTABLE ELECTRIC DRILL

These Universal grinders and drills are the product of the Standard Electric Tool Company, Cincinnati, Ohio.

Four-Cylinder Triple-Expansion Engine

A high-speed four-cylinder engine of the triple-expansion type, which is used in driving centrifugal pumps and which is known as the American-Ball engine, is manufactured by the American Engine & Electric Company, Bound Brook, N. J. The accompanying illustration shows a 1000-hp unit operating on 250 lb. initial pressure and 25 in. vacuum. The unit is of the double-angle type. The high-pressure cylinder is shown in the foreground and the intermediate-pressure cylinder to the right. The two low-pressure cylinders are vertical as illustrated.

All parts are supplied with oil from two central storage tanks, which are placed between the two vertical low-pressure cylinders. The oil collects by gravity and is then filtered and finally returned to the elevated tanks by two pumps operated by the valve-gear rocker arms of the horizontal cylinders. One of these pumps with its plunger can be seen at the left in the cut. Indicator cocks are provided for all four cylinders, and there is a permanent reducing motion on each cross-head. The governor is of the inertia type.


HIGH-SPEED FOUR-CYLINDER TRIPLE-EXPANSION ENGINE

Electric Combination Lock for Ignition Engines

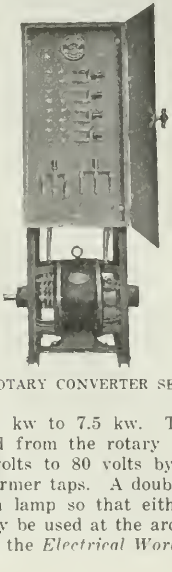
An electric device which renders ignition engines inoperative until a certain predetermined combination is solved is being introduced by the H. W. Johns-Manville Company, New York. It consists of a clock-like instrument with two movable knobs operating the hands attached, and it has six electrical connections which may be protected by flexible conduit to prevent tampering. The device is particularly adapted to automobiles and launches, thousands of which, it is said, are stolen each year.

The instrument grounds the battery and magneto circuits through an alarm bell until the hands are set to the combination. If an attempt is made to start the engine by turning the ignition switch, the electric bell sounds an alarm. There is also, when a high-tension magneto is used, no possibility of operating the engine by connecting the magneto directly with the distributer, for the magneto ground can be removed only by rewiring the car. By using this electric lock, it is asserted, the cost of burglar insurance and the number of accidents due to incompetent drivers will be considerably reduced. It is impossible for a person riding in an automobile equipped with this device to learn the combination used, for as soon as the car starts the hand locking the battery can be turned to any position while the magneto-lock hand can be moved about five spaces from the predetermined position. When using this lock the fire-insurance risk is not increased, for the car can still be pushed out of the garage in case of fire.

ELECTRIC COMBINATION LOCK

Integral Converter Set for Moving-Picture Theaters

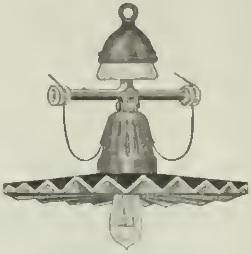
A rotary-converter outfit combining in one unit, 30 in. by 30 in. by 72 in., all resistors, fuses and switches necessary to control any desired number of arcs for moving-picture work has been brought out recently by the Northwestern Electric Company, of Chicago. Designed to operate on potentials of 110 volts, 220 volts and 440 volts and at frequencies of twenty-five cycles, thirty cycles and sixty cycles, the units are built in six sizes ranging from 2.5 kw to 7.5 kw. The direct-current pressure delivered from the rotary converter may be varied from 60 volts to 80 volts by changing resistances and transformer taps. A double-throw switch is provided for each lamp so that either alternating or direct current may be used at the arc. The converters were described in the *Electrical World* of Oct. 4, 1913.



ROTARY CONVERTER SET

Outdoor Swinging Fixtures

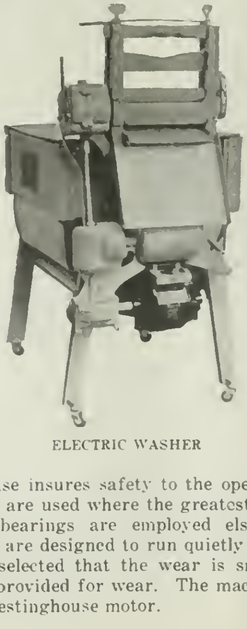
Incandescent-lamp fixtures of the center-span and rope-suspension type having two swivel joints, one above and the other below the insulator arm, are made by the Line Material Company, South Milwaukee, Wis. By means of these joints the tendency of the line wires to pull the reflector out of the horizontal and thereby prevent an even distribution of light is obviated. A locking screw is provided in case it is desired to have the joint below the arm rigid; in certain exceptional cases this is necessary. A fixture equipped with two swivel joints is shown in the accompanying illustration. This device is known as the "Kyle Line" bracket, and the provision of a joint below the insulator arm is considered to be an important improvement.



OUTDOOR LIGHTING FIXTURE WITH SWIVEL JOINTS

Electric Washing Machine

The electric washer illustrated herewith is being placed on the market by the Michigan Washing Machine Company, Muskegon, Mich. The operation of this machine is controlled entirely by push-buttons. All moving parts are covered, and an automatic electric wringer release insures safety to the operator's hands. Ball bearings are used where the greatest strains occur and bronze bearings are employed elsewhere. The moving parts are designed to run quietly and the materials are so selected that the wear is small. Adjustment is also provided for wear. The machine is driven by a small Westinghouse motor.



ELECTRIC WASHER

Commutator Slotter

A tool for cutting mica on the commutators of electric generators and motors is shown herewith. The device cuts a smooth slot with a rounded bottom. The cutter is a special form of file and is straight and very hard. The operation consists first of starting one or two slots without the guide shown, then, after adjusting the cutter and guide, the guide is used in the slots already made, the tool being worked back and forth. The guide is lifted when the cutter has started. This slotter is made in three sizes and is manufactured by Mr. F. R. Alley, 808 Cobb Building, Seattle, Wash.

SLOTTING DEVICE FOR CUTTING MICA ON COMMUTATORS

Porcelain Socket for Fixture Installation

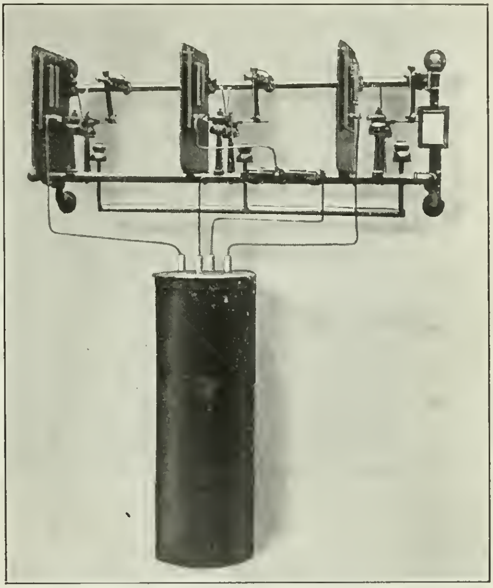
A push-button porcelain fixture socket has been placed on the market by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. This socket, which is shown herewith, is attractive in appearance and is rated at 660 watts and 250 volts. The same small quick make-and-break mechanism used in the pendent socket and other switches manufactured by this company has been adapted for this device. Instead of the usual iron set screw for securing the socket to the fixture, a locking ring is provided which secures the socket firmly to the fixture regardless of the usual differences in the diameters of fixture nozzles. For bathrooms, laundries and rooms having cement floors these "shock-proof" porcelain sockets are particularly suited. The push button employed in operating this socket is similar in design to those used with other sockets put out by the same company.

PUSH-BUTTON PORCELAIN FIXTURE SOCKET

An Electrolytic Lightning Arrester

A lightning arrester with a charge-and-discharge resistor in series with a standard electrolytic element for the protection of cable systems, motors and generators connected directly on a line without transformers, or transformers with weak insulation on their end and turns, has been placed on the market by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. The resistor limits the charging current to a low value and damps out any surges that may result in charging, particularly if the system contains enough capacity to produce resonance. The arrester is designed for circuits of pressures ranging as high as 14,500 volts.

The electrolytic element consists of treated aluminum trays stacked on top of each other and separated and insulated by porcelain spacers on the periphery of the trays. The number of trays in a stack depends upon the normal voltage of the line on which the arrester is to be used. The stacks of trays are included in frames, and each tray is filled with electrolyte. The stacks are placed in welded-steel tanks and are immersed in oil. In actual operation, a film of the electrolyte forms on the surface of each tray. This film has a high resistance at normal voltage, but the resistance becomes very low at high voltages. It therefore forms a free path for the current at abnormal voltages or for static charges, but upon the cessation of the abnormal stress the film instantly regains its high resistance.



LIGHTNING ARRESTER

The trays and electrolyte are arranged in such a manner that the electrolytic element acts as an electrostatic condenser. The flow of current due to the capacity of such a condenser varies inversely as the frequency of the circuit. Thus, at normal commercial frequencies, the flow of current is small, but at the high frequencies of lightning discharges and static disturbances considerable current flows through the element, increasing the action of discharging the static charges and preventing flow of current at normal frequency. On an electrolytic arrester being charged surging currents are set up in the system. Under most conditions these are harmless, owing to the insulation of the apparatus connected in the same circuit. However, as above noted, there are cases in which these surges are dangerous, and in order to remedy this danger the graphite resistor is used to damp out the surges and limit the charging current to a low and safe value.

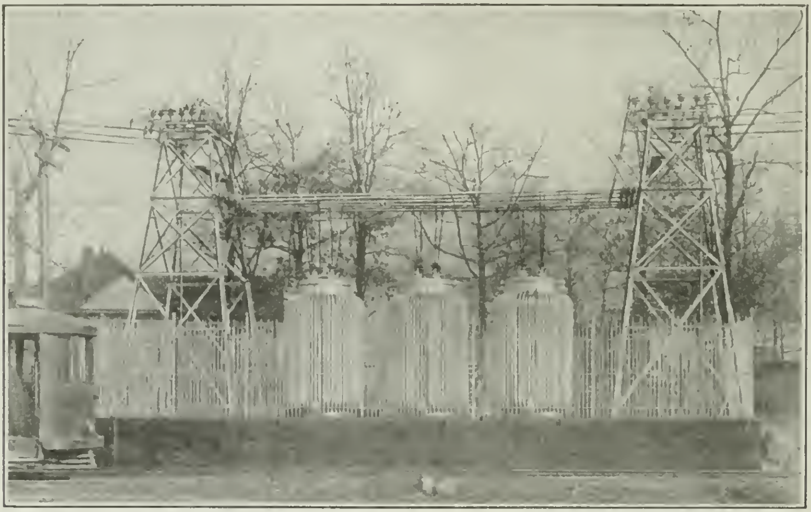
This resistor is connected in series between the horn-gap and the arrester in each phase. It is shunted, however, by a series of non-arcing metal spark-gaps which are auxiliary to the main horn-gap. While charging, the horn-gap is short-circuited as usual and at the normal voltage of the circuit the charging current takes the resistance path rather than the shunt auxiliary-gap path. On the occasion of a discharge due to lightning or static disturbances the auxiliary spark-gap path is easily broken down, and the discharge passes through it instead of through the resistor. After the circuit has been restored to normal voltage and frequency the auxiliary spark-gaps cannot maintain the circuit and it is shunted to the resistance path. This action is facilitated by the use of multiple gaps between non-arcing metal. The resistor limits the amount of dynamic current flowing, and thus helps in the final action of opening the circuit by the rise and final break of the arc on the horn-gap.

Outlet Box Holder

An outlet-box holder has been designed which will save the time and labor usually consumed in measuring and fitting boards on which to fasten outlet boxes between wooden floor joists. The device consists of two pieces of No. 14 gage sheet iron. One short strip containing two rectangular slots may be attached to the joist and box without obstructing the knock-outs in the back, while the longer piece which engages with the slotted strip in a slot-and-T-lock joint can also be nailed to the joist, making a rigid triangle. The outlet box can be fastened to the short strip with the same bolt which is employed to hold the fixture stem.

Outdoor Transformer Substation

The outdoor substation installation pictured herewith is in service on the lines of the Georgia Railway & Power Company, being about 2 miles from the center of the city of Atlanta, along the South Decatur trolley line. This substation serves for stepping up the pressure of 11,000 volts used in and around Atlanta to 22,000 volts, at which potential the substation supplies energy to the Stone Mountain-Covington-Monroe transmission line, which has a total length of about 40 miles. This 3000-kva substation receives its energy over the Atlanta line from various sources, including the new Tallulah Falls power station 90 miles away, the Bull Sluice station at a distance of 15 miles and two steam stations in Atlanta.


OUTDOOR SUBSTATION INSTALLATION

The outdoor substation has been in operation about six months, during which time, it is reported, absolutely no trouble has been experienced, although the nearest operator or attendant is 2 miles from the station. In the illustration are shown the 11,000-volt line on the left and the outgoing 22,000-volt lines at the right.

Each of the three Westinghouse transformers weighs about 12 tons, and to handle these units without difficulty a special I-beam construction was used between the car body on which they were transported and the concrete platform on which they are now installed. The concrete platform is the same height as the level of a car floor and the transformers were simply skidded along the greased surface of the I-beams to their proper places.

The two steel structures shown, each of which carries a three-pole Burke high-voltage air-brake switch, lightning arrester, choke coil, and fuse, are examples of standard models of outdoor substations built by the Transmission Engineering Company, Pittsburgh, Pa., and equipped with switching and protective apparatus manufactured by the Railway & Industrial Engineering Company, of the same city. The towers are provided with U-bolts from which tackle can be suspended to lift the transformer coils out of their tanks in case repairs or inspection should prove necessary. The station is inclosed by an iron picket fence as shown.

Jobber, Dealer and Contractor

Contractor Furnishes Festoon Lighting for Automobile Show

Twelve city blocks in the heart of the business district of Columbus, Ohio, occupied mainly by automobile and automobile-accessory salesrooms, were brilliantly illuminated by festoons, as shown in the accompanying illustration, every night during Columbus' recent automobile show. Approximately seventy-five red and green lamps were used in each festoon, which stretched between trolley poles on either side of the street and over the sidewalks from the poles to the adjoining buildings. The Avery Loeb Company, electrical contractor, erected the displays, maintained them while in operation, and purchased energy from the central-station company for their operation. The contractor in turn collected for this work from the local automobile association, paying the central-station company for the energy registered on two meters hung at the distribution centers of the ornamental system.

SPECIAL STREET LIGHTING FOR AUTOMOBILE SHOW.

Field Work of the National Electrical Contractors' Association

Under the direction of President Ernest Freeman and the other officers, the National Electrical Contractors' Association is making an intelligent and successful campaign to explain to the electrical contractors of the country its purposes and aims, and incidentally to increase its membership. The field work is directly in charge of Mr. G. W. Hill, special representative of the association, who was formerly with the Electrical Construction & Machinery Company, of Rock Island, Ill. Mr. Hill was employed to follow up the work of Mr. Duffield, except that that gentleman was engaged principally to increase the membership, whereas Mr. Hill's mission is of a rather broader scope. He introduces and explains the association's system of bookkeeping, and also explains the other branches of the association's work. In doing this missionary work Mr. Hill is also helping to make the association more valuable to its members.

Beginning last November, Mr. Hill started out in Wisconsin. In this State the electrical contractors were not particularly friendly to the national association, nor, indeed, in many cases to one another. Here Mr. Hill has been able to bring about a considerable change of feeling, and the state association, which has been perfected as the result of the suggestions of representatives of the national organization, will hereafter work with the National Electrical Contractors' Association. Mr. Hill then went into Michigan, and he practically doubled the number of members in that State belonging to the national association. He was also instrumental in bettering the feeling among electrical contractors in Michigan. In Iowa the general feeling of electrical contractors had been that the national association was too big and too far away from them to be much interested in their concerns. Mr. Hill showed them that this was an erroneous view. He later formed the new state association in Iowa, which is affiliated with the national body. Recently the special representative has been traveling in the South. In Arkansas he increased the membership of the national association and was instrumental in the formation of a state association, which has joined the national body. He has been working also with good result among the contractors in Missouri, Kansas, Illinois and Louisiana. He is at the present writing in Tennessee engaged in this interesting work. It may be added that the system of bookkeeping which the association, through Mr. Hill, recommends to electrical contractors is sold at less than cost and with the honest intent to help the electrical contractors of the United States to do their business in a businesslike way and to know how much it costs them to do business.

Advanced Electrical Merchandising and Contracting in Indianapolis

In an effort to put the retail electrical supply business and the electrical contracting industry (in this case combined in one company) on a higher plane, the Sanborn Electric Company, of Indianapolis, is taking a conspicuous part, as may be judged from the pictures of its new building and salesrooms given herewith. Indianapolis is a city of about 250,000 population, and the Sanborn Electric Company has demonstrated what may be done in the development of the retail electrical business in a city of that size. Its example may well be followed by many another electrical contracting and supply house throughout the United States.

The Sanborn Electric Company has been in the electrical contracting business for twenty-three years. Its operations have extended beyond Indianapolis, one recent large contract being in connection with the new Michigan Central Railroad terminal and office building in Detroit. The entire electrical equipment for this Detroit building, including the lighting fixtures, was furnished by the Sanborn company. The new building of the company in Indianapolis is well arranged and

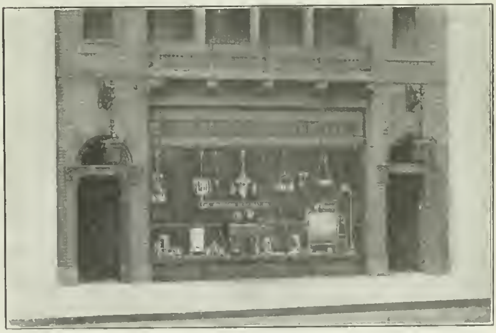


FIG. 1—SHOW WINDOW AND ENTRANCE OF THE SANBORN ELECTRIC COMPANY

unusually attractive. It was built and is owned by the Sanborn Electric Company and was especially designed to meet the present and future requirements of the company. It is of fireproof construction.

First-Floor Display Room

The front portion of the first floor is arranged for the attractive display of a large variety of articles of electrical merchandise, including electric stoves and heating utensils, washing machines, electric cleaners, cooking devices, etc. Glass showcases and wallcases are provided for the exhibition of merchandise. These cases are equipped with interior lighting, and the nickel-plated or copper appliances make an attractive display. Further, keeping these utensils in the showcases prevents their becoming tarnished and dirty.

One section of the wall is arranged with eight swinging display cases. These are about 5 ft. high with horizontal dimensions of 2 ft. by 4 ft. The backs of these wallcases are lined with black felt, on which are mounted small articles such as switches, receptacles, cut-outs, tungsten lamps, flashlights, etc. Immediately behind these cases are shelves which contain the goods that are displayed on the black backgrounds. This method permits the displaying of small objects which are generally hidden away in shelving. The fact that the article is in plain sight often suggests to the customer that he is in need of it.

Fixtures Displayed in a Suite of Beautiful Rooms

Passing from the display room the customer goes through what appears to be the front porch of a residence. From this he enters a vestibule which leads into a large reception hall. Thence the visitor is conducted into an English reception room, which, in turn, opens into a fully equipped library in Colonial style. There is also a French room, and this opens at the rear into a solarium finished in Caen stone, with tile floor and latticed ceiling. The lighting fixtures shown in these various rooms are suggestive of the periods of decoration represented, the whole being designed to give the public a correct idea of how fixtures will appear when installed in the home. A feature of these fixture showrooms is that every fixture is wired and lighted individually. Numerous outlets are provided on the ceilings, which are of residence height. By this plan the crowding of fixtures is prevented, and the fixtures are spaced a sufficient distance apart to show each one to the best advantage. Lighting fixtures for all classes of buildings are displayed.

Other Features of the Building

The two upper stories of the building are used for general offices, private offices, the engineering department, etc. A large basement affords storage and shop facilities. A rear entrance for employees has been provided. This provision brings the construction men to the construction superintendent's desk by the shortest course, and the passage is so arranged that it is not necessary for the construction men to pass through the retail department with their tools, ladders, etc. A room for employees is conveniently situated in the basement and is provided with welfare facilities such as lunch table, lavatory, shower baths, etc., as well as convenient receptacles for tools and clothing. The idea of the company has been to endeavor in every way to make the workman comfortable and to help him to maintain a neat appearance and to take pride in his work.

Mr. Sanborn's Views on Electrical Merchandising

Mr. G. M. Sanborn, the president of the company, is well known among electrical contractors. He was president of the National Electrical Contractors' Association in 1909-1910 and is at present a member of the executive committee of the association. He was chairman of the committee which developed the standard

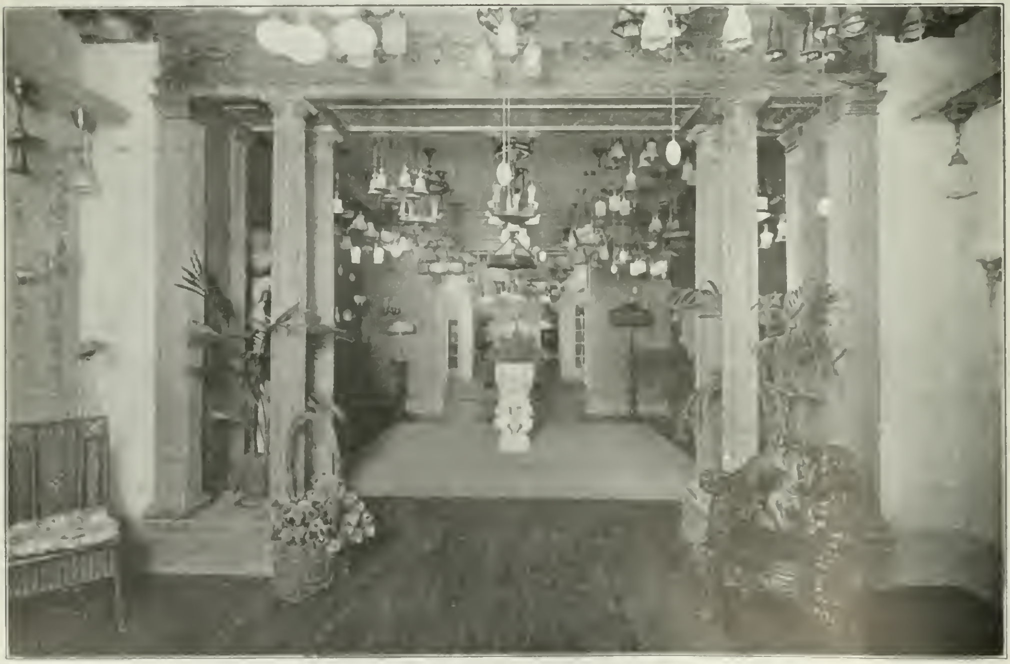


FIG. 2—FIXTURE DISPLAY ROOMS OF THE SANBORN ELECTRIC COMPANY

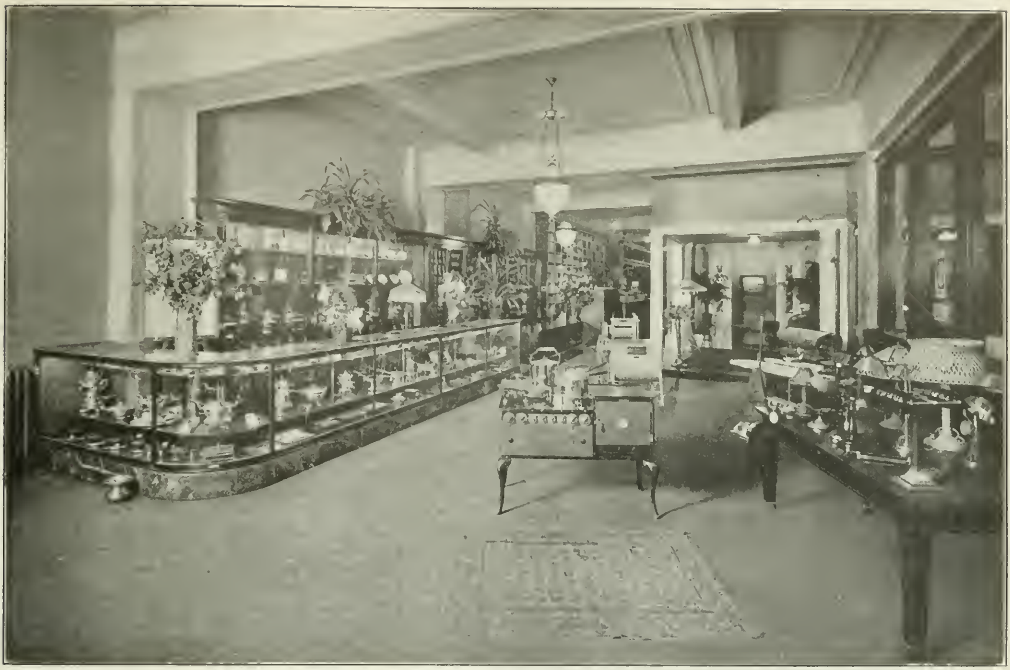


FIG. 3—ARRANGEMENT OF STOCK IN GENERAL SALESROOM OF THE SANBORN ELECTRIC COMPANY

symbols for wiring plans, the universal data and sales book and the charts showing standard sizes of conduit for wires and cables. His company is a member of the Society for Electrical Development and has reproduced in its showroom the emblem and slogan of the society. Mr. Sanborn is a member of the board of directors of the Society for Electrical Development and an advocate of the principle of co-operation.

The president of the company is optimistic in relation to the future of the electrical contracting business and the retail electrical supply business. He believes firmly that the public is ready for electrical shopping facilities of the first class and that it only remains for the contractor and dealer to develop this side of the business. Mr. Sanborn believes that the electrical contractor is the logical and natural retailer for electrical merchandise and that he is better fitted to handle and develop this business than the electric-service company or any other department of the industry.

"However," Mr. Sanborn says, "the contractor must seize the opportunity. If he does not make the proper investment and display, and prepare himself to handle the retail trade, he must not complain if the central-station company or someone else does so. If the contractor takes his proper place in the field, others will naturally leave the business to him. The lighting company should realize that the contractor needs encouragement to invest his money in an untried venture and should refrain from offering undesirable competition to the contractor, but should lend him every assistance and encouragement to develop the field. This will be of mutual benefit. Much has been said of co-operation, but it should be remembered that co-operation with the contractor must be of the kind that allows him to make a profit while selling devices. The sale of these devices means a continuing business to the electric-service company."

New Interior Wiring Ordinance in Minneapolis

Considerable interest is taken by electrical men in Minneapolis in the revised wiring ordinance adopted by the City Council a few weeks ago. This ordinance specifies the carrying capacity of wires according to the standard adopted by the American Institute of Electrical Engineers. A section of particular interest reads as follows:

"Where the circuit load does not exceed 660 watts, sixteen sockets may be installed on such circuit, provided, however, that in a residence only twelve sockets may be connected to one circuit, except that in cases where a separate appliance circuit is installed to which at least three receptacles are connected, one in the kitchen, one in the dining room and one in the laundry, sixteen sockets may be connected to each circuit used for lighting only."

The object of this amendment is to encourage the installation of an independent circuit to be used solely for electrical appliances. Electrical contractors say that, with the increase in the number of allowable sockets from twelve to sixteen wherever the appliance circuit is provided, the total cost to wire an average residence will not exceed that required to wire a residence without the appliance circuit and with the allowable number of sockets per lighting circuit limited to twelve. The Minneapolis General Electric Company, which does the electric-service business of the city, has received a number of complaints from customers who have criticised the voltage regulation. Upon investigation the trouble has usually been traced to the use of some electrical appliance on an ordinary lighting circuit. It is anticipated that the changes provided by the new wiring ordinance will encourage the installation of separate appliance circuits—a result which will be desirable for all concerned.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

New Fuel-Oil Engine Put Out.—The Covington Machine Company, of Covington, Va., has developed a new internal-combustion fuel-oil engine, which it has just put on the market.

New Section in Nela Research Laboratory.—The "Section of Applied Science" is the latest addition to the Nela Research Laboratory at Cleveland, Ohio. This division, under the direction of M. Luckiesh and C. F. Lorenz, is intended to provide a connecting link between the purely scientific research work of that laboratory and the commercial applications which develop from such research.

Utility Company Buying Large Generating Units.—An order has been placed by the American Gas & Electric Company for two 10,000-kw steam-turbine generator sets, one of which is to be installed at the Canton Electric Company's plant and the other at the station of the Scranton Electric Company, to meet increased demands for electric energy from these plants. The General Electric Company is to supply this equipment.

Kerr Turbine Sales Progressing.—Recent sales of the Kerr turbine have included twenty-five machines for driving pumps, and some of the larger turbo-generator sets lately sold have an aggregate rating of 1375 kw. Among the purchasers of the latter apparatus were the Coy Paper Company, the Standard Oil Company, the Glasgow Electric Light & Ice Company, the Kerite Insulated Wire & Cable Company, and the Gulf Fisheries Company.

Overland Motor Car Company Increases Connected Load.—A contract recently closed between the Overland Motor Company and the Toledo Railways & Light Company adds approximately 1800 hp in motor service and 600 kw in lighting to the circuits of the electric-service company. The increase has been made in a new building containing about 800,000 cu. ft. of space in which the body and machine departments of the factory will be operated. This brings the total load of the Overland company to about 7000 hp.

Electric Soldering Iron Heaters Finding Ready Sale.—In the Feb. 7 issue of the *Electrical World* a note appeared describing a new form of electrically operated soldering iron heater recently brought out by the Current Electric Company, of Chicago, Ill. The company reports large shipments to a typewriter manufacturing company, a motor manufacturer and a telephone company. Smaller lots have been sold to manufacturing jewelers and to makers of sheet-metal apparatus. The device has also been pushed abroad, according to the makers, with very gratifying results.

Electric Welding of Sugar Tanks.—The Electric Welding Company, 220 West Forty-second street, New York City, has recently successfully repaired a number of sugar tanks for Arbuckle Brothers, New York, for which concern it does all work of this kind in accordance with its special contract plan. The life of these sugar tanks, which are used to contain hot sugar solutions, is limited, and corrosion at the joints and around the rivets is extremely rapid. Formerly, when the steel plates were corroded to a point where repair became necessary, either the tank was thrown out absolutely or new parts were inserted in place of the old ones and new rivets driven. Wherever patches were put in it was first necessary to cut out the old plate, drill holes, drive rivets and calk the edges. Such repairs were expensive and consumed a large amount of valuable time. By electric arc welding the removal of old plates and tanks has been entirely done away with. If a new bottom is to be put into a tank, a plate is flanged on all edges and dropped into the bottom of the tank on top of the worn-out sheet. It is then welded all around the edge to the edge of the bottom and to the sides of the tank. Corroded spots and pits are filled with new material and made smooth by chiseling and grinding. Where the plates are weak over a considerable area, plate patches are welded onto the old sheet and the edges tapered off so as to leave no place for the lodgement of material which will promote corrosion.

Edison Storage Battery Used to Operate Pontoon Crane.—In the Boston Navy Yard there has recently been constructed a large electrically operated pontoon crane intended for handling heavy and bulky pieces, such as turrets, boilers, guns and similar equipment for battleships. The crane is electrically operated throughout, its equipment including an Edison storage battery capable of 600-amp discharge at 220 volts for one hour, controlled by a Cutler Hammer magnetic-type controller. There is also a 100-kw Diesel-engine-driven direct-current generator which can be used either to operate the crane or to charge the battery.

Middle West Electrical Dealer Optimistic.—According to Albert Korst, vice-president of the Barber-Dwinnell Electric & Manufacturing Company, of Kansas City, Mo., that company is doing a splendid business, and the prospects for electrical business in general are brighter this spring than they have been for many years. The company has just completed the installation of a three-phase plant at Burwell, Neb., and of a storage-battery lighting plant at Milligan, Neb. It also acts as Western sales agent for the Century Electric Company, the Diehl Manufacturing Company, the Richmond Electric Works and the Kimble Electric Company.

Selling Company Formed to Handle Crowe Smokeless Stokers.—The National Stoker Company has just been incorporated under the laws of the State of Delaware, with main office at Covington, Va., and branches at 88 Wall Street, New York, and at 416 Fifth Street, N. W., Columbia Building, Washington, D. C. The capital stock of this corporation is $300,000, of which $150,000 is preferred and $150,000 common. Its officers are J. S. Ham, president, Covington, Va., and Frank Lyman, secretary-treasurer, 82-88 Wall Street, New York. The company was formed for the purpose of handling the Crowe smokeless stokers in the United States. The Covington Machine Company, of Covington, Va., will manufacture the stokers, and the National Stoker Company will devote all its energies to selling them.

Emergency Service Supplied by an Electrical Manufacturer.—The recent severe storm in the vicinity of New York gave to the Western Electric Company an opportunity to display its ability to meet sudden emergencies. On March 1 the territory around and between New York and Philadelphia was visited by an unusually severe snowstorm, which practically paralyzed the overhead lines for both telephone and telegraph service in the affected area, besides tying up the transportation service temporarily. The storm wrecked over 6000 poles in this district carrying important and heavily loaded telephone and telegraph lines. At the New York headquarters of the Western Electric Company the call for emergency service was anticipated, and the force had been collected and trucks were in waiting when the first call came in. About 1500 emergency orders were received and handled. The early orders were supplied from emergency stocks, and after that rush shipments were made from the nearest factories and wire mills, some of which were put on day-and-night schedules while the rush lasted. The total emergency shipments came to approximately 8750 tons, including 150 carloads of poles, 16,000 miles of wire, hardware, tools and line supplies weighing over 500 tons, 14,000 cross-arms, 50 miles of stranded wire, 50 miles of cable, and 200,000 insulators, weighing approximately 100 tons.

Comparative Durability of Various Woods for Cross-Arms.—The Western Electric Company, from years of experience with transmission-line equipment, has just published an interesting tabulation of the comparative durability of different woods used for cross-arms. It ranks Washington or yellow fir first, with a life of over thirty years, followed by "all-heart" long-leaf yellow pine, ten to twenty years; cypress, ten to twelve years; Norway pine, six to eight years; juniper, six to eight years; oak, four to eight years; "sap" long-leaf yellow pine, four to six years, and short-leaf yellow pine, three to five years. An instance is cited of a yellow-fir cross-arm cut and put into service fifty years ago and still carrying wires without a sign of decay. The statement is made that this wood does not require painting in order to withstand the attacks of the elements.

Industrial Plant Adopts Central-Station Energy to Raise the Quality of Product.—A 25-hp gas engine operating in the factory of the Lewis Welding Company, Toledo, Ohio, was recently replaced by a 35-hp electric motor operating from the mains of the Toledo Railways & Light Company. The engine in question had been driving, among others, a grinding machine producing automobile valve mechanism in which accuracy to within 0.0005 in. is desired. Tests on the gas engine showed that the speed of the machine at the cutting tool varied as much as 7 per cent. Tests on the same machine driven from the central-station circuit showed that the average variation was 0.3 per cent and that the maximum variation was 0.8 per cent. The grinding machine is one of a group, and this slight variation is attributed to belt slippage. In addition to allowing the operators of the grinding machine to do more accurate work, the motor has proved popular among the employees, who formerly complained about the heat given off by the gas engine.

Reorganization of the Dean Electric Company.—In the Dec. 20, 1913, issue of the *Electrical World* note was made of the plans on foot for reorganizing the Dean Electric Company, of Elyria, Ohio. Announcement has now been made of the formation of the Garford Manufacturing Company, which will take over the assets and liabilities of that concern. The Garford company has been authorized to issue $500,000 of 7 per cent cumulative preferred and $800,000 of common stock. The officers of the new company are A. L. Garford, president; A. G. Bean, vice-president; A. L. Patrick, treasurer, and John Watson, secretary. Its directors are the above and John Sherwin, John Brophy, H. H. Johnson and E. F. Allen. Secured creditors of the Dean company obtain under this reorganization notes equal to the face value of their claims and payable in from one to five years. Unsecured creditors receive these notes equal to 75 per cent of the face value of their claims, while the preferred-stock holders receive common stock of the Garford company equal to 20 per cent of their stock in the Dean company.

NEW YORK METAL MARKET PRICES

	Mar. 24		Mar. 31	
Copper:	Bid	Asked	Bid	Asked
Standard spot*	13.87½	14.37½	13.80	14.30
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	65 7 6		65 2 6	
Prime Lake	14.75	to 14.87½	14.75	to 14.87½
Electrolytic	14.40	to 14.50	14.40	to 14.50
Casting	14.20	to 14.30	14.20	to 14.30
Copper wire base	15.50	to 15.75	15.50	to 15.75
Lead	4.00		3.80	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.32½	....	5.32½	....
Tin, spot	38.70	to 38.80	37.85	to 38.25
Aluminum:				
Prompt delivery	18.00	to 18.25	18.00	to 18.25
Future	18.60	to 18.25	18.00	to 18.25

*OLD METALS

Heavy copper and wire	13.62½	13.62½
Brass, heavy	8.62½	8.62½
Brass, light	7.62½	7.62½
Lead, heavy	4.00	3.80
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to March 31	44,898

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*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Consolidated Cities Company Increases Dividend Rate.—A quarterly dividend of three-quarters of 1 per cent was paid on April 1 on the outstanding stock of the Consolidated Cities Light, Power & Traction Company. An initial dividend of one-half of 1 per cent was paid on this stock on Oct. 1, 1913, and the same rate on Jan. 1 of the present year.

Dayton Company Purchases Wilmington (Ohio) Company.—The Dayton Power & Light Company has purchased the Wilmington Water & Light Company of Wilmington, Ohio. J. C. Martin, who has been president of the Wilmington Water & Light Company, is president of the Ohio Electric Light Association. F. C. Jeannot is now in charge of the plant at Wilmington.

New Stock Issue of the Shawinigan Water & Power Company.—An issue of $1,375,000 of new common stock has been announced by the Shawinigan Water & Power Company, of Montreal. Shareholders of record April 1 are allowed to subscribe to this stock at $120 per share up to April 30 on the basis of one share of new stock for eight shares of old, subscriptions payable in three instalments, $30 on April 30 and June 1 and $60 on July 2, 1914.

Initial Dividend of the Municipal Service Company.—An initial quarterly dividend of 1 per cent has been declared on the outstanding $481,000 common stock of the Municipal Service Company, which was incorporated in 1912 as a consolidation of the Chester Valley Electric Company, the Staunton Lighting Company, the Sumter Lighting Company and the Alexandria County Lighting Company. The Baker, Ayling & Company interests, of Boston and Philadelphia, control the Municipal Service Company.

Westinghouse Electric Company Matters.—To fill the vacancies in the board of directors of the Westinghouse Electric & Manufacturing Company left by the resignation some time ago of T. W. Lamont and the recent death of George Westinghouse, the election of J. N. Wallace, president of the Central Trust Company, and of H. H. Westinghouse has been announced. The report of the Westinghouse company for the fiscal year ended March 31, 1914, is in preparation and will be published early in May. It is expected that this report will show record figures in connection with the 1913 business.

Operations of Northern States Power Company.—The Northern States Power Company, of Chicago, is one of the three large holding companies of H. M. Byllesby & Company. The annual report of President Byllesby, dated Feb. 14, 1914, to which brief reference was made in the *Electrical World* of March 21, is an unusually complete and explicit document and contains considerable information of general interest. The company owns the Consumers' Power Company of Minnesota, which, in turn, controls the Minneapolis General Electric Company and other properties. Public utilities, mainly electrical, are operated in Minneapolis, St. Paul, Stillwater, Mankato, Faribault and other communities in Minnesota; Galena, Ill., and Fargo, Grand Forks and Minot, N. D. The company also serves a few small communities in Wisconsin. It operates several water-power plants, the largest being at Taylor's Falls, 40 miles northeast of Minneapolis. This plant is rated at 25,200 hp. The next largest water-power plant in the system is at the Main Street station at St. Anthony's Falls in the heart of Minneapolis. This is rated at 3400 hp. The water-power plant at Rapidan, Minn., is of 2200 hp and that at Cannon Falls, Minn., 1800 hp. At Coon Rapids, on the Mississippi River, about 6 miles above the limits of Minneapolis, the company, through the Northern Mississippi River Power Company, is completing a rather extensive hydroelectric development. Here there are to be five generating units of over 10,000 hp in total rating. It is expected that this plant will be in full operation not long after Sept. 1 of this year. Within a year's time it is the purpose of the company to complete connection by transmission lines of the water-power plants at Rapidan, Cannon Falls, Taylor's Falls, Coon Rapids, Somerset, Wis., and Riverdale, Wis. These stations will be connected with one another and also with the large steam reserve generating plants in St. Paul and Minneapolis. When these tie lines are completed it is altogether probable that a number of the smaller steam plants in the system will be shut down for normal operation. Furthermore, the connection will enable the transference from one hydroelectric station to another of any surplus of available energy. It is believed that, including the rural and farming population served, the total population contiguous to the circuits of the company is about 765,000. The number of electric-service customers connected with the system on Dec. 31, 1913, was 45,518.

California-Idaho Company Bonds Called For.—The reorganization committee of the California-Idaho Company has issued a call to the holders of first and collateral trust bonds of that company for the deposit of the same on or before May 1. Under the reorganization agreement these bonds will be replaced by collateral trust bonds of the American Water Works & Electric Company. The California-Idaho Company is the only irrigation property to be taken over by the latter concern.

Annual Report of the Canadian General Electric Company.—Gross profits of $2,029,898 were shown in the annual report of the Canadian General Electric Company for the year ended Dec. 31, 1913, and, after deducting interest and depreciation of $693,588, dividends of $776,634 and reserve of $328,134, a surplus of $231,542 was obtained for the same period. Its total surplus and reserve on the above date was $3,613,933. The company is capitalized at $10,000,000, of which $8,000,000 is common and the rest preferred stock. Total liabilities on Dec. 31, 1913, came to $22,425,774. In the *Electrical World* for May 3, 1913, a note appeared on the formation of the Canadian Allis-Chalmers Company, Ltd., which took over the Allis-Chalmers-Bullock Company, Ltd. The first mentioned of these companies was later merged with the Canada Foundry Company, Ltd., another concern controlled by the Canadian General Electric Company. The report states that during 1913 collections were very satisfactory and that the volume of business, while a little decreased toward the end of the year, was much better than had been anticipated. No material shrinkage of business has been noticed by this company. The deaths of James Ross and George A. Cox, both long connected with the company, left two vacancies in the board of directors in 1913, which places were filled by the election to that board of J. K. L. Ross and E. W. Cox, sons respectively of the deceased directors.

Marconi Company's Report for 1913.—The report of the Marconi Wireless Telegraph Company of America for the eleven months ended Dec. 31, 1913, showed a net profit of $178,251. On Aug. 1, 1913, a dividend of 2 per cent was paid on the outstanding stock of $9,402,070. The total assets of the company are given as $9,919,947. In the *Electrical World* for Feb. 8, 1913, note was made of the letting of contracts for the erection of eight long-distance stations by the Marconi company, four of which were to serve for transatlantic and four for transpacific communication. The report states that the erection work on these stations is progressing satisfactorily and that they are expected to be completed and in operation early in the present summer. It is hoped to start operations between the Pacific Coast stations and those in Honolulu prior to June 1. A high power station is under construction in Japan and will eventually connect that empire with the United States, through the station at Honolulu. Land has been purchased at Chatham and at Marion, Mass., as sites for a transmitting and a receiving station to connect this country with Norway, the station in that country being now under construction. Arrangements have been completed with the Western Union Telegraph Company whereby its system of land telegraph lines is to be connected with the Marconi stations in different sections of the country, so that wireless messages may be sent from any place where there is a telegraph office. The Marconi company is planning also to build high power stations at Ketchikan and Juneau, Alaska, to handle the commercial messages between those points and the stations at Seattle and Astoria, Wash. During the year 1913 an innovation in wireless application was tried out in the equipping of trains on the Delaware, Lackawanna & Western Railroad with wireless outfits, by which constant communication was maintained between moving trains and the offices of that road between New York City and Buffalo, N. Y. Description of this service appeared in the Jan. 10, 1914, issue of the *Electrical World.*

Business Notes

The H. W. Johns-Manville Company, of New York, has appointed F. B. Smith as assistant to T. F. Manville, president of the company.

The Weston Electrical Instrument Company has secured the services of Edwin Wortham as its district representative for the territory including the States of Virginia, West Virginia and North Carolina. His office will be at Suite 38, Allison Building, Richmond, Va.

The Goulds Manufacturing Company, of Seneca Falls, N. Y., has appointed H. F. Miller as its advertising manager. Mr. Miller has been associated with the advertising department of the Otis Elevator Company for the past year, and for four years previous to that he was with the Western Electric Company.

Belknap Hardware & Manufacturing Company.—Mr. O. Sacksteder, Jr., who for several years was in charge of the shipping department of the James C. Clark, Jr., Electric Company, of Louisville, Ky., is now sales manager of the electrical department of the Belknap Hardware & Manufacturing Company, of the same city.

The San Diego Gas & Electric Appliance Company has been formed with offices and showrooms at 939 Sixth Street, San Diego, Cal. The business of the company will be the installation and maintenance of complete gas and electric equipment in all classes of buildings, and a special feature of the work will be the maintenance of appliances on a regular monthly basis. Thurston Owens is secretary and general manager of this company.

The McGraw Company is the name of the new concern formed by consolidating the Interstate Electric & Manufacturing Company of Sioux City, Ia., and the J. R. Lehmer Company, of Omaha, Neb. For some time the two companies have been owned and operated by the same interests so that no important changes will accompany the consolidation. Max McGraw is president of the new corporation, and M. F. Van Kuren and C. A. Fried are its vice-presidents.

The Main Electric Manufacturing Company, of 219-21 South Beatty Street, Pittsburgh, Pa., has been incorporated under the laws of Delaware, with a capital of $100,000, to engage in the business of manufacturing and selling electric light and power plants of from ½-kw to 12-kw rating. These small generating sets, including storage-battery equipment, are to be sold for service in country residences and will be handled through dealers in various territories. Murray E. Main is president of the concern.

The Norma Company of America, 20 Vesey Street, New York, has secured the services of O. P. Wilson as assistant general manager. Mr. Wilson has been connected with the purchasing department of the Westinghouse Electric & Manufacturing Company for fourteen years and for ten years past has been one of its head buyers. The Norma company manufactures and imports high-grade ball bearings, roller bearings and precision instruments. On April 11 this company will move its offices from the above address to 1790 Broadway, New York City.

The Independent Electric Manufacturing Company, of Milwaukee, manufacturer of alternating-current and direct-current controlling devices, announces that it has obtained the services of Mr. H. L. Van Valkenburg, who will have charge of its engineering department. Mr. Van Valkenburg has been connected with the Westinghouse, Allis-Chalmers and Walker Electric companies and has developed a number of devices. At the present time he is giving his attention to a number of new types of apparatus which the Independent company will shortly put on the market.

Charles E. Knox, of 101 Park Avenue, New York, has been retained by the Equitable Office Building Association as consulting engineer in connection with the elevator installation in the new Equitable Building in New York. Mr. Knox designed and supervised the elevator installations in the Woolworth and the Municipal Buildings, and the Equitable Building system will be larger than either of these. Six groups, of eight elevators each, will be installed, giving a total of 20,240 ft. of single shaft, feeding to approximately 45 acres of floor area, which will accommodate 15,000 people, when normally occupied.

The Electric Service Sales is the name of an enterprise just started with headquarters at 17 North Wabash Building, Chicago, Ill. This company will act as agent for the purchasing and sale of everything electrical.

H. M. Byllesby & Company will remove their general offices on April 20 from the Insurance Exchange to the nineteenth floor of the new Continental and Commercial Bank Building, at the southwest corner of South LaSalle Street and West Adams Street, Chicago.

The Pennsylvania Indicator Company, of Erie, Pa., has been incorporated for the purpose of manufacturing and selling street and station indicators for electric and steam railway cars. The device consists of a sign which automatically indicates the streets and stations as these are approached and at the same time provides a method for calling advertising signs to the attention of the passengers. The United Sales Agency is managing the sales end of this enterprise. W. D. Nixon is president of the new company, G. C. Jones vice-president and secretary, and G. D. Giddings treasurer. R. R. Gessford, mechanical engineer for the company, was formerly connected with the Niagara Falls Power Company and is now with the Niagara Searchlight Company.

New Industrial Companies

The Clifton Electro-Chemical Company, of Boston, Mass., has been incorporated with a capital stock of $40,000 by H. S. Riley, of Woburn, Mass.; M. S. Clawson, of Weehawken, N. J., and T. M. Smith, of Braintree, Mass.

The Electric Automatic Railway Cab Signal Company, of Chicago, Ill., has been incorporated with a capital stock of $300,000 by J. H. Jacob, P. C. Vaughan and A. G. F. Schue. The company proposes to manufacture railway equipment.

The Electric Products Company, of Cleveland, Ohio, has been granted a charter with a capital stock of $1,000 to manufacture and deal in electrical supplies. The incorporators are William Rodewell, Joseph F. Meyer, George S. Meyers, V. C. Birchall and T. H. Ball.

The Munsungun Manufacturing Company, of Presque Isle, Maine, has been incorporated with a capital stock of $1,000,000 to manufacture and deal in all kinds of electrical and mechanical devices. Freemont E. Bennett is president and Asa A. Bishop, treasurer.

The Utilities Improvement Company, of New York, N. Y., has been granted a charter with a capital stock of $100,000 to construct gas, electric light, heat, power plants, waterworks, etc. The incorporators are H. H. Hance, H. R. Frost and M. Korff, of New York, N. Y.

The Electric Dish Washer Company, of Buffalo, N. Y., has been incorporated with a capital stock of $100,000 by Eugene Carey, 58 Gluck Building, Niagara Falls, N. Y.; Richard Carey and George W. Hewitt, both of Niagara Falls. The company proposes to manufacture electric dish washers.

The Ahlberg Kerosene Carburetor Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $300,000 to manufacture carburetors; also to do a mechanical and electrical engineering business. The incorporators are H. Davis, P. W. Burke and M. J. Drain, of Pittsburgh, Pa.

The Aladdin Electric Lamp Company, of Dover, Del., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $2,000,000. The company proposes to manufacture and deal in electric lamps and all kinds of machinery for generating and distributing heat, light and power. The incorporators are F. D. Buch, M. L. Horty and George W. Dillman.

The Automatic Appliance Company, of Portland, Maine, has filed articles of incorporation under the laws of the State of Maine with a capital stock of $200,000. The company proposes to do a general manufacturing business and deal in all kinds of mechanical and electrical machines. E. P. Thompson, of Arlington, Mass., is president, and H. P. Sweetzer, of Portland, treasurer.

Trade Publications

Electrical Supplies.—A net price list and discount sheet applying to its Catalog 21 has just been issued by the Illinois Electrical Company.

Fault Detector.—A folder put out recently by W. N. Matthews & Brother, of St. Louis, Mo., explains why the reader ought to order his Matthews Telefault now.

Wiring Specialties.—The Fancleve Specialty Company, of Jamaica Plain, Mass., has issued a bulletin covering its wiring supplies of various kinds. Prices and descriptions are given of these specialties.

Dynamic Braking Controllers.—Form H dynamic braking dinkey controllers for direct-current motors are described in Bulletin 1038, just issued by the Electric Controller & Manufacturing Company, of Cleveland, Ohio.

Starting Switch.—Bulletin B-54 issued by the Allen-Bradley Company, Milwaukee, Wis., refers to type H resistance starting switch for alternating-current induction motors. This device is fully described and illustrated.

Toaster Stove.—The American Electrical Heater Company, Detroit, Mich., has issued a large poster illustrating its "Tringle" electric iron and showing some samples of newspaper advertisements. Electros of these advertisements are offered dealers in connection with local publicity.

Electrical Apparatus.—"A Westinghouse Electric Device for Every Need" is the title of a pamphlet recently issued by the Westinghouse Electric & Manufacturing Company, covering the application of electrical apparatus to home, office, store, garage, farm and other industrial work.

Electrical Tools.—Bulletins E-31 and E-32, just issued by the Chicago Pneumatic Tool Company, treat of the Duntley electrical drills, grinders and spike drivers for railway work and the Duntley drilling stand, by which the portable tool can be turned into a stationary vertical drill for sensitive work.

Lamp Prices.—The Franklin Electric Manufacturing Company, Hartford, Conn., has issued a post card, size 5.5 in. by 8.5 in., which contains the new prices, effective April 1, 1914, of Franklin tungsten-filament lamps, in sizes from 10 watts to 250 watts. An illustration of a 25-watt Franklin lamp with an unskirted base, 100-130 volts, is given.

Tips and Terminals.—A twelve-page booklet has been issued by the Belden Manufacturing Company, Twenty-third Street and Western Avenue, Chicago, Ill., which illustrates and briefly describes its large variety of clips, tips and terminals. Telephone cores, connectors and pigtails are also referred to. The booklet is known as Bulletin No. 1003.

Counting and Weighing Machines.—The National Scale Company, of Chicopee Falls, Mass., has issued a catalog explaining its counting and weighing machines and the Chapman elevating truck for quick handling of heavy factory loads. A number of good illustrations are given of the above apparatus, supplementing the descriptive matter.

Directly Connected Exhaust Fans.—Bulletin 3508 of the Emerson Electric Manufacturing Company, St. Louis, Mo., has just been issued, giving information on various questions connected with the design, operation, dimensions and prices of that company's directly connected exhaust fans and ventilating fan motors, for both alternating and direct current.

Spectacles.—The American Spectacle Company, of 27-29 West Twenty-third Street, New York, has recently sent out a return postal folder, advocating its spectacles for accident prevention. Among the electrical concerns mentioned as users of its product are the General Electric Company, the National Brake & Electric Company, and the Cutler Hammer Manufacturing Company.

Electrical Machinery and Appliances.—The Barber-Dwinnell Electric & Manufacturing Company, of Kansas City, Mo., has just issued a price list on electrical machinery and apparatus of various kinds. The special features of this publication are that discounts have been figured out and that freight rates are also taken care of, the prices given being net to the trade and in most cases f.o.b. cars Kansas City.

Personal Mention

Mr. Frank J. Duffy, manager of the Southern Railway & Light Company, Natchez, Miss., has also been elected president of the company.

Mr. John E. Sweeney has resigned from the sales department of the Westinghouse Electric & Manufacturing Company to become secretary-treasurer of the Waterloo (Ia.) Electric Supply Company.

Mr. W. P. Naser, formerly covering territory east of the Mississippi River for the Trumbull Electric Manufacturing Company, has been transferred to Northern and Western territory, with headquarters in Chicago.

Mr. W. R. Abbott has been promoted to be general manager of the Chicago Telephone Company, succeeding Mr. H. F. Hill, promoted to the vice-presidency. Mr. Abbott was until recently general commercial superintendent of the company. He is one of the most popular men on the company's staff.

Mr. John A. Britton, vice-president of the Pacific Gas & Electric Company, San Francisco, Cal., has been reappointed a member of the board of regents of the University of California for the full term of sixteen years. In making the reappointment Governor Johnson paid an appreciative tribute to Mr. Britton's past services and devotion to the university.

Mr. L. Bartlett, construction engineer for the Doherty electric-service property at Elyria, Ohio, now operating under the name of "R. E. Burger, agent," has gone to Denver to assist in redesigning the switching equipment in the station of the Denver Gas & Electric Light Company. Mr. Bartlett later expects to continue his trip to his home in southern California.

Mr. H. L. Van Valkenburg has been appointed head of the engineering department of the Independent Electric Manufacturing Company, Milwaukee, Wis. Mr. Van Valkenburg was formerly in charge of rheostat design for the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., later with the detail apparatus department of the Allis-Chalmers Company, Milwaukee, and recently chief engineer of the Walker Manufacturing Company, Philadelphia, Pa.

Mr. Martin J. Wolf, Chicago sales manager for the Hotpoint Electric Heating Company, has resigned to accept the position of jobbing sales manager for W. N. Matthews & Brother, of St. Louis, and expects to remove to that city on April 15. Mr. Wolf was formerly connected with the Hobson Electric Company, of Dallas, Tex. He has been a member of the Chicago electrical contingent a comparatively short time, but was becoming well known and well liked. He is a statesman-at-large of the Jovian Order.

Mr. O. G. Draper has joined the sales staff of the Buffalo Electric Vehicle Company, with headquarters at the Boston office. Mr. Draper has been an active supporter of the electric vehicle since the beginning of the Boston campaign and was business secretary of the Electric Motor Car Club of Boston prior to entering the commercial field in person. He was assistant automobile editor of the Boston *Herald* before becoming connected with the Electric Motor Car Club and joined the latter because of his enthusiastic belief in the future of the electric vehicle.

Mr. P. J. Kearny has been appointed electrical engineer of the New York, New Haven & Hartford Railroad, New Haven, Conn., reporting to Mr. W. S. Murray, consulting engineer, with duties as assigned. Mr. Kearny was graduated from the Massachusetts Institute of Technology in mechanical engineering in 1903. In 1904 he took post-graduate work in electrical engineering at that institute. He next served as an engineering apprentice with the Westinghouse Electric & Manufacturing Company. In 1906 he was appointed assistant to the electrical engineer of the New York, New Haven & Hartford Railroad and in 1910 was appointed engineer of electric traction on the New York, Westchester & Boston Railway electrification. Since 1913 he has been with the firm of McHenry & Murray, of New Haven, Conn., acting as consultant to the New York, New Haven & Hartford Railroad.

Mr. Austin C. Dunham, of Hartford, Conn., for many years president of the Hartford Electric Light Company and a pioneer in central-station development, has just published a noteworthy little volume of "Reminiscences." Although the reader will find few comments upon electrical matters in the book beyond brief references to the development of the steam turbine as a factor in central-station production and to the erection of the Dunham Electrical Laboratory at Yale University, admirers of the venerable leader whose retirement was chronicled in the *Electrical World* of Feb. 17, 1912, will discover that it throws much light upon his personal outlook upon life and includes many carefully considered views of the economic problems of the age. Mr. Dunham is at present sojourning at Cardenas, Cuba, in company with Major J. W. Cheney, of South Manchester, Conn., and with an entourage including his two Japanese servants, a reader and a chauffeur. He expects to return to Hartford about April 15, and will probably devote much attention this summer to the application of electricity to small farming.

ROBERT E. BROWN

Mr. Robert E. Brown, the new president of the Minnesota Electrical Association, is the manager at Mankato, Minn., for the Consumers' Power Company. Mr. Brown has been connected with public utilities in Mankato for a number of years. He took charge of the local gas company in 1887. Two years later this company purchased the local electric-service company, of which Mr. Brown was made manager. In 1910 the property was purchased by H. M. Byllesby & Company. A hydroelectric plant rated at about 2500 hp was built near Mankato. Another was constructed at Cannon Falls. These two furnish electrical energy for some fourteen towns and cities in southern Minnesota. Mr. Brown has been a member of the executive board of the Minnesota Electrical Association since that body was organized six years ago. He is the president of the Mankato Automobile Association and is a member of the National Electric Light Association and the American Gas Association. The Consumers' company in Mankato operates both gas and electric-service properties and sells energy to the street-railway company. It has a steam plant which is operated in conjunction with the hydroelectric development.

Obituary

W. A. Dutton, one of the founders of the Van Dorn & Dutton Company, Cleveland, Ohio, builder of electric drills, gears and pinions, died in St. Augustine, Fla., on March 21.

Byron L. Smith, president of the Northern Trust Company Bank and a prominent financier of Chicago, died on March 22. Mr. Smith was interested in electrical development. He was a director and a member of the executive committee of the Commonwealth Edison Company, and also a director of the Chicago Telephone Company

Herman C. Tafel, a well-known electrical supply man of Louisville, Ky., died suddenly two weeks ago of heart failure. Mr. Tafel was a native of Scott County, Ky., where he was born in 1860. He had been engaged in the electrical supply business in Louisville for ten years. The H. C. Tafel Electric Company, which has filed articles of incorporation with a capital stock of $75,000, succeeds to the business.

Henry G. Patterson, of some prominence in the electrical industry in the early days, dropped dead in Decatur, Ill., on March 13. Mr. Patterson was connected with the old Thomson-Houston Electric Company of twenty-five years ago, serving both at the Lynn works and in the Chicago office. He was later superintendent of the mnuicipal electric-light and water-works plant in Austin, Tex., at the time that it was put out of commission by a flood in the Colorado River. For a time Mr. Patterson was engaged in non-electrical pursuits, but more recently he had been connected with the Illinois Traction System.

Construction

New England

SKOWHEGAN, MAINE.—The Somerset Trac. Co., of Skowhegan, has recently purchased a site on the Madison Road, just beyond Lakewood, on which it proposes to erect a new substation, 30 ft. by 32 ft. The station will have an output of 300 kw. Electricity for this substation will be secured from the transmission line of the Central Maine Pwr. Co., of Waterville, at 33,000 volts. Equipment for station has been purchased.

EASTHAMPTON, MASS.—We are informed that the Easthampton El. Lt. Co. does not contemplate any extensions or improvements during the coming year. Reported in the March 28 issue to have been granted permission to issue $10,500 in bonds, the proceeds to be used for improvements to lighting system. John N. Lyman is secretary and superintendent.

SPRINGFIELD, MASS.—The United El. Lt. Co., of Springfield, is planning to lay about 5 miles of underground conduits, work on which will begin about April 15. W. L. Mulligan is manager.

Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until April 6 for installing electric equipment in new Public School 14, corner of Fairview and Hillside Avenues, Corona Heights, borough of Queens; also for installing electric equipment in Richmond Hill High School, Richmond Hill, borough of Queens. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent, Park Avenue and Fifty-ninth Street, Manhattan, and also at branch office, 69 Broadway, Flushing, borough of Queens.

JAMESTOWN, N. Y.—The city of Jamestown expects to build an addition to the boiler house of the municipal electric-light plant, bids for which will be opened about April 1. The city will also purchase one 1000-kw turbine generator, bids for which will be opened April 16; also condenser and switchboard complete for above generator. One 200-hp return-tubular boiler and two stokers have already been purchased. Clayton O. Johnson is manager.

MORRISTOWN, N. Y.—The Gregory El. Co. expects to purchase material for distribution and lighting systems, lamps and electrical appliances and supplies to meet current needs. J. M. Gregory is manager.

RIVERHEAD, N. Y.—The Riverhead El. Lt. Co. expects to install within the next three months a 200-hp Babcock & Wilcox water-tube boiler (175 lb. pressure). Robert P. Griffing is treasurer.

SODUS, N. Y.—The Sodus Gas & El. Lt. Co. expects to purchase pole-line equipment, hardware, insulators, etc., for 110/220-volt work to meet current demands. G. R. Mills is general manager.

CATAWISSA, PA.—The proposal to sell the municipal electric-light plant was defeated at an election held recently, also the proposition to issue $8,500 in bonds for improvements to the plant. The Columbia & Montour El. Co., of Bloomsburg, has submitted a proposal to sell electricity generated at the Harwood plant to the borough, and this will be considered by the Borough Council.

DILLSBURG, PA.—The Dillsburg Lt., Ht. & Pwr. Co. expects to purchase some meters within the next six months.

FARRELL, PA.—The contract for electric wiring and fixtures for the new school building has been awarded to the Shenango Valley El. Lt. Co., of Sharon.

NEW CASTLE, PA.—An ordinance has been introduced into the City Council to grant the New Castle El. Co. a franchise to furnish electricity for street and commercial lighting for a period of ten years. It also gives the company permission to erect transmission lines from its plant in this city as may be necessary to transmit energy from the plant in Lowellville and from the hydroelectric plant of the Pennsylvania Wtr. Co. at Ellwood City. The ordinance provides for the use of 300-watt arc lamps, the lamps to be installed within six months after the contract takes effect. The company also agrees to place its wires in underground conduits to be owned by the company if the city will allow or will place them in the municipal conduit within a year after the notice is given.

PHILADELPHIA, PA.—Bids are being received by the committee on property of the board of education, Room 292, City Hall, Philadelphia, for electrical equipment for a number of schools in the city.

PHILADELPHIA, PA.—Plans are being prepared by John T. Windrim, architect, of Philadelphia, for the erection of a large substation at Germantown Avenue and Moreland Street for the Philadelphia El. Co.

ATLANTIC CITY, N. J.—Bids will be received by the board of chosen freeholders of Atlantic County, Memorial Hall, Atlantic City, N. J., until April 8 for lighting the county road from Atlantic City to Pleasantville, known as the Meadow Boulevard, for a period of five years. Bids are to be submitted for furnishing and maintaining 57 electric arc lamps of 1200 cp, to be installed at or near the locations of the present lamps. Specifications are on file in the office of A. H. Nelson, county engineer, Bartlett Building, Atlantic City, N. J.

MANASQUAN, N. J.—Plans are being considered by the Council to replace the gas-lighting system with electric lamps. If the present scheme is carried out, 100 electric incandescent lamps will replace the 85 gas lamps now in use. The Point Pleasant El. Lt. & Pwr. Co., of Point Pleasant, furnishes electrical service in Manasquan.

MILLVILLE, N. J.—The City Commission has decided to renew the fight started two years ago for a municipal electric-lighting system and to issue bonds for same.

NEWARK, N. J.—The Public Service El. Co., of Newark, has applied to the Board of Freeholders for permission to install underground conduits in Bloomfield Avenue, Glen Ridge, and in Central Avenue, Orange and East Orange.

NEWARK, N. J.—Bids will be received by the Board of Freeholders until April 15, in connection with general construction bids, for electric-lighting and power work and heating and ventilating work in the new tuberculosis hospital at Overbrook. Plans and specifications may be seen at the office of John F. Capen, 207 Market Street, Newark.

FREDERICK, MD.—The installation of an ornamental street-lighting system in the business district is under consideration.

ELKINS, W. VA.—The Elkins Pwr. Co. may, during the summer, change from natural gas to coal for fuel and use stokers for firing. C. C. Bosworth is superintendent.

WILLIAMSON, W. VA.—Within the next 30 days the Williamson Lt. & Ice Co. expects to purchase brackets, etc., to add 75 series incandescent lamps to the street-lighting system. O. B. Welch is vice-president.

COEBURN, VA.—The Coeburn Lt. & Pwr. Co. expects to purchase within the next 30 days one 5-kw transformer, one 5-amp, one 10-amp, one 15-amp and one 50-amp ammeter and 2000 ft. weather-proof wire. Claude H. Cox is manager.

MANASSAS, VA.—The validity of the $75,000 bond issue of the town of Manassas, authorized for the purpose of installing an electric-light plant, water-works and sewerage systems, has been upheld by a decision handed down by Judge L. C. Barley in the Circuit Court at Alexandria.

WASHINGTON, D. C.—An American consulate writes that a business man desires to be placed in communication with American manufacturers of electric cables and electric tape. For further information address No. 12,791, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or the branch office, Room 337, United States Custom House, New York, N. Y.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Room 509, District Building, Washington, D. C., until April 6 for furnishing cast-iron lamp-posts for use in the electrical department. Specifications and form of proposal may be obtained from the purchasing officer, District of Columbia, Room 320, District Building, Washington, D. C.

WASHINGTON, D. C.—The American consul at Madrid reports that bids are requested for supplying and installing two wireless telegraph stations in Spain. Bids must be submitted through a local agent. A list of these agents can be obtained by addressing No. 12,719, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and at the branch offices, 315 Custom House, New York, N. Y.; 629 Federal Building, Chicago, Ill.; Association of Commerce Building, New Orleans, La., and 310 Custom House, San Francisco, Cal.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 14 for 1090 lb. copper tubing to be delivered at Brooklyn, N. Y., under Schedule 6588. Bids will also be received until April 21 for delivering at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 6585—4000 ft. phosphor bronze cable, 3100 lb. No. 10 copper wire, 250 ft. strip copper (6-in. by 1/32 in.). Schedule 6595—50,000 ft. double-conductor telephone cable, 2000 ft. plain single-conductor wire; Schedule 6573—four exhaust electric fans; Schedule 6591—2800 ft. plow-steel wire rope; Schedule 6859—2900 lb. weather-proof wire; Schedule 6596-3360 lb. soft sheet brass, 1500 lb. soft sheet copper, 8000 lb. brass pipe, 3000 lb. brass tubing; Schedule 6577—9350 lb. 1 15 16 in. rolled bronze. Portsmouth, N. H., Schedule 6578—one 1-ton traveling crane, two hand-hoist trolleys. Newport, R. I., Schedule 6577—12 1½-ton trolley hoists, 300 lb. copper tubing, 157 air-pressure gages. Norfolk, Va., Schedule 6584—1440 ft. crucible steel-wire rope. Charleston, S. C., Schedule 6585—20,000 lb. condenser tubes. Applications for schedules should give the schedule desired by number. T. J. Cowie is paymaster general, U. S. N.

North Central

DETROIT, MICH.—The Murphy Pwr. Co. is planning to erect a new power plant to replace the one at the corner of Wayne and Congress Streets.

DETROIT, MICH.—The Detroit Edison Co. is reported to have awarded the contract for the construction of its new power station, to be erected at the foot of Lycaste Street.

DETROIT, MICH.—The Common Council on March 24 allowed an appropriation of $5,000 for the erection of tungsten lamps in the alleys and at dark intersections. Lamps will also be erected in the district around the municipal buildings.

DETROIT, MICH.—Bids will be received by Charles A. Gadd, secretary Board of Education, Detroit, until April 20, for electric wiring in connection with the new Albert McMichael High School, to be erected in the northeastern part of the city.

KALAMAZOO, MICH.—The City Council, it is reported, has rejected all bids for equipment of the old municipal electric-light plant.

ORCHARD LAKE, MICH.—The John D. Templeton Co., of Detroit, has secured the contract for installing electrical equipment, including motors for the new dairy farm, owned by James Couzens, near Orchard Lake.

SAULT STE. MARIE, MICH.—The Edison Sault El. Co., of Sault Ste. Marie, is planning to extend its service to include Brimley, Rudyard, Dafter, Pickford and Cedarville, where the company has already procured franchises.

ARCADIA, OHIO.—The Arcadia El. Lt. Co. expects to purchase one boiler, a generator, switches, lightning arresters, insulators, wire, incandescent lamps, posts, supplies, switches, etc. P. A. Wheland is owner.

ARCHBOLD,, OHIO.—The Archbold El. Lt. & Pwr. Co. expects to change its system from 220 volts, direct current, to 220 volts, 60 cycles, alternating current, in the near future. R. S. Rodenhuis is manager.

CAMBRIDGE, OHIO.—Within the next six months the New Midland Pwr. & Trac. Co., of Cambridge, expects to erect a 33,000-volt transmission line from Newcomerstown to Cambridge, with necessary substations, etc. The company may possibly make other small extensions. W. S. Hays is superintendent.

ELMORE, OHIO.—The town of Elmore has purchased two 25-kw transformers, necessary switchboard equipment and other apparatus to change the municipal electric-light plant to three-phase system. No other work is contemplated this year. F. H. Williams is clerk.

FREEPORT, OHIO.—Bids will be received by the village of Freeport (Prairie Depot), Wood County, until April 16, for furnishing electricity for lighting the streets, alleys, public ways and municipal buildings. H. E. West is clerk of the Freeport Corporation.

KENTON, OHIO.—The Hardin-Wyandot Ltg. Co., of Kenton, has changed its system from 125 cycles to three-phase, 60 cycles. New generators have been installed and a new 500-kw turbine is now being installed. All necessary equipment has been purchased. An item published in the issue of March 28 stated that the company was planning to install a new 500-kw turbine with entire new condensing outfit.

LONDON, OHIO.—The engineer engaged by the City Council to make investigation of the municipal electric-light plant estimates that it requires an expenditure of $10,000 to $15,000 to put the plant in good condition. He recommends that the city make the improvements required rather than purchase energy from the Ohio El. Ry. Co.

NEWARK, OHIO.—The Ohio Lt. & Pwr Co., Newark, it is reported, is securing the right-of-way for a high-tension transmission line between this city and Shawnee.

PAULDING, OHIO.—The Municipal Electric Light and Power Department would like to receive information on coal conveyors. L. O. Farnsworth is superintendent.

PLEASANT HILL, OHIO. Arrangements are being made by the business men of Pleasant Hill for the installation of an electric-light plant here. Among the promoters are Jesse Beery, Frank Longnaker, John Myers and others.

PROSPECT, OHIO.—The Prospect El. Lt. & Pwr. Co. recently changed its system from 133 cycles to 60 cycles. R. C. Oswald, of Marion, is secretary and treasurer.

WELLINGTON, OHIO.—The town of Wellington may possibly install a 75-hp to 100-hp gas engine in the municipal electric-light plant to carry the light load. A. R. Branson is clerk.

WEST LIBERTY, OHIO.—The local electric-light plant, owned by C. A. Hartzler, has been purchased by J. W. Tompkins, of Fort Wayne, Ind. The new owner, it is understood, contemplates improvements and changes to the system.

WEST MILTON, OHIO.—L. A. Pearson, owner of the Stillwater Valley electric-light plant, expects to erect about 5 miles of transmission line to neighboring villages and to purchase material for same within the next six months; also to purchase within the next 30 days 38 series street tungsten lamps, 100-cp, 2300-volt, 6.6-amp, to take the place of the present arc lamps.

YOUNGSTOWN, OHIO.—The Petroleum Iron Works Co., of Youngstown, is building an extension to its power plant to provide for the installation of compressors.

LEXINGTON, KY.—The College of Civil Engineering of the State University of Kentucky, Lexington, Ky., is preparing to install a road laboratory, which will include a standard abrasion cylinder, a ball-grinding machine, a diamond-core drill saw, a standard grinding saw and other electric-motor driven equipment.

LOUISVILLE, KY.—The Louisville Grocery Co. is planning to install electric elevators and other equipment and improvements in its five-story building on Main Street, recently purchased.

LOUISVILLE, KY.—Plans are being considered by Samuel D. Jones, business director for the board of education of Louisville, for installing electric lamps in all of the schools in the city and to make other improvements during the summer.

ANDERSON, IND.—The Board of Public Works is considering the proposition of installing an ornamental lighting system in the business district. Both tungsten cluster lamps and magnetite lamps are under consideration. Ornamental standards will be provided, which will be maintained by underground wires. It is reported that $20,000 will be appropriated for this improvement.

INDIANAPOLIS, IND.—Bids will be received by the Board of Public Works until April 20 for the street-lighting for a period of ten years, to date from the expiration of the present contract, which expires April 1, 1915.

INDIANAPOLIS, IND.—The Board of Park Commissioners is considering the question of substituting electric lamps for the gas and gasoline lamps now in use in the city parks. The proposed new system may be extended to the boulevards. For further information address B. J. T. Jeup, city engineer.

CHICAGO, ILL.—Bids will be received by the city of Chicago, Room 406, City Hall, Chicago, for furnishing one 200-kw motor-generator set to operate under 60 cycle, three-phase, 440 volts, alternating current, and deliver at 220 volts, direct current, at the municipal reduction plant of the city of Chicago, situated at Thirty-ninth and Iron Streets, according to plans and specifications on file in the office of the Department of Public Works, Room 406, City Hall. George B. Young is commissioner of health.

DONOVAN, ILL.—The installation of a municipal electric-light plant in Donovan is under consideration. J. W. Nelson is president of the board.

ELGIN, ILL.—Preparations are being made to begin work on improvements to be made to the Elgin State Hospital, including the erection of a new power plant. Dr. H. J. Gahagan is superintendent.

MORRISON, ILL.—The City Council has awarded a contract to the Illinois Utilities Co., of Chicago for lighting the streets of the city for a period of five years. The contract calls for 134 75-watt tungsten lamps for the residence portion of the city and for five three-lamp clusters in the business district. The contract calls for alternating current instead of direct current, which will necessitate the reconstruction of the entire distribution system in the city and the installation of rubber-insulated wire.

STERLING, ILL.—At an election held March 19 the proposal to install an ornamental street-lighting system was carried. H. B. Green, of Sterling, is engineer in charge.

DODGEVILLE, WIS.—A deal has been consummated whereby the Mineral Point Pub. Ser. Co., of Mineral Point, will take over the property of the Dodgeville El. Lt. & Pwr. Co. for a consideration of $15,857. Power will be generated at the local plant until July 1, when electricity will be transmitted from the plant at Mineral Spring to operate the local system. After July 1 a continuous service will be established.

EDGAR, WIS.—The installation of an electric-light plant in Edgar is reported to be under consideration.

EVANSVILLE, WIS.—Bids will be received by F. W. Gillman, city clerk, until April 17 for construction of addition to power house. This extension is to provide space for the new motor-driven triplex pump which has already been purchased. E. S. Cary is superintendent of municipal light and water plant.

RIPON, WIS.—Within the next three months the Ripon Lt. & Wtr. Co. expects to erect 20 miles of 13,200-volt transmission line and also to purchase one boiler and a generating unit. W. E. Haseltine is general manager.

SHEBOYGAN, WIS.—The Sheboygan Ry. & El. Co. is planning to rebuild its line between Sheboygan and Sheboygan Falls, at a cost of about $20,000.

TOMAHAWK, WIS.—Extensive improvements are contemplated to the lighting and power service of the Tomahawk Lt., Tel. & Improvement Co., which will include the installation of a 200-hp Skinner engine directly connected to a dynamo, and a 150-hp boiler with new smokestack at the downtown auxiliary plant. The boiler installation will call for remodeling and enlarging the boiler house. The water-power plant on the Tomahawk River will be remodeled and a new generator installed. Orders have already been placed for machinery. Victor E. Extrom is manager.

BAGLEY, MINN.—The municipal electric-light plant was recently destroyed by fire.

COMFREY, MINN.—Bonds to the amount of $8,000 have been voted for the installation of a municipal electric-light plant.

GRANITE FALLS, MINN.—A company, it is reported, has been organized by farmers of Stony Run to operate an electric-light system. It is proposed to extend a transmission line from Granite Falls. L. C. Rosetter is chairman and S. O. Tjosvold is secretary.

LAKE PARK, MINN.—The installation of a municipal electric-light plant in Lake Park is under consideration.

MONTEVIDEO, MINN.—The Montevideo El. Lt. & Pwr. Co. expects to erect within the next six months two substations, 13 miles of transmission lines and distributing system in Clara City; also to purchase within the next four months two water-tube boilers, stokers, coal bunkers and conveyors and equipment for complete steam-generating power plant. E. A. Aspnes is engineer and manager.

RED WING, MINN.—The City Council has passed a resolution appropriating $8,440 for the installation of an arc curb-lighting system.

STAPLES, MINN.—Within the next eight months the Board of Electric Light Commissioners expects to purchase some street-lighting equipment. J. Ellinger is superintendent.

SWANVILLE, MINN.—A stock company, it is reported, has been organized for the purpose of securing electricity from the electric plant at Little Falls. Mr. Miekle is interested in the company.

TRAVERSE, MINN.—The question of securing electricity from the municipal electric plant in St. Peter is under consideration by the farmers of Traverse and Lake Prairie Township. F. N Wilson is superintendent of the St. Peter plant.

WACONIA, MINN.—It is reported that an electric-light system will be installed in the new store building now being erected by Charles Hansen. The proposed plant will be driven by a gasoline engine and will furnish electricity for lamps and motors for several business buildings on Main Street.

CLARINDA, IA.—The property of the Lee El. Co., of Clarinda, is reported to have been purchased by John D Curtis & Co., of New York, N. Y. It is understood that the new owners propose to improve and extend the system, making it the radiating center of a large system. Rufus E. Lee will be retained as local manager.

HARLAN, IA.—The city of Harlan expects to purchase within the next six months one 200-kw generator, engine and switchboard. C. D. Lutton is superintendent of light and water plant.

MUSCATINE, IA.—Bids will be received by the supervisors of Muscatine and Louisa Counties, at the office of the county auditor, Muscatine, until April 14 for a steam-driven drainage pumping plant, complete, consisting of three centrifugal pumps, two of which shall have a capacity of 85,000 gal. per minute each against a maximum static pumping head of 16 ft. Alternate bids are solicited at the same time and place on an electric-driven pumping plant of the same general type. The specifications also permit bids on oil-engine-driven pumping plant. For further information address the Marmon Engineering Co., of Peoria, Ill.

NEVADA, IA.—Arrangements, it is reported, have been made by the Iowa Ry. & Lt. Co., of Cedar Rapids, for the erection of an electric transmission line between Nevada and Maxwell. J. C. Young, of Cedar Rapids, is representative of the company.

OAKLAND, IA.—The power house of the Oakland El. Co., it is reported, will be remodeled.

POMEROY, IA.—The Northern Iowa Pwr. Co., of Humboldt, is reported to have applied for a franchise to erect and operate transmission lines in Calhoun County.

HOLT, MO.—The Town Board, it is reported, is considering a proposal submitted by Kansas City promoters for the installation of an electric-lighting system in Holt.

KEYTESVILLE, MO.—The installation of an electric-lighting sytem in Keytesville is under consideration. A proposal has been submitted by Ira B. Parks, superintendent of the Salisbury municipal plant, to furnish electricity to operate the system here.

LA GRANGE, MO.—Within the next 30 days the city of La Grange expects to purchase a triple plunger power pump (6-in. suction); also to install a water-works system. C. H. Hoskins is engineer of municipal electric-light plant.

MACON, MO.—The town of Macon is considering the question of furnishing electricity in the towns of Calloa and Bevier from the municipal electric-light plant. C. F. Thudium is superintendent of the municipal plant.

MONTGOMERY, MO.—The Montgomery Ice & El. Co. is now installing a new Frick ice machine (20 tons capacity) and will be ready to manufacture ice about April 15. E. H. Algermissen is manager.

POPLAR BLUFF, MO.—At an election held March 20 the proposal to issue $75,000 for the construction of a municipal electric-light plant was carried. The proposed plant, it is understood, will be built adjoining the city water-works.

DICKINSON, N. D.—Hughes & Deiters, owners of the local electric-light plant, are now installing two 72-in. by 18-ft. horizontal tubular boilers in their electric plant.

ABERDEEN, S. D.—Bids will be received by F. W. Raymond, auditor, Aberdeen, until May 11 for furnishing and installing electric-light fixtures in accordance with plans and specifications prepared by George F. Fossum, architect, Aberdeen. Plans may be seen at the office of the architect.

CANTON, S. D.—Within the next 12 months the Sioux Valley Pwr. Co., of Canton, expects to purchase a 150-kw generator and switchboard panel. C. H. Morgan is manager.

RAPID CITY, S. D.—Within the next 30 days the Dakota Pwr. Co. expects to purchase about 45 five-lamp standards for street-lighting in Rapid City. George B. Mansfield is secretary and treasurer.

WOONSOCKET, S. D.—The installation of an electric-light plant in Woonsocket is reported to be under consideration. The present plans provide for furnishing electricity in Wessing Springs, Alpena, Lane, Frostburg and Artesian.

ATKINSON, NEB.—Within the next two months J. Skredla & Sons, of Atkinson, expect to erect about 1 mile of distribution line and to purchase about one carload of 30-ft. (6-in.-top) poles, cross-arms and wire for same.

BLUE RAPIDS, KAN.—The property of the Marshall County Pwr. & Lt. Co., of Blue Rapids, has been purchased by Prof. B. F. Eyer, formerly of the State Agriculture College, and E. A. Wharton. It is understood that the capital stock of the company will be increased from $25,000 to $50,000. Improvements are contemplated to the plant which will include rebuilding power house and installing new generators. A new auxiliary steam plant may possibly be installed. The company now secures its power from the Blue River.

KANSAS CITY, KAN.—It is reported that arrangements have been made whereby the municipal electric-light plant in Kansas City will supply electricity to operate the new interurban line of the Kansas City, Kaw Valley & Western Ry. Co. The railway company, it is understood, will expend about $25,000 for the installation of transformers in the municipal plant.

KIRWIN, KAN.—The City Council has granted the Kirwin El. Lt. & Pwr. Co. a franchise to construct and operate an electric-light plant in Kirwin for a period of 20 years. S. E. Cogswell, H. Brown, H. A. Royce and R. P. Royce are interested in the company.

Southern States

BENSON, N. C.—The Benson El. Lt. Co., recently organized, is installing a 50-hp. electric plant, equipment for which has already been purchased. W. S. Murchison is secretary and treasurer.

BETHEL, N. C.—Bonds to the amount of $5,000 have been voted for the installation of an electric-lighting system in Bethel.

GASTONIA, N. C.—Within the next three or four months the Board of Water and Light Commissioners expects to install a post lighting system in the business section. H. Rutter is superintendent of the municipal electric-light plant.

LILESVILLE, N. C.—The city has awarded a contract to install an electric-light system in Lilesville to Michael & Bivens, of Charlotte. Electricity for operating the system will be purchased from the Yadkin River Pwr. Co., of Rockingham, N. C.

ST. PAULS, N. C.—Within the next 30 days the St. Paul Lt. & Pwr. Co. expects to erect a boiler and engine room; also to purchase within the next two months a small belt-geared water pump for fire protection (a cheap second-hand pump will serve) and about 100 ft. of hose. The company is now installing waterwheel and generator at water-power plant. Opie Odum is secretary and manager.

SOUTHPORT, N. C.—Arrangements are being made by the Southport Lt. & Pwr. Co. for the installation of an ice plant in connection with its electric plant.

WARSAW, N. C.—The Duplin Pwr. Co. is reported to be contemplating the installation of an electric-light plant with an output of about 125 hp. For further information address C. W. Petty, engineer, 848 North Street, Greensboro, N. C.

GREENVILLE, S. C.—The Buncombe Road El. Lt. Co., recently incorporated to erect a transmission line, will secure electricity from the Southern Pwr. Co., of Charlotte. The incorporators are: R. K. Taylor, R. A. League and W. G. McDavid.

GREER, S. C.—Bids will be received by the city of Greer until April 14 for construction of water-works, electric-light plant and sewerage system. J. W. White is clerk.

ROCK HILL, S. C.—The Rock Hill Buggy Co., it is reported, expects to purchase a 150-hp steam turbine and direct-current generator, directly connected.

YEMASSEE, S. C.—The Southern Orchard Co., recently incorporated, is planning to develop 400 acres in Jasper County for raising figs. The company proposes to operate canning factory, ice and electric plants and sawmill. Cost of improvements is estimated at $50,000. J. W. Agey, of Knoxville, Tenn., is president.

BUTLER, GA.—A stock company, it is reported, is being organized for the purpose of developing the water-power at McCant's Mill to supply electricity for lighting in Butler. J. M. Harrison, of Montezuma, Ga., is reported to be interested in the project.

CHICKAMAUGA, GA.—The City Council is reported to have granted a franchise to a company to install and operate an electric-light plant here.

GAINESVILLE, GA.—The Sugar Hill Tel. Co., recently incorporated with a capital stock of $500,000, it is reported, contemplates the construction of a rural telephone system from Gainesville down Athens Road through Tadmore district to lower part of Hall County.

MACON, GA.—We are informed that the Central Georgia Pwr. Co. and the Central Georgia Transmission Co. do not contemplate the installation of aditional generators in the plant at the Butts County dam, as reported in the issue of March 21.

MADISON, GA.—Within the next two months the managers of the municipal electric-light plant expect to purchase one car load of poles. G. W. Hubbard is superintendent.

MILLEDGEVILLE, GA.—The Oconee River Milling Co., of Milledgeville, it is reported, will rebuild its hydroelectric plant, recently destroyed by fire, causing a loss of about $50,000.

COPPERHILL, TENN.—The Home Lt. & Pwr. Co., of Copperhill, has recently installed a tungsten street-lighting system. M. C. King is president.

DICKSON, TENN.—At an election held March 18 bonds to the amount of $15,000 were authorized, the proceeds to be used for extensions to the electric-lighting system and water-works and installing a sewerage system.

HALLS, TENN.—Preparations are being made by the city of Halls for making improvements to the plant of the Halls Wtr., Lt. & Ice Co., recently taken over by the city. The equipment will include one 100-kva, three-phase, 60-cycle, alternating-current generator and engine, directly connected, switchboard to control above unit, one tub transformer to take care of 75 lamps, poles for 7 miles of transmission line (88 ft. apart), six lightning arresters for above poles and about 5 miles of copper wire for transmission line. Contracts for the above apparatus will probably be awarded in April, and work will begin on the plant about May 1. About 12,000 ft. 4-in. cast-iron pipe and 25 hose plugs (two outlets, 2½ in.) will also be required. Bonds to the amount of $25,000 have recently been issued for municipal plant. William Hall is manager.

KNOXVILLE, TENN.—The Southern Ry. Co., of Washington, D. C., is planning to install an electric block system at Knoxville and will require special transformers in connection with the system. It is proposed to light the switches. The company, it is stated, will build a power station at Morristown, Tenn.

MEMPHIS, TENN.—Application has been made to the city commissioners by the Memphis Automatic Tel. Co. for a 30-year franchise to operate a telephone system in Memphis. The company proposes to purchase the property of the Memphis Tel. Co. and reorganize under the name of the Memphis Automatic Tel. Co., with an authorized capital stock of $2,000,000; also to expend $500,000 in telephone extensions. Among the incorporators are C. W. Thompson, J. B. Goodbar, T. R. Winfield, L. W. Johnson, George G. Alban and others.

NASHVILLE, TENN.—A permit has been taken out by the Nashville Ry. & Lt. Co. for the erection of a concrete smokestack, 150 ft. high, with an inside diameter of 12 ft., to replace two steel stacks, 200 ft. high and 12 ft. in diameter.

SHELBYVILLE, TENN.—Within the next six months the Duck River Pwr. Co. of Shelbyville expects to erect a single-phase transmission line to Manchester, a distance of 16 miles; also to purchase one 40-kw, 10,000-volt transformer in addition to line material. A. F. Trimble is general manager.

ONEONTA, ALA.—The Oneonta Ice, Lt. & Coal Co. is installing an electric plant in Oneonta. The equipment will consist of an 80-hp high-pressure boiler, engine, one 50-kva General Electric generator and switchboard, Western Electric transformers, wire, 400 red-cedar poles, 100 Western Electric meters and 1000 incandescent lamps. Contract for the work has already been awarded. R. E. Richie, of the Birmingham El. Co., is engineer in charge of the work. B. B. Hale is president of the company.

ALEXANDRIA, LA.—The Alexandria El. St. Ry. Co., it is reported, contemplates the construction of a power plant at the mill of the Bayou Rapids Rubber Co.

BATON ROUGE, LA.—The Baton Rouge El. Co. is contemplating extensive improvements to its plant: also the removal of the power house to some point on the river front accessible to the railroads.

CHECOTAH, OKLA.—Within the next two months the Checotah Wtr., Lt. & Ice Co. expects to purchase fixtures for installing about 50 6.6-amp street lamps (from 100 watts to 250 watts). The company will also purchase from time to time general supplies as demands may require. L. B. Griffing is secretary and manager.

HOLDENVILLE, OKLA.—The Holdenville Ice & El. Co. has one 90-kw and one 75-kw Westinghouse generator (single-phase, 60-cycle, 1100/2200 volts), which it would like to exchange for one three-phase generator (about 75 kw, 60 cycles, 2300 or 2200 volts). W. M. Dunn is president and manager.

PAULS VALLEY, OKLA.—The Washita El. Pwr. Co. of Paul's Valley, expects to purchase within the next three months one 100-kw generator and engine. The company would like to purchase second-hand equipment. R. S. Johnston is secretary.

DALLAS, TEX.—Extensions and improvements will be made to the property of the Continental Gin Co., of Dallas, involving an expenditure of about $300,000. The work will include equipment of power house, constructing dry kilns, building forge shop, installing electrical and heating equipment, sheds for air drying, etc.

DALLAS, TEX.—The commissioners of Dallas County, it is reported, have awarded the contract for the construction of an electric light and power plant for the new county jail and criminal court buildings to Kinnison Brothers, of Dallas, at $34,533. The equipment will include two 200-hp boilers, two generators and engines.

HOYT, TEX.—The Consumers' Lignite Co., of Dallas, it is reported, is installing an electric-light plant at its coal mines. Hoyt has not a post office.

HUBBARD, TEX.—The Union Central Lt. & Ice Co., of Hubbard, is asking for bids for 10,000 ft. to 20,000 ft. No. 14 weather-proof copper wire. W. A. Bass is president and manager.

LONGVIEW, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 12, for the construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Longview. Drawings and specifications may be obtained from the above office or from the custodian of site at Longview. O. Wenderoth is supervising architect.

SEGUIN, TEX.—Plans have been announced by the Guadalupe Wtr. Pwr. Co. for the construction of a large hydroelectric power system on the Guadalupe River, between Seguin and New Braunfels. The company proposes to build five dams between the two towns, which it is estimated will develop a total of 100,000 hp. In addition, there will be constructed in the upper portion of the river, above New Braunfels, a large reservoir with a capacity of 150,000 acre-ft. of water, which will conserve the flood waters and regulate the flow of water at the power dams. The cost of the entire project is estimated at $8,000,000. The greater part of the energy generated will be transmitted to San Antonio; other towns within a radius of 60 miles will also be supplied. Water will also be furnished from the power and storage dams for irrigating land in the valley of the Gaudalupe River. The company has already expended about $450,000 on preliminary work. The officers are: Dr. E. W. Brown, of Orange, Tex., president; W. B. Dunlap, of Beaumont, vice-president, and G. M. Abbott, secretary.

SHERMAN, TEX.—Bonds to the amount of $5,000 have been voted for street lighting.

SNYDER, TEX.—The City Council has awarded a contract to the Snyder Ice & Lt. Co. to install 20 street lamps of 80 cp.

TERRELL, TEX.—The power plant of the Terrell El. Lt. Co. was recently destroyed by fire, causing a loss of about $30,000. M. A. Joy is president of the company.

WEATHERFORD, TEX. — The power house of the Weatherford Wtr., Lt. & Pwr. Co. was destroyed by fire on March 16, causing a loss of about $25,000. The city will be without elcetrical service until a temporary installation is made.

Pacific States

NEWPORT, WASH. — The Pomona Grange, operating in Stevens County, has decided to construct approximately 100 miles of telephone lines throughout the county. For further information address Fred F. Johnston, Spring Valley, Wash.

SEATTLE, WASH.—The Board of Public Works, it is reported, is receiving bids for furnishing the Municipal Light Department with approximately 10,000 integrating, induction-type, 60-cycle, alternating-current electric wattmeters. H. W. Carroll is clerk.

SUNNYSIDE, WASH.—The Pacific Pwr. & Lt. Co., of Sunnyside, has recently completed 7½ miles of 6600-volt, three-phase transmission line into the farming districts to furnish electrical service to the farmers. V. V. Vercoe is local manager.

ALBANY, ORE.—A committee has been appointed by the Commercial Club to make investigations as to the feasibility of establishing a municipal electric plant here and cost of same and report to the club as soon as possible. For further information address A. M. Hammer, care of the Commercial Club.

AUMSVILLE, ORE.—At a special election to be held May 23 the proposal to grant a franchise to the Aumsville Flour Mills to install and operate an electric-light plant in Aumsville will be submitted to the voters.

KENO, ORE.—Plans are being considered by the Keno Pwr. Co., recently incorporated with a capital stock of $250,000, for doubling the output of its power plant and extending its transmission lines to Klamath Falls. J. W. Kearns, of Keno, is interested in the company.

MOLALLA, ORE.—The City Council is considering four applications for franchises to furnish electricity for lamps and motors in Molalla. Two applications (one by Fred Schafe, of Molalla, and the other by M. J. Lee, of Canby) have passed their first reading. The party which secures the franchise will develop water-power sites on the Molalla River, near the city.

REEDSPORT, ORE.—A permit has been granted to James Lindsay, of Portland, by the Department of Agriculture, for the construction of a hydroelectric power plant on Mill Creek within the boundaries of Siuslaw National Forest. Energy generated at the plant will be transmitted to Reedsport, a distance of 18 miles. The equipment will include three 1150-hp horizontal turbines (Francis type), operating under a head of 263 ft., directly connected to three 750-kw, three-phase, alternating-current generators.

ANTIOCH, CAL.—The Great Western Pwr. Co., of San Francisco, has applied to the State Railroad Commission for a certificate of public convenience and necessity which will authorize the company to exercise franchise rights in Antioch. The company has been granted a franchise by the trustees of Antioch to erect a tie line from its substation just outside of Antioch to the plant of the Bowers Rubber Co., near Pittsburg

BUENA PARK, CAL.—The Chamber of Commerce has passed a resolution authorizing ornamental lamps erected on Grand Avenue to be maintained by underground conduits. Plans are being considered for installing ornamental lamps, at intervals of 300 ft., along the highway from Northam to the county road on the south, a distance of 4 miles.

CALISTOGA, CAL.—Bids will be received at the office of the county clerk of the county of Napa, Court House, Napa, until April 15 for a 50-year franchise to erect and operate electric transmission lines over and under the roads and highways in Napa County, as applied for by the Calistoga El. Co., of Calistoga.

FRESNO, CAL.—Plans for the electrolier street-lighting system in the business section of the city, to cost from $60,000 to $75,000, have been adopted by the Merchants' Association. The plans provide for 487 standards for five-lamp clusters.

GRASS VALLEY, CAL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 6 for construction complete, including mechanical equipment, interior lighting fixtures and approaches to the United States post office at Grass Valley. Drawings and specifications may be obtained at the above office or from the custodian of site at Grass Valley. O. Wenderoth is supervising architect.

LAGUNA BEACH, CAL.—At an election to be held April 18 the proposal to install an electric street-lighting system in Laguna Beach will be submitted to the voters. It is estimated that 129 lamps will be required.

LOS ANGELES, CAL.—The Pacific El. Ry. Co., of Los Angeles, is contemplating equipping the Salt Lake line between Pasadena and Los Angeles for electrical operation.

PLACERVILLE, CAL.—The Truckee River General El. Co., of Reno, Nev., it is reported, will soon begin work on construction of several reservoirs and ditches and two power plants on Pilot Creek, to be known as plants No. 1 and No. 2.

SAN FRANCISCO, CAL.—Electrically operated cranes and carriers are to be installed on Piers 30 and 32 by the American-Hawaiian Steamship Co. in the near future.

SAN FRANCISCO, CAL.—Business men and property owners on Mission Street have agreed to expend $15,000 for the installation of ornamental arches on that street between Sixteenth Street and Twenty-fourth Street.

STRATHMORE, CAL.—The Mount Whitney Pwr. Co., of Visalia, is planning to erect a substation with an output of 1000 kw in Strathmore. The equipment will consist of two 500-kw transformers and four secondary circuits. The building will be of fireproof construction with out-door switches. Orders have been placed for transformers.

VENTURA, CAL.—The Ventura County Pwr. Co. has applied to the State Railroad Commission for authority to issue $200,000 in notes, the proceeds to be used to refund outstanding obligations aggregating $120,850, and the remainder for the erection of a transmission line and construction of a hydroelectric generating plant.

POCATELLO, IDAHO.—The City Council has passed an ordinance creating an ornamental lighting district (as an extension to the present cluster-lamp system) to cost about $15,000.

GLASGOW, MONT.—The City Council is contemplating the installation of a new street lighting system, to cost approximately $21,398. E. E. Crawford is city clerk.

RED LODGE, MONT.—The Northwestern Improvement Co., of Red Lodge, expects to purchase some meters, wire and lamps (on a small scale). The company operates an electric plant in connection with its coal mines which furnishes electricity for mine haulage, pumping and for lighting purposes in Red Lodge. The purchasing is done by F. G. Prest, purchasing agent of Northern Pacific Ry. Co., St. Paul, Minn.

WELLS, NEV.—Plans are being considered by Frank Jeanny to install an electric-light plant in Wells.

RATON, N. M.—Withio the next six months the Raton El. Lt. & Pwr. Co. may purchase meters for its system. J. R. Smith is manager.

Canada

KASLO, B. C.—The by-law authorizing the purchase of the plant of the Kootenay El. Co., of Kaslo, to be owned and operated by the municipality, has been approved by the ratepayers.

HALIFAX, N. S.—A bill has been introduced in the Legislature to incorporate the Nova Scotia Tramway & Pwr. Co., Ltd., to be capitalized at $5,000,000 with power to increase it to $10,000,000, also an authorized bond issue of $9,000,000. The bill authorizes the new company to purchase the property of the Halifax Tramway Co. The Neva Scotia Lt. & Pwr. Co. agrees to transfer to the new corporations its rights to certain power sites and lands. The directors of the new company are largely the same as those of the Halifax Tramway Co

BRANTFORD, ONT.—The Board of Water Commissioners has entered into a contract with the Hydro-Electric Power Commission of Ontario for 400 hp to operate the new pumps.

BRANTFORD, ONT.—The ratepayers have voted in favor of the purchase by the city of the Brantford Street Railway and the Grand Valley Railway, operating an electric railway from Brantford to Galt, for $253,000.

PARRY SOUND, ONT.—The town of Parry Sound has been granted permission by the Legislature to purchase the dams and other works of the Parry Sound River Improvement Co. on the Seguin River and to use the same to generate electricity for the town. The company blocked the waters with its dam to such an extent that the municipal electric-light plant has been rendered useless on different occasions.

WOODBRIDGE, ONT.—A by-law authorizing the municipality to enter into a contract with the Hydro-Electric Power Commission of Ontario for hydroelectric power will be submitted to the ratepayers on April 11. If the by-law carries, debentures to the amount of $6,000 will be sold to provide funds for installation of a distributing system.

SWIFT CURRENT, SASK.—The town of Swift Current, it is reported, has decided to issue $15,000 in debentures for the purchase of a site for an electric light and power plant and water-works.

Miscellaneous

PANAMA.—Bids will be received at the office of the assistant purchasing agent, Isthmian Canal Commission, 24 State Street, New York, N. Y., until April 14 for the purchase of electrical material, including transformers, motors, engines, locomotives, generators, controllers, exciter set, etc., offered for sale by the Isthmian Canal Commission. Blanks and general information may be obtained from the above office. Major F. C. Boggs is general purchasing officer. For further information see proposal columns.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until April 18 for furnishing chain sets, track spikes, cable clips, magnesia pipe covering, wire nails, cable chisels, machine bolts, steel plates, steel bars, detonators, motors, transfer cars for dry kiln, and piling trucks, steel angles, steel squares, etc., as per circular (No. 837). For further information address Major F. C. Boggs, general purchasing officer.

New Incorporations

THORSBY, ALA.—The Thorsby Lt. & Wtr. Pwr. Co. has been incorporated by A. K. Horn and others. The company is capitalized at $2,000 and proposes to construct and operate an electric-light plant in Thorsby.

HELENA, ARK.—The West Helena Consol. Co. has been incorporated with a capital stock of $650,000 to construct electric railway lines. The officers of the company are E. C. Horner, of Helena, president, R. B. Macon, vice-president, and John C. Horner, secretary.

DOVER, DEL.—The Southern Ry. & Lt Co. has filed articles of incorporation with a capital stock of $500,000, under the laws of the State of Delaware, to generate and distribute electricity for lamps, heaters and motors. The incorporators are H. E. Latter, N. P. Coffin and O. J. Reichard, of Wilmington.

FORT GAINES, GA.—The Credille-Fowler Pwr. & Mfg. Co. has been incorporated with a capital stock of $25,000 by W. T. Credille, M. L. Fowler, Hamilton McRae and M. M. Smith. The company proposes to construct an electric plant. J. N. Ely, of Atlanta, Ga., is consulting engineer.

PALESTINE, ILL.—The La Motta Co-operative Tel. Co. has been incorporated with a capital stock of $250,000 by G. L. Weener, M. Fife and E. S. Dry.

BARLOW, KY.—The Barlow Lt. & Pwr. Co. has been chartered with a capital stock of $2,000. The incorporators are J. W. Meshew, W. R. Crice and T. R. Johnson.

LEWISBURG, KY.—The J. E. Powell El. Lt. Co. has been incorporated with a capital stock of $1,500 by J. E. Powell, E. Hunt and W. T. Watkins.

GOOD THUNDER, MINN.—The Good Thunder El. Co. has been formed with a capital stock of $10,000 for the purpose of furnishing electricity in Good Thunder. It is understood that a steam-driven plant will be installed. The officers are: Dr. T. J. Schlesselman, president; E. W. O'Neill, vice-president, F. H. Groffin, secretary, and F. H. Morelock, treasurer.

KANSAS CITY, MO.—The Funsten El. Co. has been incorporated with a capital stock of $10,000 by Robert L. and Fitzhugh L. Funsten and John C. Donnell.

RED LODGE, MONT.—The Carbon & Stillwater El. Ry. Co. has been incorporated with a capital stock of $750,000 to build an interurban electric railway between Red Lodge and Columbus, a distance of 40 miles.

CAMDEN, N. J.—The Beach Haven El. Lt., Ht. & Pwr. Co. has been incorporated with a capital stock of $100,000 by Frederick R. Bagwell, G. R. Holmes, of Baltimore, Md., and S. R. Leap, of Penns Grove, Pa. The company proposes to operate light, heat and power plants.

RANDOLPH, N. Y.—The Randolph Lt. & Pwr. Co. has been incorporated with a capital stock of $20,000 to supply electricity in Randolph. The incorporators are Albert J. Woodsworth, G. D. Woodsworth and Joseph W. Randolph, all of Randolph.

ASHEVILLE, N. C.—The White Coal Pwr. Co. has been incorporated with a capital stock of $125,000 by Daniel W. Adams and others. The company proposes to construct and operate an electric railway in Old Fort and the surrounding country and to develop water and other power for commercial purposes.

CINCINNATI, OHIO.—The Diamond Lt. Co. has been granted a charter with capital stock of $30,000 to supply electricity for lighting. The incorporators are C. B. Arnold, George Dressellhouse, R. K. Hynicka, J. M. Wikel and E. W. Risley.

CLEVELAND, OHIO.—The West Ninth Street El. Co. has been chartered with a capital stock of $10,000 for the purpose of generating and distributing electricity. The incorporators are M. Greenhut, Ella Greenhut, R. Greenhut, Max P. Goodman and A. L. Dietz.

MINERAL CITY, OHIO.—The Industrial Pwr. & Lt. Co. has been incorporated with a capital stock of $200,000 by J. I. Davy, S. L. Martin, Frank Graham, W. G. Limbaugh and Frances Ferguson. The company proposes to generate and distrihute electricity.

ARDMORE, OKLA.—The Ardmore El. Ry. Co has been incorporated by George A. Craven, James C. Mort, John F. Easley, of Ardmore, Asa B. Hale and William Craven, of Milton, Ia. The company is capitalized at $100,000 and proposes to build an electric railway in Ardmore and its suburbs, covering about 7 miles. The charter of the company also gives it the right to sell electricity for lamps and motors. The cost of the system is estimated at $150,000.

QUINTON, OKLA.—The Quinton Ice, Lt. & Pwr. Co. has been incorporated with a capital stock of $5,000 by James Fogarty, Milo T. Crane and Mary E. Fogarty, of McAlester.

RIDDLETON, TENN.—The Little River Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 to develop the water-power of Little River and to operate a telephone exchange in Riddleton.

AUSTWELL, TEX.—The Austwell Utilities Co. has been incorporated with a capital stock of $25,000 by P. R. Austin, D. S. Emison and W. H. Dunson.

EMORY, TEX.—The Emory El. Lt. & Pwr. Co. has been chartered with a capital stock of $2,000 by G. W. Alexander and K. L. McCormick.

PITTSBURG, TEX.—The Home Lt. & Ice Co. has been incorporated with a capital stock of $15,000 for the purpose of building an electric plant and ice factory. Phillip Dolinski is president and W. P. Grammeer secretary and treasurer.

Directory of Electrical Associations, Societies, Etc.

Alabama Light and Traction Association. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala. Semi-annual meeting, Mobile, Ala., May, 1914.

American Association for the Advancement of Science. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

American Electric Railway Accountants' Association. Secretary-treasurer, E. B. Burritt, 29 West 39th St., New York.

American Electric Railway Association. Secretary, E. B. Burritt, 29 West 39th St., New York.

American Electric Railway Engineering Association. Secretary, E. B. Burritt, 29 West 39th St., New York.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. General meeting, New York, April 16-18.

American Electro-Therapeutic Association. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

American Institute of Consulting Engineers. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual meeting, Detroit, Mich., June 23-25, 1914.

American Physical Society. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

American Society of Refrigerating Engineers. Secretary, William H. Ross, 154 Nassau St., New York City.

American Society for Testing Materials. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

American Society of Heating and Ventilating Engineers. Secretary, Edwin A. Scott, 29 West 39th St., New York.

American Water Works Association. Secretary, J. M. Diven, 47 State St., Troy, N. Y. Annual meeting, May.

Arkansas Association of Public Utility Operators. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, Little Rock, April 21-23, 1914.

Association of Edison Illuminating Companies. Secretary, Geo. C. Holberton, Pacific Gas & Electric Co., San Francisco, Cal.

Association of Iron and Steel Electrical Engineers. Secretary, W. T. Snyder, McKeesport, Pa.

Association of Railway Electrical Engineers. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, New Orleans, May 19-22.

California Electrical Contractors' Association. Secretary, W. S. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

Canadian Electrical Association. Affiliated with N. E. L. A. Secretary-treasurer, J. H. Larmonth, 610 Confederation Life Bldg., Toronto, Can.

Colorado Electric Club. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

Commercial Section, N. E. L. A. Secretary, J. F. Becker, 1170 Broadway, N. Y.

Eastern New York Section, N. E. L. A. Secretary, C. S. Van Dyck, Schenectady, N. Y.

Electric Club of Chicago. Secretary, Fred M. Rosseland, Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

Electrical Contractors' Association of Greater Boston. Secretary, R. S. Hale, 39 Boylston St., Boston.

Electrical Contractors' Association of Massachusetts. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

Electrical Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

Electrical Contractors' Association of the City of Chicago. Secretary, M. N. Blumenthal, 179 West Washington St. Meets at noon on the second and fourth Wednesday of each month at 424 South Wabash Ave.

Electrical Contractors' Association of State of Missouri. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

Electrical Contractors' Association of Wisconsin. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

Electrical Credit Association of Chicago. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

Electrical Credit Association of Philadelphia. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa.

Electrical Salesmen's Association. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

Electrical Supply Jobbers' Association. General secretary, Franklin Overhagh, 411 South Clinton St., Chicago, Ill.

Electrical Trades Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

Electric Vehicle Association of America. Executive secretary, A. Jackson Marshall, United Engineering Societies Building, 29 West 39th St., N. Y. Sections in New England, Chicago, Philadelphia and Washington.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

Faraday Electrical Association. Secretary, W. J. Collins, 1129 Masonic Temple, Chicago. Meets at noon on the first and third Wednesday of each month at Planters' Hotel.

Gas, Electric and Street Railway Association of Oklahoma. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual meeting, May 13-15, 1914.

Hydroelectric Section, N. E. L. A. Secretary, S. A. Sewall, 29 West 39th St., N. Y.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

Independent Electrical Contractors' Association of Greater New York. Secretary, A. Newburger. 1153 Myrtle Ave., Brooklyn, N. Y.

Independent Telephone Association of America. Secretary, W. S. Vivian, Grand Rapids, Mich.

Indiana Electric Light Association. Secretary, Thomas Donahue, Lafayette, Ind.

Institute of Operating Engineers. Secretary, L. Houmiller, 29 West 39th St., New York.

Institute of Radio Engineers. Secretary, E. J. Simon, 81 New St., New York.

Internal Combustion Engineers' Association. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex.

International Electrical Congress. Secretary-treasurer, Preston S. Millar, 80th St. and East End Ave., New York. Congress, San Francisco, Sept. 13-18, 1915.

International Engineering Congress. Secretary-treasurer, W. A. Cattell, Foxcroft Building, San Francisco, Cal. Congress, San Francisco, September, 1915.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 6-11, 1915.

Iowa Electrical Association. Affiliated with N. E. L. A. Secretary, H. B. Maynard, Waterloo, Ia. Annual meeting, Cedar Rapids, April 23.

Iowa Street and Interurban Railway Association. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, Cedar Rapids, April 23.

Jovian Order. Jupiter (president), W. N. Matthews, St. Louis Mo.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

Kansas Gas, Water, Electric Light and Street Railway Association. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan.

Louisiana Electrical Contractors' Association. Secretary, J. J. Ziegler, 227 Bourbon St. Meeting every Wednesday, Audubon Building, New Orleans.

Maine Electric Association. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

Michigan Electric Association. Affiliated with N. E. L. A. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

Minnesota Electric Association. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

Mississippi Electric Association. Affiliated with the National Electric Light Association. Secretary-treasurer, Frank J. Duffy, Natchez, Miss. Annual meeting, Meridian, April 27-29.

Missouri Electric, Gas, Street Railway and Water Works Association. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis. Annual meeting, May 21-23.

National Arm, Pin and Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Association of Electrical Inspectors. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

National District Heating Association. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, Rochester, N. Y., May 26-28.

National Electric Light Association. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, Philadelphia, June 1-5.

National Electrical Contractors' Association of the United States. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago. Annual meeting, June, 1914.

National Fire Protection Association. Secretary of electrical committee. Ralph Sweetland, 141 Milk St., Boston, Mass. Open meeting, New York, March, 1915.

National Independent Telephone Association. Secretary-treasurer, J. B. Earle, Waco, Tex.

Nebraska Section, N. E. L. A. Secretary-treasurer, S. J. Bell, David City, Neb.

New England Electrical Credit Association. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Section, Electric Vehicle Association of America. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass.

New England Street Railway Club. Secretary, H. A. Faulkner, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New England Section, N. E. L. A. Secretary, Miss O. E. Bursiel, 149 Tremont St., Boston, Mass. Annual meeting, Narragansett Pier, R. I., Sept. 2-4.

New Orleans Electrical Contractors' Association. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

New York Electric Railway Association. Secretary, Charles C. Dietz, 239 W. 39th St., New York.

New York Electrical Credit Association. Affiliated with the National Electrical Credit Association. Secretary, Franz Neilson, 80 Wall St., New York.

New York Electrical Society. Secretary, G. H. Guy, 33 West 39th St., New York. Annual meeting, New York, June, 1914.

Northwestern Cedarmen's Association. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F E. Sanborn, Ohio State University, Columbus, Ohio.

Oregon Electrical Contractors' Association Secretary, F. C. Green, 291 East Morrison St., Portland, Ore. Annual meeting, Portland, June 8-9.

Pennsylvania Electric Association (State Section N. E. L. A.). Secretary-treasurer, S. C. Pohe, Bloomsburg, Pa.

Railway Signal Association. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

Society for Electrical Development, Inc. General manager, J. M. Wakeman, 29 West 39th St., New York. Annual meeting, New York, May 12.

Society for the Promotion of Engineering Education. Secretary, Prof. H. H. Norris, Ithaca, N. Y. Annual meeting, Princeton, N. J., June.

Southeastern Section, N. E. L. A. Secretary-treasurer, A. A. Wilbur, Columbus, Ga. Annual meeting, Isle of Palms, Charleston, S. C., Aug. 19-21, 1914.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. Annual convention, Galveston, Tex., May 20-23.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill.

Western Society of Engineers, Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

Wisconsin Electrical Association. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 24, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,090,841. Electro - Pneumatic Brake System; J. S. Doyle, New York, N. Y. App. filed March 17, 1910. For securing an increased application of air-brake pressure in applying the brakes.

1,090,872. Electrical Conductor; P. P. Nungesser, Cleveland, Ohio. App. filed Dec. 5, 1913. Screw fastener for securing flexible conductor to carbon brush.

1,090,877. Vibrating Circuit-Breaker; P. M. Rainey, West Hoboken, N. J. App. filed June 17, 1910. Armature in the form of a long broad vane so as to vibrate approximately at its normal rate immediately upon closing the circuit.

1,090,887. Binding Post for Electric Terminals; A. B. Simpson, Jersey City, N. J. App. filed Nov. 29, 1912. Has a pliable U-shaped strip which clamps the wire.

1,090,888. Connector for Electric Wires; A. B. Simpson, Jersey City, N. J. App. filed April 3, 1913. Wires clamped between the folds of a folded strip.

1,090,909. Primary Battery; E. G. Dodge, Maplewood, N. J. App. filed June 12, 1909. Of the type in which the negative electrode consists of a plate of oxide of copper or other depolarizing agent.

1,090,917. Electric Ionition System; T. Hubert, Cranford, and C. E. Lockwood, Plainfield, N. J. App. filed Aug. 5, 1909. To prevent sparking at the plugs at the moment of opening the battery circuit.

1,090,924. Electric Cooking Apparatus; J. Lawrence, London, Eng. App. filed March 6, 1912. Electric grill.

1,090,926. Electroplating Apparatus; G. A. Lutz, Plainfield, N. J. App. filed Dec. 30, 1911. For supporting plurality of pipes or conduits while simultaneously electroplating the same.

1,090,929. Lamp Fixture; H. D. McFaddin, East Orange, N. J. App. filed March 31, 1913. Has flexible strap which clamps around bedpost.

1,090,930. Electric-Lamp Socket; R. R. McIlvaine, Wilkinsburg, Pa. App. filed July 16, 1913. Lamps non-removable from socket and switch elements retained in place without employment of screws.

1,090,940. Crutch; S. H. Norton, Meadville, Pa. App. filed July 12, 1913. Electric-light attachment applied to the head of the crutch and controlled by switch on handhold.

1,090,983. Electric Lamp; E. A. Hawthorne, Bridgeport, Conn. App. filed June 25, 1913. Battery casing and cap is rotated to close circuit.

1,090,989. Electric Sign; George T. Kelley, Chicago, Ill. App. filed July 30, 1908. Contact springs attached to endless chain close sign-letter circuits locally, thereby eliminating considerable wiring.

1,090,990. Electric Transmission of Energy; I. Kitsee, Philadelphia, Pa. App. filed Feb. 20, 1906. True reversals and transmitted from one terminal station to the other terminal station without changing the devices placed at the station; simultaneously telegraphs and telephones over the same line.

1,090,992. Gas or Vapor Electric Lamp; R. Küch, Hanau, Germany. App. filed March 20, 1906. Electrodes of liquid metal proportioned so that each dissipates heat in proportion to the head generated within it.

1,091,003. Electrically Controlled Elevator; T. G. Mason, Toronto, Ontario, Canada. App. filed Dec. 10, 1910. Push-button control in which the operator has absolute control.

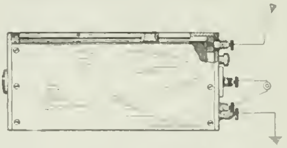
1,091,012. Electrical Switch Mechanism; R. W. Pachaly, Chicago, Ill. App. filed Feb. 15, 1913. Train ventilators are automatically switched into operation when train slows down or comes to rest.

1,091,014. Cigar Lighter; G. F. Paladani, Waukegan, Ill. App. filed Dec. 9, 1912. Has a torch which is lighted by electric spark when lifted into position for use.

1,091,038. Signaling Device; S. Chase, Los Angeles, Cal. App. filed Feb. 3, 1913. Rear signals for autos; front lights near driver's seat indicate which signal has been operated.

1,091,046. Coil for Electrical Purposes and Method of Producing Same; E. A. DeWolf, Mansfield, Mass. App. filed April 15, 1913. Simultaneously winds insulating material contiguous to the ends of the wire layers.

1,091,102. Railway Signaling Apparatus; B. F. Wooding, Denver, Col. App. filed May 23, 1911. Hangers on locomotive operated by track contacts to give safety or danger signals.



1,091,127—Wireless Receiving Apparatus

1,091,107. Car Truck; W. S. Adams, Philadelphia, Pa. App filed Oct. 23, 1913. Has equalizing bars connecting the axle boxes with springs between said bars and the truck frame.

1,091,127. Wireless Receiving Apparatus, R. R. Goldthrop, Hartford, Conn. App. filed Aug. 31, 1912. Wholly self-contained receiver unit

1,091,133. Block-Signal System; L. A. Hawkins, Schenectady, N. Y. App. filed July 5, 1910. Alternating-current system having the distant signal placed at an intermediate point in the block.

1,091,134. Normal-Danger-Signal System. L. A. Hawkins, Schenectady, N. Y. App. filed July 23, 1908. Both rails conductively continuous for all currents, alternating-current sources connected at intervals and cross-rails being of same frequency and phase and forming the only cross-connections.

1,091,153. Electric Clock; J J. Moore, Chambersburg, Pa. App. filed Jan. 10, 1913. A prime mover starts the clock by giving it an initial impulse and thereafter imparts impulses whenever the beat is below the normal length.

1,091,155. Electric Switch; T. E. Murray, New York, N. Y. App. filed Nov. 27, 1912 Closes circuit through a main fuse and thereafter connects a second fuse in parallel with the main fuse.

1,091,180. Mercury-Vapor Apparatus; J. R. Baker, Arlington, N. J. App. filed April 10, 1913. Electrode consisting of mercury and a body of carborundum penetrating the meniscus of the mercury.

1,091,185. Anode and Anode Hook; H. R. Boissier, Great Neck, N. Y. App. filed May 9, 1913. Provided with co-acting surfaces of the tongue-and-groove variety.

1,091,193. Telephone Exchange System; E. E. Clement, Washington, D. C. App. filed Jan. 19, 1906. Incoming calls are automatically apportioned among the idle portions of the connective apparatus.

1,091,222. Method for the Electrical Production of Light; P. C. Hewitt, New York, N. Y. App. filed April 11, 1898. Mercury vapor, with means for operating the electrodes alternately as cathodes.

1,091,223. Apparatus for Operating Vapor Converters; P. C. Hewitt, New York, N. Y. App. filed April 8, 1904. Employs two transformers, one with two secondaries for keeping the vapor converters alive and the other an auto-transformer having a single secondary.

1,091,225. Protection of Feeders of Electrical Distribution Systems; P. V. Hunter, Heaton, Eng. App. filed Oct. 7, 1912. Opens switches in the feeder circuit on leakage occurring from the feeder.

1,091,226. Electrical Socket and Receptacle; L. Kellner, New York, N. Y. App. filed May 13, 1913. Removal of lamp prevented by the screw shell rotating with the lamp.

1,091,242. Direction Indicator for Electromechanical Telegraph Systems; W. K. Queen and T. F. Pickett, Needham Heights, Mass. App. filed June 17, 1910. For transmission of visual and audible signals from the pilot house to the engine room and vice versa.

1,091,244. Electrode for Gas or Vapor Electric Apparatus; M. Von Recklinghausen, Paris, France. App. filed Feb. 14, 1903. Has a plurality of positive electrodes and a main negative electrode interposed between at least two of the positive electrodes.

1,091,256. Electrical Distribution System; P. H. Thomas, Montclair, N. J. App. filed March 5, 1903. Combines vapor converter with one or more magnets for regulating the current in a portion of a system supplied from a source of variating or pulsating currents.

1,091,389. Internal-Combustion Engine; H. L. Reese, Philadelphia, and H. H. Platt, Wallingford, Pa. App. filed Dec. 20, 1912. Has compression and working cylinders with a combustion chamber intermediate to the two.

1,091,420. System of Regulation for Dynamo-Electric Machines. V. G Apple, Dayton, Ohio. App. filed April 12, 1912. Maintains constant the current or the potential under varying conditions of load or speed.

1,091,465. Signaling System; F. B. Adam and L. H. Arens, St. Louis, Mo. App. filed Oct. 22, 1912. Means for causing certain signals to operate automatically at a certain period and others to operate automatically at a different period, etc.

13,704 (reissue). Heat-Dissipating Means for Electrical Apparatus; H. A. Rhodes, Denver, Col. App. filed Jan. 17, 1911. Has layers of sheet-metal foil interposed between the conductors with the extremities of the sheet slit and bent into engagement with the spool for heat-dissipating purposes.

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Fluctuating Export Returns

We had occasion to express regret in these columns recently over the fact that for the first time in many months the electrical exports for November showed quite a falling off. Then came the December figures with a slight gain, resuming the onward march and noted as encouraging. Now we have the figures for January, and here we note once more with regret the sign of retrogression. Business has faltered in one way or another, but in general the signs have been those of steady, if not large, improvement. Our foreign friends may not yet be altogether out of the woods, and there have been recent periods of anxiety on European markets. Anyhow, their purchases of electrical machinery and instruments for January were only $1,947,646, as compared with $2,217,625 in January, 1913, a loss of more than 12 per cent. While last year showed up well, the returns for the seven months ended with January indicate quite clearly the dullness of the last half of 1913, for the total of the period of seven months was only about $1,000,000 better than the prior period, or, to be exact, $15,793,291, as compared with $14,638,723. The figures as now published no longer allow one to determine where the changes fall geographically, but it is probable that in our once good outlet and market, Mexico, we are electrically doing little if anything more than "watchful waiting." Trade with some other countries has also seemed to be hesitant. The facts cited above are there to prove it.

Extension of the Calgary System

A brief description of the new plant for the supply of energy to Calgary, Alberta, points a moral regarding the growth of the cities in the Canadian Northwest. About three years ago the first transmission plant was built with an equipment rating of about 9500 kva and a 55,000-volt transmission line into the city. Two years of operation showed that the growth of the demand was such as to compel immediate action and plans were made at once for utilizing an additional source of energy 2 miles above the original location. The hydroelectric installation differs from many in the far Northwest in being of a comparatively low head, only about 70 ft. The construction work represents a good example of utilizing local facilities and making the best possible provisions for economical construction. It was found that gravel available on the spot could be used for the concrete, and work proceeded rapidly, although interrupted for a time by the high water of the summer. The hydraulic arrangements are somewhat out of the usual in that the penstocks and the draft tubes are of concrete. The draft tubes themselves are 30 ft. long and gain an effective head of 25 ft., unusually high for a plant of this size. The station contains at present two 4250-kva generators carried directly by vertical-shaft turbines. The station arrangement is exceptionally convenient in that all the working apparatus is on a single floor, save the turbines below, and consequently the whole electrical equipment is immediately accessible. The switchboard, instead of being on a somewhat inaccessible gallery, is directly on the generator-room floor, the gallery being reserved for lightning arresters and the accompanying busbars. The whole arrangement of the plant is remarkably compact and convenient and the hydraulic arrangement is particularly well adapted for good regulation. In addition to the new plant, a 4500-kva generator has been installed in the original plant so that the full equipment rating now rises to 22,500 kva, a striking result of the growth of the demand over a very short period.

Maintenance of Retail Prices

Now that many opinions have been sent to Congress in regard to the involved question of maintenance of retail re-sale prices, the ideas of the lawmakers must be clearer. They have learned that the country is not of one mind on this matter. It will not do to say that because a reasonable trade practice may be an instrument of monopoly it shall hereafter be prohibited. It will not do to say that because a reasonable thing has been a practice of monopoly no man shall hereafter adopt any modification of that method. The practices of monopoly and of independent business men are sometimes strangely alike. We do not apologize for intolerable practices of business men, large or small, but want to emphasize the fact that Congress cannot legislate safely or fairly for business if it is going to bind it with red tape. The problem with manufacturers who stake their reputation and name on their goods is to reach individual consumers at a profit. If they think that the market and their fair names are best protected by requiring retail dealers to maintain a fixed price in sales to consumers, they should be allowed to adopt this method. If they sell under like conditions to all who buy, they should be secure in the methods on which they feel their prosperity rests. If other manufacturers believe in an open market and price, let them follow the policy on which they feel their success is founded. The government should allow individual manufacturers to do what their judgment and experience dictate is best for them, provided, of course, that their action is not plainly inimical to the public interest.

Shadows by Natural and Artificial Light

An article by Messrs. J. S. Dow and V. H. Mackinney in this issue deals with a topic of great practical importance. Every landscape has its variations of light and shade. Every picture which presents itself to our conscious vision possesses its particular range of variety in illumination intensity. One might, therefore, reasonably suppose that there could be no room for difference of opinion as to how artificial illumination should be applied, because each and every human being has had abundant opportunity, from his own visual experiences, to judge what conditions of light and shadow are desirable. Nevertheless, we find that there is much difference of opinion on the subject, and that, if we were to judge from the differences expressed, we might infer that the visual experiences of different individuals had been very unlike. Some express themselves in favor of deep contrasts of light and shadow, such as are formed in a room with dark walls and hangings lighted by a single open arc lamp. Others state a preference for uniform illumination in the complete absence of all shadows, such as might be produced by indirect lighting in a room with lamps concealed behind the cornice. The article here considered presents impartially the comparative advantages of these two opposing types of illumination.

The matter is really more complex than it appears at first glance because of certain associations of visual impressions and recollections which, strictly speaking, should be eliminated from the discussion. When we think of direct lighting from a single powerful lamp like an open arc lamp, we think of the violent shadows and contrasts of light and shade, which are generally considered objectionable; but we are also likely to think of the visual distress due to having to face the brilliant arc, and of the discomfort caused by the shining of the bright light in the eyes. In the case of the indirect illumination, with the light scattered in all directions from the extensive white ceiling, we remember that in whichever direction we cast our eyes no brilliant or powerfully luminous areas met the gaze. But if, in the case of the direct illumination, the arc itself be concealed from view by a suitable screen, the contrast between the two types of illumination is greatly reduced. The difference then narrows to mere questions of uniformity of illumination and intensity of shadows.

It will generally be admitted that either extreme of chiaro-oscuro presentation is ordinarily undesirable. On the one hand, dense shadows so sharp that they seem to cut into the visual field like a knife are not esthetic, although in particular cases they may be useful. On the other hand, perfect shadowlessness is also unesthetic and a little bewildering. As children of the sun, we mortals are accustomed to shadows, and we are aided in forming unconscious estimates as to the relative distance of surrounding objects by the recognition of their shadows. In a room where no shadows exist above the table level the sense of contrasts and of distances is weakened. It is true that shadows are very weak in the diffused out-door daylight of a rainy day, but it is also at least open to discussion whether the sense of mental depression in such surroundings may not be partly due to this absence of shadows.

For ordinary workday purposes, then, it may be admitted that, provided no unduly bright surfaces are allowed within the field of vision, artificial lighting should neither be all high lights and shadows nor the monotony of shadowlessness. Granting this postulate, we agree with the author that more striking and beautiful visual effects may often be secured with appropriate artificial lighting than daylight may be able to produce.

Classifications of Molded Insulations

In electrical engineering all substances may be regarded as divided into two classes, namely, conductors and insulators. As the art advances it becomes more necessary to work both these classes of materials at increasing intensities; that is, to make the conductors as powerfully conducting as possible, and to make the insulators as powerfully insulating as possible. In other words, the tendency in electric machinery is to develop as many amperes per square centimeter as possible in the conductors and to operate at as high a dielectric stress in the insulators as tests and experience show to be safe and durable.

The limitations in forcing the conducting power of conductors are somewhat narrow. They depend on electric conductivity and upon the facilities for heat dissipation. No means have yet been discovered for increasing the conductivity of metals beyond the limits that are observed in the laboratory as pertaining to those metals in the chemically pure state. It is, of course, readily conceivable that discoveries made in the future might change this limitation. There is no need for believing that this limitation is eternal. As regards the cooling of electrically active copper, improvements are slowly but steadily being made in this direction.

The limitations in forcing the insulating power of insulations are of a different nature. Here mechanical difficulties enter. It seems to be almost an inherent necessity for a good solid insulator to be brittle. Perhaps if it were both ductile and tensile at ordinary temperatures, it might have to set aside its insulating properties. At least there is much greater difficulty in obtaining mechanical strength from insulators than from metallic conductors. Moreover, poor conductors of electricity are almost essentially poor conductors of heat, so that it is difficult to apply powerful electric stresses to insulators and yet to keep their mass cool.

Much improvement has recently been made in the electric arts by molding insulation. An early successful method was that of molding porcelain material and then subjecting it to a baking and glazing process. At the present time many insulating materials are molded in a simpler fashion than porcelain. In an article of which the concluding part is published in this issue, Mr. Emile Hemming discusses the relative merits of a number of different molded insulations, compounded, made and finished in different ways. The classifications offered as the result of comparative manufacture and tests will be helpful to many who seek to avail themselves of a proper molded insulation in the design and construction of apparatus. It is, however, necessary to remember that the conclusions from an inquiry of this kind can never be final, and that new chemical combinations and physical modes of treatment may possibly be discovered which will revolutionize all preceding ideas and practice in artificial insulator production. An enormous field appears to be open to the chemist and the experimental physicist for producing new and improved types of insulation.

Regulation According to Size

A clause in the amended bill providing for an Interstate Trade Commission gives the commission absolute power over large corporations and discretionary power over corporations without regard to size. Its language is a little obscure, however. It says that every corporation engaged in commerce (excepting those subject to the acts to regulate commerce) which by itself or with controlled corporations has a capital of not less than $5,000,000, "or, having a less capital, belongs to a class of corporations which the commission may designate," shall furnish required information. That is to say, the commission in its discretion may rule that smaller corporations shall be subject to the same supervision as large corporations. This is a departure from an early suggestion that the law explicitly exempt small corporations.

The effect of the wording will be to create a recognized division between corporate units with the capital named and those with less. The companies on one side of the line will be subject to regulation immediately and automatically, the small companies only as the commission pleases. If the object of the law is to regulate big business and to exempt little business, such a classification is appropriate, although the capital limit might be fixed higher so as to strike more directly at the large properties. This, however, is not definitely stated as the object of the law nor is it generally so understood. That it may be found desirable to bring within the law corporations having less than $5,000,000 capital, belonging to a class to be designated by the commission, is plainly inferred. The question then arises, How shall such classes be determined? Will one industry be penalized and another be immune?

There is some danger that the proposed commission may fall into the ready error of many public men in holding big business defective and little business harmless. The law should not promote that feeling. The law and the commission holding office by its authority should not hit size and disregard practices. If they do, they may encourage the development of trade practices in small companies which they will not tolerate in large companies. Size alone can never be the reasonable test. We seek mentalities of large power. Growth in volume of business is the aim of most commercial organizations. Colleges develop and enlarge. There are many small business organizations that ought to be relieved from burdensome compliance with the law but there are also many large organizations whose methods are not repugnant to just ideas. Where there is no possibility of infraction burdensome compliance with regulations of the commission should not be exacted. This policy should prevail without regard to the size of corporations.

Electricity Against the Field

Some recent German data on the relations between electricity and its nearest rivals are not unworthy of mention here. The results of competition between gas and electricity in a number of German cities during recent years, as noted in the Digest, are not a little startling. The periods considered are within the last five or ten years, and in every case for which the statistics are given it is altogether evident that the same forces are at work across the water that are operative here in gradually pushing the gas industry into a secondary position as regards lighting and motor service. The German data show the growing use of electricity for lighting in a very striking manner, the increase in some instances being twofold or threefold in the last decade, based on the yearly consumption of kilowatt-hours per capita. This change is all the more striking as much of it has taken place since the introduction of the metallic-filament lamp, so that the added consumption of energy bespeaks a much greater increase of actual lighting. Meanwhile in the same group of cities the gas consumption per capita for lighting purposes has either made only a very small increase or has actually gone down.

Similar comparisons in America would show effects, striking it is true, but quite different in their detail. The use of electricity for lighting and motor service here as abroad has increased very rapidly, but energetic competition has so stimulated the demand for light that in most places the gas consumption has kept up astonishingly well. Perhaps this result is attributable in part to the fact that while gas lighting has been pretty well driven out of large work it has managed to prosper in the very field of small consumers which has been held in altogether too much contempt by electrical central-station managers. In some large centers the gas consumption for lighting purposes has, however, considerably decreased, and while the actual output may have risen materially, it is through the miscellaneous use of the product rather than through the employment of lighting. It is not our purpose here to go into any detail regarding the situation in our own country, but merely to point out that the same inevitable forces are working in the German industries that are effective here.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Damages Denied to Marconi Company

Judge Van Vechten Veeder, of the United States Circuit Court in Brooklyn, last Wednesday handed down a supplementary memorandum to his decision in the suits brought by the Marconi Wireless Telegraph Company of America against the National Electric Signaling Company. In the memorandum Judge Veeder holds that the Marconi company is not entitled to damages for the infringement of the Lodge patent by the National Electric Signaling Company, because of the long time that has elapsed since the patent was first infringed. He said the owners of the patent made no previous attempt to assert their ownership or to complain of infringement. The Lodge patent was finally purchased by the Marconi company. An appeal from Judge Veeder's decision in both suits brought by the Marconi Wireless Telegraph Company of America has been taken on behalf of the National Electric Signaling Company to the United States Circuit Court of Appeals.

Convention of National District Heating Association

The sixth annual convention of the National District Heating Association will be held at Rochester, N. Y., May 26 to 29. Among the papers and addresses to be presented are the following: "Public Policy of Utilities," Mr. R. M. Searle, Rochester, N. Y.; "Manufacture of Welded Iron and Steel Pipe," illustrated with moving pictures; "Use of Bleeder Turbines in Connection with Steam Heating," Mr. R. D. De Wolf, Rochester, N. Y.; "Underground Construction," Mr. E. Darrow, Indianapolis, Ind.; "Records," Mr. A. P. Biggs, Detroit, Mich.; "Customers' Steam-Heating Systems," Mr. H.R. Weatherell, Peoria, Ill.; "Commercial Steam Heating in New York City," Mr. G. W. Martin, New York; "Rates," Mr. E. L. Wilder, Rochester, N. Y.; "Education," Mr. D. S. Boyden, Boston, Mass., and "Station Operating Methods," Mr. B. T. Gifford, Grand Rapids, Mich. A number of entertainment features have been arranged during the convention, including a trip to Niagara Falls by special Pullman train, Friday, May 29, as the guests of the American District Steam Company. Mr. S. Morgan Bushnell, Chicago, is president of the association, and Mr. D. L. Gaskill, Greenville, Ohio, is secretary.

Convention of Iowa Section, N. E. L. A.

The fourteenth annual convention of the Iowa State Section of the National Electric Light Association will be held at Cedar Rapids, Ia., April 22, 23 and 24. Following the address of the president, Mr. A. L. Dodd, of Charles City, Ia., the following papers will be presented: "Co-operation Between Contractors and Central Stations," by Mr. J. T. Marron, Rock Island, Ill.; "The Compensation Law and Its Application," by Mr. George A. Wrightman, Des Moines; "A Few Features of the Operation of the New Development at Keokuk," by Mr. W. A. Ross, Keokuk; "The Conduct of Public Utilities Under Commission Supervision," by Mr. A. C. Huey, Chicago; "High-Tension Lightning Protection," by Prof. A. H. Ford, Iowa City; "Is There a Saturation Point in the Sale of Electricity?" by Messrs. J. S. Forbes and J. C. Young, Cedar Rapids; "Sale of Electricity to Farmers," by Mr. Rufus E. Lee, Clarinda; "The Object and Results of Affiliation," by Mr. S. A. Sewall, New York.

On Wednesday evening there will be a banquet, and on Thursday there will be a theater party followed by a Jovian rejuvenation. The meetings of the convention and headquarters of the association will be at the Montrose Hotel, Cedar Rapids.

The Iowa Street Railway Association will hold its convention at Cedar Rapids at the same time and place as the Iowa Section of the N. E. L. A., but the program has not yet been announced.

Utilities Win Fight in California

California's attempt by constitutional amendment to require all corporations using city streets for water or for artificial-lighting purposes to procure franchises from the respective cities was declared by the United States Supreme Court on April 6 to be ineffectual as to water and light companies in business when the amendment was adopted in 1911. The private water and light companies appealed to the court to stop the State by the amendment from depriving them of several hundred millions of dollars that had been invested in the service of municipalities. The corporations claimed that the amendment was designed to enable municipalities to drive private companies out of business by refusing franchises and then to establish municipal works. The decision handed down in the case of the Economic Gas Company, of Los Angeles, turned upon rights which the corporations procured under the constitution of 1879. When this constitution was adopted Justice Hughes stated, in announcing the decision, the people were convinced that the State Legislature was moved by favoritism in granting water and light monopolies to individuals and corporations in the various cities, and for this reason the constitution provided that any person or corporation could use the streets of a city for water or light purposes without condition.

Ohio Meeting on New-Business Co-operation

The committee on new-business co-operation of the Ohio Electric Light Association will hold a meeting at the Dayton Club, Dayton, Ohio, April 15, to which central-station managers and commercial employees are invited. Nearly 100 persons attended the recent Toledo sessions of the new-business committee.

The meeting of April 15 is scheduled to open at 10 a. m. with an address by Mayor G. W. Shroyer of Dayton, after which Mr. E. L. Callahan, of H. M. Byllesby & Company, Chicago, will read a paper entitled "Suggestions to Assist Central-Station Salesmen in Securing New Business." Following luncheon there will be a round-table discussion, in the course of which the following topics will be taken up: "Assisting the Small Companies to Obtain New Business," "Handling the Chronic Kicker," "The Wiring of Old Residences," "What Percentage of Gross Revenue Should Be Expended for New Business and How Divided Between Salaries, Advertising and Miscellaneous Expense?" "What Benefits May Be Derived from the Commercial Application of Electric Heating Devices?" "What Disposition Can Be Made of the By-product of Woodworking Factories?"

The third and last meeting of the new-business committee will be held in Cleveland, May 22, during the Cleveland Electrical Exposition.

Mr. T. F. Kelly, of the Dayton Power & Light Company, is chairman of the Ohio Electric Light Association's committee on new-business co-operation.

Mr. Tripp on the Holding Company Bill

At the request of the *Electrical World*, Mr. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, has expressed his opinion on the holding company bill now pending in Congress, as follows:

"I have only one criticism to make of the Clayton bill, and that is the revival of the idea that 'lessening competition' constitutes a violation of the Sherman antitrust act or any other law (unless it goes so far as to create a restraint of trade or constitute a monopoly). A practice which lessens competition is not in itself contrary to the highest standard of business ethics, nor does it menace in any degree the public welfare unless it reaches a point where it restrains or monopolizes trade. This language and the still more comprehensive language in some others of the 'Five Brothers' bills sustain the theory of free and unrestricted competition, disregarding the fact that such practices are the surest foundation for monopoly.

"It is unnecessary for me to cite instances of monopolistic corporations having been built solely by the use of the weapons of free competition. Restraint of trade and monopolies should be prevented, but elimination of useless competition by co-operation is in almost numberless cases not only desirable from the standpoint of the parties themselves, but distinctly in the interest of the public in that it prevents unnecessary waste, and co-operation of this character should not be prohibited by statute.

"As I said in the beginning, I have no criticism to make of the bill except on that one point."

Missouri Association Acts on Tentative Classification of Accounts

A meeting of the Missouri Electric, Gas, Street Railway and Water Works Association was held in St. Louis on April 1 to consider the tentative classification of accounts proposed by the Missouri Public Service Commission. The system of accounts affects all utilities except electric railways. About fifty members were present.

Resolutions were adopted asking that the date of the hearing on the questions involved be changed from April 15 to a later time, in order that those principally affected might have time to study the subject. Another resolution, asking that the effective date of the new classifications be postponed until at least Jan. 1, 1915, was adopted. Three committees were appointed to report later to the association in detail, to suggest alternatives in the proposed rules, and to advance constructive criticism. It was felt that graded classifications should be adopted, based on the gross earnings of the companies. The tentative classification is regarded as too elaborate by the association.

Mr. Philip J. Kealy, Kansas City Railway & Light Company, acted as chairman of the meeting. The committees appointed were as follows:

Depreciation—Messrs. Kealy, chairman; J. M. Scott, Kansas City Gas Company; R. C. Russum, Empire District Electric Company, Joplin; C. E. Brenton, Union Electric Light & Power Company, St. Louis, and W. H. Foster.

Historical Matters—Messrs. Hugo Wurdack, Light & Development Company, St. Louis, chairman; S. E. Bronson, Water Power Light Company, Ozark; Adrian Steele, Consumers' Electric Light & Power Company, De Soto; F. B. Saunders, Missouri Gas & Electric Company, Chicago, and J. Hall, attorney for the association.

Classifications for Small Companies—Messrs. Edwin Gruhl, Union Electric Light & Power Company, St. Louis, chairman; V. L. Elbert, St. Joseph Gas Company; S. W. Henderson, Excelsior Springs Water, Gas & Electric Company; W. J. Achelpohl, Jefferson City Light, Heat & Power Company, and S. B. Irelan, Empire District Electric Company.

The three committees will hold a joint meeting at St. Louis on April 13 and will report to the association on April 14 in order that plans may be made to attend the hearing of the Missouri Public Service Commission on April 15.

Convention of the Doherty Organization

The annual convention of managers of operating companies of the Doherty organization was held at the Hotel Manhattan, New York, on April 6 to 10. The convention was the largest of the annual gatherings that have been held by the Doherty organization. About 150 representatives of 100 companies were in attendance. Those who attended the meeting were principally general managers, new-business managers, superintendents, engineers and accountants. Nearly all the companies in the Doherty organization were represented. Ten regular sessions were held during the week. Mr. F. W. Frueauff presided at the opening session. Mr. George Williams acted as chairman during the new-business session. On the evening of April 9 there was an informal dinner at Healy's Restaurant in New York.

At the opening meeting the subject of discussion was the relation of companies to the public, state and city commissions. Addresses on this subject were made by Mr. F. W. Frueauff and Mr. C. T. Brown. The next session was devoted in part to a discussion of the new financial plan of the Cities Service Company. Mr. Paul R. Jones, secretary and auditor of the Cities Service Company, discussed the relation of the auditing department to local companies.

The sessions of April 7 were devoted entirely to the natural-gas industry and industrial gas sales. Those who made addresses were Messrs. Holton H. Scott, Alfred J. Diescher, Frank Fisher, C. L. Bullock, H. R. Straight, F. M. Lowry and Ira Neely.

On April 8 Mr. Elbert Hubbard, of East Aurora, N. Y., addressed the convention on the subject of co-operation and the relation of employees of public utility companies to the public. This session was the beginning of the meetings devoted to new-business methods. Among those who spoke were Messrs. Henry Loebel, C. L. Bullock, W. H. Gardner, M. R. Bump, Holton H. Scott, F. J. Petura and R. G. Griswold.

There was a welfare and "safety first" session at which the discussion was led by Mr. G. O. Smith. One of the sessions was devoted to the topic of operating statistics of 1913. At the following session operating estimates for 1914 were considered. Mr. Henry L. Doherty was on the program for an address on "The Public Utility Manager." Electric vehicles were discussed on the concluding day of the convention.

Magnitude of Natural-Gas Industry

The government report issued in connection with the natural-gas industry of the United States for 1912 shows that a population of more than 8,000,000 depends largely upon natural gas for heating, cooking, industrial purposes and, to a greater or less extent, for lighting, while the natural-gas companies had in that year approximately 1,700,000 consumers.

The maximum production of natural gas was reached in 1912 in New York, Ohio and West Virginia, where it has been produced for twenty-eight years, and also in California, where production has been under way for twenty-four years; in Kentucky and Tennessee, where production is twenty-four years old, and in Oklahoma, where the first gas was produced eleven years ago. The year also saw the maximum in production for the entire country, the gas produced in 1912 being valued at $84,563,957, at an average price to the consumer of 15.04 cents per 1000 cu. ft. The value of the gas produced from 1882, when the first wells were drilled, up to the end of 1912 is given as $875,630,601.

For domestic consumption in 1912 there was distributed 193,454,802,000 cu. ft., which was sold at an average price of 26.34 cents per 1000 cu. ft., while for industrial use there was produced 368,748,650,000 cu. ft., sold at an average price of 9.11 cents per 1000 cu. ft., or a total production of 562,203,452,000 cu. ft., sold at an average price of 15.04 cents per 1000 cu. ft.

On Dec. 31, 1911, there were 28,978 producing wells in the United States. In 1912 there were 5138 wells drilled, of which 3755 were producers and 1383 dry. There were 1954 wells abandoned in 1912, and on Dec. 31, 1912, there were 30,779 wells producing gas. Large areas of land are held by the natural-gas companies. At the close of 1912 the companies owned 459,089 acres, leased 8,682,855 acres and held 1,265,940 acres by reason of operation, or a grand total of lands held by the companies of 10,407,884 acres. The largest acreage is held in West Virginia, where 3,019,316 acres are controlled, while in Pennsylvania there are 2,187,388 acres, in Ohio 1,756,167 and in Oklahoma 1,161,048 acres. As to the value of the gas produced from these holdings it was $18,539,672 in 1912 in Pennsylvania, $11,891,299 in Ohio, $33,349,021 in West Virginia, $14,492,696 in Texas, Alabama and Louisiana, and $7,406,528 in Oklahoma.

Since natural gas was first discovered in Pennsylvania the value of gas produced and sold in that State has been $355,672,362, in Ohio $114,011,567, in New York $15,986,149, in West Virginia $192,062,893, in Indiana $98,167,286, in Texas, Alabama and Louisiana $9,722,970 and in Oklahoma $21,081,670. These figures are for gas actually produced and sold and of course do not include the immense amount of gas which in the thirty-one years since natural gas has been commercially used in this country has been permitted to escape from the wells and be wasted. It is said that since natural gas became a commercial possibility in this country as large an amount has been wasted as actually has been used for domestic and industrial purposes, the greatest waste having taken place in the oil fields, although even in the natural-gas fields it has not been until within the last few years that any attempts have been made to conserve the supply.

Mr. Byllesby on Public Questions

In the annual report of the Standard Gas & Electric Company for 1913 Mr. H. M. Byllesby, the president, discusses several matters of public interest. The report calls attention to the great additional expenses with which the subsidiary companies have been burdened in defending themselves before the various taxing bodies, as well as the large legal and expert expenses incurred in connection with appearances before public service commissions. Reference is made to the benefits which are beginning to be realized from the establishment of independent and capable public-service commissions. The report continues:

"In the matter of rate regulation the tendency of the commissions, as we view it, seems to be to allow to the public-service corporations a divisible return which, after deducting from net earnings or having charged into operating expenses a suitable depreciation charge, will allow to the corporation a return upon the fair value of its property which shall be equivalent to the current return upon capital invested in other enterprises in the locality where the utility operates. The adoption of this rule will be entirely satisfactory to the Standard Gas & Electric Company."

In reference to business conditions the report says: "A pronounced suspension of activity has existed largely throughout the United States during the past twelve months. The properties at Tacoma and Everett, Wash., and the properties in Idaho, Oregon, Montana, Oklahoma, Arkansas and Colorado have felt this depression earlier and more acutely than in other sections. It is believed that this depression, as reflected in gross earnings, has reached its limit and that a recovery is now in progress which will be slower in certain sections than in others." Notwithstanding the existing agitation against holding companies, it is believed that companies of the character of the Standard Gas & Electric Company have little to fear. In no instance does the company control subsidiaries which are natural competitors.

In relation to depreciation, the report says: "When the question of a proper accruing yearly depreciation to be taken out of net earnings or included in operating expenses has been more fully determined by officials in authority in the various state commissions, or, in the absence of such determination, when the consensus of opinion on the question has reached more nearly a working basis, the controlled companies of the Standard Gas & Electric Company will adopt and put into effect whatever plan has been generally approved. In the meantime, with the large sums charged directly to maintenance and the very substantial amounts already transferred to the depreciation reserve account, it is believed that, for the present at least, the properties in which the company is interested are in a satisfactory position in this regard."

Mr. Vail Reassures Western Union Stockholders

In his annual report as president of the Western Union Telegraph Company, Mr. Theodore N. Vail discusses inquiries that have been made as to the prospects of the company, either under any possible purchase by or competition of the government or as a going concern operating independently of the American Telephone & Telegraph Company. He says that the relations between the American Telephone & Telegraph Company and the Western Union Company have always remained the same as between two entirely independent companies. The organizations of the two companies were entirely distinct and independent and, with the exception of the president and a minority of the directors, they had no officers in common. All contracts and operating arrangements were such as two independent companies could enter into under the interpretations of the existing laws, and the commercial interests of each company were carefully guarded, so that the so-called divorce of the two companies is being accomplished with very little confusion.

As to the government purchase or operation of the telegraphs, Mr. Vail says: "The property of the company cannot be taken without just compensation; that is, a full and proper equivalent for the property taken must be returned to the owners. In such a case the shareholders should receive, as a minimum, far in excess of the present market value of the shares.

"The other alternative which has been advanced, to take over the long-distance telephone lines and enter into competition with the existing telegraph lines for the purpose of destroying their business, is not only of so questionable a character as to be repudiated when its full significance is realized, but is so utterly impossible and unworkable from a practical point of view as to make it negligible. The owners of the securities of the Western Union may rest quietly and not be scared into the sacrifice of their property. Headline prophecies should be read and regarded in the light of the results which have followed the headline prophecies of the past.

"The technical department of the company has been at work in connection with that of the Bell system in the development of what might be termed mechanical transmission, and there is now in daily use rapid transmission apparatus which nearly, if not quite, quadruples the most effective yet devised and is giving great results on the trunk lines where there is a concentrated business between large places. There is nothing as yet and not likely to be anything which will supersede the old key transmission of a scattered business distributed to many points on a local line."

Annual Report of Public Service Corporation

In the fifth annual report of the Public Service Corporation of New Jersey Mr. Thomas N. McCarter, president, discusses in detail many of the affairs of the company and its subsidiaries. The operating revenue of subsidiary companies for the year ended Dec. 31, 1913, was $34,592,473, as compared with $32,654,469 in the preceding year. Operating expenses and taxes were $18,844,607 and amortization charges were $1,007,591, or a total of $19,852,198. To the net revenue of $14,740,275 there were added non-operating income of $377,972 and income of the corporation from securities pledged and from miscellaneous sources amounting to $2,308,874. This makes a total income of $17,427,121. Deductions of subsidiary companies for bond interest, rentals and miscellaneous interest were $11,911,316, leaving a balance of $5,515,805. Public Service Corporation income deductions aggregated $3,267,605. From the net income of $2,248,200 thus obtained there were deducted as appropriations of subsidiary companies for additional amortization of capital, amortization of new-business expenditures prior to Jan. 1, 1911, and adjustments of surplus account a total of $489,635. This left a balance of $1,758,565. There were appropriated $52,375 for sinking-fund accruals applicable to 1912 and adjustments of surplus account for the corporation amounting to $20,249, or a total of $72,624. This left a net increase in surplus of $1,685,941.

The fact that the net increase in surplus after the payment of dividends was only approximately $186,000 is due, Mr. McCarter says, to the large and unusual, as compared with former years, amount set aside for amortization charges. This total was $1,376,309 in the year, whereas the amount the corporation was obligated to set aside under agreement with the bankers who made the original purchase of general mortgage bonds was only $800,000. The sum set aside for similar purposes in 1912 was $722,077. Adding $261,875, the amount set aside for the sinking fund under the terms of the mortgage securing the general mortgage bonds, gives a total for amortization and redemption of securities of $1,638,184.

Mr. McCarter states that the properties have been maintained throughout the year at a high standard of efficiency. He refers to the new power plant at Burlington, which is illustrated in the report. The corporation has continued the policy of building permanent homes for subsidiary companies in the various centers in which it conducts business. Mention is made of the plan for the construction of a modern combination street railway terminal and office building in Newark, which it is desired to complete not later than Jan. 1, 1917.

Approximately $500,000 per year is being spent by the Public Service Electric Company on new underground work. Eighteen street miles of underground conduits were laid during the year and 101 miles of transmission lines installed. The number of appliances sold, both gas and electric, increased very largely over the number sold in the previous year and should affect favorably the sales of gas and electricity during the coming year. The revenue from electric sales increased 12.13 per cent. The average revenue was 5.86 cents per kw-hr., as compared with 6.16 cents per kw-hr. in the preceding year. The report shows a total of 141,936,243 kw-hr. sold, or an increase of 17.78 per cent over 1912. The number of street arc lamps supplied at the close of the year was 12,787. The number of street incandescent lamps supplied was 22,339. The total connected load was 209,835 kw.

Taxes paid in the year amounted to $2,062,981, an increase of $189,963. In addition the corporation paid large sums to municipalities in the form of new improvements, street paving and street-paving assessments. The premium for insurance carried was 38.3 cents per $100, as compared with 44 cents in 1912. The cost of welfare work in 1913 was $65,477, divided as follows: Insurance, $16,767; sick benefits, $24,917; pensions, $14,740; expenses, $9,053. The total cost in 1912 was $61,116. The cost of accidents under the employers' liability act was $56,420. Of this the total payments provided by the act amounted to $37,335, and $10,525 additional compensation was paid under the authority of the welfare committee. Expenses of the department amounted to $8,560.

Mr. McCarter remarks that the relations of the subsidiary companies with the Board of Public Utility Commissioners have remained cordial throughout the year. He comments on the pending court proceedings in regard to the rate for gas in the Passaic district. This case was argued at the November term of the Court of Errors and Appeals. Mr. McCarter expresses confidence that that court will recognize the principle of the value of the company's franchises for rate-making purposes and sustain the justice of the company's position.

Expenditures charged to fixed capital account by the subsidiary electric company during the year aggregated $3,892,038, less $656,275, or a net charge of $3,235,763. The electric company served a total of 178 municipalities with a population, according to the 1910 census, of 1,948,923.

During the year a census was made of all power plants used for manufacturing purposes which are not using Public Service power in the territory served by the electric company. A classification thereof has been prepared as a basis for an energetic canvass of this class of business. The total horse-power not operated by the company is 477,561, distributed among 2178 plants. Of the total number of these plants, 88.3 per cent are belt-driven and 11.7 per cent are electric-driven. The industries represented by these plants are of the most diversified character and afford a field for development of this business by the company that has great promise for the future.

Possibilities of the Electric Vehicle in Post Office Service

Colonel LeRoy T. Steward, superintendent of delivery of the Chicago post office, gave an informal but unusually interesting address before the Chicago Section of the Electric Vehicle Association on March 31. He discussed in an offhand manner the possibilities of using electric vehicles in connection with the local mail transportation in Chicago. Since the limit of weight on parcel-post packages has been raised to 50 lb. even the small post offices are handling from 10 tons to 15 tons of mail matter a day. In a few cities electric vehicles are being used to transport the volume of mail, which has been so greatly increased by the parcel post.

In Chicago the post office employs 357 vehicles in the collection and delivery of mail. About $175,000 a year is spent for this service, some of which is under contracts running out in 1915. The time is ripe for the testing out of automobiles, and particularly electric automobiles, for post office service in American cities; but the cost of horse-drawn mail wagons has been relatively low, amounting to about $1,073 a year for the wagon and driver. The question of price has had much to do with the slow progress made by the automobile in city mail service. The automobile heretofore has been deemed too expensive. The policy of the government has not been to own wagons and to carry the mails itself in the cities, but rather to let this work out by contract. There are some indications, however, that there may possibly be a change in this policy.

Electric vehicles on city streets have a distinct advertising value, and there is no reason why the post office should not avail itself of the good will and approval induced by the appearance of the smart, up-to-date electric wagons. Personally, Colonel Steward thought that the electric vehicle is the only practicable power wagon for mail service in cities. There are two reasons for this conclusion. One is that the mechanism is much simpler compared with the gas machine and is much less liable to get out of order. The second reason has to do with the human equation. Ordinary drivers can take charge of an electric automobile, whereas a mechanician is needed for the gas machine. Therefore the operating expenses are considerably less with the electric vehicle.

Mr. E. E. Witherby, of the General Vehicle Company, Mr. R. Macrae, of the Commonwealth Edison Company, and others took part in the discussion. In answer to questions Colonel Steward said that as the result of the parcel post the service of the post office is really going through a period of reorganization. The volume of outgoing parcel-post mail from Chicago is enormous —much larger than the incoming mail of that sort. The annual expense of running the Chicago post office is about $5,500,000, and the annual profits are about $26,000,000. To take the place of the street-railway mail-car perhaps 5-ton electric trucks would be needed. The field for the electric wagon in relation to city mail transportation is just beginning to be realized. The government is apparently about ready to investigate the whole automobile system of mail collection and delivery.

Meeting of Iron and Steel Electrical Engineers

The fourth regular monthly meeting of the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers was held at the Seventh Avenue Hotel, Pittsburgh, Pa., April 4. An illustrated talk was given by Mr. Francis Hodgkinson, chief engineer of the Westinghouse Machine Company, on "High, Low and Mixed-Pressure Turbines." The theoretical merit and development of the different types of turbines was gone into thoroughly, Mr. Hodgkinson using lantern slides and blackboard to make his points entirely clear. The development of the turbine was interestingly described, from the 2000-kw machines of 1900 to the 30,000-kw sizes of to-day, and the reduction of steam consumption from 18 lb. to 12 lb., and of the investment charges from $120 to $60 per kw, was dwelt upon. The early uses of the regenerator in connection with low-pressure turbines were touched upon, and it was related that when regenerators were first used the regenerative period of several minutes was striven for, and that the present-day practice is to install regenerative capacity for thirty to forty seconds regenerative periods. In places where conditions are favorable the possibility of allowing the boilers to blow off into the low-pressure system instead of through safety valves was suggested, the protective features of the safety valve being maintained in addition. Mr. Hodgkinson brought out that turbine blading troubles are not caused by collision or rubbing of the blades, but rather by vibration from the steam current, and that the more substantial the blading is made the more disastrous will be the effects from collision or rubbing. The speaker went into the details of the design of turbines very thoroughly, from the throttle valve to the condenser.

Lecture on the Telephone Industry

The public utility lecture at the West Side Branch of the Young Men's Christian Association in New York on April 6 was given by Mr. T. P. Sylvan, assistant to the vice-president of the New York Telephone Company. In a brief address introducing the speaker, Mr. A. B. Leach, of A. B. Leach & Company, New York, told how the wonders of telegraphy and telephony, which were miracles a few decades ago, are to-day so commonplace as to attract little or no attention from the blasé public.

Mr. Sylvan did not touch directly upon the question of government ownership until near the end of his talk. He first took up the history of the growth of the telephone system from its early stages through the time when it was decided to place the service on a license basis, instead of on one of outright sales. The early ground-return circuits were later replaced by metallic-return circuits to the improvement of the service, as explained by the speaker, and the early aerial circuits were eventually run in cables, underground in the more congested sections and overhead in other places. The paper went on to trace the developments from the magneto system to the central-battery system of operation and signaling and the introduction of the multiple-unit switchboard.

The change from the flat rate to the message rate in charging for telephone service marked, to Mr. Sylvan's mind, the beginning of the real growth of the present immense system. The organization of the American

Telephone & Telegraph Company was effected, according to the speaker, for the purpose of handling the toll-line business between the various groups of companies affiliated in the Bell system.

Some interesting figures were given by the speaker in connection with the Bell telephone system. It employs about 200,000 people and connects about 70,000 different places in the country (comparing with 60,000 post offices, approximately, according to his figures). Over 27,000,000 calls are handled daily over the lines embraced by this system. With less than 6 per cent of the population of the globe, the United States was shown to have over 65 per cent of the telephones in the world, and, as proof that the system is still growing, Mr. Sylvan said that about $60,000,000 is likely to be spent in extensions during the coming year. It was Mr. Sylvan's opinion that when the post office and other government departments are run on the same basis of efficiency as the Bell system government ownership of the latter may be viewed with less alarm.

Discussion of Public Utility Valuation Matters

At the annual meeting of the American Society of Civil Engineers the progress report of the special committee appointed by that society to formulate principles and methods for the valuation of railroad property and other public utilities was read. The chairman of this committee is Mr. Frederick P. Stearns, and the other members are Mr. Thomas H. Johnson, Mr. William G. Raymond, Mr. Alfred Noble, Mr. Jonathan P. Snow and Mr. Leonard Metcalf. The report is entitled "Valuation for the Purpose of Rate-Making."

Subsequently an addition to this report was issued, and on March 11 the discussion of the report was continued at the headquarters of the society in New York.

Further discussion of the report was brought out in meetings held in New York on the afternoon and evening of April 2, Mr. Gardner S. Williams presiding. The afternoon meeting was opened by Mr. Williams with a brief explanation of the large importance of the subject and the advisability of thrashing it out to a definite conclusion, to which the backing of the society could be given. The main characteristics of the discussion were that it dealt almost entirely with questions of railroad valuation, to the exclusion of other forms of public utility enterprise, and that considerable criticism was aimed at the committee for bringing in the question of rate-making as an object for valuation.

A written discussion by Mr. Charles Hansel urged that the engineering work incidental to a physical valuation should be more extensively treated in the report. He advised against the society approving the report in its present form.

Prof. George F. Swain commended the report highly as to its general conclusions and the value of the matter collected, but criticised its contents regarding the question of depreciation and the bearing of that item on the whole problem of valuation. Physical depreciation he considered to be only a phase of the matter, and this may actually be quite different from what it is theoretically, depending as it does almost entirely upon the maintenance outlay. Cost of reproducing new was thought by Professor Swain to be the value upon which rates should be based, not upon this item less depreciation. He thought that a depreciation allowance should be set aside each year for keeping the property up to date without additions to the capital, and he favored the sinking-fund method for this. Any method which includes consideration of the original cost he thought would be impracticable, because in many instances the figures on this are not now available. He did not favor repeated determinations of cost of reproducing new in valuation work, but thought that one such determination, supplemented by a requirement for correct accounting, to take care of depreciation in the future, would be the most practical method of procedure.

Mr. Samuel Whinery gave a short but interesting talk on some of the general factors involved in the report. He objected to the introduction of a lot of involved theories and diction, upon the meaning of which engineers themselves are divided and which could not fail to be outside the knowledge of men of other professions. He thought that a valuation can be made without considering depreciation and that expert appraisers would pay little attention to any formulas for determining that item.

Mr. J. M. Schreiber outlined briefly the results of a similar investigation by the American Electric Railway Engineering Association, which was completed last year after three years of work.

The afternoon session proved insufficient to accommodate all who had discussions to give on the subject, so an evening session was held. Mr. J. H. H. Muirhead was one of the speakers at this meeting, and he criticised the report in several respects. In the first place he thought that it should give decided definitions. Also he thought that a fair return is not represented by 8 per cent. In his opinion, the value of the franchise should be included in the valuation of the property of a utility. He thought further that the costs of lobbying should be included in the valuation of such properties.

Mr. Jonathan P. Snow, of the special committee, spoke briefly on some of the considerations that the committee had in mind in planning and carrying on its work on the report. He said that it was the unanimous opinion of the members of that body that in valuation of property and fixing of rates the cost of the service to the producer or utility should be used, not the value of the service to the user. He stated further that one of the main objects of the committee was the furnishing of a report that would provide for the full protection of the investment in utility properties.

Mr. Gardner S. Williams resigned the chair in order to take part in the discussion, expressing his views on the proper definition for depreciation and on some of the factors that he thought should be included in a valuation. Depreciation was defined by him as the difference between the present worth of the future service of a new article or system and the present worth of the future service of the article or system under consideration. Mr. Williams thought that brains should be included in the valuation of a utility property, and since watered stock frequently represents capitalized brains he thought it legitimate and desirable to include watered stock in the valuation of a property.

In closing the discussion, Mr. Frederick P. Stearns, chairman of the special committee, replied to some of the criticisms which had been aimed at the report and the committee. In the first place, he said these criticisms were applicable, if at all, only to minor portions of the report. The whole question of valuation, he thought, depends upon the theory that if the owner of a utility property is to receive the benefit of an unearned increment, with the rise in value of its own and adjacent property, it should be required to bear the burden of an unearned decrement in cases where that occurs.

No definite action was taken at this meeting on the report under discussion, as further opportunity is to be given in the near future for a more general expression of the society's opinion concerning it. The other speakers at these meetings on April 2 were Mr. D. W. Linn, Mr. J. N. Dodds, Mr. C. R. Harter, Mr. M. L. Byers, Mr. H. M. Stone and Mr. T. K. Thomson.

Underwriters' Label Service

Many consumers of electrical goods who have noticed the Underwriters' labels attached to goods passed as meeting standard requirements will be interested in learning something about the label service of the Underwriters' Laboratories of Chicago. Mr. A. R. Small, superintendent of label service of the laboratories, gave a talk on the subject at the weekly luncheon of the Chicago Jovian League on April 6. He told how the label service, which has been in existence for eight years, originated as an outgrowth of the work of the Underwriters' Laboratories, established by Mr. W. H. Merrill. The labels are furnished to manufacturers of various classes of goods, electrical and otherwise, as the result of factory inspection. The service now covers over seventy devices and materials, of which twenty-five are electrical. The label service started with rubber-covered wire, rigid conduit being the next fitting to be provided with labels. The label means the actual examination of the device at the factory of the maker, and implies from 95 to 99 per cent of compliance with standard specifications.

In the case of rigid conduit, an inspector from the Underwriters' Laboratories visits the factory four times a week in busy times. He may stay from half an hour to six hours. All inspectors are governed by very explicit instructions as to their duties. In the line of rubber-covered wire, thirty-five factories in the United States and Canada subscribe to the label service of the Underwriters' Laboratories. All of these produce New Code wire. Old Code wire is now subject to a certain suspicion that it may be, in a way, scrap from New Code wire that did not fulfil the testing requirements. The rubber-covered wire factories are inspected about five times in two weeks. Manufacturers are required to make tests themselves, and the inspector has authority to re-test any New Code wire in the factory. Many tests are made by inspectors, and in ways that the manufacturer cannot anticipate. If the manufacturer is found to be weak on any point, he is required to improve his material in that respect.

The message of the label to dealers and contractors is that competitors are complying at least with the minimum requirements. The manufacturers will note that all inspection work is done at the factory, which is desirable in a number of ways. In other respects the label conveys to the manufacturers a message of distinct business advantage.

Last year the number of Underwriters' Laboratories labels increased 33 per cent over the year before. The service has justified itself. The electrical fraternity has been more active than the other industries in supporting the work of the Underwriters' Laboratories, and in turn the laboratories seek to co-operate with the electrical industry.

In a brief discussion Mr. Small said that the expense of conducting the Underwriters' Laboratories was borne by the insurance companies, so far as the building and equipment are concerned. The pay roll is met out of the receipts from the clients of the laboratories. No charge is made to manufacturers for the overhead expense of the laboratories. Labels are furnished at a flat rate, there being no discount for quantity. Rebates are made at the end of the year if it is found that service to any particular line has been rendered at a less expense than had been anticipated. The idea is to charge for the labels what the inspection service actually costs to each line of an industry, as rubber-covered wire, conduit, snap switches, etc., the different lines being figured separately. In any event, it is not planned that the label service shall cost more than 1 per cent of the manufacturing cost.

Public Service Commission News

West Virginia Commission

Attorneys representing the Elkins Coal & Coke Company have brought suit to have declared unconstitutional the hydroelectric law passed at the 1913 session of the West Virginia Legislature. The suit is brought in the form of an action to enjoin the Public Service Commission of the State from granting to the Hydro-Electric Company of West Virginia, a subsidiary of the West Penn Traction & Water Power Company and controlled by the American Water Works & Guarantee Company, a permit to erect a dam on the Cheat River, near the Pennsylvania line. The coal company asserts that the law is unconstitutional in that it permits the taking of private property without due process of law and also that the Legislature had no authority to dispose of inherent and inalienable rights of citizens of the State in the streams, such as navigation, fishing and others. The coal and railroad companies of the State, since the passage of the law giving authority to the commission to grant water-power permits, have filed many remonstrances against the granting of permits, but this is the first attack on the law in the courts.

Kansas Commission

The first report of the Public Utilities Commission of Kansas, covering the period from May 22, 1911, to Nov. 30, 1912, contains a report of the work of the engineering department on electric service and rates by Mr. F. H. Hanson, electrical engineer. The commission made a valuation of two plants in rate cases. In addition to the items of the inventory consideration was given to engineering supervision, interest during construction, contingencies, etc., in arriving at the cost of new and present value of the tangible property. As a basis for rates in addition to the present value of the physical property an allowance of 10 to 12 per cent of the yearly gross revenues was made for working capital. This item covered stores and supplies and cash on hand. An allowance was also made for going-concern value.

Where two utilities were operated jointly a certain amount of expense was incurred for the benefit of both. This expense was apportioned to each service in the same ratio as the cost was incurred. The depreciation per year was determined by dividing the depreciable values of the property by the average life of the plant. The average life of an electric plant is about seventeen years, thus making 5.9 per cent of the rate of depreciation on the depreciable property or 5.4 per cent on the total physical property with no interest accumulations. With the fund drawing 2.5 per cent interest, 4.75 per cent of cost new of the plant would suffice.

Mr. Hanson states that profits to the company should be such as will induce investors to develop the electric utility business. Consideration must be given to the efficiency of the management, since to allow the same percentage profit to the poorly managed plant as to the efficiently managed one would be a hardship upon the consumers of the poorer plant and unjust to the owners of the efficiently operated plant. The service must also be considered as a factor in determining the percentage of profit allowable. However, to allow a less profit to the plant furnishing poor service tends to make it impossible to improve the service. The better method is to require the management of all plants to maintain the same standard service and thereby eliminate the consideration of the service as a factor of the rate of return. Another factor for consideration is the over-investment in a plant of larger capacity than is necessary to supply the demand of the consumer.

Wisconsin Commission

The Wisconsin Railroad Commission has denied the application of the Sheboygan Railway & Electric Company for an increase in street-lighting rates. The utility alleged that the previous order of the commission reducing the rates for street lighting was in error and requested a reinvestigation. A review of the testimony and facts in the case failed to substantiate the charge.

The petition of the city of Sheboygan for a certificate of convenience and necessity authorizing a municipal lighting plant, on the ground that the service rendered by the Sheboygan Railway & Electric Company was grossly inadequate, was not granted by the commission. It appears that the utility has changed hands since the petition was filed and that the present owners contemplate making extensive improvements in the street-lighting service.

The Milton Water, Light & Power Company has been authorized to put into effect a minimum monthly charge of 75 cents.

Ohio Commission

It is said that the Public Utilities Commission of Ohio is sending out, or is about to send out, an order requiring all utilities in the State to file inventories with the commission on or before Aug. 1, 1914.

New Jersey Commission

The Board of Public Utility Commissioners of New Jersey has conditionally granted the Jersey Power Company permission for the issuance of $40,000 capital stock, to be used for the construction of a new transmission line from Boonton to Dover, via Fox Hill and Millbrook, and to Wharton and Rockaway, about 15 miles. The company plans to lease the power plant of the Jersey Corporation at Boonton, discontinue the power stations now in operation by the Eastern Pennsylvania Power Company at Dover and Bernardsville, and distribute from its transmission line mainly over the system of the latter company. The board imposes the following conditions upon the stock issuance: Relieving the property of the Eastern Pennsylvania company from the mortgage now executed by a Pennsylvania corporation of the same name; not to furnish local service in either Boonton or Hanover Township except as specifically permitted later by the board, such territory now being supplied; the immediate amortization by the Eastern Pennsylvania company of the power stations to be discontinued, and the amortization of the circuit to be displaced between Millbrook and Dover. The board further states that its approval of this stock issue does not imply its approval of the contract for the sale of power which is proposed between the Jersey and Eastern Pennsylvania companies.

The board has decided that the Public Service Electric Company must comply with the terms of an ordinance of the city of Plainfield, under which it agreed to light the municipal building of such city free of cost. The company contended that such clause constituted an unjust discrimination. The board holds that when a public utility bargains with a municipality for a franchise grant it acts in a unique capacity, for it may assume obligations to make a return in money or service for the franchise privilege it seeks, or it may undertake to pay the municipality a certain portion of its receipts, or undertake to afford a stipulated amount of free service. In its conclusion the board states:

"It is one thing to promise service without charge when the utility bargains with a body politic for a franchise, and it is a radically different thing to sell service to the public generally. In the first instance particular privileges are bought; in the other case the utility sells services to consumers generally. In one case it buys a franchise; in the other it sells a service."

Current News Notes

The Gyroscope.—An illustrated lecture on the application of the gyroscope to marine purposes will be delivered by Mr. E. A. Sperry in the Schermerhorn Building, Columbia University, New York, on April 18 under the auspices of the department of electrical engineering.

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Student Show at Ohio State University.—The Ohio State University branch of the American Institute of Electrical Engineers at Columbus, Ohio, composed mainly of students, will give an electrical exhibition on April 16, 17 and 18. Mr. L. R. Yeager is the chairman of the branch.

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Alternating-Current Bakery Power Plant.—The new bakery plant of the Acme Tea Company, Philadelphia, Pa., which, as described in the *Electrical World* of April 4, has a daily output of 15,000 loaves of bread and is equipped with alternating-current drive throughout, was designed by Ballinger & Perrot, Philadelphia, as architects and engineers.

* * *

Light Without Heat.—At the convention of the American Chemical Association at the University of Cincinnati on April 7 heatless-light possibilities were discussed by Prof. W. E. Bancroft, of Cornell, who said he had achieved what he called the light known as the electric firefly. This is produced by electricity under certain conditions and is not yet commercially available. The light resembles the phosphorescent light of a firefly.

* * *

Traveling Expenses for Swedish Engineers.—The Swedish government has appropriated $13,500 for traveling expenses to be distributed among Swedish engineers who desire to visit the Panama-Pacific Exposition in San Francisco in 1915. Application should contain the reason why the applicant desires to visit the exposition, the length of time of stay in San Francisco, what industrial works in the United States it is intended to visit to complete the observations at the exposition, and the total length of time the applicant intends to stay in the United States.

* * *

New York Electric Service Company Entertains Yale Engineering Students.—On April 2 about 100 visiting electrical and mechanical engineering students from the senior class of Sheffield Scientific School, Yale University, were entertained in New York by the United Electric Light & Power Company when the students made an inspection trip of the latter's new 201st Street generating station. The students assembled at the Engineering Societies Building and were conducted to the plant in three motor buses decorated with Yale colors. About two hours were occupied inspecting the station, after which luncheon was served by the central-station company. The tables were set in the form of a large "Y" and the numerals "14" to indicate the graduating class. In addition to some of the faculty and students the following were present: Messrs. Thomas E. Murray, vice-president of the United company; John W. Lieb, Jr., vice-president of the New York Edison Company; Walter F. Wells, vice-president of the Edison Electric Illuminating Company of Brooklyn, and others. The guests were welcomed by Mr. Frank W. Smith, vice-president and general manager of the United company, who gave a brief history of the purchase of the property and the construction of the new station. Mr. Lieb and Professor Breckenridge also made a few remarks.

SOCIETY MEETINGS

May Meeting of Electrical Supply Jobbers' Association.—The Electrical Supply Jobbers' Association will hold its May meeting at the Chalfonte Hotel, Atlantic City, N. J., May 12, 13 and 14.

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Engineering Ethics.—At a dinner meeting of the American Institute of Consulting Engineers, Inc., to be held at the City Club, 55 West Forty-fourth Street, New York City, April 13, there will be a general discussion on the topics "The Conduct of Engineering Competitions" and "Interference by the Contractor with the Practice of the Consulting Engineer." Mr. E. W. Stern, 101 Park Avenue, New York, is secretary of the organization.

* * *

Chicago Jovian League.—At the luncheon of the Chicago Jovian League on April 6 Mr. Victor H. Tousely, chief electrical inspector of the city of Chicago, presided. Mr. Frank B. Chase, president of the Chicago chapter of the National Fire Protection Association, spoke briefly, announcing that the annual convention of that association will be held in Chicago on May 5, 6 and 7. The principal speaker of the day was Mr. A. R. Small, of the Underwriters' Laboratories, whose subject was the "Underwriters' Label Service."

* * *

Yonkers Division, N. E. L. A.—At a meeting of the Yonkers (N. Y.) Division of the National Electric Light Association, April 6, three papers were presented: "Line Conductors," by Mr. Edmund J. McMahon; "The Wiring of Old Residences," by Mr. George McMichaels, and "The Use of Electrical Appliances and Their Relation to the Central Station and the Home," by Mr. Joseph V. Guilfoyle, formerly of the Yonkers Electric Light & Power Company but now manager of the appliance bureau of the United Electric Light & Power Company, New York.

* * *

Ladies' Auxiliary to the Jovian Order.—At a meeting of the Jovian Electrical League of Philadelphia, Pa., to be held on Friday, April 17, at 8 p. m., the question of forming a ladies' auxiliary to the league will be discussed. This question has already been presented by Miss Dille Hastings, president of the Men and Women's Equal Suffrage League, at a luncheon of the Jovians held April 7 at Jovian Hall, Bingham Hotel. Philadelphia Jovians are seeking to distinguish themselves as the pioneers in the movement to establish a ladies' auxiliary to the order. Mr. George L. Thompson, Witherspoon Building, is statesman of the Philadelphia Jovians.

* * *

National Association of Electric Sign Manufacturers.—At a meeting of the representatives of electric-sign interests held at the Planters' Hotel, Chicago, March 30 and 31, the National Association of Electric Sign Manufacturers was formed. After much lively discussion, a constitution was adopted and officers were elected as follows: President, Mr. George R. Hall, National Electric Sign Company, Jersey City, N. J.; first vice-president, Mr. Frederic A. Kehl, Brilliant Sign Company, St. Louis, Mo.; second vice-president, Mr. Norman B. Hickox, Greenwood Advertising Company, Knoxville, Tenn.; third vice-president, Mr. T. C. Macey, Macey Sign Company, Toronto, Ont., and treasurer, Mr. C. M. Davis, the American Sign Company, Kalamazoo, Mich.

* * *

Graphic Statistics for the Engineer and Executive.—At a meeting of the American Society of Mechanical Engineers to be held at the Engineering Societies Building, New York City, April 14, Mr. Willard C. Brinton will read a paper describing some of the graphic methods not generally used by engineers but which, it is believed, could be of very great assistance to men who must frequently condense and abstract information and write reports. Some methods are now in use by the biologist and the statistician that could be widely applied to the work of the engineer if more generally understood. Much of the speaker's talk will be devoted to methods for keeping corporation operating records in form for instantaneous reference.

* * *

Water and Light Association of the Carolinas and Georgia.—The fourth annual convention of the Tri-State Water and Light Association of the Carolinas and Georgia will be held at the Piedmont Hotel, Atlanta, Ga., April 16 and 17. The association is composed of managers and superintendents of municipal lighting and water-works plants. Among the numbers of electrical interest on the program are papers on "Accounting Systems for Water and Lighting Departments," by Mr. Joel Hunter, Atlanta, and "Watt-Hour-Meters," by Mr. L. W. Carnagy, Atlanta. There will also be an address by Mr. W. Rawson Collier, Atlanta, Ga., the subject of which is to be announced later. Mr. A. J. Sproles is president of the association and Mr. M. A. Stubbs is secretary-treasurer.

* * *

Meeting of the Empire State Gas and Electric Association.—The spring meeting of the Empire State Gas and Electric Association will be held at the Alert Club, Medina, N. Y., on April 22, beginning at 10 a. m. The morning session will be devoted to the new workmen's compensation law, which goes into effect on July 1, and to the accident-prevention work of the safety committee. Mr. J. Mayhew Wainwright, member of the Compensation Commission, and Mr. Cyrus W. Phillips, member of the Assembly, will be present and will address the meeting on the compensation law and its application to the gas and electric business. There will be ample opportunity following their talks for informal discussion. The safety committee has been busy drafting rules for the prevention of accidents. These, it is expected, will be ready for discussion. The committee on arrangements is Messrs. C. M. Kaltwasser, H. K. Stein and A. L. Swett.

* * *

Philadelphia Section, N. E. L. A.—The March meeting of the Philadelphia Electric Company Section of the National Electric Light Association marked the fifth anniversary of the section's organization. Instituted in 1907 with 151 charter members, its enrolment to-day numbers 823. Prof. William J. Humphreys, physicist of the United States Weather Bureau, addressed the March 16 session on the topic "The Thunderstorm and Its Phenomena." At the meeting of the meter department branch, March 2, Mr. Charles F. Gerhard gave an illustrated talk on "The Mexican Was as It Really Is." At the meeting of the engineering department branch, March 12, medals were presented to thirty-eight employees of the company who have been in its service more than twenty years. Speeches were made by Messrs. J. B. McCall, W. H. Johnson, W. C. L. Eglin, A. J. DeCamp, J. T. Maxwell, P. H. Bartlett, and others. Before the combined meeting of the accounting and commercial department branches on March 10 Mr. H. R. Kern, auditor of the company, discussed "Commercial Law as Applied to Contracts," and Prof. W. H. Lough of the New York University School of Accounts and Finance, spoke on the subject "Business Principles."

Hydroelectric Development at Kananaskis Falls, Alberta

Extension to the Calgary Power Company's system—30,000 hp now available for municipal and industrial uses—Over one-third the effective head obtained in draft tubes

IN the Dec. 23, 1911, number of the *Electrical World* was published a description of the hydroelectric development on the Bow River at Horseshoe Falls, 50 miles west of Calgary, Alberta, Canada. At that point, where the river flows through a deep, narrow gorge, a solid reinforced-concrete dam was built during the winter of 1910, providing for four stop-log sluiceways, a main spillway and four hydraulically operated lift-gates, the working head being 70 ft. About 400 ft. below the dam Power House No. 1 was erected. It was designed to accommodate four units and two turbo-exciters, of the horizontal type. At that time only three units were installed, one 6000-hp turbine directly connected to a 4500-kva, 12,000-volt generator; two turbines to drive 2500 kva, 12,000-volt generators, and two 125-kw, 120-volt exciters, water being supplied by three steel penstocks. Two 3000-kw, three-phase transformers, installed by the Canadian Westinghouse Company, stepped up the voltage from 12,000 volts to 55,000 volts, at which pressure energy is transmitted over two No. 0000 stranded aluminum lines to the city of Calgary. Electricity is also supplied over two similar lines at 12,000 volts to the Canada Cement Company at Exshaw, about 8 miles west of Horseshoe.

Extensions to System

Owing to the rapidly increasing demand for electricity, it was discovered within the first two years of operation that extensions had to be made. On account of the extreme variation in the flow of mountain streams fed for the most part from glaciers (the Bow River varying from about 15,000 cu. ft. a second in midsummer to 1000 cu. ft. a second in winter) the only practical way to operate under a high load-factor was to build a second power house and to dam the river at another point. The Calgary Power Company adopted this scheme, and preparations were at once begun to harness Kananaskis Falls, 2 miles above the Horseshoe.

Dam No. 2

The most suitable place to dam the river was above Kananaskis Falls, where the Kananaskis River joins the Bow and where there is a solid rock riverbed. About Jan. 1, 1913, work, estimated to require a period of not more than a year and to cost $750,000, began on the new development. The whole project was undertaken and carried to completion by the company's engineers, whereas Plant No. 1 had been erected by Messrs. Smith, Kerry & Chace, of Toronto.

After various tests it was discovered that gravel for concrete could be obtained on the premises, resulting in a saving to the company of thousands of dollars. A light railway and traffic bridge was built across the Kananaskis River to connect the construction camp with the main line of the Canadian Pacific Railway. Early in the year the excavation for the dam commenced, and from that time the job was rushed for-

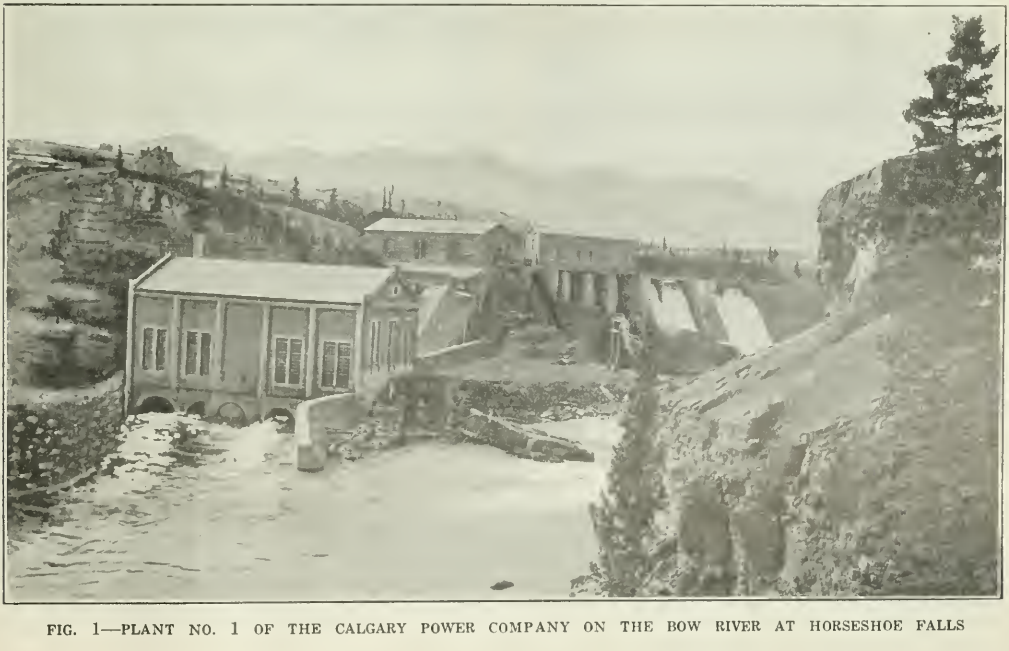


FIG. 1—PLANT NO. 1 OF THE CALGARY POWER COMPANY ON THE BOW RIVER AT HORSESHOE FALLS

ward without delay. The Bow River being a glacial stream and subject to extreme rise in flow, it was necessary that the dam structure should reach a certain height before the spring freshets interfered.

Through a solid ledge of rock extending out in the direction of the dam a temporary sluiceway was at once cut and faced with concrete, so that stop-logs could be inserted when necessary. A cofferdam was built across the stream to a point about 150 ft. from the opposite bank. When this first section of structure was completed the river had reached its summer high-water mark, and further extension of the dam in the meantime was impossible, the temporary sluiceway not being large enough to carry the flow. The completion of the north end was left till autumn, when there was less water in the river, and the temporary sluiceway was then filled in permanently with concrete.

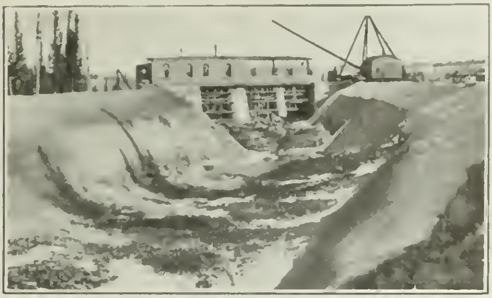


FIG. 2—VIEW OF PLANT NO. 2 OF THE CALGARY POWER COMPANY

In general the design and dimensions of the completed structure are as follows: The total length of the dam is 800 ft., which comprises eleven 24-ft. stop-log sections and seven main spillway sections also 24 ft. in length. The height of the dam to the main spillway is 57.5 ft., above which is a surface deck, acting as a traffic bridge. A traveling, electrically operated winch is placed on the top deck for handling stop-logs. Three inspection tunnels were left in the interior for draining off the seepage, and there are two main entrance drop-shafts. To minimize seepage, 2-in. holes were drilled, 2.5 ft. apart, on both sides of the dam, to varying depths, and all fissures were filled with grout.

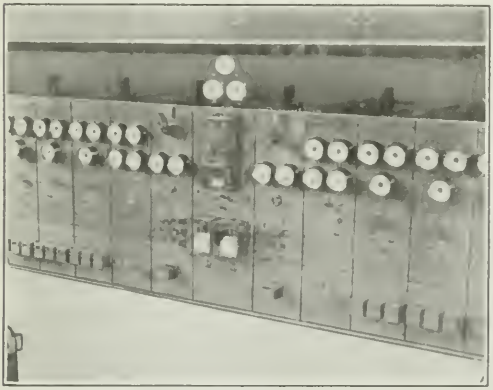


FIG. 3—SWITCHBOARD IN PLANT NO. 2, CALGARY POWER COMPANY

Canal

The power house and headworks are on the south bank of the river about 1000 ft. below the dam, and the water passes from the forebay to the headgates through a canal. From the draft tubes to the lower river the water flows through tunnels. The canal walls are lined with stone and concrete, except at its mouth, where the canal passes through solid rock. It is 700 ft. long by 80 ft. wide at the top and 50 ft. at the bottom, and permits an available water depth of 15 ft.

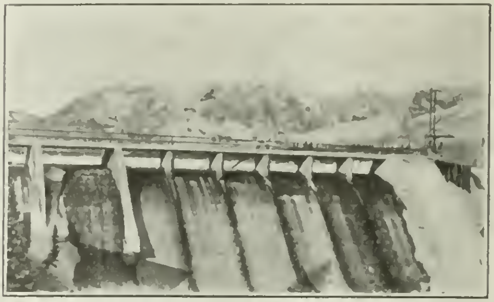


FIG. 4—DAM AT KANANASKIS FALLS, ABOVE POWER HOUSE NO. 2

Hydraulic System

Special importance is attached to the headworks, wheel chambers and tailrace systems. Water from the canal drops into two large pressure tubes built of concrete, 60 ft. in length and 35 ft. by 13 ft. in cross-section at the headgates and 12 ft. by 12 ft. at the scroll chambers. These connect directly into two turbines through wicker gates, whence the water discharges under vacuum into draft tubes of concrete, 30 ft. in length, with a varying cross-sectional area of 81 sq. ft. at the entrance to 13 ft. by 16 ft., where it discharges

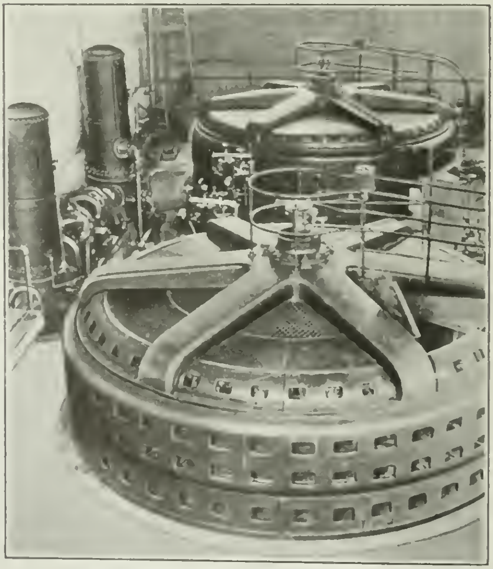


FIG. 5—MAIN UNITS IN PLANT NO 2, CALGARY POWER COMPANY

into two tunnels inlaid with concrete and is carried down to the river again below the falls. With this arrangement a total head of 70 ft. is maintained, about 25 ft. being gained through vacuum in the draft tubes. To regulate the head-water supply two stop-log openings and two Tainter gates are installed for each pressure tube. The Tainter gates were designed and built by the company's engineers and are housed by a building of hollow tile and plastered cement to harmonize in general with the architectural design of the power house.

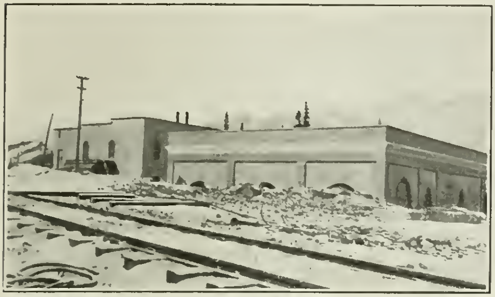


FIG. 6—TAINTER GATE HOUSE, PLANT NO. 2, CALGARY POWER COMPANY

Power House

The power house is economically arranged for its ultimate installation. It is 90 ft. long by 60 ft. wide, with foundation walls built up for 15 ft. of solid concrete, above which tile plastered internally and externally is used. On the main floor are the generators, switchboards, station-service transformers, storage battery and machine shop. From the lower floor access is had to the turbines. An upper gallery supports the lightning arresters and busbars. The hydraulic equipment comprises two 5800-hp vertical-type, single-runner, reaction turbines, built by the Canadian Allis-Chalmers Company, of Montreal, supported on Kingsbury bearings and controlled by oil governors manufactured by the same company. These turbines are directly connected to two vertical-type generators, rated at 4250 kva, 12,000 volts, three-phase, 164 r.p.m., sixty cycles, manufactured by the Swedish General Electric Company. Excitation energy is obtained from one vertical turbo-exciter, rated at 75 kw, 220 volts, 600 r.p.m., and one motor-generator exciter of the same rating. Three 75-kw single-phase transformers step down the voltage from 12,000 volts to 2200 volts for local distribution and power-house service. A 50-ton electric crane is installed for handling all machinery.

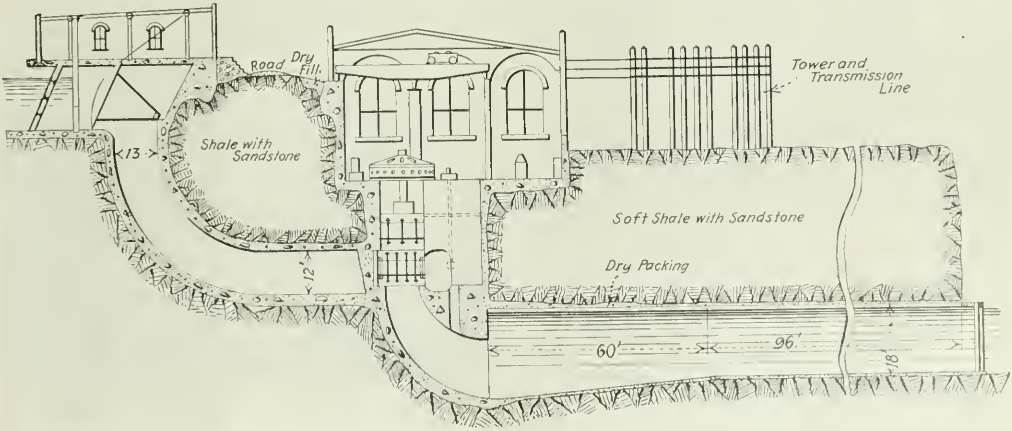


FIG. 7—CROSS-SECTION OF POWER HOUSE, HEADWORKS AND TAILRACE TUNNEL, NO. 2 PLANT OF CALGARY POWER COMPANY

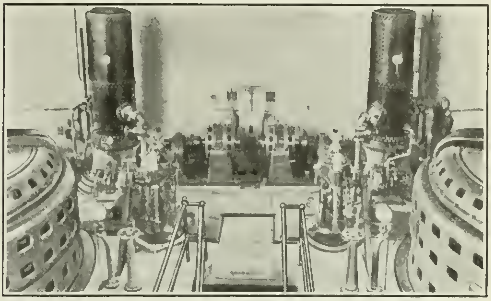


FIG. 8—WATERWHEEL GOVERNORS IN PLANT NO. 2, CALGARY POWER COMPANY

The switching apparatus and electrolytic lightning arresters were supplied by the Canadian Westinghouse Company. Direct current for remote control is delivered by an 80-amp-hr. storage battery, discharging at about 120 volts.

Exceptional progress was made in carrying out the development under the direction of Mr. C. W. Allen, construction superintendent, and Mr. H. S. Johnson, who had direct supervision of all details of design. About the middle of December the first wheel was started, and up to the present it has been carrying its share of the load. The second unit has since been tied in. The successful accomplishment of this hydroelectric scheme was not without certain difficulties, but under the skilful organization of Mr. H. A. Moore, general manager and chief engineer, these were overcome satisfactorily. The Canadian Pacific Railway Company's steel bridge across the Kananaskis River had to be raised 4 ft., and a retaining earth wall had to be built half a mile above the dam on the Bow River to protect the Canada Cement Company's shale pit, situated on the south bank.

Combined Rating of Plants

During the summer of 1913 a fourth unit, comprising a 6000-hp, 225-r.p.m. Wellman-Seaver-Morgan Company horizontal turbine directly connected to a 4500-kva, 12,000-volt, three-phase generator erected by the Canadian General Electric Company, was installed in Plant No. 1 with a steel-riveted penstock 12 ft. in diameter. Two additional 3000-kw, 12,000-55,000-volt, three-phase transformers were installed by the Canadian Westinghouse Company.

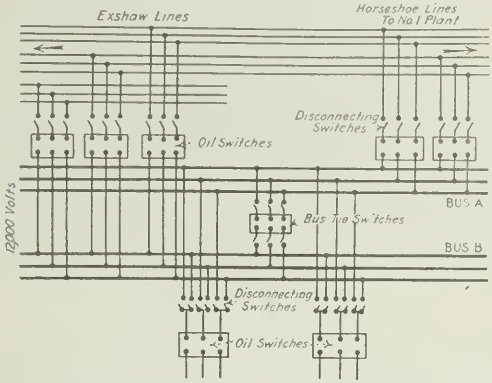


FIG. 8—CIRCUIT DIAGRAM SHOWING 12,000-VOLT BUSES

The company has now available approximately 30,000 hp. The two stations are tied by a double-circuit aluminum line, so that either station can supply electrical energy to the city of Calgary or the Canada Cement Company at Exshaw, or to both. The transformers in Plant No. 1 step up the voltage for both stations. The section of 12,000-volt lines from Plant No. 2 to its junction with the former Exshaw lines is made up of five-circuit No. 1 solid copper wire. A third aluminum circuit has been added from this point to Exshaw on double-pole structures, and the terminal station there has been enlarged to meet the increased demand for energy.

The problem of storing water for the winter season was partly solved two years ago by building a dam across the Cascade River at the outlet of Lake Minnewanka, about 40 miles west of the hydro stations. The lake, 3 miles long by 1 mile broad, is fed from glaciers and empties into the Bow River. By means of the 70-ft. high concrete dam the water was elevated about 13 ft. This additional storage supply is regulated by three stop-log openings, each 10 ft. wide.

Hydroelectric Plant with Induction Generator Operated Without an Attendant

A very interesting example of a non-attendant power plant is afforded by the recent installation of what is known as the Green River plant of the Greenfield (Mass.) Electric Light & Power Company. The company has a 3000-kw steam plant situated on the bank of a small stream known locally as the Green River. Water from this stream is used at the steam plant for boiler-feed and condensing purposes, a pond being formed by a dam across the stream below the plant, this pond having an area of approximately 10 acres.

During the year 1913 it became apparent that the dam (an ancient log structure) would have to be renewed. It was therefore decided to build a concrete gravity type of dam primarily for securing the water supply of the steam plant.

Investigation seemed to show that a small amount of power could be generated in connection with the dam, provided the operating expense could be kept at a low value. After due deliberation a 24-in. double-runner horizontal waterwheel was installed and belted to a 100-hp, three-phase, 2300-volt squirrel-cage induction motor, the motor being driven above synchronous speed so as to operate as an induction generator.

The waterwheel is controlled by a governor which holds the no-load speed about 15 per cent above normal, so that while normally the wheel runs at full gate opening, if the load drops off for any reason, the set will not run away.

The motor is connected through an automatic switch and meter to the 2300-volt distribution line of the company right at the plant. Ordinarily there is sufficient load on this line to absorb the output of the induction generator. At times of light load the output of the generator is fed back into the main station bus.

If the switch on this feeder at the main station should open for any reason, the induction generator loses its excitation but keeps right on running. When the switch is closed the generator becomes energized and immediately picks up its portion of the load. The process of starting up is simplicity itself; the wheel being started and the machine brought up to approximately synchronous speed, the switch is closed and the operation is complete. Provisions are made for operating one runner of the wheel separately in times of low water.

The normal attendance of this plant is limited to a visit three times a day, at shift changes in the main plant. The operator stops at the plant on his way to work, reads the meters, feels the bearings and observes the general condition of the machinery, racks, etc. The plant was placed in operation Jan. 1 and is fulfilling all expectations as to reliability and low operating costs.

The dam has a height of 11½ ft., including flashboards, and a spillway of 160 ft. The wheel chamber is built integral with it at one end and the generator is housed in a brick building adjacent to the wheel chamber, the wheel shaft running through a stuffing box into the generator room.

GREEN RIVER PLANT OF GREENFIELD ELECTRIC LIGHT & POWER COMPANY

The dam and building were built by Messrs. F. T. Ley & Company, contractors, under the direction of Mr. H. A. Moody, hydraulic engineer on the staff of the Greenfield Electric Light & Power Company.

Classification and Characterization of Molded Insulations—II

Additional data on the mechanical and electrical properties of molded insulations and on the types which are best adapted for particular uses in the arts. By Emile Hemming

LAST week's issue of the *Electrical World* contained the first part of this article, dealing with the division of molded insulations into nine general classes and the characteristics of some of these. The instalment which follows concludes the discussion, with illustrations and tabular data.

Rubber is the only moldable insulation which in itself, without the admixture of a filling or strengthening medium, presents all the desirable qualities of an insulator. Its toughness, elasticity and flexibility are not even approached by other insulations. It is therefore unsurpassed as a binder for organic and inorganic fillers when not subjected to a continuous temperature of 100 deg. C. or over.

Experiments are being conducted to render celluloid less inflammable and hence more suitable for electrical insulation. This material is especially adapted to use where ornamental appearance is paramount. Celluloid is a good insulator and can be molded with more ease than perhaps any other material. The substance loses its color and transparency at 140 deg. C. and decomposes at about 190 deg. C., giving off inflammable vapors. Celluloid is not soluble in water, but gradually dissolves in concentrated sulphuric acid.

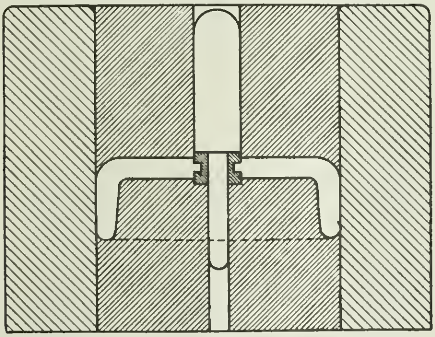


FIG. 4—DIE FOR HOLDING METAL INSERTS

Albuminoids, or casein, were produced to obtain a substitute for celluloid which would have greater heat resistivity. These products are not stable under the action of moisture, however, unless treated with formaldehyde. Casein is easily worked with tools and withstands 20 deg. to 30 deg. C. higher temperature than celluloid. It chars upon the application of heat without burning.

Synthetic resinous materials have all of the advantages of hot-molded insulations and possess higher heat resistivity. These phenol-formaldehyde products are ordinarily brittle, but when organic or inorganic fibrous materials are incorporated in them they equal or surpass all known insulations except rubber products in strength.

To produce the reinforced material, the phenol-formaldehyde condensation product is heated until plastic when hot and hard when cold, pulverized, and mixed with the fibrous filler. The mixture is heated in dies under pressure until plastic and then transformed into the hard, infusible state, or the plastic hot mixture is molded in sheet or cake form directly in dies without first pulverizing. The filler (usually wood pulp or asbestos) must be added before the binder reaches the infusible state.

The heat resistivity of these reinforced synthetic resinous insulations depends on the material used as a filler. A compound containing wood pulp can withstand 175 deg. C., while one containing asbestos may be subjected to temperatures up to 250 deg. C.

Exposure to moisture and water for several years would indicate that this class of insulation is unaffected thereby, but its relative moisture-resistivity compared with rubber is not definitely decided at the present time. The compounds containing a wood-pulp filler after immersion in water for several months appear to be affected more than those containing inorganic fillers. The more of the latter filler used the better can the resulting insulation withstand electric arcs, while the more binder employed, the easier it is to mold the articles and protect them against moisture. Absolute accuracy in dimensions can be obtained by molding this insulation.

TABLE I—MOLDED INSULATIONS ADAPTED TO THE MANUFACTURE OF DIFFERENT ARTICLES

Articles Preferably Made from Molded Insulation	Class of Materials to Use
Receptacles, sockets, rosettes, fuse blocks, wire cleats, etc.	D and B best suited, D especially, because of low cost.
Various types of switch handles	Practically limited to A and B; C, E and G not so suitable on account of finish or cost.
Small handles and knobs	A best where no heat resistance required; B good.
Receiver cases, telephone mouthpieces, terminal boards, etc	A and E best.
Overhead-line and strain insulators	A used almost exclusively; E very good; G would be ideal except for a high cost.
Magneto distributors, collectora and similar parts	G used almost exclusively.
Bushings	G and E best where great strength required; B and C suitable, and A where no high heat resistance required.
Synchronizing plug handles, etc	A best, followed by G and B.
Charging and contact plugs, etc	B, C and G best; D brittle.
Connector and plug parts for electric flatirons and electrical heating appliances	B used almost exclusively, C next best because of high heat resistance
Terminal bushings and contact parts subjected to intense heat	C used almost exclusively.

NOTE G could be used in most of the above cases except for high cost.

Vulcanized fiber is prepared by treating vegetable fibers with zinc chloride or other metallic chlorides, alkaline compounds and sulphuric acid, to produce a glutinous mass which is pressed into sheets, tubes, etc. The chemicals used in the manufacturing process unless removed will impair the insulating qualities of the fiber. Vulcanized fiber is unaffected by organic solvents and is tough and easily worked with tools, but will char and hold a flame after exposure to 175 deg. C.

Fiber treated with a resinous binder is very stable and has good mechanical properties. Its heat resistivity depends on the softening temperature of the binder.

Molded mica is made by cementing together with resinous binder thin laminas or flakes of mica, which are afterward subjected to pressure and heat to form a compact product. If mica in a powdered form could be successfully cemented together with an inorganic binder, its use would be extensive.

Either the open or closed die can be used in hot-molding insulations, but cold-molded products should be formed in closed dies only. It is customary to weigh the material when plunger-type dies are used, with the exception of porcelain, which is measured by volume. Metal parts should be knurled or roughened, to prevent loosening, if they are to be molded in an article.

When letters have to be molded on an article which cannot be removed from the die in an entirely finished condition, and subsequent hardening, grinding and polishing is necessary, the following procedure is considered good practice: Recess a portion of the surface, leaving the embossed letters flush with the surface so that when the final finishing and polishing is done the letters will receive the same finish as the rest of the surface.

Articles made of Class B, C or D materials should not have thin parallel walls, as it is difficult to mold them with sufficient mechanical strength. By designing the walls with a taper, molding is facilitated and mechanical strength increased.

By designing pieces which are ordinarily molded in hot dies with fillets and tapers instead of square cor-

TABLE II—CHARACTERISTICS OF MOLDED INSULATIONS

	Class of Insulation	A	B	C	D	E	F	G	H	I
	Mechanical strength	Less brittle than D.	Less brittle than D.	Less brittle than D, better than A or B, and poorer than E, G or H.	Brittle, good tensile strength, low elasticity, cannot withstand shock or vibration.	Strong.	Fairly strong.	Strong	Very strong.	
	Effect of moisture	None when high-class gum is used and when there is no excess of filler.	Negligible; used outdoors successfully ten years.	None if treated; successfully used outdoors ten years.	No effect if glazed.	None unless containing asbestos fiber, when dielectric strength is affected slightly.	None on celluloid; bad on casein because hygroscopic.	Same as A during time it has been on market.	Ordinary form hygroscopic, new type not so.	
Heatproof qualities	Allowable temperature: Momentary		500 deg. C.	1500 deg. C	Lavite is preferable for heat-resisting	100 deg. C.		300 deg. C.	200 deg. C.	175 deg. C
	Allowable temperature: Continuous	80 deg. C.	300 deg. C.	900 deg. C.		80 deg. C.	80 deg. C.	150-250 deg. C.	80-100 deg. C.	80 deg. C.
	Effect of heat	Binder melts.	At higher heat material deteriorates.	At higher heat material deteriorates.	Porcelain liable to crack with sudden temperature change.	Seriously affected by continued heat.	Affected by continued heat; decomposes giving off vapor.	At higher heat material deteriorates.	Vulcanized product liable to warp at 100 deg. C.	Shellac melts.
	Stability	Excellent if high-grade material is used, but reduced by adulteration.	Good	Good; improves with age.	Excellent.	Excellent when properly compounded.	Good at low temperatures.	Good.	Affected under atmospheric conditions with ordinary grades, but new type containing hardened vegetable fiber is stable.	
Adaptability to molding	Type of work	Excellent for accurate work; metal parts can be embedded.	Good for all work where variation in accuracy up to 0.01 in. can be allowed.	Especially good for flat plates and large pieces; metal parts can be embedded.	Metal parts cannot be embedded.	Excellent for accurate work; metal parts can be embedded.	Metal parts can be embedded.	Excellent for accurate work; metal parts can be embedded.		
	Method of molding	Hot.	Cold.	Cold.	Cold.	Hot.	Hot.	Hot	Pressed in sheets.	Built up of flakes or sheets
	Shrinkage	None.	Some manufacturers claim they can mold to size, others guarantee variation within 0.010 in.		As high as 15 per cent in firing; allow 0.015 variation per inch.	None.	Moderate	None.		
	Insulation dependent on	Compounding of products.	Mixture and pressure.	Compounding and treatment.	Chemical components.	Compounding of products.		Nature of synthetic binder and filler.	Physical treatment and seasoning with ordinary fiber, and on temperature pressure and synthetic cement in new types	Mica
	Resistance to chemical action of acid or alkali	Doubtful.	Doubtful	Doubtful.	Excellent.	Good to a certain extent if specially compounded hard rubber.	Doubtful.	Doubtful.	Doubtful.	
	Adaptability to machining	Can be machined, but better to finish in mold.	See A.	See A.	Cannot be machined.	See A.	See A.	See A.	Especially adapted to machining.	
	Natural color	Black or brown.	Black; depends on ingredients.	White or black.	White.	Gray-brown when containing asbestos; black if ordinary hard rubber.		Reddish-brown or black.		
	Other colors obtainable	Various colors.		Various colors.	Various colors by glazing.	Various colors.	Particularly adapted to coloring.	Black and other colors.	Various colors, but usually gray, black or red	
	Finish obtainable	Leave die with high polish, but can be buffed.	Flat and lusterless. Must use abrasive and buffer to obtain high polish.	Smooth, close-grained.	High finish with glaze.	See A	See A.	See A.		..

(From "Molded Electrical Insulation and Plastics," by Emile Hemming.)

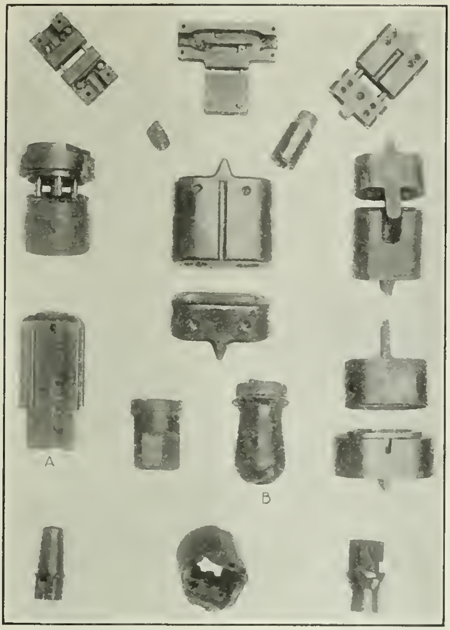


FIG. 5—PLUG PARTS MADE OF MOLDED INSULATION

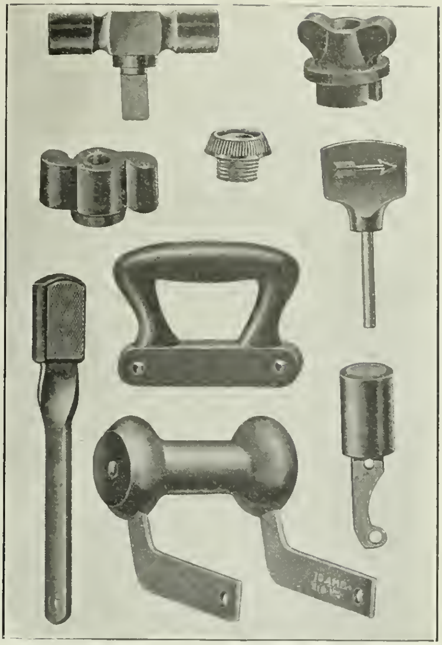


FIG. 7—SWITCH HANDLES OF MOLDED INSULATION

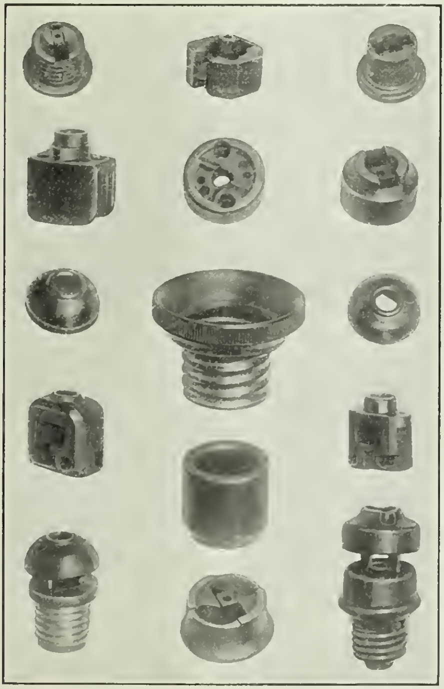


FIG. 6—INCANDESCENT LAMP PARTS MADE OF MOLDED INSULATION

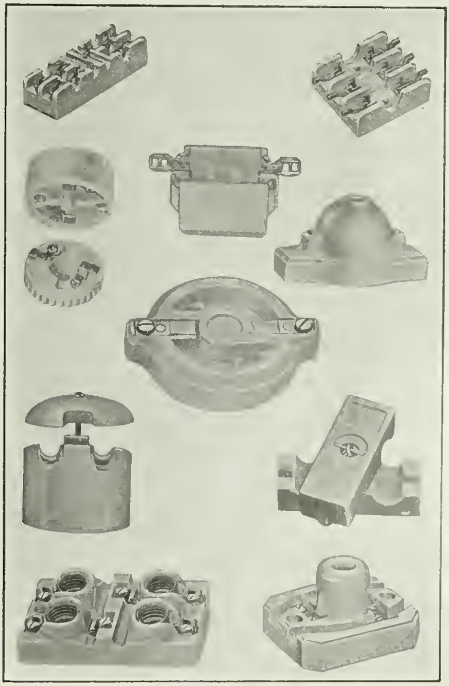


FIG. 8—ROSETTES, FUSE BLOCKS AND SOCKETS OF MOLDED INSULATION

ners, it will be possible to produce many of them by the cold-molding method, which is cheaper and also much faster.

The data tabulated herewith on the dielectric strength, ohmic resistance and tensile strength of molded insulations subjected to various conditions are the results of tests made in the Electrical Testing Laboratories, New York, under the supervision of Mr. F. M. Farmer. The samples used had the following dimensions:

TABLE III—OHMIC RESISTANCE OF MOLDED INSULATIONS

Class of Molded Insulation Tested		Megohms per Inch Cube with Samples Tested Under Conditions Below			
		As Received	After Immersing in Water 72 Hours	After Subjecting to 100 Deg. C. for 12 Hours	After Subjecting to 200 Deg. C. for 12 Hours
"A"	Specimen No. 1	235,710	513	1,000,000+*	1,000,000+‡
	Specimen No. 2	60,700	890	1,000,000+*	1,000,000+‡
	Specimen No. 3	174,200	1070	1,000,000+*	1,000,000+‡
"A" (a)	Specimen No. 1	1,000,000+	800,000		
	Specimen No. 2	1,000,000+	600,000		
"B".	Specimen No. 1	21,300	470	25,800	350,000
	Specimen No. 2	18,070	380	36,100	405,000
	Specimen No. 3	12,300	710	30,100	341,000
"B" (a)..	Specimen No. 1	51,200	14,300		
	Specimen No. 2	40,700	17,210		
"C".....	Specimen No. 1	290,000	900	1,000,000+	1,000,000+
	Specimen No. 2	115,000	1,320	1,000,000+	1,000,000+
	Specimen No. 3	240,000	1,150	1,000,000+	1,000,000+
"C" (a)..	Specimen No. 1	24,900	21,110		
	Specimen No. 2	28,100	19,000		
"G".....	Specimen No. 1	65	51.0	1,790	850,000†
	Specimen No. 2	93	40.0	2,310	970,000†
	Specimen No. 3	76	42.0	3,840	680,000†
"G" (a)..	Specimen No. 1	....	7,590	250,000	1,000,000+*
	Specimen No. 2	....	11,400	340,000	1,000,000+*
	Specimen No. 3	....	8,100	76,000	1,000,000+*
"G" (b)...	Specimen No. 1	....	6,250		
	Specimen No. 2	....	5,600		

*Samples blistered and warped slightly.
†Samples blistered and swelled slightly.
‡Samples blistered and swelled badly.
+Indicates a number greater than that given.

Class A—Plates, 2½ in. by 1⅞ in. by ½ in., cut from molded plates, 6 in. by 4 in. by ½ in.

TABLE IV—TENSILE STRENGTH OF MOLDED INSULATIONS

Class of Molded Insulation Tested		Pounds per Sq. In.
"A"	Specimen No. 1	2000
	Specimen No. 2	940
	Specimen No. 3	1090
	Specimen No. 4	1010
"B"...............	Specimen No. 1	1550
	Specimen No. 2	920
	Specimen No. 3	1285
	Specimen No. 4	1421
"C"...........	Specimen No. 1	2230
	Specimen No. 2	1985
	Specimen No. 3	2478
	Specimen No. 4	2918
"G"............	Specimen No. 1	3020
	Specimen No. 2	4000
	Specimen No. 3	2920
	Specimen No. 4	3405
"G" (a).	Specimen No. 1	4750
	Specimen No. 2	3780
	Specimen No. 3	2880
	Specimen No. 4	3860

Class A (a)—Molded bushings, irregular shape, 3 in. by 2⅜ in. over all.

Class B—Cover, over-all dimensions 2⅜ in. by 2⅜ in. by 1⅜ in. high, width ½-in. wall.

Class B (a)—Caps for hexagonal nuts or bolts, maximum width of head 1 in., thickness of wall ½ in.

Class C—Plates 3¼ in. by 2½ in. by 5/16 in. thick, cut from one plate 5 in. by 7 in. by 5/16 in.

Class C (a)—Plates 3 in. by 3 in. by ⅜ in., cut from one plate 7 in. by 7 in. by ⅜ in.

TABLE V—DIELECTRIC STRENGTH OF MOLDED INSULATIONS

Class of Molded Insulation Tested		Volts per Mil with Samples Tested Under Conditions Below						
		As Received	After Immersing in Water for 72 Hours	After Subjecting to 300 Deg. C., Cooling and Immersing in Water 24 Hours	After Immersing in Transformer Oil at 75 Deg. C. for 72 Hours	After Subjecting to 100 Deg. C. for 12 Hours	After Subjecting to 200 Deg. C. for 12 Hours	After Subjecting to 300 Deg. C. for 12 Hours
"A"	Specimen No. 1	152	114		152*	87.7*	67.0†	‣
	Specimen No. 2	178	110		170*	91.1*	60.0†	‣
	Specimen No. 2	143	103		164*	86.0*	62.0†	‣
"A" (a)	Specimen No. 1	361	287					
	Specimen No. 2	350	293					
	Specimen No. 3	353	301					
"B"	Specimen No. 1	91.8	53	80	192	90.0	98.0	96
	Specimen No. 2	83.5	58	78	169	84.0	101.0	105
	Specimen No. 3	88.0	55	83	188	91.0	96.0	102
"B" (a)	Specimen No. 1	167.0	121					
	Specimen No. 2	148.7	118					
	Specimen No. 3	159.3	107					
"C" .	Specimen No. 1	69.5	42	55	145	70.0	74.0	94
	Specimen No. 2	72.2	40	57	149	73.0	79.0	90
	Specimen No. 3	70.8	45	54	147	68.0	76.0	96
"G"...	Specimen No. 1	46.2	40		30.3	65.7	102.5	‣
	Specimen No. 2	41.7	36		29.8	67.0	109.0	‣
	Specimen No. 3	45.0	38		31.0	63.0	101.0	‣
"G" (a)	Specimen No. 1	221			186	163.5	119.0*	‣
	Specimen No. 2	213			184	159.6	116.0*	‣
	Specimen No. 3	218			180	166.0	124.0*	‣
"G" (b)	Specimen No. 1	326	235					
	Specimen No. 2	315	228					
	Specimen No. 3	333	241					

*Samples were blistered and slightly deformed after test
†Samples were swollen up and entirely deformed after test
‣Unable to test because of change caused by heat.

Class G—Plates 4 in. by 2⅝ in. by ⅜ in., cut from one plate 8 in. by 6 in. by ½ in.

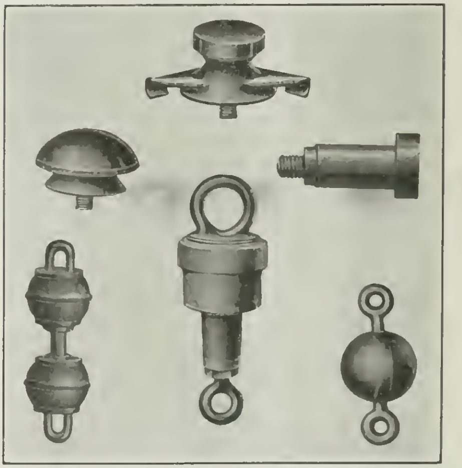


FIG. 9—STRAIN INSULATORS MADE OF MOLDED INSULATION

Class G (a)—Plates 4 in. by 2⅝ in. by ½ in., cut from one sheet 8 in. by 8 in. by ½ in.

Class G(b)—Molded bushing 1⅝ in. by 1¾ in. over all.

Ohmic resistance tests were made first on these samples, which were afterward subjected to the high-tension break-down tests. The insulation resistance was measured by the usual high-sensibility series galvanometer method, the time of electrification being one minute.

Pressures ranging from 150 volts to 700 volts were employed, depending upon the value of resistance to be measured. The electrodes employed were containers, a guard ring being employed so that the question of surface leakage was thereby eliminated. After immersing an insulation in water and before testing its dielectric strength the excess surface moisture was removed with blotting paper. Since the samples were very small and the guard ring near the edge, it is probable that the leakage current after immersion was relatively large, and the results must be considered of questionable value.

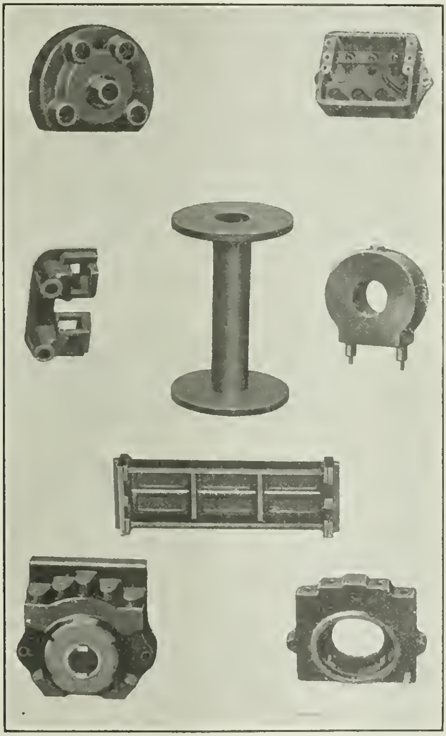


FIG. 10—MAGNETO PARTS MANUFACTURED OF MOLDED INSULATION

The dielectric strength tests were made with samples placed between blunt needle points. The impressed potential was initially low but was gradually increased until puncture occurred. The puncturing voltage was calculated by measuring the primary voltage of the step-up transformer used with a voltmeter and multiplying the reading by the transformation ratio. Sixty-cycle, practically sine-wave energy was employed in this processs.

Tensile-strength tests were conducted on samples in the form of standard briquettes like those used in cement testing. These briquettes were cut from blocks about 10 in. thick, and tests were made with a standard tensile testing machine. The total rating of this machine was 6000 lb.

Plant Betterments for the Ludlow Mills

The mills belonging to the Ludlow Manufacturing Associates, makers of twine, jute bagging and jute and linen carpet yarns, are situated along the bank of the Chicopee River at Ludlow, Mass. Water-power has been developed from the river for many years, but with the growth of the manufacturing plant the capacity of the earlier engines and waterwheels was exceeded and a central steam-electric plant was built. The next step was the development in 1901 and 1902 of a water privilege at Red Bridge, about 5 miles above Ludlow, and the transmission of energy electrically.

The erection of the so-called No. 11 mill in the present year will create an additional demand for power, amounting to about 2400 kw, when the mill is fully equipped, although only one-half of this rating will be required for the initial installation of machinery. The capacity of the power plants at present (aside from two waterwheel installations, the output of which is practically all utilized in adjacent mills) is 4575 kw for the Red Bridge plant and 2500 kw for the steam plant. These two plants are operated in parallel, and although with plenty of water in the river they could furnish all the power required, the reduced flow during several months of the year renders them inadequate.

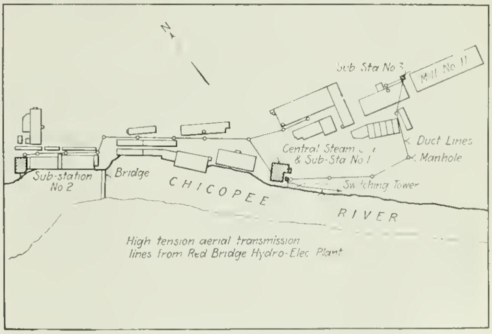


FIG. 1—LAYOUT OF LUDLOW GENERATING PLANTS AND SUBSTATIONS

In order to increase the generating capacity in the best way and at the same time to utilize as much as possible of the existing equipment, the owners decided to have an independent engineering report made on the entire power situation by Lockwood, Greene & Company, of Boston. Subsequently these engineers were retained to carry out their recommendations, made plans for enlarging the steam plant, and supervised its construction and equipment.

Existing Power System

The general plan of the distributing system at Ludlow is shown in Fig. 1. Three-phase, 40-cycle energy from the Red Bridge water-power plant is transmitted over a double pole line at 10,500 volts to a switching station in the mill yard, and from this station it is distributed at the same pressure by underground cables to the three substations.

Taking the substations in order, No. 1 is in the steam power house. Substation No. 2 contains transformers for reducing the pressure to 575 volts for the motor circuits supplying adjacent mills. Substation No. 3 is similar to No. 2 and is to have at first 1500 kva and ultimately 3000 kva of transformers for carrying the load of the new No. 11 mill. The lighting is handled by feeders connecting the substations to the 550/110-volt distributing transformers in the mills.

Substation No. 1, as already mentioned, is in the steam power house, and the low-tension terminals of its transformers feed the station busbars, thus affording a connection with the steam-driven generating equipment.

The present steam units consist of a 750-kw engine-driven generator, which is little used, and a turbo-alternator rated at 2500 kw at 80 per cent power-factor. These machines operate in parallel at 600 volts. Excitation is furnished by a 23-kw and a 60-kw motor-generator and by a 20-kw steam-driven unit for starting.

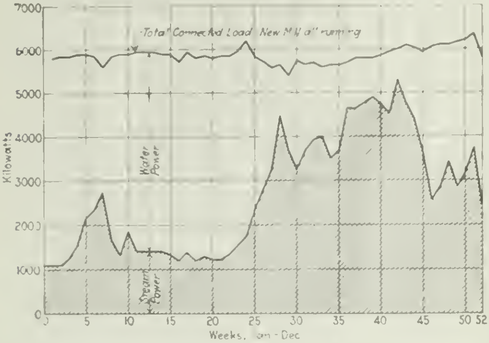


FIG. 2—LOAD CURVES OF LUDLOW MANUFACTURING ASSOCIATION

The steam plant is run only as an auxiliary to the water-power station and is ordinarily shut down for most of the year. In periods of low water, however, the steam plant carries a preponderance of the load. Only under extreme conditions of drought is it necessary to run both steam units at the same time.

Determining the Size of New Equipment

In order to determine the proper size of the additional generating equipment, the load curves which are reproduced in Fig. 2 were plotted from the Ludlow records. The total power required for the entire plant from week to week, including an additional 2500 kw to represent the estimated power required for the new mill, is shown by the upper curve. The corresponding output of the water-power plant for the same period, including an allowance to represent surplus water which might be converted into electric power with the units already installed, is plotted on the same diagram in such a way that the power lacking at any time may be read off directly. The lower curve therefore represents the amount to be made up by the steam plant.

From a study of these curves it was evident that the hydroelectric power available at certain periods of low water when the entire new mill was running would be so small that the steam plant would be called upon for about 2500 kw more than its former maximum output, not counting upon the engine unit. Accordingly it was decided to duplicate the present 2500-kw turbine. Spare capacity is provided by the reciprocating unit, which only very rarely has to carry full load when the present 2500-kw turbine is running.

Three ways were considered for delivering the power of the new generator to the No. 11 mill, viz.:

1. To generate at 10,500 volts and connect with the high-tension system at the switching station.
2. To generate at 600 volts and transmit directly to Substation No. 3 at that voltage.
3. To generate at 600 volts and connect through transformers to the high-tension system at the switching station.

Features of the Three Methods

The first scheme appeared in some ways the most logical to adopt since the Red Bridge plant has a surplus generating capacity available when there is sufficient water. In such a case the new turbine would supplement the Red Bridge water-power at the same voltage with no transformer losses.

There were, on the other hand, several objections to this plan. In the first place, there was a power load of about 1800 kw, which would have to be supplied from Substation No. 1 at 600 volts. If the old units should fail and the new unit should have to be used for this load, there would be a transformer loss when running the new turbine. On account of the fact that the turbine would be somewhat special in character because of the 40-cycle system, the expense of such a machine for 11,000 volts would about equal the cost of a 600-volt machine with transformers. From the standpoint of cost, therefore, there was little choice. There was, however, some advantage in keeping the pressure the same as before on account of the familiarity of the operating force with the low voltage.

The second plan—to generate power and also transmit it at 600 volts—overcame the objection to high-tension generation, but required expensive low-tension cables for transmission. Furthermore, in order to utilize any surplus power from Red Bridge, such as is available at the switching tower during the greater part of the year, it appeared logical to increase the number of high-tension lines to Substation No. 3 and to reduce the voltage at that point. However, this called for a high-tension line parallel to a low-tension installation and would have resulted in a large idle investment, since both lines could not be used to their capacity at the same time. In order to avoid such a duplication, the transformers might be placed at Substation No. 1 and a low-tension cable to No. 3 utilized for obtaining energy from either source. If this were done, the system would be inefficient under any conditions, for whether the energy were coming from Red Bridge or the steam plant, there would be a considerable loss in the low-tension cables to Substation No. 3.

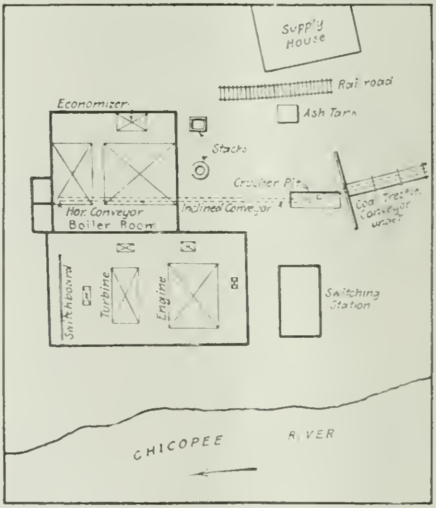


FIG. 3—ORIGINAL POWER PLANT OF LUDLOW ASSOCIATION

The third plan was the one therefore adopted, and it provides for generation at 600 volts and transmission at 10,500 volts. This scheme combines the advantages of the others without their disadvantages. The generator voltage is low and the same as that of the existing units in the station. A large part of the load is distributed directly at the pressure of generation and the power transmitted to Substation No. 3 goes over the most economical line with a small initial transformer loss. The Red Bridge power is carried over the same high-voltage line with no initial loss.

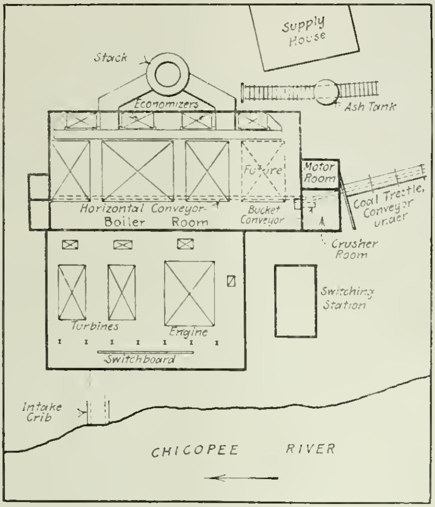


FIG. 4—REMODELED POWER PLANT

New Electrical Equipment

The new electrical equipment for the power house comprises a 2500-kw turbine, a 60-kw motor-exciter, a twenty-one-panel switchboard and two 750-kva oil-insulated, self-cooling transformers. The turbine is rated at 2500-kw at 80 per cent power-factor, with a 40 deg. temperature rise, and has a continuous overload capacity of 25 per cent. The new motor-driven exciter duplicates a present machine and has sufficient output to excite both turbines simultaneously. The present 20-kw steam-driven exciter will be used for starting in case neither turbine is running and Red Bridge service fails.

The switchboard controls the two turbines, the engine-driven generator, four exciters, twenty-three feeder circuits and four banks of transformers. The old switchboard instruments were nearly all of the primary type. They have been reconstructed as secondary meters and will be used with instrument transformers on the new board. All the former main switches and automatic circuit-breakers have been retained, and about one-third of the feeder switches which formerly had fuses for protection have been replaced by automatic circuit-breakers. The two main turbine switches are of Condit make, electrically operated, and are located in the basement. For the new turbine a 4000-amp switch is used, and apparatus for electrical operation is being installed on the old switch.

The transformers are of the standard three-phase type, having been selected instead of the single-phase type on account of the rather limited space available in both Substations No. 1 and 3. The large number of transformer units installed in both substations made remote the possibility of serious crippling by the failure of an entire three-phase unit.

The new cables from the high-tension switching station to Substations Nos. 1 and 3 are of the three-conductor, varnished-cambric, lead-covered type manufactured by the Standard Underground Cable Company. The conductors are No. 2 B. & S. gage. The line to Substation No. 3 is laid in an underground conduit, and that to Substation No. 1 is placed in a new duct line of Orangeburg fiber conduit.

At Substation No. 3 two 750-kva transformers were connected with the high-tension line and six panels were added to the board to carry the motor-service and lighting feeders to the No. 11 mill. The size of this substation precluded the use of single-phase transformers, and since no attendant is required here the self-cooling type was very desirable.

Installation of Boilers and Turbine

Having decided upon the size of the new turbine, the next question was that of its supply of steam. In view of the fact that the steam plant serves merely as an auxiliary to the water-power and operates at full capacity for only a few weeks in the year, it has been customary at such times to run the boilers at 200 per cent of their normal rating, thus keeping down the investment in plant. In accordance with this practice, which has proved successful from an operating standpoint as well as a financial one, it was decided to install only one additional boiler at this time. The 680-hp size was selected, giving the plant four boilers of about the same capacity. These will supply steam enough at 185 per cent of their normal rating to run the entire steam plant at full load. With the largest boiler out of service the others will supply the same amount of steam at 255 per cent of their rating.

Having determined upon the sizes of the new units to be added to the steam plant, the next difficulty was to place them. As will be seen by referring to the plans of the buildings (Figs. 3 and 4), the only available space in the generator room was at the west side, and this was encroached upon by the switchboard. It was accordingly determined to move this board to a position in front of all the units, giving it a more central location with reference to the generators as well as removing it from the operating floor. For this purpose the building was extended toward the south about 14 ft. This addition is two stories in height, the switchboard being on the second story on a level with the turbine room, while space is afforded in the basement for the transformers which were beneath the board in its former location.

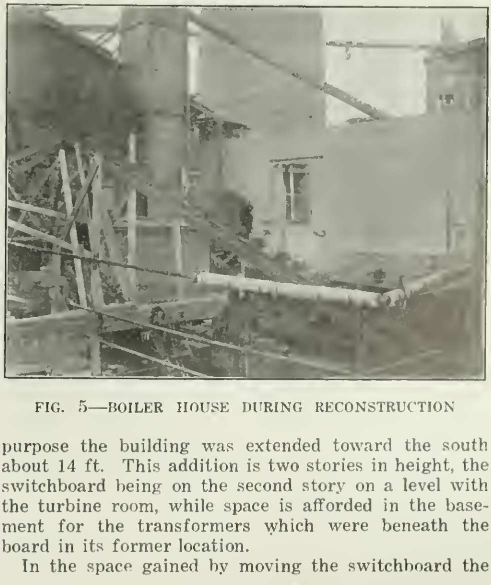


FIG. 5—BOILER HOUSE DURING RECONSTRUCTION

In the space gained by moving the switchboard the new 3125-kva turbo-alternator is to be installed. This machine is of General Electric make and operates on a steam pressure of 190 lb. per sq. in., with 125 deg. superheat. A Leblanc condenser, designed to give a 28-in. vacuum, is located in the basement.

Rearranging the Boiler Plant

The extension to the boiler house presented more difficulty than the changes in the generator room. As will be seen from the plan of the station as it was originally, two steel stacks and an induced-draft fan were situated at the east side, which would be the natural place to add new boilers in order to have a compact plant. Furthermore, coal was also received on this side through an inclined conveyor. It was finally decided to build a new chimney at the center of the north side of the boiler house and to rearrange the coal-handling apparatus so as to secure room for extension in the proper direction. The new chimney is of brick with a diameter of 10 ft. and a height of 250 ft. and has sufficient capacity to replace by natural draft the induced-draft fan and stacks formerly used and to provide for two additional boilers.

The removal of the old stacks being thus made possible, the boiler house was extended toward the east a sufficient distance to house two 680-hp boilers. This brought the new east wall close to the coal crusher, which was arranged to discharge into a vertical conveyor instead of an inclined one. In the extension of the boiler house one new 680-hp Edge-Moor boiler is to be installed at present, equipped with a Foster superheater and a Murphy automatic stoker.

Owing to the fact that the plant must be kept in operation every day during reconstruction, the work on the chimney was completed first, and all the work which would interrupt the operation of the plant was done at night and on Sundays.

The arrangement of the smoke flue and economizers deserves especial mention. On account of the limited space between the rear of the boilers and the wall, it was impracticable to increase the size of the flue for handling the gases from the new boiler, so a plan was worked out for dividing up the economizer surface into four sections of 200 tubes each, of which three sets are new. The fourth is the old set with eighty tubes removed to make it the size of the others. The travel of gases from each boiler to its economizer is very short and any section of the breeching has to handle the gases from only one boiler. By-pass dampers are provided so that any economizer may be cut out when desired. Two brick flues conduct the gases from the breeching to the chimney, both of them being provided with automatic dampers controlled by a single regulator to insure simultaneous action.

Fig. 5, which shows a view of the boiler house, indicates some of the difficulties overcome in enlarging the plant while in operation. The new brick chimney had to be finished before the square steel stack and its fan could be removed, and the coal conveyor was run until the building was ready for the new elevator.

Improving the Water Supply

The water for the condensers was previously drawn from the river in pipes, and the discharge from the Leblanc condenser attached to the turbine was returned to a concrete well in the basement. From this well the boiler-feed water was pumped, being passed through two closed heaters and returned to a standpipe in the well, from which another pump fed the boilers through the economizer.

Under the new arrangement a tunnel will bring cold water from the river into a new well in the basement, the intake of the tunnel being provided with suitable screens. The two Leblanc condensers will draw their injection water from the new well and will discharge into the old one. The overflow pipe from this hot well to the river has been provided with an elbow at such a height that the water in the well can never fall below a certain level. From this well the boiler-feed pumps draw their supply and force the water through a single closed heater to reach the economizers and the boilers.

The possibility of a failure in the supply of water to the hot well due to a stoppage of either condenser has been provided against by arranging a separate suction line from the feed pumps to the cold well. This line will be provided with a check valve which allows only warm water to be drawn by the feed pumps as long as there is a sufficient supply in the hot well. Should the hot water fall below a certain level, however, the check valve will open and automatically supply the feed pumps from the cold well.

Coal-Handling System

Coal is received in railroad cars and dumped from a trestle for storage on the ground. Underneath this trestle runs a conveyor which carries the coal to crushing rolls at the end of the new boiler house. From the rolls the coal passes to a vertical overhead conveyor, which discharges through a weighing hopper to a horizontal overhead conveyor in the boiler house. This latter conveyor discharges to the hoppers of the stokers.

Ashes are removed by the Darley suction system, installed by the Guarantee Construction Company. This consists of a horizontal pipe underneath the furnaces, with an opening at each ash pit into which the ashes are raked. The pipe discharges into an elevated tank just outside the boiler house, underneath which is a railroad track so that the ashes can be removed in cars.

Garaging, Charging and Loading Delivery Trucks

Lord & Taylor, proprietors of New York's newest and one of this country's most completely equipped department stores, have ordered forty-four electric and ten gasoline trucks, which will replace over 100 horse-drawn vehicles now employed in the firm's delivery service. Innovations have been made in the methods of loading, charging and garaging these vehicles.

The delivery department and truck-loading platforms are in the store basement, to which access from the street level is made possible by an inclined driveway extending in a loop under the entire store. While the trucks are being loaded the batteries can be given a short boost from charging plugs installed at each loading platform. The drives have been laid out sufficiently wide to prevent congestion and also to serve as garage space. Washing, cleaning, battery charging and other garage work can be performed in these passageways after delivery hours. Most of the batteries are of the Edison type, and to these will be given constant-potential charges. More attention will be paid to the method of charging the lead cells. By garaging the trucks in the loading driveways time will be saved which would otherwise be wasted in running between the store and a separate garage. Energy for charging the batteries is generated in a private plant in the sub-sub-basement.

The General Vehicle Company is furnishing forty-one electric trucks, of which thirty-nine are designed for 1000-lb. loads and two are rated at 2 tons each. The other three vehicles, rated at 1000 lb. each, were furnished by the General Motors Truck Company and the Commercial Truck Company of America.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

Electrical Salesmanship in Chicago

At a largely attended meeting of the contract department of the Commonwealth Edison Company of Chicago held in the assembly room of the Western Society of Engineers on March 10 Mr. E. W. Lloyd, general contract agent, made the interesting statement that the net contracted business of the company was nearly 70 per cent larger on the date mentioned than a year ago. Mr. Louis A. Ferguson, vice-president of the company, was the principal speaker of the evening, his subject being "Salesmanship."

Inter-Departmental Information Among Central-Station Employees

Following the policy of having a number of very short papers and brief discussions from representatives of the various departments of the company for the benefit, largely, of the men in the other departments, the Commonwealth Edison Company Section (Chicago) of the National Electric Light Association listened to six papers at its meeting of March 26. The titles of these papers and the names of the authors are as follows: "Stores Accounting," by Mr. Charles Marden, stores department; "Stores Claims," by Mr. E. J. Callahan, stores department; "Customers' Repairs," by Mr. J. N. Walton, customers' repairs department; "Interior Wiring," by Mr. James J. Kelgallon, construction department; "Interior Wiring," by Mr. B. E. Roffee, construction department; "Station Construction," by Mr. C. B. Crothers, construction department. Among those taking part in the discussion were Messrs. H. E. Addenbrooke, George Nelson, J. T. Doyle, R. H. Williams, J. J. Kelly, John Burkhardt, C. H. Ibsen and O. R. Hogue. Various entertainment features, as vocal solos, singing by a quartet, a saxophone solo, a vaudeville sketch, etc., were enjoyed.

In compact compass much useful information was conveyed in these short papers and the discussions. A few of the facts brought out may be repeated as of general interest. Thus, the customers' repairs department received 29,000 calls in the year 1913. The work of this department is divided into three classes; that is, general repairs, repairs on heating devices, and the installation and removal of lamps and meters. The construction department employs 656 men. The city is divided into seven general districts for the operation of this department, each district in charge of a general foreman. In doing interior wiring the department makes allowance for future increases in load. Unlike the situation in the case of the outside contractors, the relations of the company doing the wiring work and the customer are just beginning when the job is finished; therefore, the work must be done carefully and thoroughly with regard to the future. One important feature of the work of the construction department in recent years has been the rehabilitation of service connections under sidewalks in the central business district. In many cases this wiring, by frequent additions and changes, had become complicated, confusing and unsightly. The construction department also installs all apparatus in substations and in the generating stations, except in the case of turbo generator units. In consequence of the varied experience that Chicago gives, the employees of the construction department are in demand elsewhere. About twenty-five former employees are connected with the electrical engineering and construction work on the Panama Canal. There is a great deal of overtime work in this department, as often machinery or apparatus can be overhauled or handled only at certain hours in the night. Sometimes the men get paid for as much as ninety hours' time per week, including overtime.

Early-Morning Demonstrations of Preparing Breakfast

The New York Edison Company recently gave several early-morning window demonstrations of cooking breakfast by electricity to suggest to people hurrying to business how much quicker and more convenient the electric method is than any other. Griddle cakes were cooked on electric grids, grilled lamb chops were prepared on broilers, breakfast cereals were cooked in double boilers heated by electricity, biscuits were baked in electric ovens, and coffee was brewed in percolators. After the food had been prepared it was arranged in a tasty manner where it could be seen by people passing the window later in the day. The accompanying illustration shows the central-station window display when this demonstration was being conducted.

CENTRAL-STATION WINDOW IN WHICH BREAKFAST WAS PREPARED

Pensions for Old Employees of Baltimore Company

After long service the following employees have been retired and pensioned by the Consolidated Gas, Electric Light & Power Company, of Baltimore Md.: Mr. Robert Wright, forty-one years' service; Mr. Robert J. Korr, forty years' service; Mr. William H. Gallagher, thirty-seven years' service; Mr. Jacob H. Griffin, thirty-six years' service, and Mr. John Rodgers, twenty-one years' service. The system of retirement now employed by the Baltimore central station was planned by President J. E. Aldred and has been found to exert an excellent effect. The five men recently retired on pensions have been also put on the company's roll of honor and were recently presented with silver medals in token of their long careers of usefulness and fidelity.

Electric Moving Van

The Hebard Sheridan Road Storage Warehouse of Chicago claims to have the only electric moving van in that city. A picture of this ponderous, conspicuously lettered and rather interesting vehicle is shown herewith. Evidently, even if the van did nothing else it would have considerable value as a moving signboard.

MOVING VAN WITH ELECTRIC DRIVE

The truck was made by the General Vehicle Company and is equipped with an A-10 Edison storage battery and a General Electric 3.5-hp motor capable of driving it from 45 miles to 50 miles on a seven-hour to ten-hour charge. The battery consists of sixty cells in five trays and the normal charging rate is 80 amp at 120 volts. It is charged every night; in fact, the aim is to keep the battery charged at all times. The van is capable of carrying a load of 7000 lb. The inside measurements of this "room on wheels" are 6 ft. wide, 7 ft. high and 13.5 ft. long. The tail-gate adds an additional 4 ft. of length when lowered.

In response to a request for information about the actual operation of this interesting electric truck, the Hebard concern reports that it costs about 10 cents a mile for energy to operate the van. It is said to be almost impossible to make a statement as to the actual cost, as road conditions have so much to do with the mileage obtained. Much depends upon the driver. Some men will get a great deal more out of the battery than others. The hauls of the Hebard electric moving van average about 30 miles and its longest trip was 58 miles. It is the practice of the Hebard people to use their gas cars for hauls in outlying districts or on country roads. The electric van is used on well-paved city streets, not on the soft country roads.

There are so few moving parts on the electric van that its upkeep is reported by its owners as practically nothing compared with that of gas cars. In operation the electric van has several good points. One of these is that the average driver of a gas truck is not apt to stop his engine every time he stops his car, whereas the driver of the electric van has to shut off his energy to stop the car; in other words, with the electric van the expense stops when the car stops, while with the gas car the engine may be left running while the van is standing still. At such times the gas engine is running slow, of course, but nevertheless there is some expense, some wear and tear, and, most damaging of all, the vibration is going on all the time.

Operation of Line-Construction and Installation Truck

The Commonwealth Power Company, Jackson, Mich., which has replaced its horse-drawn installation and line-construction wagon by a 1-ton General Motors truck, submits the following figures on two months' operation of that vehicle:

Working days in use	51
Miles traversed	923
Energy for charging, in kw-hr	982
Charging expense at 3 cents per kw-hr. (public garage rate)	$29.46
Garage labor	3.61
Miscellaneous supplies, etc	6.57
Total	$39.64
Cost per mile	0.04
Operating and maintenance charges per working day	0.78
Expense of team and man replaced per day	4.50

The work now being accomplished with the electric truck formerly required a team of horses and a driver. Now the foreman of the line-construction squad operates the truck, and as much work is being performed by four linemen as was formerly done by six, owing to the saving of time in traveling to the job.

The Real-Estate Office as a Lighting Customer

In many cities real-estate offices are nightly kept open for business for some time after the evening peak load. The demands for first-class illumination, of both the general and special types, are considerable in these realty premises. Standards are being raised and the fittings of the best establishments are approaching those of banking houses. In some large offices the geographical subdivision of the duties of employees suggests the use of transparencies, motor-operated office appliances and localized billboard lighting on a larger scale than in very small establishments, although even the latter call for 60-watt and 100-watt units in general interior lighting. Sign and window lighting are important accessories, and in the suburban real-estate office the surrounding standards of lighting are often so inconspicuous that a first-class installation returns more than usual interest on the investment. Moreover, the demand for service is practically constant six nights a week. In some offices models of houses built for sale upon specially advertised terms are effectively lighted by miniature lamps, and there is almost no limit to the possibilities of window displays in the efficient lighting of photographs of properties for sale and to rent, border lighting, talking signs and transparency illumination. In this field the central-station man can do much to arouse the interest of discriminating people and to give a tone to the local office which is an important factor in drawing high-class patronage.

Persistent Soliciting Brings "White-Way" Results

Since September, 1912, the Union Electric Light & Power Company, St. Louis, Mo., has had a goodly number of solicitors devote their entire time to selling a "white-way" tungsten incandescent lamp designed especially to compete with the so-called "gas arc" lamp used for both interior and exterior illumination. According to the terms of the contract under which the lamps are sold, customers may either buy the lamps outright or purchase them on an instalment plan by the terms of which payments are distributed over five months. For an additional dollar per month the electric-service company will renew the lamps and clean both lamps and fixtures at least once a month. Energy is sold on a meter basis.

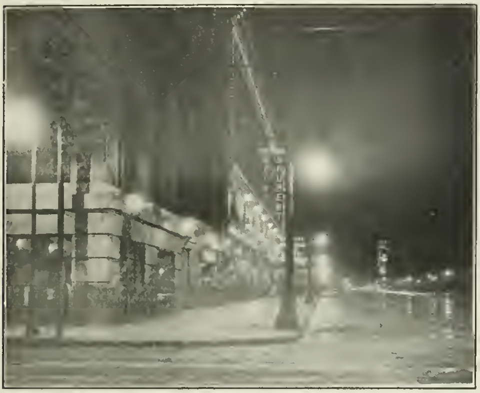


FIG. 1—LIGHTING BEFORE ELECTRIC-SERVICE COMPANY'S OFFICE

The design of the outdoor fixture is shown in Fig. 1. With these units equipped with 500-watt lamps and suspended at a height of 12 ft. above the street, the light distribution covers the sidewalk within a radius of 15 ft., giving about 6 ft.-candles beneath the lamp, which gradually diminishes to 1 ft.-candle at the outer edge of the 30-ft. circle. Indoors the fixtures are suspended from brass bases by means of chains instead of the iron pipes shown in the illustrations.

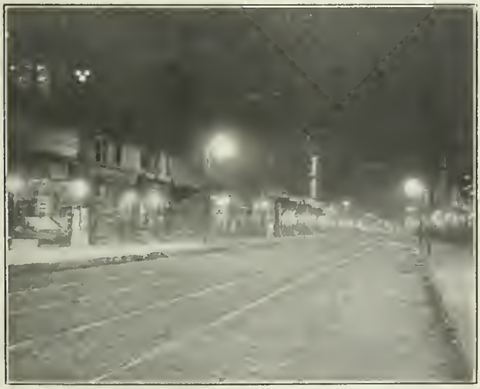


FIG. 2—A STREET WELL LIGHTED WITH "WHITE-WAY" LAMPS

Records of the sale of these lamps compiled during the latter part of January show that there now are in operation more than 5000 units. Another interesting compilation made shows the tendency of customers to use an increased amount of light as time goes on if it is available. For instance, an average of 101 representative customers' bills over a period of from two to five months in 1912 showed that these patrons had used 64,774 kw-hr., while a like average taken under similar conditions for 1913 showed that 83,089 kw-hr. had been used. These data show that energy consumption for these customers had increased 22.04 per cent in one year owing to longer use of lamps and increased voltage.

Motorcycle Repair Men in Columbus

Motorcycle repair men in the trouble department of the Columbus (Ohio) Railway & Light Company care for the small repairs necessary in the customers' homes. The fact that one of these men is able to make an average trip and arrive at the home of the customer fifteen minutes from the time the call is telephoned to the office gives the customers confidence in the service. The headquarters of the repair men are in the same building with the meter department just across the alley from the new-business department. Men of the latter department say that the service rendered by the motorcycle men is invaluable in producing satisfied customers. Twenty-four-hour service is given by the motorcycle repair corps.

Electric Refrigeration in the Florist's Shop

By Sydney F. Walker

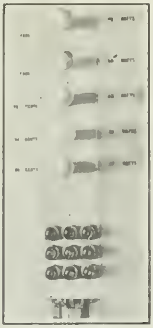
In England extensive use is made of artificial refrigeration to enable certain flowers to be kept ready for table use all the year around. An example is the lily-of-the-valley, which may be seen on display in English shops every month out of the twelve. One seed merchant in Birmingham recently told the writer that he had lilies-of-the-valley, and a good quantity of them, on his dining table the whole year, except during a few weeks before Christmas. This he accomplished by cold storage as follows:

When the "crowns" of the lilies, as they are called, are just beginning to shoot, the plants are taken up out of the ground and placed in cold storage. They may be kept at any temperature which is convenient. The effect of the low temperature is to retard the development of the plant without injuring it. In the United Kingdom large quantities of such "crowns" of lilies-of-the-valley are thus kept in cold storage, being taken out in batches as they are wanted. After being removed from the low temperature the plants are placed in the ground out of doors, when the season is favorable, and when not, in soil in ordinary pots in the greenhouse, or in moss in vases. In any case the plants bloom in from three weeks to a month from the time of being taken out of cold storage. A number of other plants, principally lilies, but bearing no relation whatever to lilies-of-the-valley, are also grown from bulbs. These include lilium auratum, lilium lancifolium and the like. Their bulbs are also kept in cold storage and are taken out when required. Placed in pots or in moss, they then bloom at various periods. Some of the lilies bloom in five weeks, others take twelve weeks. It will thus be seen that it is only a question of arranging an advance schedule in order to have any of these plants that can be cold-stored in bloom at any time of the year.

In addition to the foregoing the florist adopting cold storage has at his command a method of retarding the blooming of plants in actual growth. It sometimes happens that flowers are wanted for a certain day to exhibit at a show, or for decorating on some special occasion. Owing to the vagaries of the weather, the plants may perhaps come forward too rapidly, so that their blooming period is over before the time they are required. By placing them in cold storage for a little while the development of the plant is retarded, and they can be brought out again before the occasion for which they are required and allowed to finish their blooming.

Putting Lamp Renewal Prices on the Wall

At the office of the Hartford (Conn.) Electric Light Company the renewal prices of lamps are painted on the wall beside the exchange counter, as shown in the accompanying photograph, the corresponding lamps being wired to receptacles set into a wooden box, 7 ft. high, 8 in. wide and 3 in. deep, and equipped with individual snap switches near the lower end. The lamps range in size from 500 watts to 15 watts, and the posting of this oft-desired data in black letters ½ in. high, combined with the lamp display, saves much time for customers and clerks. The arrangement of the lamps in a vertical row greatly increases the legibility of the display throughout the office area and is a factor in attracting inquiries regarding electric service in general. The method may be found of use elsewhere.



LAMP RENEWAL PRICES ON WALL

Finding a Market for the Waste Products

Finding that the main objection to installing motor drive with central-station energy in the woodworking plants at Toledo, Ohio, lay in utilization of shavings and waste material as fuel for the boilers, the motor-service salesmen of the Toledo Railways & Light Company set out to find a market for this waste product. Calling fifty-five feed barns, livery stables, coal dealers and small grocers on the telephone, it was found that these small dealers paid 25 cents a load for shavings and would willingly pay 15 cents a load at the mill. Further investigation showed that approximately eight carloads of shavings were shipped into the city during the course of the month to supply these dealers. With these arguments in hand the motor-service solicitors are now approaching the owners of the thirty woodworking factories in the city with an argument to refute the "by-product waste argument" which has been raised by the woodworking plant owner in the past.

The Electric Furnace as a Load Builder

Recent investigations conducted by Mr. R. A. McGregory, of the Doherty Operating Company, 60 Wall Street, New York, have brought out data regarding the electric furnace as a builder of central-station load. In the city where the investigations were conducted the central station has an annual output of approximately 2,336,000 kw-hr. This energy is delivered at 33.33 per cent load-factor, the maximum demand being approximately 800 kw. It has been estimated that the fifty electric furnaces of 45-hp rating each, operating 6600 hours a year in a factory, create a maximum demand of 1687 kw and consume 11,137,500 kw-hr. Combining these two loads the central station's annual output would be 13,437,500 kw-hr. delivered at 61.8 per cent load-factor. Thus with an increase of but a small amount of generating equipment the station's annual output would be increased five times.

Investigations conducted by Mr. McGregory show that the electric furnace is practicable for forge fires, riveting, annealing and hardening, where operations are conducted between 1200 deg. and 2300 deg. Fahr. Oil and gas furnaces are at present the main competitors of the electric furnace, but investigations tend to show that their upkeep is higher than on the electric furnace.

Flat-Rate Wiring Campaign at Columbus, Ohio

A wiring campaign in which prospective customers are offered a complete wiring installation of eight outlets, together with fixtures, glassware, pull-chain sockets and 40-watt lamps, for $49.45, has recently been inaugurated at Columbus, Ohio. The campaign is designed to interest the man with a medium-sized house in which eight outlets will supply sufficient service. Co-operation of the Columbus contractors has been secured, and if a prospective customer expresses a desire for more than eight outlets an estimate under the terms of the company's standard wiring contract is given to him. To allow the company's salesmen as well as its advertising to approach prospective customers with a direct statement "We will wire your home for $49.45" is the principal idea of the campaign. Payments may be made on the instalment plan.

Under the direct supervision of Mr. W. A. Wolls, manager of the new-business department, much publicity is being given to the company's efforts through newspaper advertising, street-car posters and advertising appearing on theater programs. Additional solicitors have also been added to the regular force, as personal solicitation is depended upon to follow up all inquiries and ultimately to close the business.

CHRISTOPHER COLUMBUS OF COLUMBUS, OHIO

Taking a hint, perhaps, from the New York Edison Company, the Columbus Railway & Light Company features in its advertising the "at-your-service" man shown herewith, substituting the Genoan features of Christopher Columbus for the courtly figure of Father Knickerbocker so familiar to New Yorkers and to visitors to the metropolis.

Illumination and Wiring

Shadows of Natural and Artificial Light

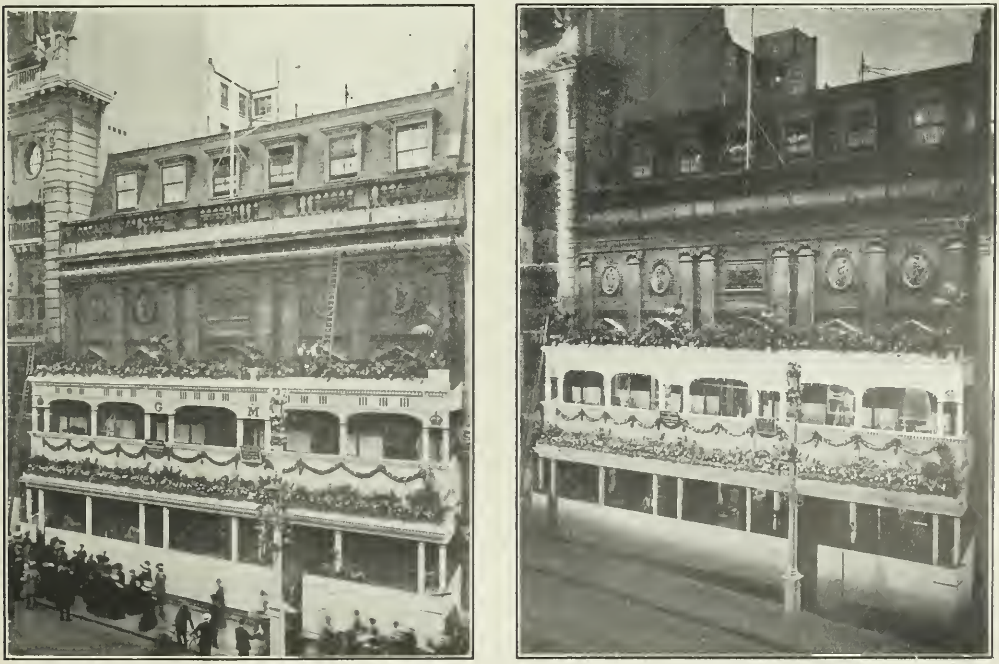
By J. S. Dow and V. H. Mackinney

The subject of shadows by artificial light has as yet been only very imperfectly explored. Mr. M. Luckiesh, of Cleveland, read a paper on the subject last year, pointing out the importance of their effect in connection with carving and sculpture, and a few other references have been made from time to time. But there seems still to be much uncertainty as to the best method of attacking the problem experimentally. Photometric measurements have sometimes been employed. For example, it has been proposed to estimate the general character of the diffusion of light in a room by means of photometric determinations of the surface brightness in the brightly illuminated parts and also in the deepest shadow. The ratio between these two values might serve as a rough criterion. There is something to be said for such a method, but it does not record the degree of "softness," that is, the manner in which the density of the shadow diminishes toward its edges. Nor does it give any information as to the shape of a shadow, which can naturally only be represented pictorially.

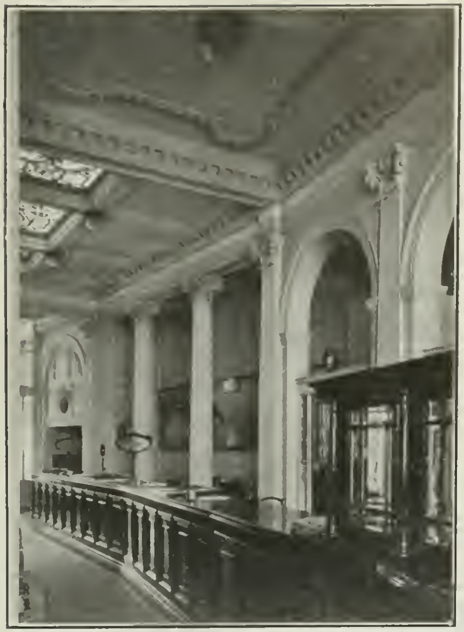
Good photographs taken by artificial light often furnish an exceedingly useful method of portraying shadow, and in a recent paper before the (British) Illuminating Engineering Society in London the authors showed a number of illustrations of this kind. On the other hand, it must, of course, be recognized that, however conscientious the photographer, a photoraphic print cannot, in many cases, show *exactly* what the eye sees. For example, experience shows that in the average print one cannot expect to get a greater tone ratio than about thirty to one, and in most cases it is less. Yet in the actual view to be photographed there may be objects whose relative brilliancy far exceeds this. Consequently a photograph, while giving a correct impression as to the general nature of shadows, may not truly represent the gradation in tone. On this point more will be said later.

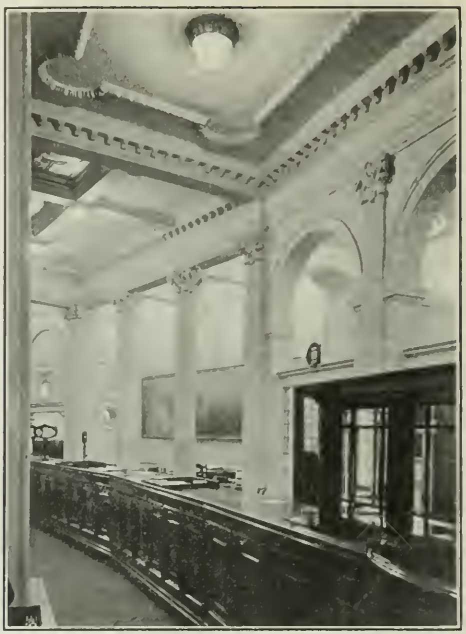
In this article it is proposed to discuss a few of the most typical examples of practical cases in which shadow is of importance and to illustrate these by a few photographs shown on the occasion referred to above. For example, Figs. 5 and 6 contain views of the same room, illuminated in turn by indirect lighting and by a bare lamp. The difference in the shadows in the two cases represents the extreme conditions likely to be encountered in practice.

It will be readily appreciated that there are many cases in which good diffusion is very vital, particularly in connection with industrial lighting. As a rule (but not always) one desires to have light coming from a number of different directions so that the objects in the room are illuminated on all sides. This seems really needful in order to see an object clearly and is probably essential to proper stereoscopic vision. The reflection from light walls and ceilings in a room is chiefly valuable on this account. It is not only that the amount of light reaching the working plane is greater, but the fact that the reflected light from the walls and ceilings comes at many different angles, so that the shadows cast are necessarily soft, makes the illumination considerably more useful. With a well-diffused illumination there is much less likelihood of inconvenient shadows being cast by a worker when bending over the job, or of troublesome shadows being cast by the hand owing to improperly placed lamps. Moreover, light reflected from a good white ceiling is able to penetrate into corners and recesses, so that with a well-diffused system of lighting it may be possible to see underneath bulky objects or into complicated machin-



FIGS. 1 AND 2—VIEWS OF WHITE'S CLUB, LONDON, ENG., TAKEN BY DAYLIGHT AND ON CORONATION NIGHT.





FIGS. 3 AND 4—VIEWS TAKEN BY DAYLIGHT AND ENTIRELY BY ARTIFICIAL LIGHT RESPECTIVELY

ery, when with a system giving very sharp shadows it might be difficult to do so.

Another point that is not always appreciated is the part played by the size of the room. Data for calculating the effect of reflection in rooms with walls and ceilings "dark, medium or light" are often given, but it is not always sufficiently recognized that the distance away of the reflecting surfaces makes a great difference in their practical utility. This is one of the great distinctions between most indoor and outdoor lighting. In the streets the objects illuminated are so comparatively far distant that the shadows are usually sharp, and in the case of rapidly moving vehicles this may confuse the pedestrian. But, in addition, the fact that surrounding objects are not, as a rule, lighted from many different directions makes it difficult to distinguish them as satisfactorily as by daylight. For example, it is often difficult to recognize acquaintances in the streets by night, even when the local illumination is very powerful. The reason is that the face is frequently strongly lighted up in parts, but other portions are left in partial shadow. Again, the mere facts of the majority of objects (houses, etc.) being comparatively far from the sources of light and being as a rule dark in tint also tend to make the effect of the light less distinct than it would be indoors. Anyone who has had the experience of trying to light a large barrack-like interior, such as a drill hall with dingy walls, will appreciate these points.

In the great majority of instances, therefore, we meet in practice a demand for well-diffused illumination, and light coming from one direction only would be considered quite unsuitable. On the other hand, there are instances in which such "unidirectional" lighting is just what is required. For example, the value of the beam from a motorist's head-lamp lies not alone in its intensity, a factor of equal importance being the oblique inclination at which the rays of light strike the road surface, showing up every little inequality in the roadway. An excellent instance was also recently encountered in a printing establishment. In many departments—for example, in the packing and dispatching rooms and to a great extent in the machine room—general diffused lighting is the rule. But an instance of unidirectional lighting is afforded by the sloping board on which the "lay-off" sheet is placed for examination when it comes off the machine. When this trial sheet is removed from the machine it is necessary to examine the impression very closely in order to insure that the pressure is exactly right. Otherwise the type would press too much on the paper and would show through on the reverse side of the page. Now, in order to show up these irregularities in the surface what one requires is light striking the paper very obliquely. In this case the printer, therefore, arranged the paper on a sloping board and placed an adjustable shaded lamp near one extremity so that the more remote parts of the paper were lighted by slanting rays and every little projection was clearly shown up. If one were to use vertical illumination, these irregularities would not be seen nearly so clearly.

In the same way anyone examining deliberately a sample of paper will hold it in a slanting manner so that the light strikes it very obliquely and shows up small irregularities in gloss or texture. But to a person reading a book in the ordinary way these conditions, which show up defects, are exactly what he wishes to avoid. The advantage of good diffusion, enabling light to strike the page from many different directions, is therefore appreciated by the reader.

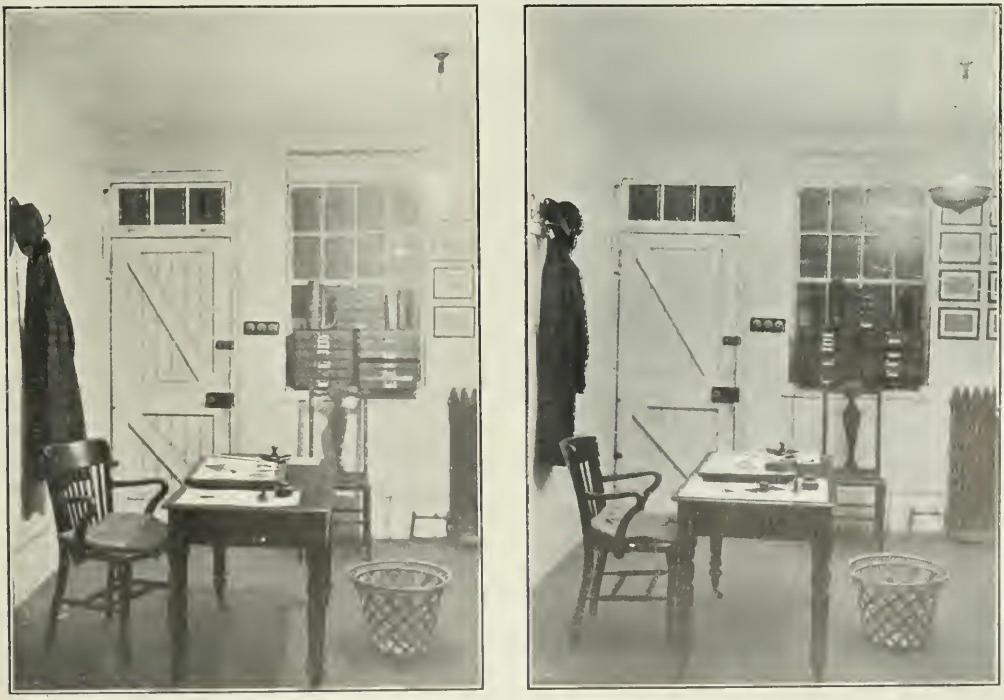
Indirect lighting has often been recommended on the ground that it reduces the troubles arising through glare from shiny paper to a minimum and is therefore pleasant for reading purposes. But it is a matter for consideration whether for this very reason it is not unsuitable for the illumination of showrooms and workshops in which cloth of varying texture is dealt with. For in examining knitted goods, broché silk and similar materials one is really guided by the observation of small irregularities in the surface, and it seems conceivable that a very soft illumination might not show these up in the same way as a system giving fairly dense shadows. It is a curious fact that people who have to do a great deal of sewing seem to prefer a local light. This may be due to the fact that they usually secure a greater illumination by this means, and that they find the local system of lighting favorable to mental concentration. But is it not possible, also, that the explanation may lie partly in the fact that a worker using a local shaded lamp can readily twist the material about and so, by altering the angle at which the rays of light strike it, more readily perceive differences in texture?

A somewhat similar point arises in connection with the display of highly polished materials, jewelry, silver, china, etc. The charm of such objects depends to a great extent on the reflected images on their polished surfaces, and one would suppose that, in order to produce this "sparkling" effect, sources having a fairly high intrinsic brilliancy should be used. It is probable that pure indirect lighting would give a somewhat flat effect. Similarly, in stores devoted to fancy goods, silks, velveteens and materials having patterns of a glossy nature on a matte ground, light coming from very large and evenly illuminated surfaces, such as occur in indirect lighting, might not be quite proper. Such conditions of illumination tend to blot out the inequalities of reflecting power and to reduce the entire surface to a dead level of "matte-ness." The authors have carried out a series of experiments on such materials in small booths and the results certainly seemed to justify this view to some extent.

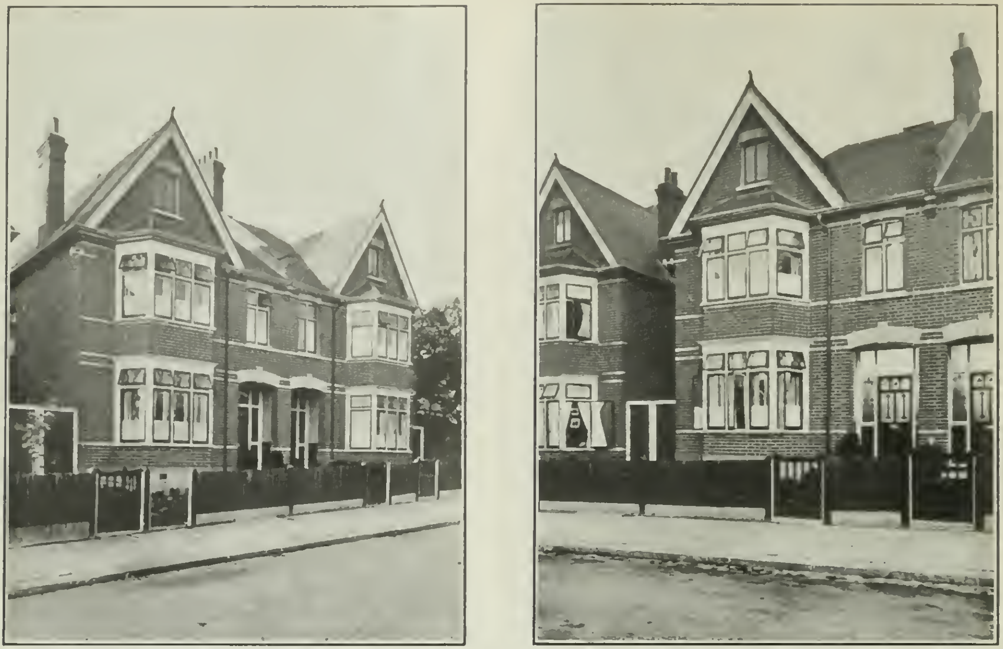
The desirability of directional lighting comes in for consideration in the case of rooms having friezes in relief. In order to show up such friezes satisfactorily, or to display wallpapers with embossed patterns, light coming from all directions is not suitable. A certain general illumination may be desirable, but superimposed over this one may require special local lighting in order to produce a striking effect. For example, in the hall in the Savoy Hotel, London, the general lighting is by semi-indirect units, but in addition to this concealed local lamps are used at the base of the white frieze and are considered expedient in order to show up the figures clearly.

Another case in point is illustrated in Figs. 1 and 2, which show two photographs of the front of White's Club in London, taken respectively by natural and artificial light. The wording under the pictures explains sufficiently the nature of the concealed lighting, producing the contrast in the appearance of the front of the club. It will be seen that the carving and medallions are much more prominent features when lighted artificially by the oblique rays than they are during the daytime. Architecturally this point is an interesting one. It has sometimes been argued that these unusual light effects, being entirely distinct from those encountered by daylight, are unnatural and not in good taste. But surely it might be reasoned that in any case artificial light is something quite different from daylight—something new—and should not be treated in the same way or expected to give the same results. On the contrary, it would be much more logical to say that in artificial light we have something far better under control than daylight and capable of producing entirely novel effects, and that it is therefore quite legitimate to use this light to produce new effects, provided that they are pleasing and artistic.

The two interesting illustrations reproduced in Figs. 3 and 4 suggest another point for the consideration of



FIGS. 5 AND 6—VIEWS OF ROOM WITH LIGHTING FROM BARE LAMPS AND WITH INDIRECT LIGHTING



FIGS. 7 AND 8—VIEWS OF HOUSE TAKEN IN FULL DAYLIGHT AND AT DUSK RESPECTIVELY

the architectural profession, the difference in appearance of many interiors by daylight and by artificial light. This building interior, which is the office of the Allan Steamship Company in Cockspur Street, London, was selected because it illustrates so strikingly the curious reversal of shadow that so often occurs by artificial light, and also because it is in itself a most pleasing interior. The interesting point to notice is that the chief features are entirely reversed, the pillars, which appear light against a dark background in the daytime, appearing dark against a light background at night, owing to the concealed lamps above. It may fairly be claimed that the effect of the interior by artificial light is distinctly the better one. The contention has been made that buildings of any architectural pretensions are invariably designed with a view to their being seen by daylight, and in fact architects in most cases seem to take little interest in their appearance when illuminated artificially. Yet as a matter of fact the possibilities of design by artificial light would seem to be very great, and the combination of the architect's art and the illuminating engineer's knowledge might often give rise to highly striking and impressive lighting effects.

The concluding illustrations are shown merely as an example of the deceptiveness of photography, when it is deliberately intended to produce a misleading effect. Figs. 7 and 8 show two views of the same house taken respectively in full daylight and in dusk. The photographs have not been retouched in any way. All that has been done is to vary the exposure and development so as to make the pictures look as much alike as possible. It is only on close examination, when one sees the shadow on the roof in the left-hand photograph and observes the artificial lamps shining through the glass above the door on the right, that one can detect which is taken by day and which by night.

These two photographs are reproduced to show the futility of photographs taken with the object of comparing two systems of lighting or two installations, unless reliance can be placed on the impartiality of the experimenter. Photography is a most valuable tool in the hands of the lighting engineer, if wisely used; but, like all tools, it can be misused and applied to give most deceptive results.

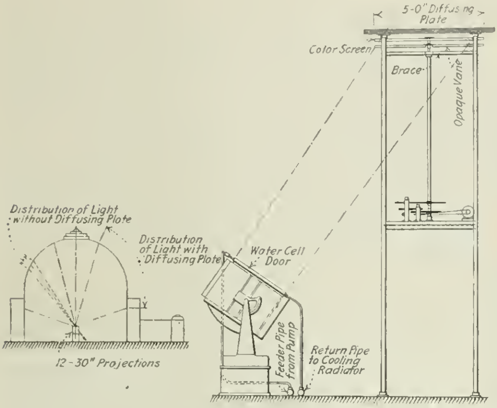
Long-Hour Lighting Methods in Denver

The Denver Gas & Electric Light Company, seeking for means to fill up the valley in the load curve after the evening peak, has recently started a campaign to induce business men to connect the interior lighting of their stores or places of business with outside switches, with the understanding that the electric-service company's patrolman is to turn out the lights at midnight. This allows the merchants to keep their stores brilliantly illuminated as long as there are any people on the street. It is found that merchants using this system take great pains to have the interior of their establishments always in fine shape. This creates a habit that reaches into the daytime, and this neat appearance causes much favorable comment, valuable advertising being the result. Several merchants have already adopted the plan, the largest restaurant in the city being one of the first. When one sees the big array of tables, with their spotless linen, brought out so advantageously under the brilliant lighting, he cannot but be impressed with the fact that here is a good place in which to dine.

The company has also been quite successful in taking flat-rate contracts for second-story and third-story window lighting which burns from dusk until midnight. The merchants using this form of advertising are some of the largest in the city.

The Great Luminous Dome for the Palace of Horticulture

The palace of horticulture at the Panama-Pacific International Exposition to be held at San Francisco next year will be built almost entirely of glass and will be surmounted by a dome 150 ft. high and 152 ft. in diameter of similar construction. To illuminate this dome from the interior and to make it one of the feature spots of the exposition sixteen 30-in. searchlamp projectors will be placed in a circle about a column at the center of the dome. At the top of this column, as shown in the accompanying sketch, will be mounted a color screen of six segments, an opaque vane which will cover two segments at the same time, a lens and a diffusing plate.


5-0" Diffusing Plate
Color Screen
Brace
Opaque Vane
Distribution of Light without Diffusing Plate
Distribution of Light with Diffusing Plate
Water Cell Door
12-30" Projections
Feeder Pipe from Pump
Return Pipe to Cooling Radiator

METHOD OF ILLUMINATING DOME FOR PALACE OF HORTICULTURE

The segments of the color screen will be of red, green and yellow. The screen will revolve at the rate of 500 r.p.m. and the vane at the rate of 499 r.p.m., thus enabling the screen to make one full revolution a minute more than the opaque vane.

The rays of the searchlamps will be thus focused on the screen and diffused onto the dome, the revolutions causing the various colors of the spectrum to illuminate the glass.

A combination of three lenses will be used, so arranged that only one will be in position over the screens at one time. One lens will be composed of a number of tiny lenses which will have the effect of producing "spots" of light upon the dome. Another will be plain. The third will produce the most spectacular effect of all, presenting the appearance of countless tiny tadpoles squirming about the interior of the dome.

Steel-Taped Cable Installations

At a recent weekly luncheon of the Chicago Jovian League Mr. M. R. Lash, of M. B. Austin & Company, gave a short talk to those present concerning steel-taped cable and its installation. In describing comparative costs for underground distribution systems the speaker said that to install 1000 ft. of three-conductor No. 6 circuit in vitrified-clay conduit would cost $780; the same circuit in fiber conduit, $640; in lead cable, $606, and in steel-taped cable, $400. Quoting from reactance tests on single-conductor steel-taped cable laid in Charles City, Ia., the speaker said that 1000 ft. of No. 6 wire carrying 2300 volts showed a drip of 6.7 volts, of which 3 volts was accounted for by ohmic resistance. These results, he said, prove the feasibility of using such cables on series alternating-current circuits.

Exterior Illumination of New York Companies New Building

A carefully studied example of the exterior illumination of a large building is to be found in the new home of the New York Edison Company and the United Electric Light & Power Company at Irving Place and Fifteenth Street, New York City. The present artistic scheme of decorative lighting was evolved only after months of experimenting and testing, during which, it is reported, the companies' illuminating engineers arranged lamps of various candle-power at different distances, positions and angles, and then made observations from a distance. Four thousand tungsten lamps ranging from 10 watts to 500 watts and aggregating 128,000 cp are used on the outside of the building alone.

The brilliancy of the illumination is accentuated by the gilt trimmings of the building, the coping presenting the appearance of a golden crown of light. This coping consists of alternate large and small gilded fans set a short distance apart, the large ones being about 8 ft. high. Lamps for illuminating these fans are arranged at their base similar to stage footlights. As the result this surmounting feature has from a distance the appearance presented by a delicate tracery of gold lace.

EXTERIOR ILLUMINATION OF ELECTRIC-SERVICE COMPANIES BUILDING, NEW YORK

Letters to the Editors

Systems of Charges for Energy

To the Editors of the Electrical World:

Sirs:—The advancement of civilization has developed systems of measurements as required by each new service or commodity until at the present time all services may have a number of systems for measuring the quantity bought and sold, as, for instance, electrical energy, which is measured by the kilowatt-hour, horse-power-hour, lamp-hour (size of lamp being designated), etc.

When a new service is first offered to the public it is generally sold in an unmeasured state, since, being new, it requires a development period before it has created and established a market. During this period the supplying company should receive some compensation from the consumer for the service supplied. This compensation depends upon the market created and the social convenience or necessity of the service. It is during this period, too, that the service is frequently sold in an unmeasured state as stated above. This method of selling is often the best, because, the service being new, there is practically no knowledge regarding the actual costs of supplying it. A hypothetical cost would very likely be far from the actual cost at that time or from the actual cost when the business becomes established.

In the majority of cases satisfactory methods and means of measuring the new service are undeveloped and unknown in the earlier periods of the art. If it is employed for a purpose similar to that for which an existing service is used, some of the methods of measuring, as well as some of the systems of charges, of the existing service may be utilized until the art is more fully developed, but this may not be as satisfactory to both the supplying company and consumer as an unmeasured system of charges.

When the service is bought or sold in an unmeasured state the consumer is entitled to use whatever quantities he wishes whenever and in whatever way he wishes. In fact there are no restrictions placed upon his method or manner of using the service. Moreover, the supplying company must supply him with whatever quantity he desires to use and at whatever time he desires to use it, for which it receives in payment a predetermined amount at stated times.

The sum paid per period may be more or it may be less than a reasonable price when all the factors entering into the cost of supplying the service are considered. This depends largely upon the demand made by the consumer for the service, the quantity of the service used and the time when it is used.

The unmeasured system of charges may be satisfactory to both parties as long as the number of consumers is small and the supply unlimited, but as soon as the number of consumers becomes large and the supplying company gives some thought to the cost of supplying them this system of charges proves to be very unsatisfactory to the company as well as unfair to the consumer who makes only a small demand or uses only a small quantity of the service.

The unmeasured system of charges wholly disregards the three elements of cost. It is a system of charges based upon the normally unjustifiable principle which is commonly known as "expediency."

In the electric industry, when the service is not measured by a meter, it has become common practice to refer to the system as a contract rate. In other public utilities the term "contract" is not often applied to a system of charges.

There are several systems of charges that are commonly known as contract rates or systems of rates. As a general rule this name is given to any system in which the quantity of service to be supplied to the consumer is stated in a contract. Great care must always be used not to confuse the name of the system with the method of securing the business. If the service is measured, no matter by what manner or means, the system must necessarily be classed as measured. If there is any statement or clause in the contract that mentions or infers that the demand made upon the supplying company, the quantity of the service to be supplied, or the time when the demand is made or when the quantity is supplied is to be controlled or measured, the service is not purchased under an unmeasured system but under one of the seven measured systems described later.

An illustration of an unmeasured system of charges is the proviso in the franchise or powers granted a water-supplying company by a municipal government stating that all school buildings or all municipal buildings shall be supplied free of charge with water from the supplying company's system.

Measured Service

The development of new services has been so gradual that methods and standards of measurements have been devised and developed about as soon as required by the new businesses. It requires a new business threatened by active competition to develop new methods of measuring the service as well as new systems of charges.

Just as soon as a new service creates a market of sufficient size to be profitable there is a tendency in most cases for numerous persons or companies to engage in the same or like business as competitors. This is not true when the service, or some essential of the commodity or rendering of the service, is controlled by a patent right or exclusive franchise.

The competing company, as an entering wedge, formulates and puts into practical operation a system of charges by which the consumer can be supplied with the service at an apparently lower rate than that charged by the existing company. To be able to retain its present consumers and to obtain additional consumers the existing company must make its charges appear equal to or lower than those of the new company. The unmeasured system of charges is very unsatisfactory when the prices have to be repeatedly changed. Should the existing company be using an unmeasured system of charges it will, for economic reasons, abandon the existing system and establish in its place a new measured system.

A shrewd business management, as soon as it begins to study or even to think about the cost of supplying the consumer with the service, discovers the economic wastes incurred by the unmeasured system of charges and adopts a measured system.

When formulating a new system of charges for a new service, remodeling systems of charges already in use, or judging of the reasonableness of a system of charges in connection with regulation proceedings, it must always be kept in mind that the system is of necessity either a measured or an unmeasured one and that for a measured system the total cost of supplying the service will depend upon three elements of cost. These are:

The demand that the consumer is likely to make upon the supplying company,

The quantity of the commodity or service that the consumer takes or uses, and

The time at which the consumer makes the demand and the quantity then taken or used.

Fundamental Principles

The fundamental principles upon which all systems of charges now used or which have been used are based, no matter how simple or complex they may appear, may be designated as follows:

- Unmeasured
  - Unrestricted
  - Restricted
    - Time
    - Place
- Measured
  - Demand (maximum rate of consumption)
  - Quantity (consumption)
  - Time

The unmeasured system, as a general rule, wholly ignores all three elements of cost and allows "expediency" to be the ruling principle. Expediency may be a satisfactory principle to use as a base for a system of charges while the supplying company is developing a new service, but on account of its perverting nature it it has no justifiable right to be principally used afterward as the base if the system is to be equitable to the consumer as well as to the supplying company.

All the measured systems of charges recognize as a base one or more of the three elements of cost. There are seven apparently fundamental systems of charges which have as a base one or more of the three elements. Of these seven systems, one has all three elements as its base and it is the fundamental system of charges, the other six being only partially fundamental. The degree with which they approach the fundamental system depends upon how closely the elements of costs used as a base approach the total cost of supplying the service. These seven systems may be divided into the three following classes:

Monadic, which involves measurement by only one of the fundamental units, either demand, quantity or time.

Dyadic, which involves measurement by two of the fundamental units.

Triadic, which involves measurement by all three of the fundamental units.

The monadic and dyadic classes have three systems of charges, the partially fundamental, while the triadic class has only one, which is the fundamental system.

Monadic System of Charges

The monadic system of charges is apt to be inequitable to either the supplying company or the consumers or both. A system of this nature may favor consumers having particular individual requirements more than other consumers having very different requirements and, by so doing, it unjustly discriminates against the latter class. The costs of supplying the service are not equitably apportioned among the various consumers having different requirements and habits of use, because, as this system is not a complete measure of the service, there is no way of knowing definitely how much the two ignored elements of cost affect the total cost of supplying the service to the individual consumer. The true cost of supplying the service to the consumer not being known, the amount of profit derived from each consumer is not always the proper percentage of the reasonable value of the property actually used and useful in conducting that part of the business which relates to the particular consumer. There will be some consumers who pay an undue amount of the expenses as well as of the profits of the supplying company, while others may not reimburse the supplying company for their apportioned share of the expenses or profits.

There are services which by the methods or the conditions under which they are manufactured, sold or delivered have the major portion of the total expenses represented by one of the elements of cost and the other two elements have only a slight influence upon the total cost of serving the consumer. Under these circumstances a system which has the most important element as a base and ignores the other two, which are of only minor importance, may be equitable, but the conditions named can never be taken for granted. The greatest injustice is done to the consumers and supplying company (or to the consumers alone if the supplying company is prosperous) when the system has as a base one of the elements of cost which enters only in a minor degree into the cost of supplying the service and ignores a dominant element and also perhaps a minor one.

Even if a system is applicable to one special class of service, that is no reason *a priori* why it will be suitable and fair for other kinds of service, because the differences between the means and methods of producing and distributing the service give different weights and values to the three elements of cost. No one kind of service can be used as a criterion for all others, but analytical studies must be made of any service to which it is proposed to apply a monadic system of charges.

Dyadic System of Charges

The dyadic system of charges has for a long time been considered ideal for public service companies because in most cases it approaches more nearly the total cost of supplying the service. Indeed, this system, having two of the three elements as a base, is usually more equitable than the monadic system of charges. The chances of unjust discrimination between consumers are not nearly so great because the expense of supplying them is more equitably distributed, and in general no one consumer is required to pay exorbitantly high prices to help defray the expenses caused by another consumer favored with an unduly low charge. With some kinds of service the total expense of supplying the consumers is substantially represented by two of the elements of cost, the third being nearly negligible. If the two elements which really dominate the cost of the service are those which are allowed to enter into the formulation of the system, it approaches in justice the triadic system. However, it must be taken into consideration that there are cases where the location of the business may make one element of cost of greater importance than the other two, while in a different location the reverse would be true.

Moreover, as a system of charges approaches more nearly the true or actual cost data for supplying the service, neglecting one of the three elements of cost, no matter how unimportant it may be, has necessarily greater influence in determining whether the system is an equitable distribution of costs. While with some classes of service it approaches the true cost of supplying the consumer, the dyadic system of charges may be as faulty in this respect as the monadic system, and the triadic system is then the one recourse.

Triadic System of Charges

In the triadic system of charges all three of the elements of cost enter as a base. No element is wanting. All are considered, and each receives the proper position due its importance. The chances of favoring any one consumer are reduced to a minimum through the triadic system. Likewise discrimination is reduced to a minimum. Each consumer pays his proper proportion of the expenses and of the profits. The size of the consumer has no undue influence on the privileges accorded him. The small consumer is assured the treatment due him by right the same as the large consumer.

This is in reality the only complete system of charges, because it considers every element of cost. A system of charges to be reasonable to both the supplying company and the consumer, which should always be the aim, must consider all the factors that enter into the total cost of supplying the consumer with the service. The triadic system of charges is the only one that fulfils all of these requirements.

Atlantic, Mass. L. C. Tomlinson.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems Notes on Practical Subjects Questions and Answers

Water Rheostat Mechanism for Operating Induction Motor

To start and stop large wound-rotor motors frequently with a hand-operated controller is usually tedious work, and the cost of installing an automatic controller to perform this operation is sometimes prohibitive. The apparatus illustrated herewith, which is used to control a 450-hp motor at the Penn Iron Mines, Vulcan, Mich., is simple and requires only a moderate investment. A single air valve simultaneously controls an air-operated primary switch and regulates the resistance in the rotor circuit by raising or lowering plates in a specially designed water rheostat.

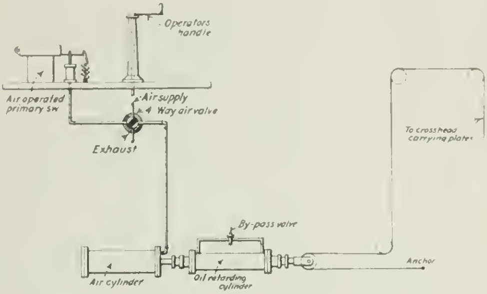


FIG. 1—OPERATING MECHANISM FOR WATER RHEOSTAT

This water rheostat consists of an open-top concrete tank containing a weak solution of sodium carbonate in which three sets of plates electrically connected to the rotor rings may be immersed. Four large trapezoidal-shaped plates and six smaller auxiliary plates are suspended from a wooden frame as indicated in the diagram. In raising and lowering the plates the frame supporting them is guided by four vertical rods. The plates are supported at an angle and the narrower sides are hung downward so that when the plates are immersed the conducting areas increase and gradually approach each other.

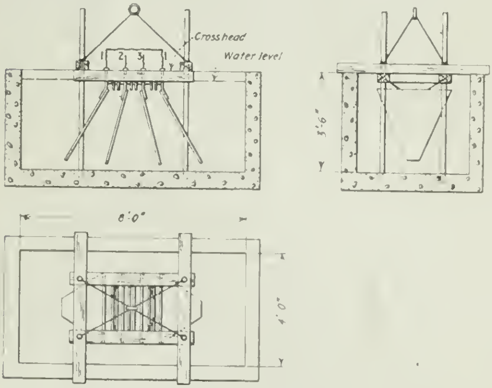


FIG. 2—WATER-RHEOSTAT CONTROLLER FOR 500-HP INDUCTION MOTOR

Between the large adjacent plates and connected to them as shown are the auxiliary plates which enter the electrolyte just as the main plates become completely submerged. By adjusting the distance between the smaller plates the full-load speed of the motor can be fixed.

The plates are raised by a cable operated by an air cylinder and are lowered by their own weight at a speed determined by the valve opening in the by-pass of the oil-retarding cylinder. A four-way air valve is employed to control the primary switch and water rheostat. In one position the valve allows air to enter a small cylinder and close the primary switch, while air is being exhausted from the water-rheostat cylinder, lowering the plates. In the "off" position air the process is reversed.

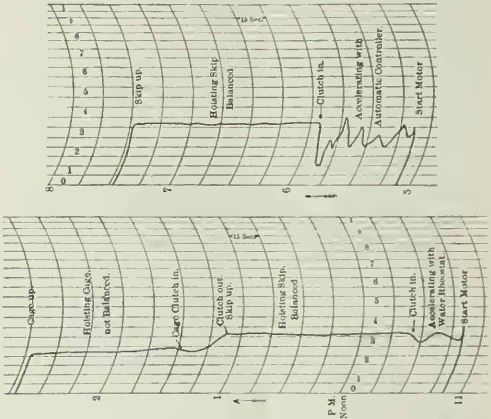


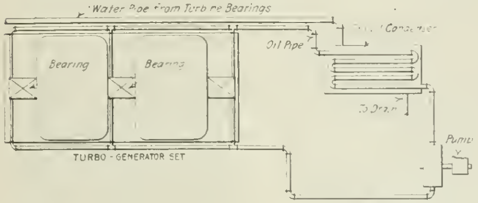
FIG. 3—STARTING CHARACTERISTICS WITH AUTOMATIC CONTROLLER AND WITH WATER RHEOSTAT

In the accompanying diagrams are shown starting curves employing the water rheostat and also an automatic starting controller with the same motor. With the former the motor was accelerated in twenty seconds, while with the latter forty seconds was required and the energy consumption was less uniform.

Additional Cooling for Turbine Bearing Oil

After two years' operation the bearings on a turbo-generator in the plant of the Canton (Ohio) Electric Company began to heat the oil circulating through them to a degree which Mr. A. L. Platt, chief engineer, considered dangerous, and the scheme shown in the accompanying illustration was resorted to as a remedy. Under the worst of the conditions described oil left the machine at temperatures as high as 189 deg. Fahr., and in no case was the oil ever cooler than 148 deg. Fahr.

The scheme laid out to reduce the temperature was as follows. A small heater (or, more properly, a small condenser), which had formerly been used on a hot-water-heating system, was inserted in the oil piping. Water piping was also connected so that water leaving the bearings of the machine circulates about these bearing-oil pipes. The oil is then returned to the turbine bearings through a small pump situated in the basement beneath the machine. Since this apparatus has been put into operation water enters the bearings at 54 deg. Fahr. and leaves the machine at 65 deg. Fahr. It is then led through the exterior passages of the small condenser and is delivered to the waste-water system of the station at 80 deg. Fahr., having been raised 15 deg. in passing through the condenser. The result is that oil leaving the last bearing of the machine now registers approximately 132 deg. Fahr. at all times. The cooling water for the turbine is always of even temperature, about 54 deg. Fahr., as it is taken from wells driven on the company's property at one end of the generating station.



PIPING SCHEME FOR REDUCING OIL TEMPERATURE

A Paint That Warns of Overheated Bearings

By J. P. Schroeter

Many kinds of paint are at present employed for the purposes of protection and conservation, but no pigment has heretofore been devised with the particular idea of protecting parts of machinery from overheating. Such a paint was, however, recently put on the European market under the trade name "Efkalin," its manufacturer being Franz Korn, of Halle, Germany. This paint, which is of a light red color, is applied as other paints to parts of machines, bearings, etc., which are subject to becoming overheated. The color of the paint immediately changes on exposure to about 50 deg. C. to a brown red, at about 70 deg. C. to a dark red, and at about 85 deg. C. to nearly black. Its bright-red color when cool is so striking that any change is immediately noticeable, giving warning in ample time to avert injury to the machine. The engineer, foreman or superintendent is thus able to see at a glance that everything under his care is in good order without being compelled to feel with the hand or to inspect the bearings closely. Perhaps the most interesting property of this paint is the fact that it changes back again to its original color after the part to which it is applied has been cooled. On this account Efkalin will last practically indefinitely, which is important as the paint is rather expensive on account of its constituents.

Another even more interesting paint is "Acalorin," which is made by Koch & Gruen, Offenbach a. M., Germany. This paint is intended to protect against the heat rays of the sun on hot summer days. Applied to glass or to slate, corrugated-iron or other metal roofs, it is declared to keep the rooms thus covered at temperatures 15 deg. to 35 deg. Fahr. cooler than they would be otherwise, according to the surface covered by it.

Relative Economies of Mercury-Arc Rectifiers and Motor Generators on Arc-Lamp Circuits

In your issue of Feb. 28 "F. L. W." inquires: "What is the ratio of the energy consumptions in the two cases which follow: A 25-amp motion-picture arc lamp operating on a 110-volt direct-current system, and the same lamp fed from a mercury-arc lamp rectifier operating on a sixty-cycle circuit?" Your answer to his question is correct, but his question was improperly stated and therefore he did not get the information desired. He should have stated that about 50 volts is required for the operation of the arc lamp. In the case of the 110-volt direct-current system 50 volts must necessarily be absorbed in the rheostat, incurring a loss of about 54 per cent of the energy purchased. But in the case of the mercury-arc rectifier, operating at an efficiency of 86 per cent, the loss is only 14 per cent. This shows the advantage in the mercury-arc rectifier of 40 per cent over the direct-current service. This solution does not take into account the economy possible by the use of a motor-generator set in place of resistance, but even in this case the comparison is in favor of the mercury-arc rectifier, for it is doubtful if the motor-generator set of 2-kw or 3-kw rating could be built with this efficiency. D. J. E.

The answer printed on page 496 of the *Electrical World* for Feb. 28, 1914, was based on the assumption that in each case the lamp and a resistor would be connected permanently in series to be operated at 110 volts, thus consuming 2750 watts at 25 amp. Since the lamp circuit proper need consume only 50 volts, or 1250 watts at 25 amp, it will be apparent that the series resistor can be eliminated with an initial saving of 60 volts × 25 amp, or 1500 watts, against which must be placed such losses as occur in voltage or current-transforming apparatus, for example a motor-generator set for the direct-current supply or a mercury-arc rectifier for alternating current. The efficiency of a motor-generator set might be from, say, 55 to 65 per cent, while that of the rectifier might be, say, from 68 to 72 per cent. An outline of the methods in use for supplying energy for motion-picture arc lamps was printed on page 513 of our issue dated Sept. 7, 1912.

Magnetization Values of Silicon Steel

Will you furnish me with some values of the flux density which can be obtained in 2.75 per cent silicon steel with the corresponding values of field intensity? A. U. A.

Values of flux density obtainable in silicon steel with a definite field intensity vary slightly because of different methods of conducting the experiments, but these differences are quite small. In the *Electrical World* of Aug. 31, 1907, it was stated that the reluctivity of a certain sample of 3 per cent silicon steel was about 60 micro-ersteds per unit of mmf, which would give a flux density of about 16,660 with a field intensity of 200. But this value is only approximate, being computed from an average reluctivity and unit mmf. In a later issue of the *Electrical World* there were published more extensive data on magnetization-curve values, also taken from 3 per cent silicon steel. The data referred to are as follows:

Ampere-turns per inch.	25	50	100	200	300	400	700
Kilolines per square inch.....	85	95	105	110	115	120	130

Another article appearing in the Sept. 20, 1909, issue of the *Electrical World* said that the flux density in 2.28-3.15 per cent silicon steel is 17,000 when the field intensity is 140. More recent data on 2.5-3.5 per cent silicon steel are given below. These are average values taken from twenty-nine tests made on rings of 0.014-in. sheet silicon steel.

B	*H*	*B*	*H*
18,600	200	14,640	20
17,000	100	14,260	15
15,860	50	13,660	10
15,180	30		

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Brushes for Traction Motors.—G. BASIL BARHAM.—Some general notes on brushes for traction motors. The properties of coke brushes, coke-graphite brushes and graphite brushes, a hardness test and an electric test for brushes are described. Current passing through the holder springs draws their temper, makes them weak and leaves the brushes with insufficient tension. If sparking of a brush is due to weak tension, the sparking will cease when the brush is pressed down with a stick—which is the test for poor tension. Many times, however, excessive tension is used as a cure for sparking due to some other cause. All tension over and above what is needed merely increases the wear on the commutator and brushes, and is to be avoided. Sparking troubles sometimes attributed to poor adjustment of the holder may be due to a rough commutator or eccentric commutator, or to a high or low or loose bar in the commutator, or to a loose core, or to the commutator having twisted around until the bars short-circuited by the brushes are no longer connected to coils that are in a commutating part of the field. It is therefore advisable to see that all parts are in perfect order before interfering with either brushes or brush holders.—London *Elec. Times*, Feb. 12, 1914.

Lamps and Lighting

"Half-Watt" Lamps.—Brief illustrated descriptions of a number of special types of "half-watt" lamps of English make. Special features are the arrangement of the filaments so as to send the light in a certain direction, the use of special reflectors, and special forms of the globes.—London *Elec. Times*, Feb. 5 and March 5, 1914.

Electric Lighting of Steam Passenger Trains.—C. W. BENDER.—An article, illustrated by diagrams, discussing the different systems of electric lighting of passenger trains on trunk-line railroads. These systems may be classified under three main headings, namely, straight storage, head-end and axle-generator. Each of these systems possesses advantages and also disadvantages over the other two systems, and these are analyzed by the author. As adapted by different railroads, each system shows modifications that have been made to fulfil the needs of its special service, and each modified system is described and illustrated.—*Gen. Elec. Review*, April, 1914.

Generation, Transmission and Distribution

German Energy Supply Statistics.—G. SIEGEL.—A statistical article on electric energy supply with special reference to Germany. The generating rating of power plants in Germany in millions of kilowatts was 0.06 in 1891, 1.60 in 1900, 6.10 in 1909, 8.01 in 1911 and 10.10 in 1913. In the mining district of Dortmund the electrical connected load was 24,499 kw in 1906, 100,144 kw in 1908, 188,474 kw in 1910, and 280,276 kw in 1912. The total connected load of the municipal central stations of Germany in thousands of kilowatts was 36 in 1895, 655 in 1905, 1873 in 1909, 2478 in 1911, and 3726 in 1913. In Austria there were in 1911 740 stations with 378,736 kw of rating and 461,755 kw of connected load, while in 1913 there were 854 stations with 457,010 kw generating capacity and 568,595 kw in connected load. In Switzerland there were 766 stations with 360,000 kw capacity in 1911, and 1000 stations with 434,000 kw in 1913. In France there were 700 stations with 130,000 kw in 1901, and 1860 stations with 900,000 kw in 1911. In England there were 311 stations with 851,000 kw of rating and 1,181,000 kw connected load in 1909, while in 1911 there were 393 stations with 962,000 kw of rating and 1,395,000 kw in connected load. In the United States there were 4712 stations with 4,032,000 kw of rating in 1907, and 6128 stations with 9,476,000 kw in 1912. In Germany 9,000,000 persons were employed in industrial plants in 1900 and 12,400,000 in 1913. The kilowatt-hours used per workingman have increased from 111 in 1900 to 850 in 1913. The annual coal consumption per industrial workingman has increased in the same time from 6.55 tons to 8.20 tons. In the period from 1900 to 1913 the sale of electrical energy per industrial workingman has therefore increased by 770 per cent, while the coal consumption has increased by 25 per cent. An extensive table is also given on the comparative consumption of electricity and gas; it shows a rapid increase of the use of electricity.—*Elek. Kraftbet. u. Bahnen*, March 4, 1914.

Horn-Type Lightning Arresters.—C. GARRARD.—An illustrated article in which the author gives curves showing the jumping voltage of horn-gap arresters to be dependent on the gap and the diameter of the rod used for the horns. He then considers what value should be taken for the series resistance used with such arresters to limit the short-circuit load to a convenient figure. In practice the best results are obtained by experiment; that is, by trying different values of series resistance and using the lowest that is possible with regard to safety of operation. As liquid resistors lend themselves most easily to adjustment and moreover possess other characteristics fitting them for this work, they are generally to be recommended. The surface should be covered with a layer of oil to prevent evaporation. To know approximately the values which such resistors should have, some considerations are given based on a theory by Steinmetz.—London *Electrician*, March 20, 1914.

Small Outdoor Substation.—E. B. MERRIAM.—The central stations of the country, in co-operation with the manufacturers of electrical apparatus, have from time to time conducted campaigns for the education of the farmer and the rural resident in the conveniences of electricity; but before any returns can be realized from these efforts it becomes necessary to supply the prospective customers with a source of electric power and at a cost for equipment that will insure a fair return upon the investment. This has been a problem for the manufacturer, and in the present article the author describes some of the apparatus that has been developed for tapping off small amounts of power from medium and high-voltage transmission lines. Such substations are usually installed out of doors to save the cost of a special building, and the designer is confronted with the problem of producing an inexpensive piece of apparatus which at the same time will insure reliable service under severe conditions.—*Gen. Elec. Review*, April, 1914.

Recent Tests in Railway Power Stations.—An illustrated article on recent boiler tests in the Formby power station, which supplies energy to the electrified section of the Lancashire & Yorkshire Railway between Liverpool and Southport. The test of the Lancashire boilers lasted eight hours. Draft downtake, 0.31 in. water gage; CO_2 in flue gases at downtake, 15.5 per cent; temperature of feed-water entering economizer, 52.8 deg. Fahr., and entering the boiler, 196.4 deg. Fahr.; steam pressure, 155.75 lb. per sq. in.; superheat, 135.17 deg. Fahr.; ordinary firing slack used, containing 13,208.9 lb. Fahr. heat units per pound of dry coal; total coal burned, 88,244 lb.; evaporation per pound of dry coal, 10,717 lb.; total thermal efficiency, 81 per cent.—London *Elec. Times*, March 12, 1914.

Rolling Mills.—WINTERMEYER.—An article, illustrated by diagrams, on different systems of electric operation of rolling mills.—*Elek. Kraftbet. u. Bahnen*, Feb. 24, 1914.

Traction

St. Gothard Railway.—JOHN B. SPARKS.—An article giving particulars and estimated cost of equipment of 67 miles of route, using the fifteen-cycle, single-phase system at 7500 volts. This line will be completed in 1918. Steam and electric traction are compared by the author. The estimated saving per train mile of electric operation is 3.42 cents. The total annual saving is $52,500. While the cost per electric locomotive-mile is considerably greater than the cost per steam locomotive-mile, the saving in operation is effected by the use of fewer but more powerful locomotives. The cost of electric energy is over 50 per cent of the total cost of operation. While the actual generating costs are not given, it would appear that the electric energy will cost at least 1 cent per kw-hr. delivered to the collector of the locomotive.—London *Elec. Times*, March 19, 1914.

Railway Motor Gearing.—W. G. CAREY.—The author traces the development of railway motor gearing from the time that gears and pinions (as used on stationary apparatus where plenty of space is available to permit the use of cast iron) were applied to railway motors down to the modern gearing which has been developed to meet the severe conditions of up-to-date railway practice. Most of the early part of this work resolved itself into devising means and ways of increasing the life of the pinion to approximate that of the gear. The different methods adopted to produce a harder and more durable pinion are described. The life factors necessary to determine the maintenance cost of different types of pinions are given.—*Gen. Elec. Review*, April, 1914.

Mining Locomotives.—F. RIEP.—An article giving data of first cost and cost of operation for mining locomotives energized from a trolley wire.—*Elek. Kraftbet. u. Bahnen*, Jan. 24, 1914.

Electric Braking.—C. ROSSINSKY.—A fully illustrated description of an automatic brake system employed on trailers of a German railway having considerable grades. The magnetic track brake is used and the brake is automatically set in operation should the trailer be accidentally separated from the motor-car.—*Elek. Kraftbet. u. Bahnen*, Jan. 4, 1914.

Installations, Systems and Appliances

Italy.—A review of the status of the electrical industry in Italy in 1912. Of the large electrical companies of Italy only two did not pay any dividend in 1912. Fourteen paid the same dividend as the year before, nine paid a higher dividend, and three a smaller dividend. The average dividend was 6.69 per cent, against 6.56 per cent the year before. With respect to the amount of invested capital the electricity supply industry is now the most prominent Italian industry, but considerable money from outside of Italy, especially from Switzerland and Belgium, is invested in Italian electric plants. The total capital thus employed is $98,000,000, with a reserve fund of $10,000,000 (or 10.4 per cent of the capital). Considerable progress is being made in the development of water-powers. During 1910 and 1911 125 licenses were granted for developing water-powers of an aggregate of 80,000 hp, increasing the total water-power so far developed for the generation of electricity to 956,000 hp. Of this, 678,000 hp is in northern Italy, 215,000 hp is in central Italy, and 61,000 hp is in southern Italy and on the islands. Considerable power is being used for traction.—*Elek. Kraftbet. u. Bahnen*, Feb. 4, 1914.

Cooking and Heating.—Illustrated notes on progress in cooking and heating in Great Britain. The use of electricity at the National Training School of Cooking is described. Further, various pieces of cooking apparatus are described, together with an open-scale low-reading wattmeter for use in rooms to take readings of the energy consumption of cooking and heating apparatus. Roberts, the borough electrical engineer at Durban, Natal, reports the great success of a new rate schedule in which the minimum charge is based upon the ratable value of the property supplied, and covers a certain number of "kelvins," while all energy in excess of this minimum is charged for at 1.5 cents per kelvin. For tenants of premises rated at $6,000 the minimum charge is $3.62 per month, and increasing minimum charges are made according to the value of the property up to $24,000, for which the minimum required is $6.25 per month. The number of consumers who have taken advantage of the new tariff is 550, and although it cannot be claimed that all these are using electricity largely for cooking purposes, many are doing so and the amount of energy supplied at 1.5 cents is increasing steadily. During August, 1912, for instance, 22,147 kw-hr. were sold at this rate, but in July, 1913, the number had grown to 51,676 kw-hr. Complaints are few. The mean consumption for an average family is 15.20 kw-hr. per day, while for a household of two the daily consumption averages 10 kw.—London *Elec. Times*, Feb. 5, 1914. Other electric cooking and heating notes in London *Elec. Times*, Feb. 12, 1914.

Combined Municipal and Private Ownership.—An editorial note stating that the "mixed system" of combined private and municipal ownership does not seem to be an unmixed success in Germany. At Cassel the town authorities have finally refused to deal with any of the great electrical groups in Germany, so the fifteen-hundred-thousand-dollar scheme of the Allgemeine Elektricitäts Gesellschaft has been abandoned. The municipality intends to execute the work itself. A correspondent writes: "This seems to be the forerunner of the reactionary feeling that is setting in, and I am inclined to think that as far as large stations in Germany are concerned we shall see very little more of this mixed-company business." The Bavarian Ministry has just decided to take complete control of its 90,000-hp water scheme without the participation of private enterprise.—London *Elec. Times*, Feb. 26, 1914.

German Electrical Industries.—A continuation of the series of reviews on the status of the different electrical industries in Germany in 1913. Alfred Schwartz deals with measuring instruments, meters and methods of measurement, Markus Dumermuth with overhead and underground line construction and cable manufacture, A. Steinhaus with electric lighting, A. Steinhardt with electric heating and cooking, and G. W.

Meyer with electric driving of machines. *Elek. Zeit.*, March 19, 1914.

Electricity in Bavaria.—F. GEBELE. A general review of a Bavarian government publication on electricity supply in Bavaria at the end of 1913. Data as to the ownership and equipment of the different power plants are given with a map, and figures are presented on the first cost and rate schedules of different stations. *Elek. Zeit.*, March 19, 1914.

Wires, Wiring and Conduits

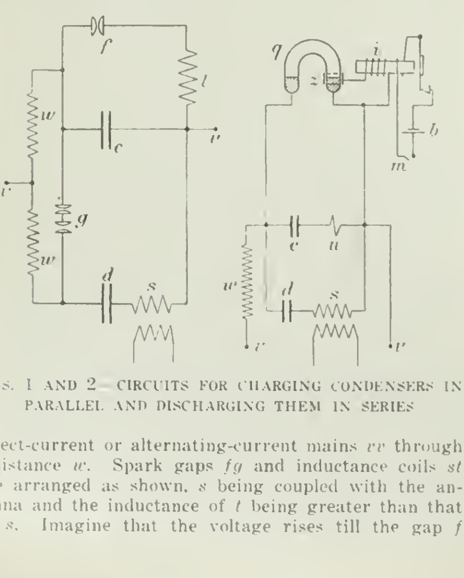
Feeder Reactance.—F. C. BARTON. The author gives reasons why feeder reactances should be included in many station equipments to assure furnishing uninterrupted and high-quality service. Their disadvantages are also discussed and are shown to be of a far less serious nature than has often been supposed. —*Gen. Elec. Review*, April, 1914.

Electrophysics and Magnetism

Physical Science.—J. J. THOMSON.—A review of his first three lectures before the British Royal Institution on recent discoveries in physical science dealing especially with problems of atomic, molecular and electronic theory.—London *Electrician*, March 20, 1914.

Units, Measurements and Instruments

Charging Two Condensers in Parallel and Discharging in Series.—In an article by W. H. Eccles on recent progress in wireless telegraphy mention is made of a patent of the Compagnie Générale Radiotélégraphique for a new method of charging two batteries or condensers in parallel and discharging them in series. The advantage accruing from this process has led to many former proposals of means for effecting it, most of them depending on the arrangement and rearrangement of the condenser connections by means of switches. Also it has been proposed to discharge the condensers of two circuits of different periods across the same gap in such a way that when the phases of the currents become opposite the circuits discharge in series. But in the present invention the one condenser remains fully charged until the other has reversed its polarity by discharge, and thus the condensers are connected in series with practically their full charge. Fig. 1 shows a method of carrying out this result. The two condensers *cd*, approximately equal, are charged from the direct-current or alternating-current mains *vv* through resistance *w*. Spark gaps *fg* and inductance coils *st* are arranged as shown, *s* being coupled with the antenna and the inductance of *t* being greater than that of *s*. Imagine that the voltage rises till the gap *f* breaks down. Condenser *c* discharges and *d* cannot, but when *c* has by discharge reversed its voltage there exists practically double voltage in circuit *csdg* and the gap *g* breaks down. It is stated that a more practical form of the apparatus is obtained by replacing the spark-gap *f* by a mercury lamp, thus taking advantage of the remarkable quenching powers of the mercury-vapor arc. In this case the action is a little different and is worth notice. In Fig. 2 the coil *u* in series with condenser *c* is very small compared with coil *s* in series with condenser *d*, and therefore *c* discharges more quickly than *d*. The mercury lamp *q* is provided with a starting terminal *z*, energized by the inductorium *i*. Initially condensers *cd* are charged, and when the inductorium lights the lamp *c* begins its discharge and performs half a swing in a time so short that *d* loses little charge. At the moment *c* becomes fully charged with electricity of reverse sign, the current through the lamp vanishes, the lamp is extinguished, and both condensers now discharge in series in the circuit *cusd*. The lighting of the lamp may be accomplished by a rotating commutator, so that a musical note is produced by signaling.—London *Electrician*, March 20, 1914.



FIGS. 1 AND 2—CIRCUITS FOR CHARGING CONDENSERS IN PARALLEL AND DISCHARGING THEM IN SERIES

Electric Thermometer.—HANS VOGT.—An illustrated article on the measurement of temperatures at a distance by electrical means. The arrangement of the Wheatstone bridge is described. For measuring temperature at three different places the arrangement of Fig. 3 may be used. S_{I}, S_{II}, S_{III} are the three resistance wires of nickel or nickelin, having a temperature coefficient of 0.0042 or 0.0043. By closing one or the other of the three contacts D_1, D_2 and D_3 any one of the three resistors S can be connected to the Wheatstone bridge so as to measure the temperature at that particular place. The wires *b*, *c* and *d* are made of constantan, which has a very low temperature coefficient. *B* is a battery and *J* a galvanometer of high sensitiveness. By means of the contact D_4 the resistance *Rw* can be inserted into the Wheatstone bridge for control and regulation. Since the voltage of the battery *B* changes somewhat correction must be made for this change. For this purpose the resistance *Rw* is inserted in the Wheatstone bridge and the needle of the instrument adjusted to a zero point. W_1, W_2, W_3 are small resistance coils which make the readings independent of the leads to the three resistance coils *S*.—*Zeit. f. Feinmechanik*, March 20, 1914.

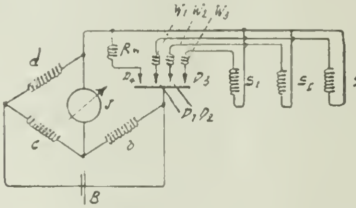


FIG. 3—ARRANGEMENT OF ELECTRIC THERMOMETER

Telegraphy, Telephony and Signals

Wireless Telegraphy.—W. H. ECCLES.—A second article of his review on recent patents in wireless telegraphy and telephony. The chapter on generating equipment is concluded and the author passes on to receiving apparatus.—London *Electrician*, March 20, 1914.

Wireless Telegraphy.—EUGEN NESPER.—An article, illustrated by diagrams, on the so-called "shock excitation," describing besides Wien's shock excitation another so-called ideal shock excitation. The article is to be concluded.—*Elek. Zeit.*, March 9, 1914.

Book Reviews

MOLDED ELECTRICAL INSULATION AND PLASTICS. By Emile Hemming. New York: Ward, Clausen & Company. 207 pages, illus. Price, $3.

This treatise is devoted exclusively to molded insulating materials and such plastics as are in common use in the electrical industry. An authoritative textbook and reference on this subject has long been conspicuous by its absence, and the present work will doubtless be welcomed by electrical engineers, designers and manufacturers alike. Unlike many works dealing with manufactured products, the book contains only first-hand information, indicating the author's intimate knowledge of the subject and his practical experience as well. Historical references are limited to the past ten years, which may be said to embrace the renaissance period in the art of molded insulation. Previous to that time very little had been done except with non-heat-resisting molded materials and porcelain, and designers were content to use the simple products they found at hand. The latter are described, together with other discarded materials which have been brought out from time to time only to fail in actual service. The various classes or types of molded insulation which have survived and are now in general use are fully described. A feature of interest is the space devoted to the raw materials employed in their manufacture. No reference is made to individual products, the author establishing a general classification based on characteristic principles of manufacture. The various classes and their properties are very fully discussed in the light of their behavior under actual service conditions. Not the least valuable part of the book, especially to the engineer and the designer, is the very practical chapter devoted to illustrations of typical insulating parts with brief but satisfactory notes indicating the class of material best suited to particular conditions. It is not unusual for designers to consider only the mechanical and electrical features of apparatus and to ignore the limiting conditions of insulation manufacture. This often results in a narrow choice of material or in high cost owing to complication of design, both of which might be avoided by a better understanding of molding requirements. The chapter on die or mold design will therefore be welcome, detailing, as it does, the essential points to be considered in the design of parts. Tables compiled from electrical tests made especially for this work are included. The concise yet thorough treatment of the subject by the author and the practical nature of its contents make the book a valuable addition to the library of the electrical engineer.

DAS MODERNE BELEUCHTUNGSWESEN. By Dr. H. Lux. Leipzig, Germany: B. G. Teubner. 1914. 120 pages, 54 illus. Price, 1.25 marks.

This recently issued little volume—No. 433—of the well-known Teubner series gives a good description of the theoretical and practical relations of artificial illumination. The book is divided into two sections, the first theoretical and the second practical. The chapters in these sections relate to the following topics: The nature of light; temperature emission; luminescence; photometry; artificial illumination; fuel-burning lamps; gas lighting; electric lighting; comparison of various light sources. The treatment of the subject is essentially practical and from the applied science standpoint. The book is strongest on the side of its radiation theory. It will be of interest to students of illuminating engineering desirous of acquainting themselves with German methods, symbols and apparatus.

ANNUAIRE POUR L'AN 1914. Published by the Bureau des Longitudes. Paris, France: Gauthier-Villars. 501 pages. Price, 1f. 50c.

The present is the 118th issue of this annual publication, which is very serviceable to physicists, mathematicians and geodesists as well as to astronomers. The physical and chemical tables have been revised so as to include the latest determinations of important constants. There are three magnetic charts of France, containing respectively the isogonic, isoclinic and isodynamic lines of equal horizontal intensity for the epoch 1911. The supplement contains three papers on subjects of timely interest. The first, by Mr. P. Hatt, is on the deformation of images in telescopes; the second, by Mr. G. Bigourdan, is on the day, its subdivisions, the international meridian and hour-zones, and the last, by Mr. B. Baillaud, is a report on the work of the International Geodetic Association.

L'ANNÉE ELECTRIQUE, ELECTROTHERAPIQUE ET RADIOGRAPHIQUE. By Dr. Foveau de Courmelles. Paris, France: Librairie Polytechnique. 340 pages.

This is the fourteenth of a series of annual volumes successively reviewing the progress of electrotherapy and radiography for the preceding year. The book is primarily intended for members of the medical profession, but incidentally it treats of electrical progress in other lines than those of medical applications. This volume deals with the following subjects in successive chapters: General apparatus, electrochemistry, light, heat, traction, signaling, radio-telegraphy, atmospheric electricity, electricity from various sources, various electrical applications, hygiene, physiology, radiography, radiotheraphy, phototheraphy, radioactivity, jurisprudence, and necrology. The medical side of the subject is fully developed, and much information is offered that will be useful to physicians. The chapters on X-rays are particularly good.

ANNUAIRE DE L'ELECTRICITÉ. Paris, France: *La Lumière Electrique.* 446 pages. Price, 4 francs.

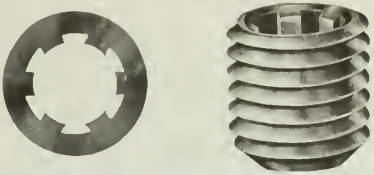
Considerable valuable information relating to the electrical industry in France is published in condensed form in this book, which is divided into eight chapters: Distribution, traction, electrical companies, associations and bureaus, legislation, educational institutions, publications, and electrical manufacturers. In the first chapter, comprising 243 pages, are tabulated the names and population of all communities receiving electrical service grouped according to the departments in which they are situated. The names of the operating companies, station ratings, voltage and nature of energy produced and rates for lamp and motor service are included. Under traction are the names and main offices of companies operating street and interurban railways, together with the routes covered, length of track and method of delivering energy to the cars. The next chapter contains the organization of electrical constructing, distributing, consulting and traction companies, with the date of incorporation, capitalization and location of the main offices. The fourth chapter contains the names, members and officers of various electrical commissions, syndicates and associations. Under legislation are quoted French decrees and decisions promulgated during the last year relating to the electrical industry. Names of electrical educational institutions with their courses of instruction and teaching staffs are listed in the next section. In the seventh chapter are given the names of electrical publications, their editors, frequency of publication and prices of subscription. The last chapter contains a list of manufacturers of electrical apparatus.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed
Manufactured Products of Interest to Electrical Readers

Safety Set Screws

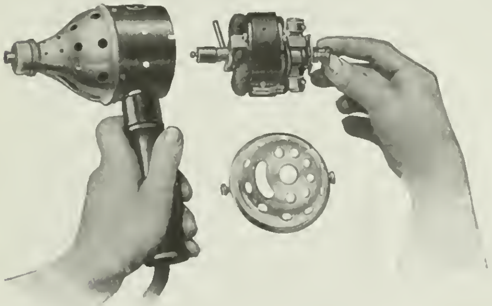
One of the results of the "safety-first" movement is a set screw without a head. A device of this kind will eliminate a number of dangerous projections on moving machinery. In Fig. 1 is shown a cross-section of a hollow safety set screw having six dovetailed slots on the inside. Special "goose-neck" wrenches are provided with six outside flutes to correspond with the six slots of the screw. The wrench fits snugly inside the screw, and in tightening and driving the screw home a uniform rotary motion is given to it. These set screws are subjected to a special hardening treatment, and they are manufactured by the Bristol Company, Waterbury, Conn.



FIGS. 1 AND 2—HOLLOW SAFETY SET SCREW

Electric Vibrator

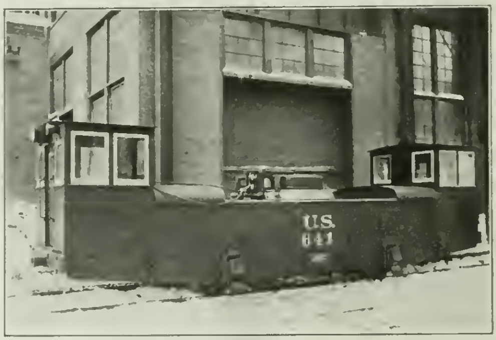
The motor used in the electric vibrator shown in the accompanying illustration can be removed as a unit, and its parts therefore can be easily inspected or repaired. To get at the commutator, the brushes and the starting and regulating device, all that is necessary is to remove the top shell by loosening two thumb screws. The line terminals of the motor consist of two springs, which engage with two pins protruding into the case of the vibrator. When removing or replacing the motor these pins and springs automatically break or make the circuit. The shell of this machine is made of light metal stampings. A spring sleeve which engages the eccentric is designed to take up the wear automatically. This electric vibrator is being placed on the market by the Lindstrom-Smith Company, 1100 Wabash Avenue, Chicago, Ill.



ELECTRIC VIBRATOR WITH MOTOR REMOVED FROM CASE

Electric Towing Locomotives for Panama Canal Locks

One of the forty electric locomotives for towing vessels through the locks of the Panama Canal is shown in the accompanying illustration. The machine weighs 82,500 lb. and measures 32 ft. 2.5 in. long by 8 ft. wide by 9 ft. 3 in. high. The locomotive is designed to exert a maximum tractive effort of 47,500 lb. and a windlass-rope pull of 25,000 lb. Four units, two on each side, will ordinarily pull steamships through the locks, although six engines will be needed occasionally to handle very large vessels. No vessel will be allowed to enter the locks under its own power.



ELECTRIC TOWING LOCOMOTIVE

While towing and while going up or down the steep grades from one level to another the locomotive will be propelled by means of a rack rail at a speed of 2 miles per hour. While running idle or on the return tracks, the rack pinion will be released and the speed will be increased to 5 m.p.h. Each locomotive is driven by two 75-hp totally inclosed motors of the mill type, one being directly connected through reduction gearing to each axle. Three-phase, twenty-five-cycle, 220-volt alternating current is used. The motor and traction gearing are mounted on a common baseplate, which in turn is carried on a driving axle and a spring suspended from the locomotive frame.

In the center of the locomotive is a vertical windlass with a drum having a capacity of 800 ft. of 1-in. steel hawser cable. The windlass with its driving motors and gearing is mounted on a solid baseplate. The cable drum extends above the locomotive cover and has a floating guard placed around it to retain the cable while coiling loose.

The windlass is operated by two 20-hp motors which are totally inclosed and of the mill type. One is geared for a rope speed of 12 ft. per minute at a maximum pull of 25,000 lb. with a 2-ft. radius. The other motor is geared for a rope speed of 200 ft. per minute with a 2-ft. radius. The cable drum is driven through a friction device which can be set for any desired value from zero up to the full capacity of the motor. These locomotives were built by the General Electric Company, New York.

Electric Vehicles for Street Sprinkling, Washing and Sweeping

Electrically propelled street cleaners and sweepers, which have been developed to a high state of perfection by practical operation in several large cities in Europe, are at the present time being introduced into Great Britain by Messrs. Mossay & Company, Ltd., of Westminster, London. These vehicles are driven by two high-speed motors geared to the front wheels through pinions and spur wheels. As the vehicle is driven and not pushed, it has, it is claimed, no tendency to skid, while the separate drive of each of the front wheels insures that there will be no strain on the tires when turning. The use of two motors also allows series-parallel control to be employed, which is an advantage from the standpoint of traction. The energy consumption of these vehicles is well under 1 kw-hr. per car-mile.

Taking the cost of a street-sweeping machine complete with tires and battery to be $2,800, and the equipment of a garage, including charging panel, etc., as $75, the total first cost of the outfit would be $2,875. The running cost per car-mile would be made up as follows: Energy at, say, 2 cents per kw-hr., 2.4 cents; battery upkeep and renewal, 2.6 cents; tire upkeep and renewal, 0.6 cent; chassis and cleaning apparatus upkeep and renewal, 2 cents; miscellaneous material, 1.2 cents—the total being 8.8 cents. The cost per year, assuming 30 miles operation per day and 300 working days per year, with the energy and upkeep costs as quoted above, would work out as follows: Charging energy and upkeep, $792; driver at $7.50 per week, $390, making the annual running charge $1,182. The interest on investment, assuming a rate of 5 per cent, would be $143.75; depreciation at 10 per cent per annum, $287.50; insurance, taxes, rent and license, $97.50, making the fixed charge $528.75. The total cost per annum would therefore be $1,710.75, and the total cost per car-mile 19 cents. Assuming that 80 per cent of the time is occupied in useful work, 83,000 sq. yd. of street surface could be cleaned per day. Making assumptions similar to those above, the running cost per car-mile with the street-washing machine works out to be 8.6 cents, the total cost per annum $1,745, the total cost per car-mile 19.6 cents, and the area cleaned per day 84,000 sq. yd.

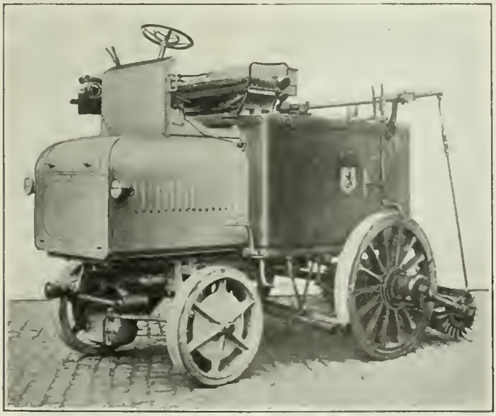


FIG. 1—ELECTRIC STREET WASHER

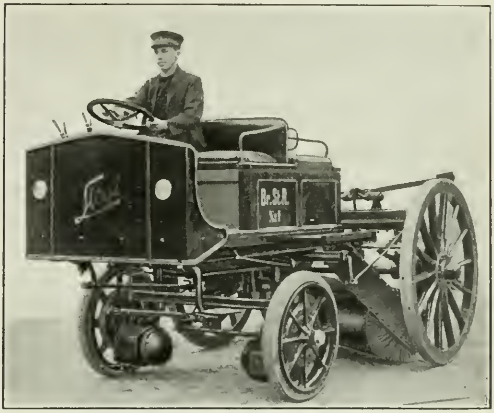


FIG. 2—ELECTRICALLY OPERATED STREET SWEEPER

Battery manufacturers are willing to maintain the batteries in good condition at a guaranteed rate per car-mile, hence a vehicle can always be kept at its original high state of efficiency at a definite cost. Experience has proved that the cost of tire renewals is less with electric vehicles than with the internal-combustion engine-driven type, and other parts subjected to wear may be easily and cheaply replaced. The fire risk attending the use of highly volatile oil fuels is eliminated in electric vehicles and an insurance policy covering all risks can therefore be obtained at about half the rate usually charged for gasoline cars. Moreover, the operation of electric vehicles is so simple that only a short period of instruction is necessary to qualify men to operate them satisfactorily. Another advantage in this type of street-cleaning apparatus is that the cars can be turned round without backing in a street 18 ft. wide. As municipal work often has to be done at night, the absence of noise and odor renders these vehicles particularly adaptable to this class of service.

TABLE 1—DATA ON STREET-WASHING MACHINE

Test on Good Level Road	Tank Full (Drum Lifted)	Tank Full (Drum Operating)
Speed in m.p.h.	5.9	5.25
Current consumption in amperes	26 to 30	32 to 35
Energy consumption per car-mile in terms of discharge, watt-hours	370	500
Energy consumption per car-mile in terms of charge, watt-hours	500	665
Average energy consumption per car-mile, including losses in starting and on grades and bad roads, watt-hours	740	1000
Miles per charge	42	31
Miles per kilowatt-hour charge	1.35	1.0

In the Lloyd electric street-washing machine shown in Fig. 1 two motors are employed which are rated at 2 hp each but which are capable of developing and carrying 5 hp to 6 hp. Energy is supplied to these units from a Tudor battery containing forty elements and rated at 240 amp-hr. The length of the vehicle wheelbase is 5 ft. 3 in., the gage is 4 ft. 9 in., the over-all width of the chassis is 7 ft. 5 in., the over-all length 10 ft. and the over-all height 8 ft. 6 in. The vehicle, completely equipped with battery and a 450-gal. tank full of water, weighs 11,800 lb.

Table I shows the results of a test on one of these washing machines. The surface cleaned per charge was 108,000 sq. yd., or at the rate of 3500 sq. yd. per kw-hr.

Fig. 2 shows an electric sweeping machine which weighs 5400 lb. equipped with battery. The front tires are made of solid rubber while the back wheels have steel rims. Table II contains data compiled on this machine. The area swept per charge was 76,000 sq. yd., or 2600 sq. yd. per kilowatt-hour charge.

TABLE II—DATA ON STREET-SWEEPING MACHINE

Test on Good Level Road	Brush Lifted	Brush Sweeping
Speed in m.p.h.	7.25	5.6
Current consumption in amperes	32	48
Energy consumption per car-mile in terms of discharge, watt-hours	340	670
Energy consumption per car-mile in terms of charge, watt-hours	455	900
Average energy consumption per car-mile, including losses in starting and on grades and bad roads, watt-hours	680	1340
Miles per charge	46	22 to 28
Miles per kilowatt-hour charge	1.5	0.75

Vehicles of this type are being employed in several towns in Germany and other European countries, where they are giving continuously good service, so that there is every reason to believe that street cleaning can be successfully and economically performed with electrically operated apparatus.

Electric Washer with Push-Button Control

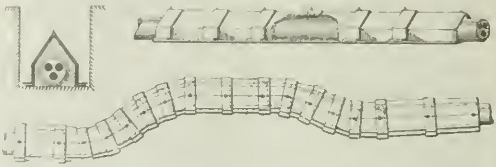
An electric washer the operation of which is controlled entirely by push-buttons has been placed on the market by the Michigan Washing Machine Company, Muskegon, Mich. All of the moving parts of this machine, which is illustrated herewith, are designed for quiet operation and are inclosed. The machine is provided with an automatic wringing release.

ELECTRIC WASHING MACHINE

On page 780 of the *Electrical World* of April 4 it was stated that the washing machine shown thereon was manufactured by the above company. This was an error, the fact being that it was made by the Conlon Electric Washer Company, Chicago, Ill. Both machines are operated by Westinghouse motors.

Flexible Armor for Underground Cables

The difficulty of protecting underground cables from mechanical injury is well known. Cable coverings such as burnt clay, concrete, cement and even iron do not always give sufficient protection against mechanical injuries that may be caused by the driving of pointed iron poles when excavating for gas or water. Some of these cable coverings are not even proof against atmospheric conditions, so that in the course of time the decay which sets in may cause the coverings to part at the joints, or, when digging is required to trace defects in the cable, they may collapse at the slightest shock.


ARMOR FOR UNDERGROUND CABLES WITH ROLLED-IRON SECTIONS

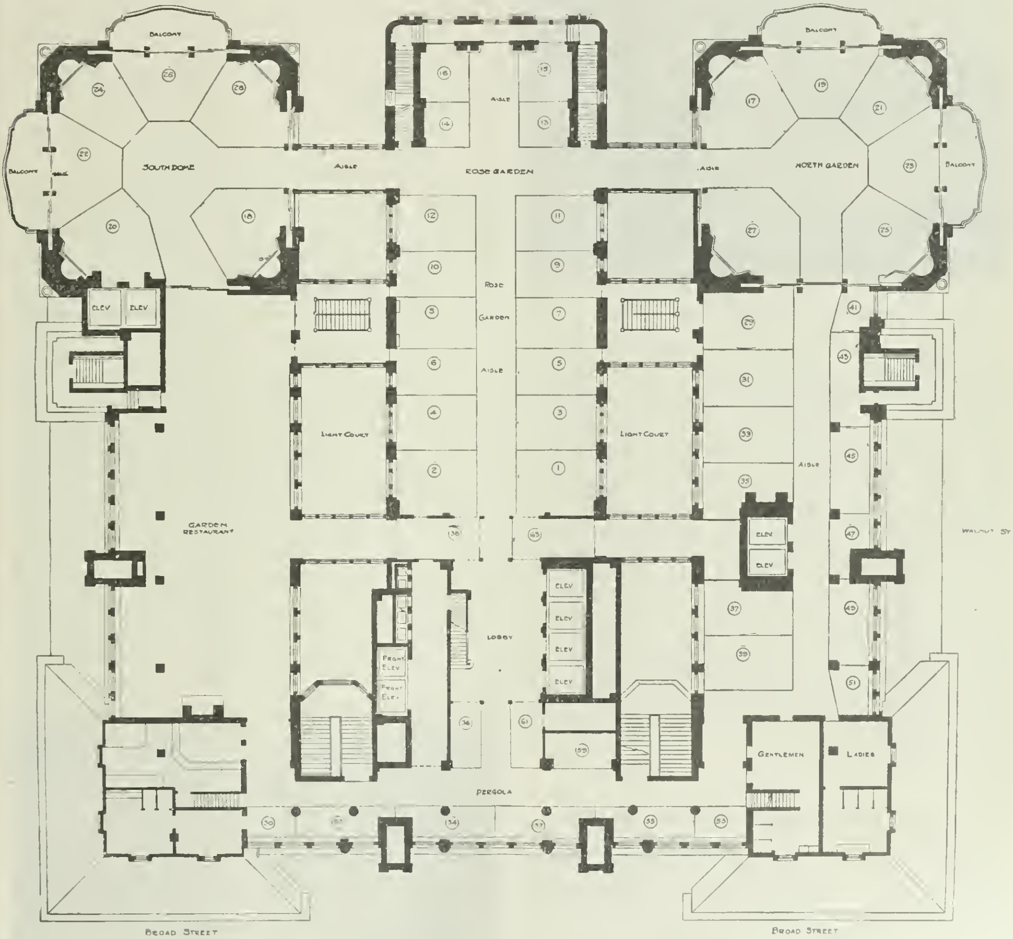
Contrivances made of iron have up to the present offered a somewhat better protection against damages of this kind, but they are not very convenient, because the cable must be laid in as straight a line as possible in order that it may be covered with relatively long-profile iron members. It is not permissible, however, to draw high-tension cables taut, on account of temperature changes. Such long-profile iron members cannot always accurately follow or yield to the proper course of the cable, and as a result the latter will in places be exposed at the joints of the conduit.

To obviate the foregoing troubles, a new type of armor duct consisting of short roof-like rolled-iron sections has been constructed, these sections overlapping and hinging together. These short A-shaped sections are linked together by studs and holes at the top ends in such a manner that one of the sections in sleeve-joint fashion alternately overlaps the end of two adjacent sections. The general style of structure is shown in the accompanying drawing. By this arrangement, which has been introduced by Messrs. Werths & Company, of London, England, the scale-armor duct can readily yield to the bends of a cable in any direction, either horizontally or vertically, and when it is required to uncover the cable all that is necessary is to lift the scale section above it. Owing to the simple construction of the duct, a single workman can cover a considerable length of cable in a very short time, and when branch lines are to be connected, or in the case of repairs, it is only necessary to lift short portions of the duct from the cable. As the profile is A-shaped, the duct effectively deflects the direction of any attacking picks or pointed poles, etc., while its joints do not, it is claimed, loosen through shock of any kind likely to be encountered in ordinary installations.

Another important point is that the roof-like iron covering makes the complete embedding of the cable unnecessary, as the latter can be interfered with only in a vertical direction, that is to say from the surface of the ground. When laying a cable across streets, to avoid interruption of traffic, the A-scales can be placed on and clamped to special rolled-iron bedplates which are supplied for that purpose, thus forming a permanent culvert for the cables. As the tarred A-scales are loosely hinged to one another, no joints can corrode or cling together, an advantage which it is worth while taking into account.

Exhibits at the National Electric Light Association Convention

The accompanying illustration shows the floor plan of the roof garden of the Bellevue-Stratford Hotel, in Philadelphia, which is to be given over for exhibition purposes during the convention of the National Electric Light Association, June 1 to 5. According to the exhibition committee, almost all of the exhibition space has already been disposed of. Appended is an alphabetical list of the exhibitors:



FLOOR PLAN OF THE ROOF GARDEN OF THE BELLEVUE-STRATFORD HOTEL, PHILADELPHIA, PA.

American Ironing Machine Company, Barnes & Kobert Manufacturing Company, Bell Electric Motor Company, James G. Biddle, *Central Station*, Century Electric Company, Cooper Hewitt Electric Company, Delta Star Electric Company, Edison Lamp Works of General Electric Company, Edison Storage Battery Company, Electric Service Supplies Company, Electric Storage Company, *Electrical Review and Western Electrician*, *Electrical World*, Federal Electric Company, General Electric Company, G & W Electric Specialty Company, Hubbard & Company, Hughes Electric Heating Company, Hurley Machine Company, H. W. Johns-Manville Company, Lombard Governor Company, Metropolitan Engineering Company, National Lamp Works of General Electric Company, Ohio Brass Company, Otis Elevator Company, Palmer Electric & Manufacturing Company, Philadelphia Electrical & Manufacturing Company, Philadelphia Storage Battery Company, Pittsburgh Transformer Company, John A Roebling's Sons Company, Rumsey Electric Company, Sangamo Electric Company, Southern Exchange Company, Standard Underground Cable Company, Wagner Electric Manufacturing Company, Western Electric Company, Weston Electrical Instrument Company, Westinghouse Electric & Manufacturing Company, Westinghouse Lamp Company, Westinghouse Machine Company.

It is planned to have an exhibit of beauty and interest in a setting of unequaled attractiveness. The garden has a wide view over the whole city, and it has a separate restaurant. The entire convention will be housed in one building, and the facilities will be such as to minimize crowding or difficulty in circulation and to afford to the delegates every opportunity to make the convention a great success.

Jobber, Dealer and Contractor

Anticipating the Holidays with Window Displays

The problem of originating attractive designs for window displays—one which occupies a good deal of the time of electrical storekeepers—has been in part solved by Mr. Charles T. Rockwood, manager of the F. Bissell Company's store in Toledo, Ohio, by dressing the windows to suggest approaching holidays. Just before Washington's Birthday the window of the Bissell electric shop was patriotically decorated in red, white and blue tissue paper, with a Bissell vacuum cleaner occupying the center of the display. This cleaner surmounted by a flag was mounted on a revolving table so that all sides of the device were shown to the passing public. The interior of the electric shop, with its comfortable reclining chairs for women customers and its neatly kept floors, is shown herewith. In addition to the manager two salesmen are on duty in the store at all times, while two other men solicit business on the outside.

INTERIOR OF SUPPLY STORE IN TOLEDO

The company takes great pride in its service department and boasts that it is always able to have one of its men call upon a housewife whose washing machine or vacuum cleaner needs repairing within twenty minutes from the time a telephone message reaches the store. In addition to this down-town salesroom the F. Bissell Company operates a factory and a jobbing house elsewhere in the city.

Convention of Iowa Electrical Contractors

The second semi-annual convention of the Iowa Electrical Contractors' Association will be held at Cedar Rapids, Ia., April 22 and 23, partly in conjunction with the convention of the Iowa State Section of the N. E. L. A. Following is the program:

Wednesday, April 22, 10 a. m.—Address of welcome, Mr. John Wunderlick, Cedar Rapids; response, Mr. George O. May; address of the president, Mr. M. McCarten; paper, "Modern Business Methods Applied to Electrical Contracting," by Mr. Ed. Kunkel, Davenport. Afternoon session, 1:30 p. m.—Paper, "Co-operation Between Contractors and Central Stations," by Mr. J. T. Marron, Rock Island, Ill.; paper, "Our Compensation Law and Its Application," by Mr. George A. Wrightman, Des Moines.

Thursday, April 23, 10 a. m.—Paper, "Uniform Plans and Specifications," by Mr. Floyd A. Wallace, Des Moines; paper, "A System of Bookkeeping for Electrical Contractors," by Mr. W. J. Ball, Moline, Ill. At 1:30 p. m. interurban cars will leave for trip to Iowa City to visit the state university, where a paper on "High-Tension Lightning Protection" will be read by Prof. A. H. Ford.

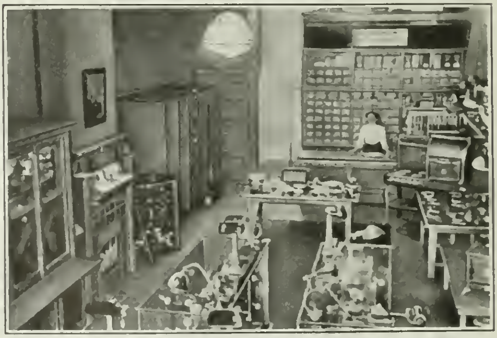
On Wednesday evening there will be a banquet, and for Thursday night a theater party is scheduled, followed by a Jovian rejuvenation.

Sales Methods and Stock Arrangements in a Cleveland Appliance Store

In the basement of the retail store of the Erner Electric Company, Cleveland, Ohio, a model laundry equipped with an electric washing machine, a motor-driven drier and electric irons has been fitted up so that customers may have a practical demonstration of the apparatus. The room is neatly finished with a concrete floor, and both hot and cold water are at hand. It is the practice of the company to send one of its wagons for the washing of the prospective customer and put it through a process of electric cleansing while the interested person is in the store. Particular attention is given to electrically operated apparatus for laundries in hospitals and similar institutions, guaranteed estimates on the cost of doing the laundry work for such places being submitted to the boards with the price of the apparatus. Mr. G. M. Siess, sales manager of the store, states that apparatus sold on this basis is making satisfied customers by effecting the saving which the company predicted.

On the ground floor, shown in the accompanying illustration, heating appliances have been arranged in glass showcases and on demonstrating tables. The bulk of this type of stock, however, is kept in a storeroom beneath. A saleslady who acts as demonstrator for household appliances is on duty at the store during shopping hours. Economy in space has been effected by attaching a complete line of sockets, receptacles and wiring devices on a set of swinging panels at the rear of the main room. Devices can be selected from this group and supplied from the stock of broken cartons kept in the small rear room on the same floor.

Co-operative meetings of the company's employees preceded by a dinner are held at regular intervals. At some of these meetings manufacturers' representatives are invited to address the company's men, and others are given over to discussions of problems arising in the organization. Among the employees much credit for the existing co-operative spirit is attributed to the democratic attitude of the president of the company, Mr. C. T. McKinstry, who, it is said, never passes one of his own men on the street without a cheery hail and a word of encouragement.


NEATLY ARRANGED ELECTRICAL STORE IN CLEVELAND

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

New York State Farmers Buy Lighting Equipment.—Mr. R. V. Sutliffe, of 136 Liberty Street, New York, has recently returned from a successful trip through New York State in the interests of the Dayton Electrical Manufacturing Company. On this trip he secured orders for a number of that company's small lighting plants and found among the farming population a very general satisfaction with present conditions. This coincides with his own experience in the handling of several lines of electrical apparatus in and around New York City.

Habirshaw Wire Company Breaking Even.—Questioned as to the business outlook in general and of his own company in particular, Mr. J. B. Olson, of the Habirshaw Wire Company, stated to an *Electrical World* representative that the general dullness is shared in by that company and that a period of real activity is not expected until July or August at the earliest. He said that by continual activity sales have been kept to a fair level, but this business has consisted of frequent orders of small size rather than of substantial sales. Accompanying the increased activity of the sales force, the production force has been worked somewhat under capacity. Mr. Olson feels that his company is at least breaking even and that there is a real prospect for better business later on in the year.

Westinghouse Lamp Factory in Milwaukee.—Further advices in relation to the new electric incandescent-lamp factory of the Westinghouse Lamp Company in Milwaukee, to which references in the *Electrical World* have appeared in the issues of Jan. 24 and March 28, are to the effect that the company has obtained possession of a building at Thirty-second and Center Streets, Milwaukee, originally occupied by the Romadka Brothers' Trunk Company. The Westinghouse Lamp Company is now equipping this factory for the manufacture of Westinghouse tungsten lamps. It is believed that when the plant is in full operation it will be equal to a daily output of 20,000 lamps and will furnish employment for about 500 hands. Irving B. Cary, representing the executive officers of the Westinghouse Lamp Company, is in charge of the establishment of the new factory.

Application of Lock Lamp Sockets.—The Best Electric Company, of Pittsburgh, Pa., gives the field of application of its lock lamp socket, in the use of which the lamp has to be broken in order to remove it and insert another. The lock socket is furnished in either brass, porcelain or composition, with or without key switch for turning the light off or on, and in brass only with or without special key release attachment. The company finds that in places where expert mechanical labor is not employed the lock socket with key release, which permits the removal of the lamp without breaking, is very satisfactory. Where high-grade mechanical labor is employed, however, as in railroad and machine shops and tool rooms, the key-release attachment lessens the efficiency of the lock, since keys can be made by unscrupulous workmen. Both kinds of these lock sockets are enjoying a good sale.

Outlook in Electric Specialty Field.—The firm of Harvey Hubbell, Inc., of Bridgeport, Conn., has recently developed a new type of polarized plug and receptacle for three-wire work, the sale of which is promising. In general this company is finding business very dull, and it has recently increased its sales force in an effort to work the existing demand more intensively. The dullness is not confined to its sales in the metropolitan district, but is widespread. In some sections of Ohio, in the Northwest and in part of the South the greatest recent activity has been noticed by this concern, but even in those places no phenomenal sales have been enjoyed. Some time ago plans were laid by the Hubbell company for an increase in its factory facilities, to be made at about this time, but the protracted dullness has caused the abandonment of these plans, at least temporarily, and the present production force is somewhat under normal.

New Chicago Storage-Battery Factory.—Removing from its former quarters at 1631 South Michigan Avenue to a modern brick and concrete structure at the corner of West Lake and Albany Streets, Chicago, the Petschel Storage Battery Company has begun the manufacture of storage batteries and will soon begin to make small farm-lighting sets and switchboards. The building now occupied is a fireproof structure measuring 100 ft. by 180 ft., in ground dimensions and with one 18-ft. story. When running at full capacity the factory, it is said, will be able to manufacture about 10,000 plates a week. It is affirmed that the plates used in the Petschel batteries contain a patented paste of new composition allowing the batteries to be formed within from fourteen hours to sixteen hours after the pasting process has been completed. In addition to this feature tests on the plates are said to show higher relative ratings than have hitherto been obtained.

Electric Controller Manufacturer Prospering.—A short time ago the Electric Controller & Manufacturing Company, of Cleveland, Ohio, completed a new five-story addition to its factory which increased the working space about 30 per cent. The interests of the employees have been advanced in this connection by the installing on the top floor of this new building of a large dining room, open to all who choose to use it. The company has had very satisfactory sales recently, among the most important being the furnishing of the complete control equipment for the electric cranes, mill tables, hoists and auxiliary motor drives in the plant of the Minnesota Steel Company, at Duluth, Minn. In the new merchant mill of the Bethlehem Steel Company all of the mill tables are controlled by this company's magnetic-switch-type controllers, with series-wound accelerating switches. The blooming-mill manipulators in the same works are operated by this company's magnetic controllers with a specially developed torque limit relay. This relay made it possible to adapt motor drive to this service, which formerly required hydraulic shifting mechanisms.

Spring Business of the Hurley Machine Company Excellent.—Mr. Niel C. Hurley, who is in charge of the New York office of the Hurley Machine Company, at 949 Broadway, New York City, likes the way business has opened up this spring for his company's product of washing machines and vacuum cleaners. The March sales of washing machines were the largest the company has ever had in the same period, and the sale of its vacuum cleaners has been fully as satisfactory. The latter are put out for free trial, and the sale through this method in many cases runs as high as 70 per cent of the machines placed out. It is considered to be the company's best merchandising method on this class of goods. Questioned concerning the progress of the commission sent by the Illinois Manufacturers' Association in February to investigate South American trade and industrial conditions, Mr. Hurley replied that so far he had received only the most meager details from the party, and that these included nothing concerning these conditions. Mr. E. N. Hurley, president of the Hurley company, was the official head of this party and carried a special commission from Secretary Redfield as a representative of the United States government. Although the complete itinerary of the party will consume several more months, Mr. Hurley's return to the United States is expected in a short time.

Manufacturer Advocates Renting of Interchangeable Signs.—Harvey Deschere, of Harvey Deschere & Company, 50 Church Street, New York, manufacturers of the Argus miniature electric signs, explained to an *Electrical World* representative this week a new plan which he has developed to bring his product to the favorable attention of the users of such signs. The initial cost of his product is somewhat higher than that of other similar apparatus on the market, which has made his selling problem more difficult. Three selling plans have been inaugurated as the opportunities for expansion grew. In the first place, the usual cash payment plan was used and continues to be used to some extent. To meet a demand for credit a deferred-payment plan was then adopted, allowing the initial cost to be spread over a definite period and met in small amounts. The company has now brought forward a leasing plan, which it says is the most satisfactory of the three, both from its own and from the customers' standpoint. By this plan for regular payments of a very small percentage of the cost of the apparatus, if bought outright, signs can be obtained of various sizes and for various lengths of time, as required, enabling their economical use for special sales, expositions and similar work. This plan has worked well so far and is expected greatly to increase the company's business. In order to aid in the pushing of this and the other selling plans, the company is now increasing its sales force. Since the beginning of the year the concern's factory has been in the Factory Terminal Building, at 1507 Garden Street, Hoboken, N. J., and after May 1 the main office will be located there also and the New York office discontinued.

Statement of the Copper Producers' Association for March

A tremendous export of copper during the month of March was shown by the report for that month of the Copper Producers' Association. This movement was accompanied by a large increase in production and in domestic deliveries, but as predicted in the March 14 issue of the *Electrical World*, the stocks on hand at the end of that month were still further reduced. The increase in production and in domestic consumption seemed fairly probable, but the large increase in foreign deliveries was unexpected. The complete figures for March are as follows:

	March, pounds		February, pounds	
Stocks on hand in the United States on first of month.		78,371,852		87,296,685
Production		145,651,982		122,561,007
		224,023,834		209,857,692
Domestic deliveries.	69,852,349		47,586,657	
Foreign deliveries...	89,562,166		83,899,183	
		159,414,515		131,485,840
Stocks on hand at end of month.....		64,609,319		78,371,852

NEW YORK METAL MARKET PRICES

	Mar. 31		Apl. 7	
Copper.	Bid	Asked	Bid	Asked
Standard spot*	13.80	14.30	13.87½	14.37½
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*....	65 2 6		65 15 0	
Prime Lake	14.75	to 14.87½	14.75	to 15.00
Electrolytic	14.40	to 14.50	14.45	to 14.55
Casting	14.20	to 14.30	14.25	to 14.35
Copper wire base........	15.50	to 15.75	15.75	to 15.87½
Lead		3.80		3.80
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter....		7.00		7.00
Spelter, spot	5.32½	...	5.32½	....
Tin, spot	37.85	to 38.25	36.55	to 36.85
Aluminum:				
Prompt delivery	18.00	to 18.25	18.00	to 18.25
Future	18.00	to 18.25	18.00	to 18.25

*OLD METALS

Heavy copper and wire	13.62½	13.62½
Brass, heavy	8.62½	8.62½
Brass, light	7.62½	7.62½
Lead, heavy	3.80	3.80
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to Apl. 7.......................... 6,119

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*From daily transactions on the New York Metal Exchange.

Corporate and Financial

General Electric to Pay Off Maturing Notes from Cash in Its Treasury.—The eight-million-dollar issue of General Electric nine-month notes, maturing April 16, is to be paid off from cash in that company's treasury.

Receiver for Ohio Hydroelectric Plant.—The Sandusky River Power Company, which owns the hydroelectric plant south of Fremont, Ohio, has been placed in the hands of B. J. Jones as receiver. The application for a receivership was made by a local stone company which has a claim of $891.

New Capital Required for Lighting Companies.—Government statistics relating to the revenue for strictly lighting and motor service show that the gross for the United States is now about $30,000,000 per month. Statistics collected by the *Electrical World*, covering a large proportion of the operating companies and groups of companies having gross monthly incomes of $100,000 or more, indicate that the gross income for lighting and motor service during February, 1914, was 10 per cent in excess of the corresponding income during February, 1913. When it is remembered that every dollar per year of new business requires from $5 to $10 of new capital investment, and that the normal increase in earnings of the electric energy supply companies is around $4,000,000 per month, some idea will be gained of the magnitude of the never-ending demand of this industry for new capital.

Offer of Denver Notes.—Henry L. Doherty & Company offer $3,500,000 Denver Gas & Electric Light Company collateral trust 6 per cent gold notes at 99 and interest. The notes are dated April 1, 1914, and mature in three years. They are callable on any interest date on sixty days' notice at 101 and interest. Principal and interest of the notes are guaranteed by the Cities Service Company. The notes are secured by deposit of $5,752,000 first and refunding mortgage 5 per cent bonds of the company and $936,000 general mortgage 5 per cent bonds of the Denver Gas & Electric Company. A letter from Frank W. Frueauff, president of the company, states that the gross earnings for the year ended Dec. 31, 1913, were $3,161,763. Expenses for operation and maintenance and taxes were $1,779,093, leaving net earnings of $1,382,670. Bond interest was $358,645, leaving a balance applicable to interest on this issue of $1,024,025.

Wisconsin Edison Company Securities Offered.—A letter issued to shareholders of the North American Company by James D. Mortimer, the president, offers them an opportunity to subscribe for debenture bonds and capital stock of the Wisconsin Edison Company. This company was organized under the laws of New York and owns all of the securities of the following companies which were formerly owned by the North American Company: The Milwaukee Electric Railway & Light Company, Milwaukee Light, Heat & Traction Company, Wisconsin Gas & Electric Company, Watertown Gas & Electric Company, Burlington Electric Light & Power Company, North Milwaukee Light & Power Company and Wells Power Company. The capitalization of the Wisconsin Edison Company consists of $10,000,000 authorized ten-year 6 per cent convertible gold denbenture bonds dated May 1, 1914, of which $6,500,000 are issued. and 400,000 shares of capital stock without nominal or par value, of which 215,000 shares are issued. All of the issued securities are owned by the North American Company. The opportunity offered to shareholders is to subscribe pro rata in proportion to their holdings for $3,000,000 debenture bonds and 30,000 shares of the stock. The holder of each ten shares of North American stock may subscribe for $100 debenture bonds and one share of capital stock for $136. Regular dividends of $3.50 per share annually are being paid upon the stock. The subsidiary utilities of the Wisconsin Edison Company serve a population estimated at 580,000. All the electric lighting, gas and heating franchises are in the form of indeterminate permits. A description of the company, inclosed with the letter of Mr. Mortimer, states that the street railway franchises are of long duration and may be surrendered at any time and indeterminate permits obtained in lieu thereof. Gross earnings of the subsidiary utilities have shown a large growth. They have increased from $1,891,551 in 1898 to $8,495,324 in 1913. Earnings for the twelve months ended Feb. 28, 1914, available for the payment of interest on the debentures of the Wisconsin Edison Company and dividends on its stock and for depreciation of subsidiary utilities were $2,087,559. Interest on the debentures and regular dividends on the stock yield about 7 per cent on the purchase price of the securities. Reserves of the subsidiary utilities aggregate over $4,715,000, and the book surplus accounts are in excess of $2,146,000.

American Power & Light Company and Subsidiaries.—A pamphlet report giving various details about operations has been issued to stockholders of the American Power & Light Company. It covers operations of that company and its subsidiaries, the Kansas Gas & Electric Company, the Pacific Power & Light Company, the Portland Gas & Coke Company and the Southwestern Utilities Corporation, for the year ended Dec. 31, 1913. F. G. Sykes, the president, states that the policy of acquiring property and of building for the future has been continued, and the amount of the present cash investment not yet materially productive is approximately $4,521,000. The subsidiary companies supply electric light and power service to eighty-nine communities, and in addition other public utility services to a number of the communities. The total population served is estimated at 850,000. There were 61,378 electric customers in 1913. Of the total developed electric power capacity of approximately 78,200 hp, 20,760 hp was generated by hydroelectric plants. The capacity in operation at the end of the year was 58,340 kw, while there were under construction facilities for 16,460 kw additional. There were in operation 702 miles of high-voltage transmission lines while 83 miles were under construction. Earnings from electric light and power companies comprised 55 per cent of the total gross revenue. Gross earnings of the operating companies for 1913 were $5,864,165, an increase of 9.7 per cent over 1912. Net earnings were $2,678,831, an increase of 12.6 per cent over the previous year.

Standard Gas & Electric Company to Retire Notes Before Resuming Dividends.—President H. M. Byllesby, of the Standard Gas & Electric Company, presented the annual report to the stockholders for the year 1913 on March 23. The total estimated population served by the subsidiary properties is 876,027. The "applicable income" from the subsidiaries is given as $1,933,624. From this there was deducted $787,804 for operating expenses, interest charges, etc. This leaves $1,145,820. The sum of $912,420 is required for the 8 per cent dividends on the average amount of preferred stock outstanding during the year. This leaves a balance of $233,400, equivalent to 2.5 per cent on the common stock outstanding during the year. However, the subsidiary companies did not pay out all the "applicable earnings" in dividends, but allocated certain sums to depreciation and surplus. Therefore the actual income of the company was $1,539,311. Deducting from this operating expenses, interest charges, etc., as stated, leaves a balance of actual income of $751,507. The company paid on the preferred stock cash dividends of $362,456 and scrip dividends of $549,964. These exceed the actual income for the stock by $160,914. This excess amount was charged to the company's previously accumulated surplus. Following the plan of depositing $75,000 per month to retire the notes due June 1, 1914, $225,000 notes had been retired at the date of the report. The financial condition of the subsidiary companies was reported as good. The directors deem it imprudent to resume cash dividends until the collateral trust notes are entirely retired.

Western Union Telegraph Earnings.—Total gross earnings of the Western Union Telegraph Company in the year ended Dec. 31, 1913, were $45,783,512. The income account for the year was reclassified so as to treat amounts paid other lines for the transmission of messages and refunds made in connection with services rendered, aggregating $1,110,517, as deductions from total earnings rather than as expenses, which had been the practice. The increase in earnings over the preceding year was 3.9 per cent. Operating expenses increased 4.2 per cent. The balance of income after payment of the 3 per cent dividend on the stock was $242,671. Net additions to the property account for the year were $3,761,496. There were added to the land-line plant 623 miles of pole and 18,458 miles of wire. This was made up by an increase of 25,797 miles of copper wire and a decrease of 7339 miles of iron wire. The company has 25,060 independent and joint offices. Considerable work was performed during the year in the improvement and rehabilitation of offices, in moving them to more desirable locations and in closing others which were not remunerative. Inventories were taken of all materials and supplies in the field and warehouses as of Nov. 30, 1913, and the amount shown in the balance sheet is the cost value thereof less adequate reserves to provide for any depreciation in values. Litigation between the American Speaking Telephone Company *et al.* and the American Bell Telephone Company on the contract of Nov. 10, 1879, was finally concluded in 1913 in favor of the former company. The Western Union company received as dividends $3,230,545. This was credited to surplus reserve. The balance sheet shows reserves as follows: For maintenance of cables, $1,676,926; for reconstruction of land lines, $2,168,084; for employees' benefit fund, $1,000,000.

Annual Report of United Gas & Electric Corporation.—The annual report of the United Gas & Electric Corporation for 1913 says that during the year more than $3,000,000 was expended for additions, betterments and extensions in the railway, gas and electric and water departments. Of this amount $1,200,000 was expended on the International Railway, Buffalo, and $474,000 on the Harrisburg Light & Power Company. George Bullock, the president, states that ample expenditures have been made out of earnings to maintain the physical condition of the property and in addition that an adequate reserve has been set aside during the year to provide for renewals and replacements. Notwithstanding the depression in the last quarter and the increased cost of labor, fuel, oil and taxes, which added $229,000 to expenses during the year, net earnings increased. Officers of the company believe that the cost of raw material has reached the maximum and that the tendency, the signs of which have already shown themselves, will be toward a reduction in price, which they hope will tend to a saving in operating expenses. Over 95 per cent of the total outstanding common stock of the American Cities Company has been exchanged for United Corporation stock under the offer made on Sept. 25, 1913. The directors are of the opinion that the properties thus controlled will prove to be valuable acquisitions. A consolidated surplus account is published for the United Gas & Electric Corporation and the subsidiary United Gas & Electric Engineering Corporation covering the year 1913. The surplus on Jan. 1, 1913, was $56,691. Dividends of subsidiary companies actually declared during the year and miscellaneous direct earnings, after deduction of expenses, amounted to $876,183. From this there were deducted $302,225 interest and $556,188 preferred dividends, a total of $858,413. This left a balance of $17,771, or, with the surplus as of Jan. 1, a total of $74,462. There was deducted $18,332 discount on coupon notes negotiated during the year less profits on transactions in bonds of underlying companies, less a profit of $70 made by the engineering corporation on the sale of notes, or $18,262. The surplus on Dec. 31, 1913, therefore, was $56,200. There was also published a statement of earnings from all sources. This shows direct earnings less expenses of $1,184,434. This amount is stated as earnings of the corporation and net earnings of subsidiary companies after deduction of dividends on their preferred stock, including the equity of the direct subsidiary companies in the operations of their respective subsidiary companies calculated on the basis of their holdings at the end of the period and after providing reserves for the federal income tax on main holding companies amounting to $11,355. Interest and preferred dividends of the United Gas & Electric Corporation aggregated $858,413, leaving net surplus earnings of $326,021, of which $308,251 was added to the surplus account of the subsidiary companies, not declared as dividend. Out of this sum and previous accumulations of surplus of subsidiary companies there were charged during the year various amounts on account of extraordinary expenditures not directly applicable to operations for the year, of which the proportion corresponding to the holdings of this corporation was $153,838. The combined properties of the United Gas & Electric Corporation and the American Cities Company showed an output of 430,107,920 kw-hr. compared with 405,643,998 kw-hr. in the preceding year. The number of electric meters in use was 88,396.

Business Notes

The Columbia Lamp Division of the National Lamp Works of the General Electric Company has moved its New York branch office to 68 West Thirty-eighth Street.

The Shelton Electric Company has announced the removal of its office on April 15 to the Forty-second Street Building, 30 East Forty-second Street, New York City.

The S. W. Electric Company, of 42 Lexington Avenue, New York City, has announced its removal to 652 Hudson Street in the same city. This concern manufactures electrically heated tools and reconstructs other makes of tools for electric heating.

The Covington Machine Company, of Covington, Va., has secured as its general manager A. P. Montague, who has been for the past ten years associated with the Lynchburg (Va.) Foundry Company, occupying at the time of his departure the position of general superintendent of that company.

The Dietz-Warner Electric Company has been formed with headquarters at 195 Second Street, Milwaukee, Wis., and will do an electrical supply, contracting and repairing business in that neighborhood. C. L. Dietz, president of the company, was formerly with the Commonwealth Power Company. J. J. Warner is vice-president and Oscar Wuesthoff secretary-treasurer of the new organization.

The Taylor Underground Heating System, of Pittsburgh, Pa., has engaged T. E. Keegan as assistant manager to represent the concern among architects and engineers in all the large cities of the United States. Mr. Keegan has served with the Atlas Engine Company, the American Stoker Company, the Consolidated Engineering Company of Chicago and the Open Coil Heater & Purifier Company.

The E. W. Ham Electric Company was recently incorporated for the purpose of conducting an electrical jobbing business, and its present address is 5 Barton Place, Worcester, Mass. J. B. Bailey, formerly of the Stuart-Howland Company, of Boston, is president of the new concern, and E. W. Ham is treasurer. This company took over the electrical jobbing business formerly owned by Mr. Ham and plans to extend it.

The Viking Electric Company, manufacturer of Viking bell ringers and other products, in order to take care of a rapidly growing business, is moving its plant from Albany to 292 Taaffe Place, Brooklyn, N. Y. The new plant, containing twice as much floor space as the old plant, will be equipped with additional machinery and more help will be taken on. The present sales office at 150 Chambers Street, New York, where a large stock is carried, will be maintained.

New Industrial Companies

The Ex-El Electric Company, of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 by L. J. Kohn, J. S. Kohn, L. M. Young, L. C. Maisner and J. B. Dwerken. The company proposes to manufacture and deal in electric devices.

The Harmo Electric Company, of Chicago, Ill., has been incorporated wth a capital stock of $10,000 to manufacture and deal in musical instruments, machines and devices. The incorporators are Roy M. Harmon, M. V. Lyons and H. R. Frey.

The Electro-Acoustic Company, of New York, N. Y., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing apparatus for receiving and recording sounds. The incorporators are R. M. Mitchell and A. F. Gerstner, of Newark, N. J., and W. P. Andrick, of New York, N. Y.

The V. M. Nussbaum Company, of Fort Wayne, Ind., has been incorporated to deal in electrical supplies. The company will take over the electrical department of the Hanna-Brackenridge Company, which Mr. Nussbaum has purchased from the trustees in bankruptcy of the Hanna-Brackenridge Company. The directors are V. M. Nussbaum, L. P. Nussbaum and J. W. Thompson.

Trade Publications

Electrical Supplies.—The Pacific States Electric Company, San Francisco, Cal., has recently issued some additional leaves for its loose-leaf catalog. These loose leaves supersede others covering the same items.

Conduit.—A small folder recently issued by the American Conduit Manufacturing Company, Pittsburgh, Pa., tells briefly about the prominent characteristics of Wireduct, a flexible conduit. A price list is also given.

Oil Switches.—The General Electric Company has just issued a bulletin, illustrating and describing its Type F, Form K12 oil switches. This contains up-to-date information on a very important piece of electrical apparatus.

Guy Anchors.—The Oshkosh Manufacturing Company, Oshkosh, Wis., has issued a folder describing and illustrating the Oshkosh guy anchor. Exceptionally great expansion is claimed for this device, and tests have shown that it has good holding power in all kinds of soil.

Switchboard Panels.—Section DS 1410, a Westinghouse publication, covers direct-current switchboard panels for 100-volt and 220-volt systems. A detailed description is given of the various apparatus mounted on the boards, and sketches are shown of the arrangement furnished on standard panels.

Switches and Receptacles.—A neat booklet of twenty pages has been published by the Metropolitan Electric Manufacturing Company, East Avenue and Fourteenth Street, Long Island City, N. Y., which is devoted to its detachable mechanism push-button switches, lock switches and flush receptacles. These devices are illustrated, and a price list is given.

Rectifiers.—The alternating-current rectifier for charging storage batteries which is manufactured by the Mohawk Electric Manufacturing Company, Newark, N. J., is the subject of a clearly written pamphlet. The information that the user and prospective user want to have about this apparatus is given in a practical manner, accompanied by illustrations.

Wiring Specialties.—Bulletin No. 8, recently brought out by the Connecticut Electric Manufacturing Company, Bridgeport, Conn., combines all bulletins and describes new specialties not listed in its Catalog No. 4. The present publication contains sixteen pages and illustrates the company's latest types of push-button switches, conduit receptacles, rosettes and other wiring specialties.

Silent Chain Drive.—Data Book 125, lately issued by the Link Belt Company, of Chicago, Ill., contains a compendium of information on chain-belt drive for all kinds of service. Price lists and dimensions of the various designs of this company's product are contained in the book, together with numerous descriptions of chain-belt installations. The book is well illustrated.

Lighting Supplies.—The Federal Sign System (Electric), Lake and Desplaines Streets, Chicago, Ill., has issued a large-size "bargain list," which contains illustrations and prices of articles of which the company has an over stock. There is a limited number of each class of goods, and they are offered at special prices. Indirect fixtures, portables, lamps, signs, sockets and other specialties are among the offerings.

Steel Poles.—The Franklin Steel Company, Franklin, Pa., has issued an attractive sixteen-page catalog devoted to its "Tripartite" steel pole and rolled-steel specialties. The adaptability, durability and first cost of steel poles are discussed. Among the excellent illustrations is one showing the 55-ft., 40,000-volt transmission line installed by the United States government in Arizona, for which steel poles are used.

Safety Device.—The Draeger Oxygen Apparatus Company, 422 First Avenue, Pittsburgh, Pa., is sending out printed information regarding the new Draeger "self-rescuer." This device is in extensive use for prompt rescue work in mines, metallurgical and chemical plants and gas companies. The pamphlet contains a description of the working principles of the apparatus and instructions for use. An illustration is shown of a Draeger two-hour mine rescue apparatus in service.

Personal Mention

Mr. R. A. Long has been appointed superintendent of the municipal electric light and water plant at Cuyahoga Falls, Ohio.

Mr. Claude H. Shepherd has been appointed electrical engineer in charge for the Commissioners of Lincoln Park, Chicago, Ill.

Mr. Allan Pierson has been appointed general superintendent of the Weston (Ont.) Electric Light & Water Works Commission.

Mr. H. C. J. Peisch has been made superintendent of the Chippewa Valley Railway, Light & Power Company, of Chippewa Falls, Wis.

Mr. Sidney Allen has been appointed secretary and treasurer of the Corpus Christi (Tex.) Ice & Electric Company to succeed Mr. E. A. Born.

Mr. Lloyd Kerns has been made superintendent of the municipal electric-light plant of Logansport, Ind., as successor to Mr. J. H. Stewart, resigned.

Mr. E. A. Born, formerly secretary and treasurer of the Corpus Christi (Tex.) Ice & Electric Company, has been appointed vice-president and manager.

Mr. Leonard Work has resigned from the engineering and construction departments of the Isthmian Canal Commission and will spend four months in Europe.

Mr. Lewis A. McArthur, formerly assistant to Mr. J. E. Davidson, general manager of the Pacific Power & Light Company, Portland, Ore., has been made assistant general manager of the company.

Mr. H. E. Johnson, formerly assistant superintendent of the Canton (Miss.) Electric Light and Water Works, has been elected superintendent of the Senatobia (Miss.) Electric Light and Water Plant.

Mr. D. F. McGee, chief engineer of the Pacific Power & Light Company of Portland, Ore., has resigned to accept a position with Mr. G. E. Claflin, vice-president of the Electric Bond & Share Company.

Mr. J. C. Martin, formerly assistant in the engineering department of the Pacific Power & Light Company, Portland, Ore., has been appointed engineer of the company, vice Mr. D. F. McGee, resigned.

Mr. J. B. Woodyatt, for many years superintendent of the Sherbrooke (Que.) Railway, Light & Power Company, has resigned to accept a position with the Southern Canada Power Company, Montreal, Quebec.

Mr. F. W. Harris, who was formerly superintendent of the Coatesville (Pa.) plant of the Chester Valley Electric Company, has been appointed general manager of all the properties of the Chester Valley Company.

Mr. James T. Lynn, who is the head of a syndicate operating a number of electric plants throughout the country, has been reappointed a member of the Detroit (Mich.) Public Lighting Commission for a term of six years.

Mr. E. W. Trafford, who has been acting as manager, superintendent and consulting engineer of the municipal electric light and water plant at Richmond, Va., was made superintendent and city electrician on April 1.

Mr. George S. Searing, Chicago manager for the Hart & Hegeman Manufacturing Company, is confined to his home by illness. Mr. Searing is one of the best known of the older electrical men in Chicago and has the genuine sympathy of many friends.

Mr. H. D. Johnson has resigned his position with the Canadian British Insulated Company to join the engineering staff of the Eugene F. Phillips Electrical Works as assistant contracting manager. Mr. Johnson is considered one of the best authorities on underground distribution in Canada.

Mr. Frederick D. Adams celebrated his twenty-fifth anniversary with the United Illuminating Company of New Haven, Conn., on April 1. Mr. Adams, who is the secretary and treasurer of the company, is the oldest employee in point of service with the exception of Mr. James English, the president.

Mr. Charles D. Calkins has been appointed superintendent for the North Missouri Light & Power Company at New London, Mo. This company, which began construction work on April 1, has franchises in Perry, Center, New London and Frankford, and it will distribute energy purchased from the Mississippi River Power Company.

Mr. Leonard Day, who recently resigned as electrical engineer of the Bureau of Fire Alarm and Telegraphs of the Fire Department of New York City, was presented with a diamond watch fob by the members of the Fire Alarm and Telegraph Bureau as a token of their appreciation and in commemoration of many pleasant years spent with them.

Mr. W. R. Minor has just been appointed manager of the Holophane Works of General Electric Company to succeed Mr. V. R. Lansingh. Mr. Minor has been connected with the Holophane Works during practically all of his business career and is known throughout the country as a type of the progressive young business man and as a remarkably successful sales manager.

Mr. Edward J. Wright has been appointed chief engineer of the Tygert Allen Fertilizer Works of the American Agricultural Chemical Company at Greenwich Point, Philadelphia. Mr. Wright, who was born in Charlottesville, Va., and educated at the Philadelphia High School, will overhaul the large and complex plant at Greenwich Point, comprising a network of both alternating-current and direct-current lines and a complete electric-car-conveyor system, together with several miles of pipe lines and acid-handling apparatus.

Mr. William Weedon Cole, for many years connected with the Elmira (N. Y.) Water, Light & Railroad Company, and more recently with Messrs. Day & Zimmerman, engineers, of Philadelphia, has retired from the latter organization and will devote his entire time to investigation of reports of public utilities, industrials and advising in regard to the reorganization and mechanical operation of railroads. He has opened an office at 43 Exchange Place, New York City, for the practice of a general consulting engineering business.

Mr. J. E. Davidson, vice-president and general manager of the Pacific Power & Light Company, Portland, Ore., and heretofore in charge of maintenance and operation, has received jurisdiction over engineering matters as well, so that he will now have complete control over all engineering, operating, new-business, purchasing and tax and property departments of the Pacific Power & Light Company. Mr. Davidson, who is well known in central-station circles as one of the most progressive public utility managers of the country, became associated with the Pacific Power & Light Company four years ago in the capacity of new-business manager. He was formerly with the public utility companies at Port Huron, Mich., and Montpelier, Vt., and was president of the Vermont Electrical Association in 1909, president of the New England Section of the National Electric Light Association in 1910-1911, and president of the Northwest Electric Association in 1911-1912.

J. E. DAVIDSON

Mr. E. W. P. Smith has been appointed city electrician of Cleveland, Ohio. Mr. Smith was graduated in electrical engineering from the Colorado College in 1908, and after a year of operating experience in the West entered the railway engineering department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. He was later employed by the city of Cleveland in the smoke-prevention division, where a preliminary report on the electrification of steam railroads in the city of Cleveland was prepared. During the latter part of 1913 Mr. Smith was in the mechanical department of the Lake Shore & Michigan Southern Railroad. He is an associate of the American Institute of Electrical Engineers, a member of the Electrical Railway Association and a member of the Cleveland Engineering Society.

Construction

New England

LEWISTON, MAINE.—The Lewiston & Auburn El. Lt. Co., of Lewiston, is contemplating the installation of a steam-power plant in the Lincoln mill property which will develop from 6000 hp to 8000 hp.

KEENE, N. H.—The Public Service Commission has granted the Keene Gas & El. Co. permission to issue $150,000 in capital stock, of which $50,000 will be used to take up preferred stock outstanding, the remainder for the purpose of taking up outstanding notes issued for additions and improvements to property and for working capital.

BRADFORD, VT.—The Bradford El. Ltg. Co. expects to purchase within the next two months one car load of cedar poles. A. F. Dickey is manager.

BRANDON, VT.—The Hortonia Pwr. Co., of Brandon, recently incorporated, has acquired a series of ponds and lakes situated in Hubbardton and Sudbury, Vt., and purposes to build a hydroelectric power plant at Hortonville at the outlet of Lake Hortonia. The power house will be of concrete construction, situated 1200 ft. from the dam, between which and the power house will be laid a steel penstock 54 in. in diameter. The initial installation will consist of a 500-hp turbine directly connected to 2300-volt, three-phase, 60-cycle generators. Energy generated at the plant will be transmitted to Brandon at 11,000 volts, where the company has a long-term contract with the Neshobe El. Co., of this town. Transmission lines will also be erected to Sudbury and Orwell. Among the incorporators of the Hortonia Co. are Edward D. Blackwell, of Brandon; A. W. Hyde, of Sudbury, and W. A. Jennings, of Orwell.

HEARTWELLVILLE, VT.—It is reported that W. B. Plunkett, of Adams, Mass., will establish an electric-power plant to furnish electricity to light his summer home in Heartwellville. The output of the plant, it is understood, will be sufficient to furnish electricity in the village in case electrical service is wanted.

WHITE RIVER JUNCTION, VT.—Within the next four months the Mascoma El. Lt. & Gas Co., of White River Junction, expects to purchase material for distribution system (2½ miles) and 40 brackets for tungsten lamps. Frank Collins is general manager.

BOURNE, MASS.—C. D. Parker & Co., 78 Devonshire Street, Boston, Mass., it is reported, contemplate the construction of a power plant near Bourne to furnish energy for the proposed canal electric railway and for manufacturing purposes.

GEORGETOWN, MASS.—The town of Georgetown has applied to the State Legislature for permission to furnish electricity in the towns of Boxford and Newbury. It is proposed to erect transmission lines from the municipal electric-light plant to the above towns and install distributing systems in each place.

OAKHAM, MASS.—A committee, consisting of Gardner M. Dean, Gilbert C. Butterfield, John P. Day, Clarence H. Parker and Walter R. Dean, has been appointed to investigate the feasibility of establishing a municipal electric-light plant in Oakham.

SPRINGFIELD, MASS.—Bids will be received by the committee on city property for the city of Springfield until April 16 for two steam engines and generators for the High School of Commerce, Springfield. Drawings and specifications may be seen at the office of Kirkham & Parlett, architects, Carr Building, Springfield. George S. Cook is chairman of committee.

WOONSOCKET, R. I.—Contracts have been placed by the Blackstone Valley Gas & El. Co., of Woonsocket, for material for the ornamental lighting system, consisting of 39 General Electric 4-amp luminous inverted arc lamps, erected on ornamental brackets on present poles, maintained by overhead wires. The cost of the work is estimated at $3,000. A. F. Townsend is local manager.

MANCHESTER, CONN.—Preparations are being made by Cheney Brothers to build a new weaving shed, 150 ft. by 321 ft., for its velvet manufacturing plant and a yarn-dyeing house, 80 ft. by 326 ft. A temporary boiler house will be built in the rear. The company purposes to build, some time in the future, a central heating and power plant to supply all its mills. The new mills will be operated by electricity.

MERIDEN, CONN.—The Board of Public Works has authorized W. S. Clark, superintendent of the board of public works, to draw up a contract with the Meriden El. Lt. Co. to furnish electricity to operate the pumping station at the Broad Brook reservoir. C. A. Learned is general manager of the Meriden company.

SOUTH NORWALK, CONN.—Plans are being considered by the electric light commissioners for replacing the arc lamps in the outskirts of the city with incandescent lamps. Albert E. Winchester is superintendent of the municipal electric-light plant.

Middle Atlantic

CHERRY CREEK, N. Y.—The village of Cherry Creek has granted the Randolph El. Lt. & Pwr. Co., of Randolph, a franchise to furnish electricity here.

DEPOSIT, N. Y.—The power house of the Deposit El. Co. was recently destroyed by fire, causing a loss of about $25,000. The town at present is without electrical service.

ELMIRA, N. Y.—The Elmira Wtr., Lt. & R. R. Co. has filed notice of increase in capital stock from $2,000,000 to $5,000,000.

KINGS PARK, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, N. Y., until April 27 for electrical work in buildings A, B, C and D, at Kings Park State Hospital. Drawings and specifications may be consulted and blank forms of proposals obtained at the office of the State Hospital Commission, 1 Madison Avenue, New York; at Kings Park State Hospital, Kings Park, and at the office of Lewis F. Pilcher, state architect, Capitol, Albany. Plans and specifications may be obtained upon application to the architect. For details see proposal columns.

NEW YORK, N. Y.—The Public Service Commission has awarded the contract for the construction of Section No. 1-A of Route No. 12 (part of the Eastern Parkway subway in Brooklyn) to the Cranford Co., of Brooklyn, for $2,225,519.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, headquarters of Fire Department, 157 and 159 East Sixty-seventh Street, New York, until April 13 for furnishing and installing complete electric and gas lighting equipment in the quarters of engine company No. 18, Borough of Manhattan. Blank forms and further information may be obtained and plans and specifications seen at the above office.

NIAGARA FALLS, N. Y.—The Public Service Commission has authorized the Cliff Electrical Distributing Co., of Niagara Falls, to issue $150,000 in capital stock, the proceeds to be used to purchase additional equipment.

NORTH CREEK, N. Y.—Within the next few months the North Creek El. Co. expects to purchase an automatic waterwheel governor for high-pressure waterwheel. C. S. Wade is secretary and treasurer.

CANONSBURG, PA.—The West Penn Ltg. Co. has closed a contract with the Pittsburgh Coal Co. to furnish electricity for the Harrison mine, near Bridgeville. C. A. Hall, local superintendent of the West Penn company, has charge of installing the new equipment at the mine. About 250 hp will be required.

ERIE, PA.—Plans are being prepared by Arthur G. McKee, engineer, Rockefeller Building, Cleveland, Ohio, for an addition to power house and equipment for same for the H. F. Watson Co., of Erie.

HUNTINGDON, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 11 for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Huntingdon, Pa. Drawings and specifications may be obtained from the above office or from the custodian of site at Huntingdon. O. Wenderoth is supervising architect.

WARREN, PA.—It is reported that the Dunkirk, Allegheny Valley & Pittsburgh Railroad, which is leased by the New York Central R. R. Co., will be equipped for electrical operation between Warren and Youngsville, a distance of 9 miles, and interurban cars operated over that section of the road.

BLOOMFIELD, N. J.—The Town Council is considering the extension of the lighting system in connection with awarding a new lighting contract to the Pub. Ser. El. Co., of Newark.

BOONTON, N. J.—The Board of Public Utility Commissioners of New Jersey has granted, conditionally, the Jersey Pwr. Co. permission to issue $40,000 in capital stock, the proceeds to be used for the erection of a new transmission line from Boonton to Dover, via Fox Hill and Millbrook, and to Wharton and Rockaway, a distance of about 15 miles. The company proposes to lease the power plant of the Jersey Corporation in Boonton, to discontinue the power stations now operated by the Eastern Pennsylvania Pwr. Co. at Dover and Bernardsville, and to distribute energy from its transmission line mainly over the system of the latter company. Among the conditions imposed upon the company are the following. It is not to furnish local service either in Boonton or Hanover Township except as specifically permitted later by the board, such territory being supplied the immediate authorization by the Eastern Pennsylvania company of the power stations to be discontinued, and the authorization of the circuit to be displaced between Millbrook and Dover.

CAMDEN, N. J.—Plans are being considered for the installation of a new boiler house, power plant, refrigeration system and ice-manufacturing factory at the new creamery to be erected at the creamery plant of the Garden State Dairies, at Eighth and Market Streets.

HIGH BRIDGE, N. J.—The Hunterdon El. Lt. & Pwr. Co., of High Bridge, is reported to be contemplating extending its transmission line to Hampton and Glen Gardner to furnish electrical service in those towns.

SPRING LAKE, N. J.—All bids submitted March 30 for lighting the streets and public places in Spring Lake were rejected. E. V. Patterson is borough clerk.

ROCK HALL, MD.—The Council is considering submitting the proposal to issue $10,000 in bonds for the installation of an electric-light plant to the voters.

MOUNDSVILLE, W. VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 14 for the construction, including mechanical equipment and lighting fixtures and approaches, of the United States post office at Moundsville. Drawings and specifications may be obtained from the above office or from the custodian of site at Moundsville. O. Wenderoth is supervising architect.

BRIDGEWATER, VA.—The North River El. Co., of Bridgewater, expects to make considerable improvement to its plant during the coming summer. As yet nothing definite has been decided upon. G. Richard Berlin is president and manager.

FREDERICKSBURG, VA.—Within the next two months the Rappahannock El. Lt. & Pwr. Co., of Fredericksburg, expects to erect an addition to its Hazel Hill power plant for which equipment has been purchased; also within the next three months to purchase two switchboard panels, exciter, mechanical stoker and condenser, and also to purchase poles, lightning arresters and 5000 lb. of wire within the next two months. S. C. Foster is superintendent and electrical engineer.

FREDERICKSBURG, VA.—Bids will be received by the buildings and ground committee until April 15, at the office of Charles M. Robinson, Inc., architect, Times-Dispatch Building, Richmond, for construction of dormitory, complete, including heating, plumbing and electric wiring, at the State Normal and Industrial School at Fredericksburg, Va. Plans and specifications may be seen at the office of the architects, where copies may be obtained upon deposit of $10, to be refunded upon return of plans. P. J. White is chairman of buildings and grounds committee.

HAMPTON, VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 9 for the construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Hampton, Va. Drawings and specifications may be obtained at the above office or from the custodian of site at Hampton. O. Wenderoth is supervising architect.

MONTEREY, VA.—Within the next eight months the Monterey Garage & Lt. Co. expects to install a 60-hp boiler, 45-hp engine and 30-kw generator. C. M. Lunsford is manager.

NATIONAL SOLDIERS' HOME, VA.—Bids will be received at the office of the National Home for Disabled Volunteer Soldiers, National Soldiers' Home, Va., until May 4 for remodeling telephone system. F. E. Skinner is treasurer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 28 for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 6623—1018 composition unions; Schedule 6624—2000 ft. plain twin conductor, 350 receiver cords, 25 head gears for wireless, 200 insulators, 2000 ft. leaded and armored, soft-steel, twin-conductor wire. Brooklyn, N. Y., Norfolk, Va., and Mare Island, Cal. Schedule 6624—11,500 ft. interior communication cable. Bids will also be received until May 5 as follows: Brooklyn, N. Y.

Schedule 6603—two 900-kw, 200-volt generators. Mare Island, Cal., Schedule 6629—22,000 lb. condenser tubes. Puget Sound, Wash., Schedule 6629—2190 lb. 1¼-in. to 5-in. seamless copper tubing. Application for proposals should designate the schedule desired by number.

North Central

GRAYLING, MICH.—Bids will be received at the office of the quartermaster general, Lansing, until April 15, for the construction of a combined electric-lighting and water-supply system at the Hanson State Military Reservation near Grayling, consisting of power house, system of water mains, 40,000-gal. concrete reservoir, well, direct-current electric transmission and lighting system. Bids on all or any part of the work will be considered. Walter G. Rogers is quartermaster-general.

IONIA, MICH.—Bids will be received by Dr. O. R. Long, superintendent, until May 12 for electric wiring of a new brick building to be erected for the Ionia State Hospital. Plans and specifications may be seen after April 17 at the office of Edwyn A. Boyd, architect, of Lansing, Mich., or at the office of superintendent at Ionia.

LAPEER, MICH.—Plans are being considered by the city of Lapeer for installing a small electric-light plant to furnish electricity for lighting the streets and public places of the city.

MANISTIQUE, MICH.—The proposal of bonding the city for $35,000 for the construction of a gravity main and dam and power plant will be submitted to the voters some time this month.

MIDLAND, MICH.—Bids will be received by the city clerk until April 24 for four deep wells, 500 ft. piping for wells to tanks, 3700 ft. of 10-in. pipe for tank to present distributing system, four small pump houses of concrete and brick, two electrically operated centrifugal pumps, two electrically operated deep-well pumps and 1 mile of transmission line.

MONROE, MICH.—Bids will be received by Thomas R. Waters, secretary of board of education, until April 28 for the electric wiring of the old high school building, which is to be remodeled throughout.

ROGERS CITY, MICH.—The Michigan Limestone & Chemical Co., it is reported, is plannnig to install a 1000-hp steam turbine and generator in its power plant.

AMELIA, OHIO.—Bids will be received by W. A. Williams, village clerk, until April 18 for furnishing material and construction of an electric generating plant for the village of Amelia, according to plans and specifications on file at the office of the village clerk.

ATHENS, OHIO.—Plans are being prepared for rehabilitating the municipal electric-light plant. For further information address B. Davidson, public service director.

BLUFFTON, OHIO.—The Board of Public Affairs expects to purchase a 250-hp to 300-hp Diesel oil engine and about 15 transformers with a rating of about 10 kw. Cyrus Schumacher is superintendent.

COLUMBUS, OHIO.—Bids will be received at the office of the board of trustees of the Ohio State University, Columbus, until April 21 for furnishing material and labor as follows: (1) Construction of addition to physics building (east wing) on the Ohio State University campus; (2) an underground tunnel, approximately 684 ft. long, in accordance with specifications and drawings prepared by Joseph N. Bradford, university architect, on file in the office of the auditor of state; (3) one horizontal turbine generator in the power plant of the Ohio State University; (4) one five-retort underfeed automatic stoker in the boiler house at the Ohio State University, in accordance with plans and specifications prepared by William C. McCracken, engineer, on file in the office of the auditor of state. Plans and specifications for above improvements may also be seen at the office of the architect, the engineer and the secretary of the board of trustees. Form of proposal may be secured at the office of the board of trustees. Carl E. Steeb is secretary.

DENNISON, OHIO.—The City Council has entered into a contract with the County El. Co., controlled by the United Service Co., for lighting the streets of the city. The company, it is understood, will install new arc lamps.

FREEPORT, OHIO.—Bids will be received by the village of Freeport (Prairie Depot), Wood County, until April 16, for furnishing electricity for lighting the streets, alleys, public ways and public buildings. For details see proposals columns. H. E. West is clerk of Freeport Corporation.

HAMILTON, OHIO.—Bids will be received by W. W. Crawford, county auditor, at the office of the county commissioners, Hamilton, until April 18 for lighting fixtures for the court house, situated in Hamilton, according to plans and specifications prepared by George Barkman and F. G. Mueller, architects, copies of which may be obtained at the office of G. Mueller, Rentschler Building, Hamilton, Ohio, upon deposit of $3.

JAMESTOWN, OHIO.—Within the next few months the Jamestown El. Lt. Co. expects to purchase a few 2-kw or 3-kw transformers. S. A. Brown is secretary and manager.

JOHNSTOWN, OHIO.—The Board of Public Affairs expects to purchase within the next four months 12 lightning arresters and six electric-light meters for house service; also within the next six months wire for a complete line service for the village. D. H. Crawford is superintendent and engineer.

TIFFIN, OHIO.—As the result of the approval by the State Public Utilities Commission of a bond issue of $2,000,000, electric-light plants in nine Ohio cities and towns will be united under the control of the Ohio Lt. & Pwr. Co., of Tiffin. The plants which the company will acquire are situated in Fremont, Fostoria, New Lexington, Logan, Crooksville, New Straitsville, Shawnee and Lancaster.

BARLOW, KY.—The Barlow Lt. & Pwr. Co., recently incorporated, will install an electric plant to furnish electricical service in Barlow. The equipment will include a 230-volt direct-current generator, switchboard, etc., 3 miles of distribution lines and 500 incandescent lamps. L. F. Wider is engineer in charge. J. W. Meshew, of Barlow, is interested in the company.

CADIZ, KY.—Steps have been taken toward the organization of a company for the purpose of installing an electric-light plant in Cadiz, work on which will begin in the near future. George L. Smith, A. P. White and Stanley White, of Cadiz, are interested.

COVINGTON, KY.—The Liberty Cherry & Fruit Co., of Covington, recently incorporated, will equip, for packing maraschino cherries and candied fruits, a plant which will be equipped with electrically operated machinery. Edgar Bettman and others are interested.

IRVINE, KY.—The City Council will soon offer for sale an electric-light franchise for the town. It is understood that parties are ready to install a plant in Irvine.

LOUISVILLE, KY.—The Louisville Gas & El. Co. has applied for a permit to erect a boiler room at 217 West Washington Street. The building will be 108 ft. by 27 ft. (steel and concrete construction) and will cost about $125,000.

MAYSVILLE, KY.—The City Council is contemplating the installation of a municipal electric-light plant to furnish electricity to maintain 125 arc lamps. The cost of the plant is estimated at $22,000.

PRINCETON, KY.—The installation of a municipal electric-light plant in Princeton is under consideration. For further information address R. W. Lisanby, Mayor.

SHEPHERDSVILLE, KY.—A company is being organized by the citizens of Shepherdsville for the purpose of installing an electric-light plant, ice factory and cold-storage plant here. The company will be incorporated under the name of the Shepherdsville El. Lt., Wtr. & Cold Storage Co. with a capital stock of $10,000. It is proposed to acquire and enlarge the existing plant. The officers are: S. W. Bates, president; S. H. Ridgeway, vice-president; Conrad Maraman, secretary, and C. F. Troutman, treasurer.

BEDFORD, IND.—The power plant of the Furst-Kerber Stone Co., 4 miles north of Bedford, was destroyed by fire recently.

CRAWFORDSVILLE, IND. — Superintendent McVey of the municipal electric-light plant has recommended to the City Council the purchase of a new generator for the municipal plant, which would make it possible to add 100 arc lamps for lighting the city.

FORT WAYNE, IND.—The Board of Public Works has awarded the contract for a 3000-kw turbo-generator set, a 100-kw motor generator exciter set and switchboard complete to the Fort Wayne El. Co., of Fort Wayne, at $33,985; for condenser and auxiliaries to the Alberger Pump & Condenser Co., of New York, N. Y., for $11,902.

LOGANSPORT, IND.—The Logansport Htg. Co. is reported to be contemplating extending its transmission lines to furnish electricity for lamps and motors to the farmers throughout Cass County and also to light the county roads.

APPLE RIVER, ILL.—The Warren Lt. & Pwr. Co. is reported to have been granted a franchise to furnish electricity for lamps and motors in Apple River.

MATTOON, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, expects to rebuild at once the distribution system in Anna.

PANA, ILL.—Local business men have decided to organize a company, to be capitalized at $50,000, to construct and operate an electric-light plant. The city has been without electrical service since last November, when the Central Illinois Pub. Ser. Co., of Mattoon, refused to accept a franchise offered by the City Council. Harvey W Ferguson is interested in the company.

URBANA, ILL.—Bids will be received by the board of trustees of the University of Illinois, Room 648, 29 La Salle Street, Chicago, Ill., until April 27 for plumbing, heating, ventilating, electric wiring and composition flooring for the addition to the chemical laboratory at the University of Illinois. James B. Dibelka, of Chicago, is state architect.

BRILLION, WIS.—Within the next two months the F. Paustian Milling Co., of Brillion, expects to erect a substation and transmission lines; also to purchase material for distribution system (to change from direct current to alternating current), and a series street-lighting system. The company has entered into a contract with the Wisconsin Pub. Ser. Co., of Green Bay, for 500 kw. A. F. Paustian is secretary

BURLINGTON, WIS.—The Burlington El. Lt. & Pwr. Co. expects to purchase within the next six months some electrical appliances and supplies, but as yet nothing definite has been decided. W. J. Leach is electrician.

CLIFTONVILLE, WIS.—Within the next 12 months the Water and Light Commission expects to purchase one 12-in. by 30-in. simple Corliss engine directly connected to a 60-cycle, single-phase, 2300-volt generator. George C. Stewart is superintendent.

EAU CLAIRE, WIS.—The Chippewa Valley Ry., Lt. & Pwr. Co., of Eau Claire, expects to erect 50 miles of 33,000-volt transmission line within the next six months and to purchase equipment for same, including transformers, poles, lightning arresters and insulators; also to expend about $10,000 for electrical appliances and supplies within the next six months. George B. Wheeler is secretary and general manager.

EDGAR, WIS.—The installation of an electric-light plant in Edgar is reported to be under consideration.

FLORENCE, WIS. — Preliminary estimates are being prepared by D. H. Maury, engineer, 1137 Monadnock Building, Chicago, Ill., for improvements to the municipal electric-light plant in Florence. E. E Wilcox is president water and light commission.

GREEN BAY, WIS.—The Wisconsin Pub. Ser. Co., of Green Bay, is contemplating extending its transmission lines from Wrightstown through Greenleaf to Brillion, and thence to Reedsville and surrounding country. The company has entered into a contract for a period of ten years with the Paustian El. Co., of Brillion, whereby the latter company will distribute electricity in Brillion, Reedsville, Forest Junction and Gilbert Junction. A line may be extended east from Reedsville to serve Whitelaw, Grimms and other towns.

HAYWARD, WIS.—Within the next five months the Hayward El. Lt. & Pwr. Co. is planning to build a water-power plant and expects to enter into a contract with the Northwestern El. Equipment Co., of St. Paul, Minn., for the complete installation of the proposed plant. J. F. Purnhagen is secretary and treasurer.

LUCK, WIS.—The contract for construction of a power house is reported to have been awarded to L. Helgerson, of Luck.

MADISON, WIS.—The City Council has approved the ornamental street-lighting system proposed by Alderman Frank Alford. An engineer, it is understood, will be engaged to prepare plans.

MILWAUKEE, WIS.—The City Council has awarded the contract for the proposed street-lighting survey of the city to Robert Hunt & Co., of Chicago, Ill., at $4,850. The object of the survey is to replace the present street-lighting system in such a manner as to eliminate all waste and at the same time properly light the city.

SHEBOYGAN FALLS, WIS.—The Railroad Commission has refused to grant the city permission to establish a municipal electric-light plant. The petition was refused owing to the local plant having changed hands and because the new owners contemplate making extensive improvements in the street-lighting system.

LAKE CITY, MINN.—The Board of Water and Light Commissioners is preparing to change the municipal electric-light system (now operated by steam-driven plant) to hydroelectric motive power, energy to be secured from the transmission line of the Minnesota-Wisconsin Pwr. Corpn., of Wabasha, to be delivered at 2300 volts, alternating current. At present 60-cycle, single-phase, 110/220/1100/2200-volt, 6.6-amp alternating-current system is used. They will retain two single-phase arc-lamp panels and will probably install one single-phase lighting panel, one three-phase power panel, one total input panel with necessary voltmeters, ammeters, automatic oil and other necessary switches, transformers, etc. As yet nothing definite has been decided upon. With the installation of the new machinery and devices, etc., the city will probably overhaul the entire distributing system. It is expected to change over the system by June 1. The city is looking for an electric fire alarm apparatus that will not involve tank and compressed air. J. Cole Doughty is president of board.

WINONA, MINN.—The installation of an ornamental system on 10 blocks in the city, to cost about $8,100, is under consideration. A contract will soon be signed with the Wisconsin Ry., Lt. & Pwr. Co. to install the lamps.

ZUMBRO FALLS, MINN.—A movement has been started by business men for the installation of an electric-lighting system. A dam will probably be built across the Zumbro River.

BROOKLYN, IA.—The Grinnell El. Lt. & Htg. Co., of Grinnell, has submitted a proposition to the Town Council offering to extend its transmission lines to Brooklyn to furnish electrical service here.

LYONS, IA.—A committee has been appointed to make investigations in regard to establishing a municipal electric-light plant in Lyons. L. C. Moesinger is member of the committee.

MASON CITY, IA.—At an election held March 26 the proposal to issue $65,000 for a municipal electric-light plant was defeated.

MISSOURI VALLEY, IA.—An engine and dynamo is reported to have been destroyed by an explosion recently at the plant of the Missouri Valley El. Lt. Co.

SHELLSBURG, IA.—The Iowa Lt. & Pwr. Co., of Cedar Rapids, represented by F. J. Cross, has applied for an electric-light franchise in Shellsburg. It is proposed to erect a transmission line from Center Point, via Palo and Covington. The proposal will be submitted to the voters on April 26.

CLARKSVILLE, MO.—The City Council has granted A. Vogel, of the Louisiana Lt., Pwr. & Trac. Co., of Louisiana, a franchise to furnish electricity for lamps and motors here; also water service. The ordinance will be submitted to the voters at the April election.

EXCELSIOR SPRINGS, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 13 for construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Excelsior Springs, Mo. Drawings and specifications may be obtained at the above office or from the custodian of site at Excelsior Springs. O. Wenderoth is supervising architect.

KANSAS CITY, MO.—Bids, it is reported, are being received by Baird & Huselton, Kansas City, Mo., for wiring and installation of electric equipment in the new Muehlbach Hotel, to be erected in Kansas City.

WEST PLAINS, MO.—The Board of Water and Light Commissioners expects to erect about 1 mile of transmission line within the next six months; also to purchase about 50 meters. Within the next 12 months it expects to purchase about 100 100-cp and about 25 350-cp (5.5 amp) series street lamps. W. P. Britain is superintendent.

BUFFALO, N. D.—The property of the Buffalo El. Lt., Ht. & Pwr. Co. has been purchased by Henry Christenson, of Buffalo,, who, it is said, will increase the output of the plant.

JAMESTOWN, N. D.—The Western El. Co., of Jamestown, expects to purchase within the next 12 months electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, switches, etc. John H. Canham is manager.

NEW SALEM, N. D.—Arrangements are being made by Charles F. Peterson for the installation of an electric-lighting system in New Salem. Electricity for operating the system will be purchased from an industrial plant, now using direct current for power purposes. The equipment will include a switchboard, 100 meters, one constant-current transformer, 135 35-ft., 25 25-ft. and two 45-ft. poles, 1200 ft. No. 6 wire and 2500 ft. No. 8 wire, incandescent lamps, fixtures, etc.

TOWER CITY, N. D.—The citizens, it is reported, have decided to install a municipal electric-light plant in Iowa City, work on which will begin at once.

HECLA, S. D.—R. D. Twaddle, owner of the local electric-light plant, expects to purchase one 50-hp boiler within the next three months.

HOLSTEIN, NEB.—A committee has been appointed to investigate the feasibility of installing an electric-lighting system in Holstein.

MEAD, NEB.—Bids will be received by the Mayor of Mead until April 17 for the construction of a municipal electric-light plant. The cost of the plant is estimated at $13,000. Bruce & Standevin, 420 Bee Building, Omaha, are engineers.

POTTER, NEB.—Bonds to the amount of $15,000, it is reported, have been voted for the installation of lighting and water plants in Potter.

MINNEAPOLIS, KAN.—It is reported that H. F. Jackman, manager of the local electric-light plant, contemplates erecting a transmission line to furnish electrical service to the farmers along the river east of Bennington.

WELLSVILLE, KAN.—Plans are being prepared for the installation of an electric-light plant and ice factory, to cost about $22,000. E. B. Murray and L. C. Hamilton, Missouri Savings Bank Building, Kansas City, Mo., are engineers

Southern States

LEXINGTON, S. C.—Within the next three months the Lexington El. Lt. & Pwr. Co. expects to purchase one 14-kw, 6.6-amp regulator. B. H. Barre is manager.

COLUMBUS, GA.—The Columbus El. Co., it is reported, contemplates improvements and extensions to its power plant and street-railway system, to cost about $300,000. The Stone & Webster Management Association, of Boston, Mass., are general managers.

CORDELLE, GA.—The white way committee of the Chamber of Commerce, it is reported, is asking for bids for an electric plant to maintain an ornamental street-lighting system, consisting of 125 to 150 posts, to cost about $5,000. The equipment to include generator, engine, switchboard (have boiler) and 900 ft. of feed wire to extend from plant to the beginning of street-lighting system. Standards for five-lamp clusters preferred. Louis Spencer is secretary of committee.

HABERSHAM, GA.—Plans and specifications are being prepared for a 400-hp hydroelectric development on the Soque River for the Habersham Mills. A three-phase transmission line will supply electricity for lamps and motors in the mills, about 1 mile distant, in the town of Habersham, and probably to other nearby towns. J. I. Linler, of Walhalla, S. C., is engineer.

MACON, GA.—Contract, it is reported, has been awarded by the city of Macon to F. M. Marshall for the construction of electrical building, at $10,073.

WOODLAND, GA.—The installation of a municipal electric-light plant in Woodsville is reported to be under consideration.

HOMESTEAD, FLA.—Preparations, it is reported, are being made to install an electric-light plant in Homestead, to cost about $30,000. J. B. McCrary & Co., of Atlanta, Ga., will have charge of the engineering work.

DICKSON, TENN.—Arrangements are being made by the Electric Light Commissioners for improvements and extensions to the municipal electric-light system, for which bonds were recently issued. The work will include putting the street lamps on a separate circuit and extending the street-lighting system to the newly annexed territory. E. S. Payne is commissioner.

JOHNSON CITY, TENN.—Arrangements, it is reported, are being made by John W. Hunter for the installation of an electric-light plant to furnish electricity for lighting, street railway and domestic purposes in Johnson City.

MARYVILLE, TENN.—The local electric-light plant, it is reported, has been purchased by Eastern capitalists, who, it is said, propose to enlarge the plant and extend the service to Johnson City, Morristown, Greeneville and other nearby towns and cities.

MEMPHIS, TENN.—We are informed that C. P. Cooper is not interested in the movement to extend the ornamental lighting system as reported in the issue of March 28. As yet no definite steps have been taken toward extending the lighting system.

NASHVILLE, TENN.—A seven-story garage, it is reported, will be built by Dr. Walter Page, to cost about $100,000, which will include a machine shop, equipped with electrically operated machinery.

PARIS, TENN.—Plans are under consideration for rebuilding the municipal electric-light plant, changing the system from three-wire, direct current, to 60 cycles, alternating current. M. W. Younkin is manager.

SPRINGFIELD, TENN.—Within the next six months the city of Springfield expects to erect an addition to the municipal power house and to install a 300-kw generating unit with condenser; also to purchase engine and generator for the above unit, exciter, circuit feeder panels and two pumps for water-works. G. B. Shawver is superintendent.

BREWTON, ALA.—The city of Brewton expects to install within the next 60 days one 250-hp engine, one 150-kw generator, two motor-driven fire pumps and one 175-hp boiler in the municipal electric-light plant. J. S O'Bannon is superintendent.

GADSDEN, ALA.—The erection of a municipal electric-light plant is recommended to the City Council by a joint committee of the Chamber of Commerce and City Council.

BELONZA, MISS.—The Water and Light Department expects to install a duplicate generating unit in the municipal electric-light plant within the next six months; also to purchase one 100-hp boiler, one 100-hp engine, one 100-kva, three-phase, 2200 110-volt generator directly connected to engine, switchboard for above unit; also 100 25-ft., 25 30-ft., and 10 45-ft. poles, and 10 series incandescent center-span street lamps. J. J. Sisloff is manager.

HORATIO, ARK.—The City Council is reported to have granted the De Queen Ice & Lt. Co., of De Queen, a franchise to furnish electricity here.

BREAUX BRIDGE, LA.—The installation of a municipal electric-light plant in Breaux Bridge is under consideration.

JENNINGS, LA.—A deal has been closed whereby the Southern Ht. & Lt. Co. has taken over the property of the Jennings Lt. & Pwr. Co. The Jennings Co. has been reorganized under the name of the Jennings Gas & El. Co. The officers of the company are: George Z. Zigler, president; J. P. Haber, secretary, and F. N Litten, manager.

NEW ORLEANS, LA.—Bids will be received by the Board of Commissioners of the port of New Orleans, 200 New Court House Building, New Orleans, until April 22, for furnishing and erecting, complete, ready to operate, all of the steel framing, machinery, conveyor belts and chains, electric motor, fixtures and wiring, conveying apron, corrugated galvanized iron and canvas siding and covering necessary for the construction and operation of three banana conveyors of the Harris-Eddleston type, in accordance with plans and specifications. Conveyors to be erected on the lower end of Pauline Street Wharf. Plans and specifications are on file in the office of L. H. Guerin, consulting engineer, 1002 Perrin Building, New Orleans, where copies may be obtained upon deposit of $15, to be refunded upon return of same. Robert G. Gueard is president.

BROWNWOOD, TEX.—Arrangements have been made by the Texas Pwr. & Lt. Co. for the installation of a new street-lighting system in Brownwood, to cost about $15,000, consisting of 162 tungsten lamps of 100 cp, maintained by overhead wires. Contract for material has been awarded. W. P. Murphy is manager.

CONROE, TEX.—The Conroe Gin, Ice & Lt. Co. expects to erect an ice plant within the next 12 months. J. McDade is president.

DALLAS, TEX.—The City Commission has authorized C. D. Hill, architect, to prepare plans for the installation of an ornamental-lighting and fan system for the municipal building. The cost of the work is estimated at about $10,000.

HICO, TEX.—Within the next six months the Hien El. Lt. & Pwr. Co. expects to erect 22 miles of transmission lines; also to install another turbine and boiler and to purchase one tuh transformer for incandescent lamps. The company has just completed 44 miles of transmission line. H. Gleason is secretary and manager.

HUTTO, TEX.—The installation of an electric-light plant in Hutto is under consideration. Hamstrom & Tinning are reported to be interested in the project.

LOCKHART, TEX.—The owners of the Lockhart water-works expect to purchase one car load of 30-ft. (7-in.-top) poles. C. E. Jones is manager.

SAN ANTONIO, TEX.—Plans are being prepared by the San Antonio Gas & El. Co. for doubling the output of its power plant on the Conception Road. The building will be enlarged and a 5000-kw generator installed. E. E. Eysenbach is general manager.

VAN ALSTYNE, TEX.—Within the next three months the Yoder Ice & El. Co., of Van Alstyne, expects to purchase a small amount of wire in cable (size about No. 8) suitable for conveying 440-volt, three-phase, 25-cycle current through fiber conduits. D. P. Yoder is owner and manager.

Pacific States

BELLINGHAM, WASH.—The Puget Sound Trac., Lt. & Pwr. Co., of Bellingham, expects to purchase ground detector equipment for seven substations.

EVERETT, WASH.—The installation of a tungsten street-lighting system to replace the lamps now in use is under consideration by the city commissioners. If the change is made, extensions will be made to the present system.

SOUTH BEND, WASH.—The City Council has granted Frank McKean, of South Bend, and associates a franchise to furnish electricity for lamps and motors in South Bend.

WENATCHEE, WASH.—The Cashmere Wtr. Pwr. Co., of Cashmere, recently organized, has applied to the City Council for a franchise to furnish electricity for lamps and motors in Wenatchee. The company owns water-power rights on the Wenatchee opposite Cashmere. O. B. Hollis, of Cashmere, is secretary of the company.

GOLD HILL, ORE.—The Rogue River Pub. Ser. Co., of Gold Hill, has filed on water rights on Rogue River at Hell's Gate for the development of 4000 hp. It is understood that work will begin at once on the construction of a 200-ft. dam.

KENO, ORE.—Contracts have been awarded by the Keno Pwr. Co., recently incorporated, for the construction of a 1000-hp power plant. The equipment will include two Leffel turbines, one 250-hp and the other 600-hp; Woodward waterwheel governors; General Electric three-phase, 60-cycle, 2200-volt generators, switchboard (General Electric Thomson type), 400-kva transformers (three-phase and single-phase, 2200/100-volt), Oregon fir poles for 15 miles of high-tension transmission line, 150 hp in motors for operating pumps for irrigation purposes, and about 200 lamps for farming districts. J. W. Kerns is engineer in charge.

MILTON, ORE.—Within the next two months the city of Milton expects to build 3000 ft. 50-in. continuous-stave wood power flume to increase the hydraulic head, thereby increasing the municipal electric power plant by 260 hp, for which machinery has already been installed; also to purchase 22 ft. 6-ft. standpipe, to be made of ¼-in. boiler plate and erected on top of the 56-ft. standpipe now in use, and a 2000-lb. balance flywheel for turbine shaft. L. E. Boyle is manager.

MYRTLE POINT, ORE.—Preparations are being made by the Oregon Pwr. Co. to rebuild its distributing system in Myrtle Point and Coquille, at a cost of about $10,000.

PORTLAND, ORE.—The Portland Ry., Lt. & Pwr. Co. in acquiring the control of the Willamette Valley Southern Ry. Co. will guarantee the $700,000 in bonds to be issued by the latter company and will take charge of construction and operation of the 32 miles of line from Oregon City to Mollala and Mount Angel, Ore. About 7 miles of the railway is completed. Energy for operating the railway will be supplied by the Portland Ry., Lt. & Pwr. Co.

PORTLAND, ORE.—George H. Cecil, United States district forester, has issued a special permit to the Golden Gate Mining Co., which is developing mines in the Whitman National Forest, in the Blue Mountains, to erect a power house, conduit and auxiliary improvements for generating and transmitting electricity. The site of the project is in Grant County, and the water will be diverted from Granite Boulder Creek, a tributary of the John Day River. The power house will be erected about 6 miles from Greenhorn and 500 hp is to be developed.

SUMMERVILLE, ORE.—A. Klees & Son, owners of the local electric-light plant, have reorganized under the name of the Klees Wtr. Pwr. Co. Plans, it is reported, have been prepared and preliminary work completed for the erection of a larger central station and distributing system and also for an auxiliary steam plant. The company will also furnish electricity in La Grande.

BAKERSFIELD, CAL.—The trustees have decided to install ornamental lamps in the downtown district. Ornamental pressed-steel posts (14 ft. high) carrying five-lamp clusters will be used. Bids will be asked for furnishing and installing standards on Nineteenth Street, between G and M Streets, and on Chester Avenue, between Twenty-fourth Street and the Santa Fé tracks.

COLTON, CAL.—Preparations are being made by the Pacific Fruit Express Co. to install a 250-kw turbo-generator set at its pre-cooling station in Colton. The turbine will be operated by exhaust steam from the ice machines.

GREENVILLE, CAL.—Several mining companies have made application to the Great Western Mining Co., of San Francisco, for the erection of a transmission line from Butte Valley through the Seneca district into Indian Valley.

LOS ANGELES, CAL.—The City Council has decided to call an election in May to submit the proposal to issue $6,500,000 bonds to complete the aqueduct power project and for distribution system for same.

LOS ANGELES, CAL.—The City Council has adopted a resolution instructing the Board of Public Works to advertise for bids for furnishing electricity for street-lighting for a period of 18 months. The resolution provides for the installation of 500 additional street lamps in different parts of the city.

MILL VALLEY, CAL.—The State Railroad Commission has granted the Marin County El. Ry. Co. authority to construct a street railway in Mill Valley and to sell $67,000 in stock for same. The first branch of the new railway will run up to the Cascades and the base of the trails to Tamalpais, Muir Woods, Big Lagoon and the Bolinas district. W. Wesley Hicks is general manager.

OCEANSIDE, CAL.—The Oceanside El. & Gas Co. has been asked to extend its transmission lines from Oceanside to South Oceanside and Carlsbad to furnish electrical service in those districts.

POMONA, CAL.—Plans are being prepared by Paul F. Higgs, architect, for the civics committee of the Chamber of Commerce for an ornamental street-lighting system for the city. The plans provide for an electrically lighted arch to be erected on Garey Avenue and for a series of 300 ornamental lamps for the more important business and residential streets.

SOUTH PASADENA, CAL.—Committees have been appointed by the Chamber of Commerce and the Board of Trade to promote the movement for the installation of an ornamental street-lighting system. It is proposed to bring the whole city under a uniform system.

MALAD CITY, IDAHO.—The City Council has granted a franchise to G. C. McLaughlin to install and operate an electric-lighting system in Malad City.

GREEN RIVER, UTAH.—The town of Green River is contemplating the installation of a municipal electric-light plant at the Green River mill race about 6 miles north of the town. The cost of the plant and transmission line is estimated at $10,000.

PROVO, UTAH.—The city of Provo has entered into a contract with the Utah Pwr. & Lt. Co., of Salt Lake City, for lighting the streets of the city. The contract calls for fifty 6.6-amp luminous-arc lamps.

SALT LAKE CITY, UTAH.—A committee, consisting of Charles Tyng and W. J. Halloran, was appointed from the board of governors of the Commercial Club to investigate the question of installing an oil-burning electric-generating plant in the Commercial Club Building.

HELENA, MONT.—At a special election held March 28 the proposal to grant the Standard El. Co., of Seattle, Wash., a franchise was defeated.

DENVER, COL.—Extensive improvements and extensions are contemplated by the Denver Gas & El. Co. during the current year, including the installation of a new switchboard to handle all the electric circuits of the company in Denver and surrounding territory, at a cost of about $200,000, and extensions to its electric light and power and gas-distributing systems.

DENVER, COL.—Work will begin on construction of the union depot and terminals in Denver as soon as the season's heavy tourist traffic is over. The total cost of the work is estimated at $4,000,000, of which $300,000 will be used for remodeling the present union station, $150,000 for new train sheds, $160,000 for subways for passengers, baggage and express, $110,000 for electric safety equipment and $3,280,000 for extension of terminal yards, etc.

TRINIDAD, COL.—The City Council has instructed the city attorney to prepare a contract with the Trinidad El. Transmission, Ry. & Gas Co. for the installation of 115 ornamental street lamps. The posts are to be installed by the company. The standards will be 29 ft. high and equipped with four-lamp clusters and will also carry the trolley supports. The 1000-cp arc lamps in the residence portion of the city will be changed for tungsten lamps. Work has begun on the installation of the system. Franklin P. Wood is manager of the Trinidad Co.

Canada

BRIGDEN, ONT.—Tenders will be received by the Town Council for an automatic engine, generator, storage battery, switchboards, etc., of sufficient rating to furnish electricity to maintain 25 60-watt street lamps; also for lighting about 100 residences, averaging about 150 watts. R. B. Brown is secretary of town council.

HAVELOCK, ONT.—The Havelock El. Lt. & Pwr. Co. expects to erect a boiler house and to purchase a 300-hp boiler and engine, complete, to cost about $7,000, for use as an auxiliary during low-water periods. Aleck Rose is secretary.

GROSSE ISLE, QUE.—Tenders will be received until April 20 for an electric generator, steam engine, switchboard, etc., for quarantine station, at Grosse Isle. Plans and specifications may be obtained from the Department of Public Works, Ottawa, Ont. R. C. Desrochers is secretary.

ST. LAMBERT, QUE.—The town of Lambert is contemplating installing a new street-lighting system. The plans provide for the erection of 43 standards carrying five-lamp clusters and the installation of 7050 ft. of single conduit. The Montreal Lt., Ht. & Pwr. Co., of Montreal, furnishes electrical service in St. Lambert.

CARLYLE, SASK.—We are informed that contracts have been placed for equipment and work for extensions and improvements to the municipal electric-lighting system. Work will soon begin on the proposed extension. Reported in the issue of March 28 to be contemplating extensions and improvements to the plant. John Salt Engineering Co., of Winnipeg, Man., has charge of the engineering work.

New Incorporations

DOVER, DEL.—The Electrical Pwr. Co. of the Western States of America has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $3,000,000. The company proposes to operate generating plants, distribute electricity, etc. The incorporators are W. J. Maloney and O. J. Reichard, of Wilmington.

SHANNON, IDAHO.—The Salmon River Pwr. & Lt. Co. has been incorporated with a capital stock of $400,000. The company, it is understood, will build a power plant near Shannon. The incorporators are C. L. Mackenzie, H. H. Bloomer, Grant Smith, Edward Riggs and Ralph Irwin.

MOUNT VERNON, ILL.—The City Railway Co. has been incorporated with a capital stock of $40,000 to construct and operate an electric railway in Mount Vernon. The incorporators are L. G. Pavey, C. C. Baldwin and E. Green.

DEXTER, MAINE.—The Ripley Lt. & Pwr. Co. has been incorporated for the purpose of erecting transmission lines between the lines of the Central Maine Pwr. Co., in Dexter and Ripley Mills, to furnish electricity for lamps and motors to farms along the road and at Ripley Mills. The officers are M. E. Tibbetts, president; Fred Tibbetts, vice-president and treasurer, and Percy A. Hasty, clerk.

KIMBALL, NEB.—The Kimball El. & Pwr. Co. has been incorporated with a capital stock of $25,000 by William Dubois, Theodore C. Thelle and J. D. Clark.

LUZERNE, N. Y.—The Riddell El. Lt. Co. has been incorporated with a capital stock of $10,000 by Edward E. Riddell, Myron B. Riddell and Edward J. Riddell.

SOCIETY HILL, S. C.—The Society Hill Pr. Co. has been incorporated with a capital stock of $4,000 by Bright Williamson, of Darlington, S. C., and J. E. Blackman, of Society Hill.

BURTON, WASH.—The Vashon El. Co. has filed articles of incorporation with a capital stock of $75,000. The incorporators are H. H. Edwards, S. J. Linden, E. W. Edwards and Ivy L. Linden.

TORONTO, ONT., CAN.—The Stanworth Pwr. Co. has been incorporated with a capital stock of $250,000 by W. J. Simpson, Stewart W. Hall, Robert E. W. Duke, Alfred Wales and H. G. Hammond. The company proposes to do a general power development and power distribution business.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 31, 1914

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,091,488. Attachment for Internal Combustion Engines; W. W. Dodge, Chicago, Ill. App. filed April 3, 1911. Electric heater attached to intake.

1,091,500. Self-Winding Clock; N. Friedman, New York, N. Y. App. filed April 20, 1912. Operated by ordinary high-voltage lighting current.

1,091,505. Switching Device; D. D. Gordon, Chicago, Ill. App. filed Sept. 10, 1912. Pull switch with oscillating switch member yieldingly held in either position.

1,091,528. Circuit Detector; W. J. Murdock, Chelsea, Mass. App. filed Feb. 23, 1909. Telephone testing set for testing for continuity, short-circuits and grounds.

1,091,548. Electromagnetic Bell; E. W. Vogel, Chicago, Ill. App. filed Nov. 10, 1909. For railway crossings; operated by solenoid.

1,091,559. Electrode; J. W. Brown, Lakewood, Ohio. App. filed July 28, 1911. Built-up furnace electrode which may be added to as consumed.

1,091,562. Plug Socket; L. J. Castonguay, Harrisburg, Pa. App. filed Feb. 1, 1911. Key-socket structure with multi-lock shell.

1,091,563. Vapor Electric Apparatus; J. T. H. Dempster, Schenectady, N. Y. App. filed April 4, 1904. Has contact points spaced apart and disposed between the electrodes for starting.

1,091,564. Vapor Electric Apparatus; J. T. H. Dempster, Schenectady, N. Y. App. filed April 4, 1904. Series of fluid electrodes between the main electrodes.

1,091,582. Electrical Water Heater; R. R. Lockhart, Winnipeg, Manitoba, Canada. App. filed May 28, 1913. For use in connection with ordinary range boiler.

1,091,586. Cigar Lighter; J. F. O'Connell and C. E. Whiteman, La Grande, Ore. App. filed July 22, 1910. Lighter wick automatically ignited when swung to operative position.

1,091,589. Induction Coil; A. Plecher, Las Animas, Col. App. filed March 16, 1912. Plurality of both primary and secondary windings with an intermediate magnetic core.

1,091,613. Dynamo-Electric Machine; E. F. W. Alexanderson, Schenectady, N. Y. App. filed July 27, 1910. Constant flux obtained by a winding in shunt to the load circuit mounted on a portion of the field magnet, which is of restricted cross-section.

1,091,614. Dynamo-Electric Machine; E. F. W. Alexanderson, Schenectady, N. Y. App. filed July 7, 1911. Has connections forming for the commutator brushes, a local circuit for producing a secondary magnetic field and an external circuit.

1,091,616. Graphite Conductor; W. C. Arsem, Schenectady, N. Y. App. filed March 13, 1911. Homogeneous filament consisting of a graphite base and a graphite coating.

1,091,630. Electromagnetic Device; E. R. Carichoff, Schenectady, N. Y. App. filed June 25, 1909. "Notching relay" for increasing potential to motor step by step.

1,091,632. System of Vehicle Propulsion; A. Churchward, New York, N. Y. App. filed March 10, 1910. Generator operated by internal-combustion engine, with lock for the accelerator pedal, which is controlled according to current being generated.

1,091,637. Electric Vaporizer; C. L. Davis, Detroit, Mich. App. filed May 9, 1913. For explosion engines using kerosene, etc.

1,091,641. Arc Lamp; J. T. H. Dempster, Schenectady, N. Y. App. filed Nov. 16, 1903. Novel construction of "non-consuming electrode" and electrode feed mechanism.

1,091,648. Method of Connections for Starting Metallic-Vapor Lamps; F. Girard, Hanau, Germany. App. filed Oct. 9, 1911. Resistance automatically put in series before starting and removed when predetermined value of operating current is reached.

1,091,650. Electromagnet; E. J. Guay; Lynn, Mass. App. filed April 11, 1907. Has tubular armature fitting inside solenoid and provided with upturned arms inclosing the outside of the solenoid.

1,091,653. Telltale for Compasses or the Like; J. L. Hall, Schenectady, N. Y. App. filed Jan. 7, 1911. For indicating movements of the magnetic compass in various parts of the ship.

1,091,659. Oil Switch; F. M. Hewlett, Schenectady, N. Y. App. filed Nov. 7, 1904. Has a wooden oil pot.

1,091,661. Method of and Means for Determining the Ratings of Incandescent Lamps; W. G. Housekeeper and H. S. Donning, Philadelphia, Pa., and New Dorp, N. Y. App. filed May 16, 1910. Measuring instrument consisting of an indicator and a chart, one of which parts is connected with the movable member of the photometer.

1,091,669. Vapor Electric Apparatus; O. O. Kruh, Schenectady, N. Y. App. filed Aug. 7, 1905. A wire shield protects the solid electrode.

1,091,678. Insulating Composition; F. M. Locke, Victor, N. Y. App. filed May 19, 1909. Aluminum silicate having a boron compound incorporated therein.

1,091,679. Insulator; F. M. Locke, Victor, N. Y. App. filed March 9, 1909. Silica and boron fused together in a homogeneous body.

1,091,680. Vapor-Electric Device; F. W. Lyle, Lynn, Mass. App. filed Oct. 11, 1911. A thermal device renders the tilting means inoperative while the temperature exceeds a predetermined limit.

1,091,694. Automatic Train-Stopping System; J. L. Neble, Omaha, Neb. App. filed April 14, 1913. Brushes on train engage conductors at inner sides of rails.

1,091,713. Induction Motor; C. L. Spinney, Lynn, Mass. App. filed Sept. 30, 1912. Squirrel-cage armature whose conductors have inclined ends integrally united with the short-circuiting rings.

1,091,714. Electric Cooking Device; W. Stanley, Great Barrington, Mass. App. filed Dec. 21, 1912. Flat disk-shaped heating unit for broiling.

1,091,716. Voltage Regulator; C. W. Stone, Schenectady, N. Y. App. filed Dec. 7, 1909. Auxiliary device linked with a Tirrill regulator.

1,091,722. Synchronism Indicator; V. A. Wolcott, Butte, Mont. App. filed Sept. 9, 1911. Electrostatically actuated indicator connected between insulating supports.

1,091,725. Insulating Composition; L. E. Barringer, Schenectady, N. Y. App. filed Jan. 18, 1913. Gum copal, castor oil, rubber resin and colophony.

1,091,733. Electric Heating and Ventilating Device; F. J. Cook, Cleveland, Ohio. App. filed June 27, 1913. Has tubular heating units located directly in the heat-conveying conduit.

1,091,734. Support for Electric Trolley Mechanism; F. C. Cuseo, Columbus, Ohio. App. filed Feb. 13, 1904. For mine locomotives; can be positioned below the top surface of the locomotive.

1,091,738. Electric Brake; R. R. Dunlop, Columbus, Ohio. App. filed Jan. 17, 1905. For preventing too rapid descent of an elevator or conveyor.

1,091,748. Dynamo-Electrical Machine; E. C. Ketchum and D. H. Andrews, Boston and Newton, Mass. App. filed April 25, 1912. Equal balance of the armature avoids end thrust.

1,091,755. Gas Burner; W. W. Ogden, Maquoketa, Ia. App. filed Jan. 23, 1912. Thermal-controlled electromagnet cuts off gas when flame is extinguished.

1,091,756. Train-Locating and Time-Recording Apparatus; B. F. Osborn and E. F. Zirbel, Ripley, Ia. App. filed Feb. 8, 1911. Annunciates location of trains throughout a division.

1,091,761. Thermostat; H. E. Reeve, New York, N. Y. App. filed Sept. 11, 1913. Thermal insulator interposed between the thermostatic arm and its support.

1,091,765. Automatic Selector Switch; J. N. Reynolds, Greenwich, Conn. App. filed July 8, 1911. Panel type, for automatic or semi-automatic exchange systems.

1,091,767. Electrical Connection for Sadirons and the Like; E. A. Rutenber, Logansport, Ind. App. filed Dec. 10, 1912. Insulated and mechanically protected plug connection.

1,091,768. Method of and Apparatus for Selective Wireless Telegraphy; F. G. Sargent, Westford, Mass. App. filed Nov. 14, 1912. Synchronously revolving indicators at sending and receiving stations indicate by their position at the instant of transmitting a signal the character intended to be signaled.

1,091,774. Electric Heating Device; M. H. Shoenberg, San Francisco, Cal. App. filed Nov. 6, 1912. Particularly for heating milk bottles.

1,091,782. Vaporizer; O. P. Underwood, Des Moines, Ia. App. filed June 23, 1913. With electric heater, heat supplied being proportional to fuel being consumed.

1,091,804. Printing Meter; J. E. and F. L. Burch, St. Louis, Mo. App. filed May 10, 1913. Dot made upon record sheet at every twenty-fifth revolution of wattmeter shaft.

1,091,808. Electric Crucible Furnace; D. F. Calhane, Worcester, Mass. App. filed Nov. 3, 1911. Current is forced to flow in a restricted path along the walls of the crucible.

1,091,820. Combined Typewriting and Adding Machine; A. H. Ellis, Kingston, N. Y. App. filed Aug. 8, 1905. Permits inspection and erasure of wrong numerals so that they are not added.

1,091,832. Selective Signaling System; E. R. Gill, Yonkers, N. Y. App. filed Sept. 18, 1909. Telephonic train dispatching.

1,091,875. Electrical Contact; H. J. Wiegand, Milwaukee, Wis. App. filed Aug. 3, 1911. Sheet-metal contact of cupped form adapted to be embedded in plastic composition with only its head exposed.

1,091,898. Electric Bell; C. J. Schwarze, Adrian, Mich. App. filed Sept. 11, 1912. Single-stroke bell with pendulum hammer.

1,091,902. Bell-Ringing Apparatus; W. F. Wacker, Sioux City, Ia. App. filed Aug. 25, 1913. Has electromagnetically operated means for coupling the motor to the oscillating bell shaft after it has reached proper speed.

1,091,932. Steering Wheel; J. S. Hill, Bethesda, Md. App. filed Feb. 12, 1914. Has plurality of grips containing lamps or like heating elements.

1,091,940. Motor Controller; W. B. Lucas, Chicago, Ill. App. filed Jan. 7, 1910. Has means for automatically reducing the starting resistance in the motor circuit.

1,091,942. Hanger; C. Mather, Passaic, N. J. App. filed April 8, 1913. For supporting cables placed in conduits.

1,091,961. Electric-Light Fixture; R. C. Ratto, Waterbury, Conn. App. filed Aug. 21, 1913. Central body portion and radiating arm construction in which the wiring is facilitated.

1,091,965. Telephone Mouthpiece Protector; C. Russell, Columbus, Ohio. App. filed July 21, 1913. Truncated conical protector which may be made to collapse and be carried in the pocket.

1,091,995. Transformer; N. A. Wolcott and W. C. Woodland, Warren, Ohio. App. filed May 12, 1910. Equalizes the magnetite density in the various parts of the yokes.

1,092,009. Grounding Device; G. A. Bishton, Cedar Rapids, Ia. App. filed Feb. 10, 1912. Uses a driving element by which a relatively thin, flexible conducting strip can be driven into the ground.

1,092,037. Plug Switch; T. E. Gambrell, London, England. App. filed Nov. 13, 1913. For use with resistance boxes, Wheatstone bridges and the like.

1,092,063. Signaling Apparatus; E. D. Lopez, New Orleans, La. App. filed Oct. 9, 1912. Electrically operated semaphore and bell; automobile rear signal.

1,092,065. Method of Ascertaining the Nature of Subterranean Strata; H. Löwy, Göttingen, Germany. App. filed April 1, 1913. Determines the variation of capacity and frequency and damping coefficient as compared with a prior calibration.

1,092,083. Electric Lamp; C. P. Steinmetz, Schenectady, N. Y. App. filed Dec. 19, 1903. Starts the arc by relatively moving the two bodies of vaporizable material.

1,092,117. Electromagnetically Operated Sounder; C. J. Schwarze, Adrian, Mich. App. filed Oct. 13, 1910. Loud-sounding alarm.

13,710 (reissue). Telephone Exchange System; H. G. Webster, Chicago, Ill. App. filed June 3, 1903. (Original patent 668,472, dated Dec. 10, 1901.) Improved line-signaling mechanism.

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The Haste for Legislation

There seems to have developed in Washington a desire for much haste to enact a law regulating business, an undue anxiety to get something done. It is not so important to get something done as it is to make sure that when something is done it will do good and not harm to business. In view of the complex problems involved and the lack of agreement on the proposed legislation, the postponement of definite action until the next session of Congress would provide time for study and the crystallization of a sane policy. Delay would be preferable in every way to a law working serious damage. The country is not so much in need of reformatory legislation as it is in need of more business. To any reasonable legislation business can conform without dire results. To any unreasonable or revolutionary legislation, such as some propose, business cannot conform without very serious results. Therefore Congress should think less about getting any kind of a law passed and more about getting a law passed that will actually benefit business. Everybody is agreed that business needs a stimulant. It will be stimulated by the manifestation of a sane attitude in Washington regarding business legislation. The opportunity is one that Congress should not reject lightly. It has a responsibility for which it will have to answer. In tampering unduly with the practices of commerce Congress is playing with interests upon which the prosperity of the country primarily depends. If it cannot legislate now without grave disturbance to those interests, it should wait. Disturbance of business interests means disturbance to every interest in the land.

Commissioners Who Leave Office

The question of what becomes of men who retire as public service commissioners concerns both the public and the companies. We speak not of those who are so inefficient that they can well be spared from the commission but of those who have rendered faithful, intelligent, constructive public service. New commissioners have to become acquainted with the problems confronting them before they can do much in the way of solution. Few, if any, state officials have the opportunity that is before public service commissioners of acquiring a knowledge that may be definitely valuable after retirement from office. Their experience is a valuable training of whose benefits the community ought not to be deprived. If the public is so foolish as to let capable commissioners leave office, the corporations ought to be wise enough to seek the knowledge available in these trained men. Certainly the corporations need to adopt the fair-minded, balanced attitude which characterizes an impartial commission. We are not of those who think that a sharp line should be drawn between men who serve the public and men who serve the corporations and that a step from one side to the other is a step to destruction. There is no logical reason why an able, broad-minded man should not honestly and acceptably serve either one freely. By reason of his familiarity with the corporate side, he can better serve the public as its representative. Similarly, his experience as a public servant better fits him to be a corporation official. Until the public learns enough to keep good commissioners there will be frequent changes. One of the best public servants that New York State ever had was the first chairman of its Second District Commission. After his retirement Mr. Stevens became counsel for the New York Central & Hudson River Railroad, advising it on questions of valuation. That is a proper and conspicuous application of a practice which is to be warmly commended.

A Forum for Public Utilities

The meetings of the Finance Forum under the auspices of the Young Men's Christian Association in New York City are affording an excellent opportunity for the presentation of public utility issues. Constructive work of this kind will be necessary in other cities if the public is to learn more of the public utility side of present problems. Speakers at the various meetings have discussed many different subjects of importance to public utility industries. They have brought out facts which are not matters of common public knowledge but are matters of common discussion in the court and commission proceedings of the times. Officials of companies have said too little to the public in the past in regard to their problems. It is not too late to begin anew and every effort should be made to lead the public to feel that the problems of the companies concern consumers just as much as owners of the property. Because the task of meeting an uninformed public is not easy is no reason why it should be neglected. It is not reasonable to expect that an immediate public acceptance of a reasonable corporation point of view will follow a few meetings of this character. If the meetings held in New York do no more than to inspire similar gatherings in a number of leading cities of the country, they will have exercised a far-reaching influence, for which operators may well be thankful. The talk made at the meeting this week by Mr. Thomas N. McCarter, of the Public Service Corporation of New Jersey, an abstract of which is published elsewhere, is the kind of frank discussion that will help the public to understand that there is a side different from the one presented by politicians. The corporate side is entitled to as fair a hearing as is the agitator's side.

The Richmond Hydroelectric Plant

From the standpoint of hydraulics, the plant described in this issue affords a lesson that will well repay study. It is a singularly good example of what modern methods and apparatus can do in making the best use of opportunities. Not only is the particular privilege utilized interesting as one of the earliest American developments, but until the reconstruction which resulted in the present modern equipment it was a conspicuous relic of methods now outworn. The old pumping station, in fact, contained probably the last considerable installation of overshot wheels in the country, and with its replacement the type practically passed out of existence. A change in the water-works system forced action, and the result was not only an up-to-date electrical pumping station adapted to the needs of a prosperous and growing city, but a municipal lighting plant adequate to its requirements. The present dam furnishes water for four directly coupled units aggregating 1700 kva. These drive six 200-hp motors which serve the new pumping plant. As the pumping is essentially a day load, the generating equipment can be utilized also for the lighting of the streets and municipal buildings. The street lighting, we may note, is on a considerable scale for a city the size of Richmond, comprising nearly 1300 arc and more than 1000 incandescent lamps, the latter being chiefly of the 100-watt size in clusters of five. It is worth noting that the underground circuits which feed energy mainly to 10-amp flame-arc lamps are tied in through the series transformers, which raise the main circuit current from 7.5 amp to 10 amp.

As water in the James River runs low in summer, it was necessary to provide an auxiliary steam equipment, which is in the highly effective form of a pair of 1000-kva turbo-generators with a suitable modern boiler plant. A somewhat unusual arrangement appears in the exciter equipment, which consists of a pair of 50-kw generators coupled to induction motors wound for the full primary emf of 4000 volts. These sets are accelerated from rest by a Pelton wheel, receiving water from the city mains, which furnish a pressure of 80 lb. per sq. in. When the excitation is brought to full voltage for the motors the driving belt of the motor is shifted. For the drainage of the engine-room level use is made of a receiving drainage tank, which is cleared by a pair of centrifugal pumps, a plan made necessary by the fact that when the river is at its high stages the engine-room floor is below water level.

As far as was possible the foundations and dressed granite walls of the old plant were used for the new, and by the exercise of considerable ingenuity practically only the boiler room and stack had to be of new construction. The electrical equipment is mainly of standard type, but it is worth mentioning that the generators are wound for three-phase, four-wire distribution, so that both 4000-volt and 2300-volt circuits are in use. As a whole, the Richmond plant represents an excellent example of skilful reconstruction to secure economy of cost and efficiency of operation and shows admirably what can be gained by taking full advantage of improved methods.

Meteorological Influences on Radio-Telegraphy

It is well known that atmospheric disturbances affect radio-telegraphic signals, and occasionally in a most markedly objectionable manner. The disturbances are of at least two kinds, namely, those due to electric discharges, or lightning, in the air, and those due to the influence of sunlight. The lightning disturbances may be most violent during a thunderstorm in the vicinity, when radio-telegraphic station operators may be compelled to ground their antennas and bring their signaling to a close. The lightning disturbances, on the other hand, may be so mild and remote as to produce only occasional feeble cracklings in the listener's telephone. All degrees of intermediate disturbance may exist. In the tropics, under the local great intensity of solar radiation, lightning disturbances are naturally intensified.

The effects of daylight do not become noticeable until the sending and receiving stations are separated by a distance of 100 km or more. At long distances the effects become very noticeable. The general effect is a comparative constancy of signal intensities during daylight hours, when both sending and receiving stations are in full daylight. At night, when both stations are in shadow, the signal intensities are usually much stronger than by day, although they are subject to considerable and occasionally to sudden changes. Moreover, pairs of distant stations on east-west lines are subject to marked fluctuations in signal intensity near the times of sunrise and sunset between them. The causes of the daylight effect seem to be associated with the ionizing influence of violet and ultra-violet solar rays in the upper regions of the atmosphere, and also possibly with a semi-permanent layer of ionized matter at a high level in the atmosphere, perhaps caught from the sun's expelled corona. During night time this hypothetical layer of electrified dust may serve as an inverted reflecting layer, or a concave ocean in the sky, to guide the electric waves forward without further expansion upward. During daylight hours ionization at lower levels would tend to destroy the beneficent action of this permanent layer.

At sunrise and sunset, as was first pointed out in this country, the layer of discontinuity between sunlight and shadow, or ionized and non-ionized air, may be supposed to have dispersing action to waves passing through it, and also feeble reflecting action; so that when this shadow boundary falls on one side or the other of a pair of east-west stations there is a temporary stimulus to the transmitted and received signals, in east to west order, by partial reflection, with a marked diminution or weakening when the boundary strikes in between them. Much remains, however, to be investigated in these directions, although there can be little doubt that investigation will reveal facts of meteorological importance, as well as facts of importance in radio-telegraphy. The whole subject of meteorological influence on radiotelegraphy has been discussed in a recent article by Dr. Paul Ludewig in *Elektrotechnik und Maschinenbau*, as abstracted in this week's Digest.

The Universal Electric Vehicle

Arguments showing that there is a demand for an electric vehicle from which all unnecessary refinements in upholstery and other luxuries have been eliminated are well presented in letters by Messrs. H. G. Overbeck and H. H. Skinner on page 882 of this issue. In many respects these writers corroborate the statements made in a lecture before the Electric Vehicle Association of America by Dr. C. P. Steinmetz, who pictured the passing of the gasoline automobile and predicted the era of the electric vehicle. Taking for ourselves a rather more conservative viewpoint, we hesitate to join in with this prediction of easy conquest for the battery-propelled vehicle, for one must not forget that the gasoline-propelled competitors have a tremendous start in numbers, while in the way of conveniences they are rapidly adding details which leave only a narrow margin between the gas car and the electric. Capricious as it is intangible, custom yet has enormous inertia, and pure logic alone will not eliminate the lead secured by millions of dollars invested in the gas-car industry.

Always practical, Dr. Steinmetz did not leave his attractive picture of an all-electric future without first offering real constructive suggestions as to how the desired end shall be speeded. As the golden text of his address there stands out above everything else, we think, his pregnant proposal concerning early-morning off-peak charging for vehicles. During the hours of darkness after midnight the average central station could profitably charge the batteries of a fair number of passenger cars at an individual cost as low as even, perhaps, $5 per month. The operation would be under the supervision of expert batterymen, thereby insuring satisfaction to the customer. And, to the central station's benefit, this night load would conveniently fill the early-morning niche in the load curve when thousands of dollars' worth of equipment is standing idle. The ingenious system of identification cards suggested for noon boosting charges (coinciding, by the way, with that midday sag in the demand curve) reveals additional kindly solicitation for the interests of both the vehicle owner and the central station. Such interesting questions as whether the electric automobile is to sweep the field of self-propelled locomotion, or whether $600 will be adequate to buy a light battery car, as authorities both inside and outside of our own field have asserted, can be assigned by the central-station man for consideration at a future date.

Grounded Transmission Systems

The grounded star connection for transmission lines has been long acclaimed in theory but most frequently avoided in practice. The advantages gained under normal conditions are altogether obvious, but the ever-present chance of grounds on the lines has always been a cause of worry. On the whole, we think the danger has been somewhat overestimated, for prevention is much better than cure and in a moderately simple system a "ground" ought to be a rather remote contingency. Yet grounds in a system with grounded neutral may make serious trouble in the way of interruptions to service. It is the reduction of this particular danger that Mr. Max H. Collbohm discusses in an article in this issue. As grounded systems are generally arranged an additional ground on a line will open a circuit-breaker. The author suggests overcoming this difficulty by placing in the ground circuit a series transformer which puts the circuit-breakers out of action by breaking the tripping circuit and sounds an alarm for the purpose of giving the operator a chance to make use of a spare line or apply other remedial measures before the service is interrupted. Such conditions mean quick work, but even a few minutes saved at this stage may avert an interruption of service.

Another scheme mentioned by Mr. Collbohm is the protection of insulators against arcing over by the installation of arcing rods above and below to lead the arc away from the insulator as soon as it is formed. Modern insulators of either the suspension or the pin type, if well designed, will withstand much hard usage, and if an arc can be promptly removed from the insulator a mischievous ground may be prevented. Mr. Collbohm calls attention to a very good use for copper-clad wire as a protective conductor. Its tensile strength and fairly good conductivity as compared with the usual stranded steel are in its favor, and its inductance is moderate compared with that of steel having equivalent conductivity. This wire is mounted 10 ft. above the circuit wires, a height we are inclined to think is advantageous. At all events, the experience with these various safety precautions during the past season seems to have been very encouraging. To encounter some sixty hours of severe thunderstorms with only four seconds of interrupted service surely bespeaks good protection as well as good luck. The fact that no insulators were lost through lightning affords good evidence of the usefulness of the arcing rods. First and last, the grounded line seems to have operated as well as one could wish. It is worth noting that one of the advantages of tower construction with long spans is the comparative ease of applying protection at each point of support. It is an application of the advice ascribed to Carnegie to put all eggs in one basket and then watch that basket. Certainly the time has arrived when overhead transmission lines can be so built as to insure a degree of continuity of service that is very satisfactory. The price for this is thorough construction and constant vigilance.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Convention of National Electrical Contractors' Association

The various committees of the National Electrical Contractors' Association are now actively at work in connection with the forthcoming convention of the association, which will be held in Detroit, Mich., July 14-18, inclusive. The convention headquarters will be at the Hotel Cadillac, and an elaborate and most entertaining program has been arranged for the week. One of the special events will be a steamboat trip on Lake Erie to historic Bois Blanc Island, 19 miles from Detroit. The visiting contractors will also be shown the chief industries of Detroit, which city leads the world in the manufacture of motor cars, automobile accessories and adding machines.

Electric Clearing House at Louisville

Desiring a more thorough and mutual understanding of the National Electrical Code and the local rules, the electrical contractors, inspectors and representatives of the Louisville lighting companies have effected an organization known as the Electric Clearing House of Louisville. Mr. C. C. Childers, of the Childers & Waters Company, is president; Mr. F. G. Burdorf, of the Burdorf & Brecker Company, vice-president, and Mr. E. C. Knopp, of the Kentucky Actuarial Bureau, secretary of the organization. Meetings will be held monthly and arrangements will be made for lectures and demonstrations of an instructive nature. All the devices and changes in rules will be brought before the meetings and fully explained. Informal talks and illustrated lectures by inspectors will also be features.

Electric Ranges for Worcester Apartment House

Electric cooking will be exclusively employed in a new eighteen-suite apartment house being built at Worcester, Mass., by the Colonial Real Estate Trust. The building will not contain a single foot of gas piping, and the only coal bin will be utilized by the central steam-heating boiler. In the face of a 75-cent gas rate and sharp competition by the local gas company, eighteen No. 33 electric ranges will be installed by the Simplex Electric Heating Company, of Cambridge, Mass., and energy will be supplied by the Worcester Electric Light Company at its regular heating rates, which are established on a sliding scale, starting at 10 cents per kw-hr. and working rapidly downward with increased consumption. The suites are of four and five rooms and are to be equipped with electric vacuum-cleaner service and a central motor-driven refrigerating plant. A master meter will probably be installed and energy distributed to the tenants by the landlord. At full load each range consumes about 4800 watts. The apartments are situated in the fashionable West Side district, and their equipment for electric cooking follows a thorough trial of a similar range for several months in the home of the builder. Much local interest has been aroused in the installation, and many inquiries are being received at the office of the central station as a result of the victory of the electric range over its competitors.

New Trust Legislation Bill

The text of the omnibus bill embodying the revised ideas of administration leaders in Congress in regard to trust legislation was made public in Washington by Representative Clayton on April 14. A new feature of the proposed legislation is the incorporation in the bill of provisions defining the status of labor unions under the law, limiting the power of the United States courts in the issue of injunctions and providing for jury trials in cases of indirect contempt of court. The bill is designed to take the place of four bills which have been under discussion by the judiciary committee of the House of Representatives.

The consolidated bill contains a modified section dealing with holding companies. The proposed restrictions regarding interlocking directorates have also been changed. New conditions governing price discrimination and competition are set forth.

The Washington Meeting of the A. I. E. E.

The American Institute of Electrical Engineers will hold a meeting at Washington, D. C., April 24 and 25, under the auspices of the electrophysics committee and with the co-operation of the American Physical Society. The headquarters will be in the Electrical Building, Bureau of Standards. The joint technical and scientific sessions of the meeting will be held in the new electrical laboratory of the bureau. A special attraction of the meeting will be the exhibit of apparatus which is being arranged by the American Physical Society in co-operation with the Bureau of Standards. There will be exhibits by manufacturers and importers and scientific and industrial research laboratories. A number of the federal scientific bureaus will also be represented.

On Friday morning there will be a joint meeting of the A. I. E. E. and the American Physical Society. For 1 p. m. a luncheon has been arranged in the West Laboratory, tendered by the scientific staff of the Bureau of Standards. Opportunity will be afforded to inspect the laboratories of the bureau and the special exhibit of lecture, laboratory and research apparatus under the auspices of the Physical Society. At 3.30 p. m. Sir Ernest Rutherford will lecture on "X-Ray and Gamma-Ray Spectra." At the joint evening session the following papers by members of the Institute will be presented: "Solenoids," by Mr. C. R. Underhill; "Some Investigation of Lightning Protection for Buildings," by Mr. L. A. DeBlois, and "Some Simple Examples of Transmission-Line Surges," by Prof. W. S. Franklin. Following this session a buffet smoker will be tendered by the Baltimore and Washington Sections of the A. I. E. E. to the members of the American Physical Society, the members and guests of the Bureau of Standards, and the visiting members of the Institute.

The joint meeting on Saturday morning will be conducted by the Physical Society. The program includes two Institute papers, "A Milliampere Current Transformer," by Prof. Edward Bennett, and "Theory of the Corona," by Mr. Bergen Davis. The afternoon will be devoted to visiting points of interest in Washington.

Municipal Street-Lighting Plant Idea Scored at Springfield, Mass.

In connection with the purchase of 1500 acres by the city of Springfield, Mass., last week on the Little River watershed to augment the local water supply, a plan to develop a hydroelectric plant for municipal street lighting has received considerable discussion. Prof. Harry E. Clifford, of Harvard University, street-lighting expert of the municipality, was asked to give his opinion of the proposed municipal-plant scheme a few days ago, and in forcible terms he said that the city would do far better to make a new contract with the United Electric Lighting Company than to enter upon the unprofitable task of attempting to generate and transmit its own energy in competition with the efficient local central-station system. Professor Clifford said that it would cost the city at least $3,000,000 to build underground ducts and install the necessary street-lighting cables, and further said that municipal operation would be unsuccessful if applied to the lighting and motor service of the famous "Municipal Group" of public buildings on Court Square. Attempts have been made within the past two or three months to establish an isolated plant for this service. In analyzing the bids, Professor Clifford pointed out that no allowance had been made for auxiliary machinery and that the present boiler equipment is insufficient for electric requirements.

Electrochemical Possibilities of St. Louis

Several out-of-town visitors attended the weekly luncheon of the St. Louis League of Electrical Interests, Jovian Chapter, at the American Hotel Annex on April 14. A special meeting of the Missouri Electric, Gas, Street Railway and Water-Works Association was held during the morning, and the Union Electric Light & Power Company entertained a party of twenty-five at the luncheon. Mr. Walter O. Pennell, equipment engineer of the Southwestern Bell Telephone System, presided, and Mr. Courtland F. Carrier, Jr., of Lawrence & Carrier, Inc., consulting chemical engineers, read a paper on the "Possibilities of St. Louis as a Field for Electrochemistry." Mr. Carrier spoke of the close relation of chemistry and electricity. In St. Louis there is already one plant for the electrical production of hydrogen and oxygen, and another will soon be established. An electric steel furnace will soon be put into operation in St. Louis. The speaker thinks that St. Louis has a good opportunity to build up electrochemical industries. Chemical industries in the United States pay 70 per cent higher dividends than other industries. In Germany an average of forty chemical industries show 14 per cent dividends. Speaking of the Niagara Falls situation, Mr. Carrier said that the rates for electrical energy are rather higher in Buffalo than in St. Louis. Right at the Falls the rates are a little lower. Electrochemical plants are desirable. A good one should be able to maintain an 85 per cent load-factor. Single electrochemical industries take as much as 40,000 kw. Consumption of energy in the electric furnace for making steel ranges from 200 kw-hr. to 800 kw-hr. per ton. After a time the tendency of prices for electrical energy, now going down, will go upward. St. Louis, with cheap energy and near the raw materials of many products, is favorably situated for the location of electrochemical industries. Mr. Philip J. Kealy, of the Kansas City Railway & Light Company, was called on. He said that Kansas City is rapidly developing as an electrical center. The revenue of his company has more than doubled in the last four years.

Mr. McCall on Pennsylvania Commission

Mr. Joseph B. McCall, president of the Philadelphia Electric Company, refers, in his annual report to stockholders, to the public service company law enacted at the last session of the Pennsylvania Legislature. Mr. McCall says that the commission has broad powers and the Pennsylvania companies controlled by the Philadelphia Electric Company will come under its control. He adds: "Your management feels there will be no serious difficulties in your companies operating under this regulating act and that an equitable and reasonable interpretation of it will result in benefit."

Mr. McCall also refers to the contract made with the Pennsylvania Railroad Company during the year, under which the Philadelphia Electric Company will supply all the electrical energy for the section of the road between Philadelphia and Paoli, which is now being electrified. and such additional energy as from time to time may be necessary for the electrical requirements of the railroad. The contract is for a period of five years with a minimum guarantee of 3750 kw. Contracts of this character made with other public service corporations. Mr. McCall adds, demonstrate the growing tendency to the use of one central source of supply in large communities.

The membership of the Philadelphia Electrical Beneficial Association is 2191, or 87 per cent of the total of 2502 employees. The receipts to Dec. 31, 1913, were $206,503. Disbursements were as follows: Disability benefits, $97,290; death benefits, $62,550; medical expenses, $12,691; total, $172,531. The balance in cash and securities at the end of the year was $33.972.

Missouri Association Adopts Reports of Committees on Accounting System

At the adjourned meeting of the Missouri Electric. Gas, Street Railway and Water Works Association, held on April 14, in the assembly room of the Union Electric Light & Power Company of St. Louis, reports of committees on the proposed uniform system of accounts of the Missouri Public Service Commission were presented. Mr. A. C. Einstein, vice-president of the Union Electric Light & Power Company, occupied the chair as acting president of the association. Mr. F. D. Beardslee, St. Louis, acted as secretary. Among those in attendance were representatives of the Doherty. North American, Insull and McKinley interests.

Mr. H. Spoehrer, secretary and treasurer of the Union Electric Light & Power Company, told of an interview with the members of the commission, who stated that they were glad to have the views of the association in regard to the classification of accounts. Mr. Philip J. Kealy, Kansas City Railway & Light Company, chairman of the committee on depreciation, presented the report of that committee. Taking up the proposed deduction of depreciation reserve from fixed capital account, the committee recommended that the commission be petitioned to consider the depreciation reserve as a reserve account. The committee set forth objections to the plan to consider the depreciation reserve as a fund. The report asked that the committee be continued, as further light will be needed concerning the exact meaning of the definitions of the commission. After a brief discussion the report was adopted unanimously.

Mr. Hugo Wurdack, Light & Development Company, St. Louis, reported as chairman of the committee appointed to consider the tentative requirements of the commission in relation to historical data. The committee said that the expense of keeping this information in the manner requested by the commission would be prohibitive. It believes that the proposal in its entirety is wholly impracticable. It is difficult to see how much of the information requested will be of value. A company should not be required, the committee declared, to meet the expense necessary to furnish most of the information shown on the tentative schedule. This report was also adopted unanimously.

Mr. Edwin Gruhl, Electric Company of Missouri, St. Louis, reported as chairman of the committee on the classification of accounts as applied to small companies and on the construction of the classification as applied to large companies. This report went into the matter in detail, pointing out the difficulty of complying with the requirements of the tentative classification. Some substantial items have been omitted from the classification. One is the cost of complying with the requirements of the commission. In the discussion on this report, Mr. Wurdack said that the law creating the Missouri commission provides that the company may keep any account it desires provided the books are always open to the inspection of the commission. Mr. R. C. Russum, Joplin, Mo., said he doubted if this interpretation of the law is correct. Mr. Gruhl said that many of the requirements of the tentative system are very drastic for small companies.

It was suggested that a company whose gross earnings are less than $25,000 be considered a small company under the classification. The report of the committee was adopted unanimously.

Votes were taken thanking the committees for their work. Some discussion ensued on the procedure to be followed in filing protests with the commission in legal form if such protests are thought to be necessary. A number of those who attended the meeting left St. Louis on the evening of April 14 for Jefferson City in order to attend the formal hearing on the proposed system of accounts before the commission beginning April 15.

At the hearing before the commission at Jefferson City on April 15, after a discussion lasting several hours, a committee of twelve was appointed headed by Mr. Philip J. Kealy. This committee will confer with Chief Accountant McShane of the commission in regard to modifications of the classification. The committee will report after May 15.

The Electric Vehicle at Boston

At a regular meeting of the Electric Motor Club of Boston on April 8 plans were discussed for holding a tent exhibition of electric passenger cars and trucks in various New England cities in the late spring, and the co-operation of several central stations was manifested in regard to the securing of sites and supplying of garaging facilities. It is planned to exhibit as many of the seventeen representative makes having agencies in New England as can be induced to join in the enterprise, the Boston Edison Company providing the tent, which will be illuminated by fifteen 500-watt tungsten lamps. In addition to cars and trucks there will be an exhibit of rectifiers, batteries, tires and other equipment of direct interest to the electric-vehicle owner.

Mr. C. H. Miles, Boston, stated that quotations have been received from one of the foremost map-publishing houses in New England for printing a map showing the location of charging stations and the automobile routes in this section of the country. The concern is ready to supply 5000 copies at 10 cents each or 10,000 copies for about 7 cents each. Mr. R. S. Hale, of the Boston Edison company, called attention to the adoption in England of the 150-amp charging plug recently standardized by the Electric Vehicle Association of America and exhibited samples of cab-tire sheathing for charging cables, emphasizing the demonstrated value of this material abroad as a tough, acid-proof and alkali-proof wire covering, and urging its production by American manufacturers. Other matters briefly discussed were plans for the annual outing of the club and for an electric-vehicle convention to be held in Boston about the middle of May.

New York Meeting of the Illuminating Engineering Society

Papers were read before the New York Section of the Illuminating Engineering Society on April 9 by Mr. M. Luckiesh, of the National Electric Lamp Association's physical laboratory, Cleveland, Ohio, on "Glassware for Protecting the Eyes in Industrial Processes"; by Mr. R. E. Simpson, engineer for the Travelers' Insurance Company, Hartford, Conn., on "Illumination as a Factor of Safety in Industrial Plants," and by Dr. William Churchill, on "Some Reasons Why Red Is Not a Proper Color for Danger Signals."

Mr. Luckiesh stated that certain special uses of illumination and certain industrial processes require light rich in ultra-violet radiation, and in these cases protection of the eyes by some transparent glass medium is demanded. Such protection is accomplished by glasses which do not transmit the ultra-violet energy and which also reduce the retinal image to a safe brightness. Colorless or neutral glasses are to be preferred, but no glasses of this character have been found to be wholly satisfactory. As a general solution of the problem of eye protection it is proposed that a yellow-green glass totally absorbing ultra-violet be combined with a shade of smoke glass of such density as to reduce the brightness to a safe degree. Transmission curves of several characteristic glasses were shown. Spectrograms of the light from a quartz-tube mercury arc and from an iron arc have been made through many samples of glass. For many cases such spectrograms provide sufficient data for analyzing the absorbing property of the glass.

As no neutral-tint glass was found which totally absorbed the ultra-violet, a yellow-green glass was chosen as most desirable for several reasons. It was found that workmen in welding processes preferred this color to any other. They successfully used this at once, while condemning amber glasses. Colors are distorted less through this glass than through glass of any other color. Another significant fact is that the relation of the temperature and luminosity for black or gray bodies is practically the same through a yellow-green glass as to the unobstructed eye.

In the discussion following the reading of Mr. Luckiesh's paper, Dr. Churchill called attention to the necessity of putting the use of the different colored glasses on a scientific basis and of standardizing the various kinds of glasses so that a person can be reasonably sure of getting what he asks for.

In his paper on illumination in factories, Mr. Simpson showed that many accidents in industrial plants can be avoided by providing proper illumination. Many of the mishaps, he declared, are due to employees falling in poorly lighted passageways. In ship-building particularly, open hatches, incomplete stairways and dark gangways furnish hazards that can be materially lessened by means of good lighting. The author also dwelt upon the use of reflectors and the avoidance of glare in the workmen's eyes.

For normal vision red is the most effective color of warning, Dr. Churchill asserted, and in railroad engineering where rigid examinations are made to eliminate employees afflicted with color blindness this cardinal color lends itself very well to signal work. Owing to the increasing use of red, however, as a warning of danger in other fields, and on account of the belief that 4 per cent of males and 1 per cent of females are color blind, the possibilities of accidents are increased. In the operation of automobiles, for instance, red taillamps are used. It is safe to conclude that 4 per cent of the chauffeurs are color blind. As these chauffeurs are not subjected to examinations for eyesight, the risks on account of misinterpretation of signals are manifold. It would be better and safer, the author declared, to adopt some other color which most people would be able to recognize as a signal of danger.

Committee of United States Chamber of Commerce on Trust Legislation

The Chamber of Commerce of the United States is holding a referendum on the proposed Interstate Trade Commission. Those who are voting are 543 commercial organizations in forty-seven states. The referendum is on the report of the following special committee: Messrs. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, New York; William L. Saunders, president of the Ingersoll-Rand Company, New York; Charles R. Van Hise, president of the University of Wisconsin; Henry R. Seager, Columbia University; Charles F. Mathewson, attorney, of Krauthoff, Harmon & Mathewson, New York, and George Rublee, of Washington, formerly member of the firm of Spooner & Cotton, New York. Mr. R. G. Rhett, president of the People's Bank, Charleston, S. C., acted as chairman of the committee.

The definite recommendations placed before members of the Chamber of Commerce are as follows:

"1. That there be created an interstate trade commission of at least five members appointed by the President and confirmed by the Senate, not more than a mere majority of whom shall be of the same political party.

"2. That jurisdiction of the commission in conducting investigation extend to all corporations engaged in interstate or foreign commerce, except such as are amenable to the Interstate Commerce Commission. (It has not been judicially determined whether or not banks are engaged in interstate commerce, but it is not understood to be the purpose of the bill creating an interstate trade commission to include banks among the corporations placed within the judisdiction of the commission.)

"3. That the commission should not now be given authority to advise applicants concerning the legality of proposed contracts, combinations, etc., under the Sherman act.

"4. That the annual reports of corporations, if required, should at the outset be confined to those of the larger corporations (say, to those having capital resources of $5,000,000 or more, or to those having an annual income of $2,500,000), and to such other classes of corporations as the commission may officially determine.

"5. That in the annual reports made to the commission corporations ought not to be required to disclose trade processes, shop costs, classification of sales and profits among particular articles, names of customers or other like private information.

"6. That the publication of facts obtained by the commission be confined to such as are to the public interest.

"7. That Congress should direct the commission to investigate and report to Congress at the earliest practicable date on the advisability of amending the Sherman act to allow a greater degree of co-operation in the conduct, and for the protection, of the foreign trade."

The committee declares that neither size nor any other arbitrary standard of classification is a sure criterion of lawfulness or unlawfulness under the antitrust act or under any other law.

It is expected that the committee will hold further meetings and make a separate report on other features of the proposed legislation.

Business Conditions in California

Business conditions in California are discussed in detail in the annual report issued to stockholders by the Southern California Edison Company. Mr. John B. Miller, the president, refers to the estimate of gross earnings which he made at the annual meeting in February, 1913. At the time he estimated that gross earnings in 1913 would be $5,000,000. The actual amount was $4,779,279. Instead of his estimated amount of $2,500,000 for operating expenses, including taxes, insurance and maintenance, but exclusive of depreciation, the actual amount was $2,430,290. The net earnings as estimated were $2,500,000, but the actual amount was $2,348,989. Interest and amortization were estimated at $820,000, but the actual charge was $813,969. Instead of the estimated surplus of $1,680,000, the actual surplus was $1,535,020.

Undisturbed by this showing, Mr. Miller makes a new estimate for 1914. Based upon ability to finance expenditures for new business and upon normal conditions, he estimates that gross earnings will be $5,250,000 or will exceed that amount. To reach that amount would mean an increase of 9.8 per cent. He estimates the surplus applicable to dividends and depreciation at $1,775,000. The report says that financial conditions not only in the United States but throughout the world became so unfavorable shortly after the first of the year that, commencing in April, the directors thought it the part of wisdom to restrict expenditures for all purposes, including new business, to the lowest point consistent with safety and due regard for the company's duty to the public. Had it not been for this, Mr. Miller says, the estimate would not only have been realized but probably somewhat exceeded. Under the conditions the showing made should be gratifying, he adds. While the company has recently raised its dividend rates to stockholders, it has also lowered rates to customers all over the system, which shows the strongly intrenched position the company occupies.

During the winter just ended Southern California was visited with two of the heaviest rains that have been known in many years, in January and February,

1914. All public utilities were out of commission because of floods and washouts and the total damage will amount to several million dollars. Mr. Miller declares that this is more than compensated for, however, by the benefit of the abundant rains assuring the water supply for several years and, so far as the company is concerned, abundance of water for generating cheap power. The Southern California Edison Company went through the first storm with less than $5,000 loss and practically no interruption in service. The intervals between the storms, however, were too short to permit strengthening all the places weakened by the first storm, and in the second storm, while practically no injury to power plants was experienced, a great deal of damage to transmission lines took place. Notwithstanding this, there was no serious interruption to business, and with the exception of one small district in the San Fernando Valley the company was able to carry all of its consumers.

Mr. W. A. Brackenridge, vice-president and general manager, says in the report that it is probable that during the present year an amendment to the State constitution giving the Railroad Commission jurisdiction with respect to regulation of rates of public utilities within incorporated cities will be placed before the electorate. The present power of the commission regarding regulation of rates is limited to territory outside of incorporated municipalities except in a few instances where municipalities by authority of the present law voted to transfer such powers to the Railroad Commission.

Mr. S. M. Kennedy, general agent, says in a letter included in the report that under the assumption that financial conditions will very shortly become normal the prospects for additional business during 1914 are unusually good, as many projected enterprises have been held back which will be pushed to a conclusion as soon as the opportunity occurs and funds are made available.

President Wilson Wants Trust Legislation Pushed

Coincident with persistent reports that an effort will be made among democratic leaders in Congress to shelve the proposed anti-trust legislation for the remainder of this session, President Wilson early in the present week called Representative Clayton, chairman of the House judiciary committee, to the White House for a conference on the subject and agreed with him that an omnibus bill should be brought in from the House committee, as is to be done by the Senate committee on interstate commerce.

The President made it clear to callers at the White House that he believes the canal tolls repeal bill, rural credits legislation and anti-trust legislation can all be disposed of by Congress before adjournment. Whether he will have cause to change his mind remains to be seen, in view of a belief which is said to be growing in Washington that it would be the course of political wisdom to adjourn Congress without attempting anti-trust legislation. This belief has been strengthened since it became known that it was proposed to add to the omnibus trust legislation bill in the House a provision for the regulation of injunctions in labor cases, for it is said in Washington that if a question in which labor is vitally interested is added to the anti-trust legislation program much additional time for consideration and discussion will be required. Some of the Democratic leaders do not believe as much can be done before Congress adjourns as President Wilson believes. All their thoughts center upon the campaign for the House of Representatives this fall, and they say they will require time at home. They say that one of the necessities of a successful campaign is that business conditions shall not be disturbed, and that if anti-trust legislation is rushed through business conditions will be upset for awhile.

The Senate committee is still working on its proposed omnibus bill. Senator Newlands, chairman of the committee, expects to report it before the canal tolls repeal bill is disposed of and believes that it will be taken up as soon as that matter is out of the way.

Operating Under Difficulties in Mexico

The civil war now going on in Mexico has made it necessary for all large industrial companies to adopt means to safeguard their property. Armed guards are therefore established to resist not the attacks of the contending forces, but the incursions of marauding bandits who take advantage of the chaotic conditions at present existing in Mexico and commit depredations on private property. The electric-lighting companies among others have found it necessary to adopt defensive means, and an insight into the conditions existing is afforded in the case of the Mexican Light & Power Company, which operates the largest hydroelectric station in Mexico at Necaxa, about 125 miles from the city of Mexico. The plant has an effective head of about 1400 ft. and develops over 50,000 kw, which is transmitted to the city of Mexico. The equipment comprises two 10,000-kw General Electric machines and six 5000-kw Siemens-Schuckert machines, all operated in parallel and feeding into four transmission lines of stranded copper cables on pin insulators. The lines are tied together at Necaxa and Mexico City, so that in case of trouble any line may be disconnected. The generators, which are wound for 4400 volts, three-phase, and operate at a frequency of fifty cycles, are vertical machines directly connected to impulse wheels built by Escher, Wyss & Company, and controlled by governors of the same make. Oil-insulated, water-cooled General Electric transformers step up the potential to 88,000 volts.

Trouble was at first encountered at night because of miscreants within the station who sympathized with the rebels tripping out the exciter circuit-breakers and tampering with important switches. Cement dust was sprinkled on the concrete floor for the purpose of discovering whether the culprits wore shoes, the sandals of the peon, or were bare-footed. Doors were also locked in order to protect certain apparatus. By this means a Mexican oil and rebel sympathizer was apprehended. A powerful 30-in. projector fed with direct current from a motor-generator set is used at night to sweep the surrounding country in search of rebels and bandits. One night the generator of the motor-generator set used for the searchlamp was discovered wrecked, and dirt was found in the bearings. This was done by some sympathizer, in order to hide the movement of a number of Zapatistas six miles off. By prompt work and not very elaborate repairing the projector was placed in service again that night, and an electrician was placed in charge of it. Part of the operating force was also sent out on guard duty in anticipation of an attack which fortunately did not take place. Every one in the power house is armed with a Mauser rifle furnished by the company.

Not long after the above incident a man was shot, and it was determined to run a line down to the likeliest place of trouble and light up the trail by means of four 60-watt tungsten lamps controlled by a switch at the sentry box overlooking the trail. An enameled wash-pan was placed behind the lamps to serve as a reflector and keep in darkness the background where the armed operators were stationed. Another of these home-made bull's-eye lanterns was placed on a different trail, and when seven or eight weeks later there was a little fuss in the locality these lanterns became very useful. Two prisoners were taken alive, and a third was shot. Station operators were able to track him by blood marks to where he left the trail in the dark and evidently plunged headlong to his death in the canyon below, for two days later buzzards flocked to the spot.

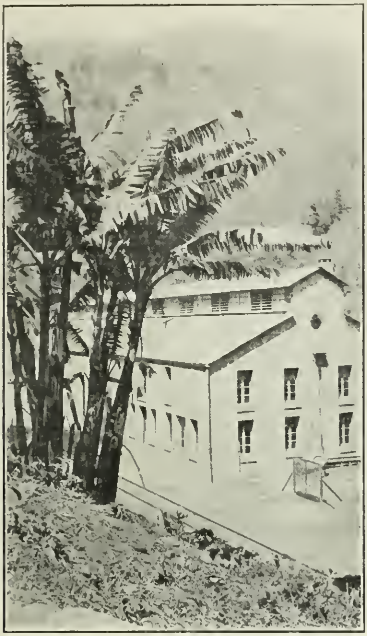

FIG. 1—POWER STATION AT NECAXA

Of course, it is necessary to protect the power station, although it is situated in a rather inaccessible canyon, since the city of Mexico depends upon it for transmitted energy for public and private lighting and for railway purposes. From five to eighty-five soldiers are quartered at the station at various times. Some of these are good men, some scoundrels, and others absolutely worthless. There are also a Hotchkiss rapid-fire field gun and three Colt machine guns available at the station in case of attack. Strange as it may seem, the transmission lines are not tampered with very much. The rebels at first climbed the steel towers and cut the lines with machetes, but inasmuch as this resulted in a 88,000-volt arc and a dead rebel, and was not very helpful to the cause, these pranks were short-lived. The rebels then began shooting at insulators. One night all four lines were shot down almost simultaneously, as well as the telephone lines strung on the transmission towers. However, there was a telephone line on wooden poles some distance from the transmission line but parallel to it which was fortunately overlooked, and over this communication was had with Mexico City. This trouble occurred during a New Year's celebration and left the theaters, streets and dance halls in darkness, also tying up the railways until a small steam plant in Mexico City could be started. No rioting occurred in the city, and the President himself telephoned to the plant at Necaxa to ascertain whether or not it had been taken by rebels. Next morning soldiers were started from the plant and also from Mexico City, traveling toward each other. This

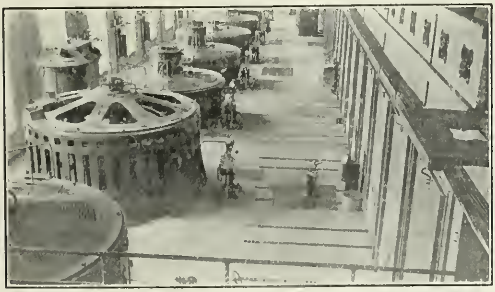

FIG. 2—GENERATOR ROOM, NECAXA STATION

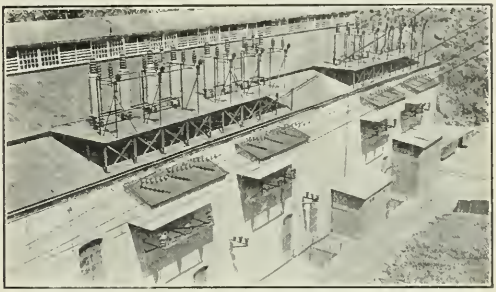

FIG. 3—OUTGOING LINES TO MEXICO CITY

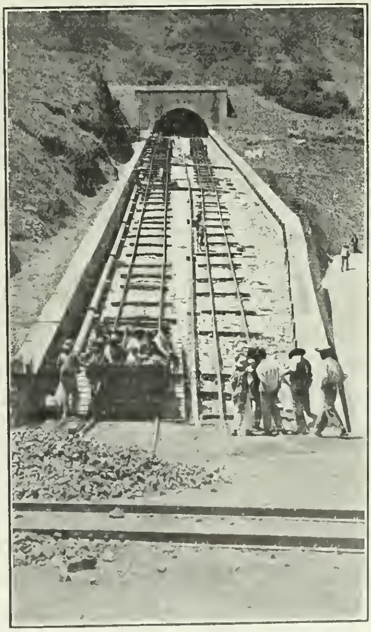

FIG. 4—NARROW-GAGE ROAD LEADING FROM STATION

was the only time in which all four lines went down at once, and the lines since then have been constantly patrolled, so that trouble from this source has been almost entirely eliminated.

Needless to state, because of the presence of rebels or bandits in the vicinity the station operators do not stray far from the station. Two men were out on an inspection trip recently on a hand-car on the little narrow-gage railroad, 25 miles long, by which the station is reached, and on the way back were met at a turn in the road by six bandits. One had a rifle, but the others were armed only with machetes. The car was going down grade, and although ordered to stop the two men, both armed, continued on. One or two shots were fired, and a peon said later that one of the bandits had been killed. Bandits, when captured by the government troops, are in most cases executed by a firing squad of five men in charge of an officer. The usual and official custom is to have all five soldiers shoot with ball cartridges, then the officer stabs the victim with a saber or shoots him with a revolver to make certain of his death.

There are no wagon roads in the vicinity of the generating station, so that no wheel vehicles are to be found anywhere about the plant. The site is almost impregnable. All transportation except that by the private narrow-gage road owned by the company is by human beings or animals. Indians carry enormous loads on their backs, supported by a band passing over the forehead, and Mexicans are expert in loading pack mules.

Decision on Suspension-Insulator Patent

Much interest is attached to a decision rendered by Judge C. J. Lacombe, of the United States Circuit Court of Appeals, in a suit brought by the General Electric Company and Mr. Edward M. Hewlett against Mr. Louis Steinberger. The suit related to the disk-strain-insulator patent issued to Steinberger on Nov. 17, 1908, upon an application filed Jan. 20, 1908, which covered substantially the same type of insulator for which a patent application was filed by Hewlett on April 20, 1907. Having discovered its error in overlooking the prior Hewlett application, the Patent Office on Nov. 2, 1911, declared interference between Hewlett and certain claims of the Steinberger patent.

The invention in question consisted of a disk strain insulator comprising suspension members partially enveloped by a mass of insulating material and having a disk portion provided with annular collars or flanges extending in opposite directions therefrom and generally parallel with the suspension members. On April 29, 1912, the examiners in chief upheld the decision of the examiner of interferences, but the first assistant commissioner reversed the findings in a decision dated Aug. 6, 1912. On April 26, 1913, the Court of Appeals of the District of Columbia upheld Steinberger's priority. Subsequent proceedings were then instituted by the General Electric Company in the United States District Court for the Eastern Division of New York, before Judge Chatfield, in Brooklyn, the complainants availing themselves of a right granted in Section 4915 of the United States Revised Statutes.

Judge Chatfield rendered a decision on Oct. 9, 1913, reversing the award to Steinberger and declaring Hewlett the prior inventor. Supplementary opinions were filed on Oct. 18 and 21. The District Court held that the patentable invention lay in the use of annular flanges, which would accomplish water-shedding and insulating area-protecting purposes, under the conditions described in the drawings and specifications.

In the decision rendered by Judge Lacombe for the United States Circuit Court of Appeals, attention was called to the fact that upon the hearing of the interference Steinberger took testimony to show that he conceived the invention and made sketches about March or April, 1904. He did not, however, reduce his invention to practice until he filed his application in 1908. Judge Lacombe expressed the opinion that Steinberger did not display such reasonable diligence as would entitle him to priority over Hewlett, whose application was filed nine months earlier.

Steinberger further showed that in October, 1905. he wrote to Mr. Harold W. Buck disclosing an insulator and inclosing a sketch thereof. This, he alleged. embodied the invention in interference, and he contended that Buck had communicated it to Hewlett. Hewlett's attorney, being of the opinion that Steinberger's letter and sketch did not embody the invention, took no testimony on behalf of Hewlett. The examiner of interferences held that the letter and sketch were not a disclosure of the invention and awarded priority to Hewlett. On appeal the board of examiners-in-chief affirmed this decision. The next appeal was to the Commissioner of Patents, who held that there had been a disclosure to Buck and that upon the record as it stood it was to be inferred that Buck had communicated such disclosure to Hewlett. The latter then appealed to the Court of Appeals for the District of Columbia, which affirmed the Commissioner of Patents. Thereupon this suit was begun, with the result above set forth.

Judge Lacombe stated that while rain-shedding flanges were patentable at the date of the application, Steinberger's sketches, made in March or April, 1904. did not disclose the arrangement shown in his application filed on Jan. 20, 1908, and affirmed the decree of the District Court, Eastern Division of New York. giving priority to Hewlett.

A petition has been submitted to the Supreme Court of the United States, asking that the evidence be reviewed, and a motion has been filed requesting Judge Lacombe not to hand down his decree to the lower court until the Supreme Court has acted in the matter.

Graphic Statistics for Engineers Discussed

On the evening of April 14 there was given at the New York meeting of the American Society of Mechanical Engineers an interesting lecture on the application of graphical statistical methods to engineering problems. Mr. H. R. Cobleigh presided, and after brief remarks on the importance of the subject and the growing need for standardization of the methods for graphical representation of engineering statistics, introduced the speaker of the evening, Mr. W. C. Brinton, of New York.

The lecturer opened with an explanation of the large importance of proper presentation of reports and other matter where comparative statistics are dealt with. He stated that very often, after a large sum has been spent in collecting facts for such reports, their whole value is lost because of the poor manner in which they are presented for the consideration of the deciding parties. He stated that the reason why the engineer is often—in fact, generally—subordinated to the lawyer in the preparation of public reports is that the lawyer is better trained in expressing facts in a way that the public can understand. As a remedy for this undesirable state of affairs, he advocated a co-operative movement by all classes of engineering interests toward the provision of a standard method for the graphical presentation of engineering statistics. His lecture showed a number of illustrations of methods, bad and good, now in use for that purpose, as well as for other work along the lines of biology and government census. Along with the illustrations he gave some of the fundamental principles that have become partially standard practice and that help to make graphical presentation clearer.

Pittsburgh Meeting of A. I. E. E.

A meeting of the American Institute of Electrical Engineers was held in the Fort Pitt Hotel, Pittsburgh, April 9 and 10, under the auspices of the committee on the use of electricity in mines and the Pittsburgh Section of the A. I. E. E.

At the opening session Mr. Wilfred Sykes, chairman of the committee on use of electricity in mines, made a short address, which was followed by a paper on "Mine Duty Controllers," by Mr. H. P. Reed, of Milwaukee. The paper at the afternoon session was prepared by Mr. H. O. Swoboda, of Pittsburgh, and dealt with self-contained portable electric mine lamps. On the evening of April 9 there was an informal Dutch dinner at the Fort Pitt Hotel, at which Prof. C. F. Scott, past-president of the A. I. E. E., spoke on the growth of the electrical industry. At the session on April 10 the following papers were presented: "The Development of the Electric Mine Locomotive," by Mr. G. Eaton, of East Pittsburgh; "Construction and Operation of Mine Substations," by Mr. H. Booker, of Pittsburgh, and "Motor-Generator Sets Versus Synchronous Converters," by Mr. W. M. Hoen, of East Pittsburgh. Abstracts of all of the foregoing papers with the discussion elicited theron will appear in a subsequent issue.

Mine Regulations

Mine regulations for electrical installations containing German, English and American mining congress rules and Bureau of Standards and Pennsylvania state regulations were discussed on both Thursday and Friday afternoons.

Mr. Clark, in discussing the rules, said that they should help and not hinder, should preferably be divided under five headings, and should properly define ambiguous terms.

It was recommended that the divisions occupy the amount of space indicated in the following: General list of definitions, 10 per cent; character of equipment, 20 per cent; installation, 30 per cent; operation and maintenance, 15 per cent; inspection, 20 per cent; miscellaneous, 5 per cent.

Mr. C. W. Beers suggested that signs of warning printed in several languages be placed on electrical apparatus throughout every mine. The speaker was of the opinion that 250-volt distribution has no advantages over the 500-volt as regards safety and that the higher-voltage system has no advantages over the lower-voltage for maintenance. Alternating current was recommended for fairly high-voltage motors, provided that the primary windings are stationary. Impregnated windings and flexible couplings were considered desirable for increasing the reliability of high-voltage electrical apparatus. In addition, it was recommended that all framework be grounded. Mines should be divided into gaseous and non-gaseous sections, and rules governing work in these divisions should be general and should conform with A. I. E. E. standards.

Mr. E. M. Hewlett, Schenectady, N. Y., suggested that switchboards be designed so that if a person comes into accidental contact with a "live" conductor it will be impossible for him to fall against it after the shock.

Mr. J. P. Clayton, Mattoon, Ill., called attention to the Illinois law limiting mine-trolley voltages to 275 volts. He predicted that alternating-current mine equipment will be employed almost exclusively in the future to eliminate converting apparatus. Alternating-current coal-cutting apparatus, with which the speaker has had experience, has cost less to operate than the direct-current type and is more satisfactory mechanically.

It appeared to be the opinion of those present that cables should be armored to prevent danger from accidental contact with miners' picks and tools of a similar nature.

Mr. C. M. Means, Punxsutawney, Pa., considered the existing bituminous coal code to be unsatisfactory and suggested that a new code be drawn up along the lines of the Underwriters' rules. In discussing the diagrammatic representation of electrical installations it was suggested that symbols be employed rather than a color scheme so that it will be possible to reproduce the plans on a blueprint.

Mr. J. S. O'Donovan, Sharpsburg, Pa., suggested painting high-voltage lines in different colors to indicate the potential at which they operate.

Mr. Beers spoke of a Polish school for instructing miners how to care for a person who has received an electric shock.

Mr. Thomas said that the permissible voltage to use in mines depends entirely on the conditions of operation. Too many danger signs are about as bad as too few because they lose their effectiveness.

Mr. A. S. Biesecker, Scranton, Pa., said that in anthracite regions the corrosion of cables by acid had been eliminated by covering them with jute. Several hundred alternating-current coal cutters have been installed in the same region, but none is being operated now, as they proved unsatisfactory.

Chairman Dudley called attention to the difference between the voltage of a direct-current system and that of an alternating-current circuit having the same effective value when considering the effect of a shock from alternating current.

Mr. Newton discussed the subject of bonding, saying that the compressed terminal bond is the best and that there is no reliable method of making a temporary bond.

Mr. A. F. Nesbitt, University of Pittsburgh, commended the Bureau of Mines for its work and urged the A. I. E. E. to help young student engineers by placing all available information in their hands.

Mr. C. G. Braehm, Uniontown, Pa., suggested that electrical inspectors be employed to enforce rules in mines.

Mr. Means brought out the fact that inspection often works a hardship on the small mine operator, since the average profit is only 2 cents or 3 cents per ton at the most and an additional cent for inspection would lower the profit still more. Several steel-mill engineers emphasized the advantage of inspection, saying it often costs more than repairs but is worth the expense.

On the subject of portable apparatus Mr. Bright remarked that it was formerly bought by purchasing agents without attention to its application, but conditions are now different and more satisfactory.

Mr. Bright suggested that lamps be placed at all crossovers and in wall-pockets. Pump and fan installations should also be well illuminated.

Mr. Thomas recalled a suggestion to place lamps in multiple so as to prevent darkness in case one burns out.

The meeting adjourned Friday afternoon. Saturday was devoted to an inspection of the industrial plants of the Pittsburgh district.

Mr. McCarter on the Future of Public Utilities

At the meeting of the Finance Forum of the Young Men's Christian Association in New York on April 13 the subject was "The Future of Public Utilities," and the speaker was Mr. Thomas N. McCarter, president of the Public Service Corporation of New Jersey. Mr. O. B. Willcox, of W. P. Bonbright & Company, Inc., New York, introduced the speaker, after a very brief talk on the transition of the public utilities from small, independent and locally controlled enterprises to large interconnected systems financed and controlled by large centralized bodies of capital. Mr. Willcox thought this growth a natural outcome of the fact that the utility generally grows at a rate much in excess of the growth of the community and of its capacity to care for the necessary financing.

The definition of public utilities given by Mr. McCarter for the purposes of his lecture was "all street-using corporations operating under state or municipal grants, such as gas and electric supply, street-railway, telephone and telegraph companies." Before taking up the subject proper the speaker outlined the political situation in this country as he understands it. This has much to do with the public utility situation and with the present temper of the people with relation thereto.

In the first place the people distrust the public utility official. Mr. McCarter said that at one time he had occupied political positions of importance, but he realized that he has now and forever barred himself from political preference by occupying his present position. Two years ago, when president of the American Electric Railway Association, he, in company with other railway men, visited many of the important electric railway centers throughout the country, explaining the situation that confronted the companies. While he felt that the trip was well worth while, he humorously referred to the fact that the present disposition of the people toward electric railways showed no evidence of conviction produced as a result of his labors.

Mr. McCarter took occasion to register a vigorous protest against the seemingly prevalent opinion that a public-utility official cannot be as honest and as patriotic as other citizens.

Continuing, Mr. McCarter said that the political parties of the country have largely outlived their fundamental principles. While he personally is by tradition and choice a Republican, he really would have trouble in defending his position, so uncertain are the present tenets of that as well as of the other parties. It appears that what has occurred politically in England and Germany must eventually come about in this country, namely, a reclassification of the population politically into radicals and conservatives, old party demarcations being eliminated. The fate of public utilities is involved in this political situation because the new parties will disagree radically as to the management of these properties.

The principle of regulation is now accepted generally as desirable but the practical application of the principle involves many problems. Regulation as practised is expensive. It may also have a depressing effect on the value of securities. Since the provisions of the Hepburn bill went into effect railroad securities have depreciated in value by $3,000,000,000, and this is partly, at least, due to government regulation. To be successful commissions must be composed of men of the highest character and best experience. Moreover, they must be restricted to their real functions. The exercise of plenary powers is municipal ownership without responsibility.

The allowable rate of return, said Mr. McCarter, is a vital element of successful regulation. The conservative view is that a fair rate of return on a reasonable valuation should be provided for. There will obviously be no incentive to capitalists to put their money into such hazardous undertakings if rates are kept down without due regard to all factors involved. Just what is an average fair return the speaker was not prepared to state, but it should certainly not be less than 8 per cent.

In valuing property for the purpose of determining rates of fare due allowance must be made for franchises, depreciation, etc., but the tendency is against this. Commissioner Daniels, formerly of the New Jersey Board of Public Utility Commissioners and now of the Interstate Commerce Commission, was publicly criticised and the ratification of his appointment to the latter position was jeopardized because he was willing to make allowance for intangible values in rate-making.

In discussing franchises, Mr. McCarter said that there are many wrong impressions in the public mind. Existing franchises were in most cases granted to induce capital to build railways on the same principle as the federal government gave a vast acreage of public land to the Union Pacific Railroad to induce it to extend its lines. Franchises should not be limited in term. A limited-term franchise is like a limited-term lease of a lot upon which a valuable house is built. The only way in which such an investment is made feasible is by the creation of a sinking fund which will retire the value of the house during the period of the lease. An expiring franchise is a distressing spectacle, as has been seen in a few recent examples. During the last five years the property is allowed to run down and service is poor. There is now no valid objection to a perpetual franchise in view of the regulating tendency of the times. Such franchises should contain provision for periodical review to insure compliance with their provisions.

The chief objection to municipal ownership is furnished by the unsatisfactory results of municipal administration in this country. The theories of federal and state government have worked out well in the country, but this is not true of the city governments. Here graft, incompetent selection of officials and other evils have been conspicuous. When one considers the responsibilities already on the shoulders of municipal officials he concludes that they are enough.

Another serious item mentioned by Mr. McCarter is that of financing. Our cities now labor under serious financial burdens. If the electric railways of the country were purchased under a fair condemnation process, the burden would be enormously augmented. No one claims that cities could operate railways cheaper than individual companies, but it is supposed that they can borrow money cheaper. The fact is that if the cities were to go into public utility work on a large scale they could not get the money any cheaper than individuals, and even if they did, the losses due to less efficient operation would more than wipe out the difference. The only theoretical saving by municipal ownership is the difference between interest rate and the existing dividend rate, which would soon vanish in graft and mismanagement.

In conclusion, Mr. McCarter called attention to the efforts being made by public utilities for the welfare of employees. His own company has gone to the limit in this direction and a loyal spirit has been developed. Old-age pensions, sick and death benefits, participation in profits and other items of extra compensation are in effect. All of this is good, but after all real manhood is at the bottom of success and the future of the public utility depends on this.

Public Service Commission News

California Commission

The Railroad Commission of California has issued an order authorizing the Ocean Side Electric & Gas Company to renew $12,442 notes and issue $25,000 bonds, The company proposes to sell enough bonds to realize $14,100 and with the proceeds to pay the notes and reimburse the treasury for $1,656 expended on additions and betterments from income. Commissioner Loveland wrote the decision. He says that ordinarily when no depreciation account has been maintained the commission would demand that the treasury should be reimbursed for the $1,656 from income, but considering the uncontroverted testimony that the plant has been kept in excellent condition from income and that this amount has been expended for additions and betterments, he believes that the commission should approve the payment of this sum from the proceeds of the bonds.

Wisconsin Commission

The Wisconsin Railroad Commission has issued an order readjusting the rates of the Monroe Electric Company. An analysis of the investment and operating expenses showed that the revenues from commercial lighting were considerably in excess of the costs and that the cost of furnishing power exceeded the revenues derived therefrom. The present rates for commercial lighting, ranging from 15 cents to 10 cents per kw-hr., are to be abandoned and the following schedule substituted: Primary rate, 12 cents per kw-hr. for the first thirty hours' use per month of the active connected load; secondary rate, 9 cents net for the next sixty hours' use of the active connected load; excess rate, 4 cents net. The classification of consumers according to the percentage of their connected loads to be deemed active is the same as that used by the commission in the majority of its rate cases.

The rates for unlimited power service are to be as follows: Service charge, 80 cents net per month per active hp connected; energy charge, 3 cents per kw-hr. for the first 70 kw-hr. use per month of the active horse-power and excess rate of 2 cents per kw-hr. The active horsepower is to be graduated from 90 per cent of the first 10 hp connected to 50 per cent of all capacity over 60 hp. The order provides that where power consumers agree to use power during certain stipulated off-peak periods the service charge may be reduced 10 cents per hp.

The commission has authorized the Wisconsin Telephone Company and the Ashland Home Telephone Company, operating competing exchanges in the city of Ashland, to exchange property. According to the terms of the certificate, the Bell company will transfer to the Ashland Home Telephone Company its exchange and lines in the city of Ashland and will receive in exchange therefor the toll lines of the Ashland company with its exchange at Mellen and a valid title to the property now owned by the Northern Wisconsin Toll Line Company and the Bayfield County Telephone Company, which are to be acquired by the Ashland company. The latter company will also turn over to the Bell company $17,500 stock and a like amount of bonds, authority for the issue of which has just been granted.

In reversing the order of the lower court, the Supreme Court has sustained the contention of the Railroad Commission to the effect that the Chippewa County Telephone Company, although furnishing service to a few subscribers in the city of Eau Claire, was not doing a local exchange business and, therefore, its successor, the Citizens' Telephone Company, could not issue securities for the enlargement of the exchange and the extension of its service without first securing a certificate of convenience and necessity from the Railroad Commission.

Indiana Commission

In deciding the case arising from the issue of bonds proposed by the Indianapolis Water Company, the Public Service Commission of Indiana has made several interpretations of the law. The issue requested by the company was over $2,000,000, but only $476,000 was for other than refunding purposes. About $140,000 of the latter amount was intended to reimburse the treasury for sums expended out of earnings for new construction. To this the city authorities objected. They contended that the law did not intend that a utility should capitalize new-construction expenditures when it was possible to take the sums required from the earnings. The commission pointed out that the law provides that expenditures for new construction shall be capitalized. The bond issue was allowed, the commissioners asserting that the appraisal of the property, showed the values to be sufficient to sustain it.

Maryland Commission

Changes in the Maryland Public Service Commission law were made during the closing hours of the Legislature. One amendment gives the commission power to regulate the quality of gas. Another provides that when a franchise is once exercised by a public service corporation it cannot be abandoned. Still another amendment gives the commission jurisdiction over all municipal lighting and water companies which do a general business in competition with other corporations. The hours during which the office of the commission shall remain open were, by another amendment, fixed at from 8:30 a. m. to 5:30 p. m. instead of from 8 a. m. to 9:30 p. m., as formerly. The bill increasing salaries of the two associate commissioners from $5,000 a year to $6,000 a year was also passed.

The measure giving the commission authority over all public service utilities owned and operated by municipalities, counties, etc., except Baltimore city, arises from the fact that the commission has had much trouble with several municipally owned utilities in western Maryland and on the eastern shore, but has been powerless to control them.

Massachusetts Commission

The Haverhill Gas Light Company has withdrawn its appeal from the order of the Gas and Electric Light Commission for the establishment of an 80-cent rate and has abandoned the suit brought against the board by it in the United States Circuit Court. Litigation has extended over sixteen years, and the case is one of fundamental importance in relation to the rate-fixing powers of the commission. In 1898 the city government petitioned for a lower rate after the original company had sold out to the then Nevin interests. The board ordered an 80-cent rate and the new owners appealed to the courts. In 1909 the company was purchased by Stone & Webster, and in connection with a reorganization an effort was made to increase the capitalization. This led to a second petition for a lower rate, the original order for an 80-cent rate having been abandoned by mutual consent, and the commission issued a new order establishing an 80-cent rate dating from Feb. 1, 1913. Stone & Webster appealed from this ruling to the United States Circuit Court, and Mr. Robert M. Dodge, of Newburyport, Mass., was appointed master to hear the evidence. Many thousands of pages of evidence have been presented before the master, and the company enlisted the services of the ablest gas engineers in the country in the endeavor to show that it could not sell gas at 80 cents at a reasonable profit. In withdrawing the suit and establishing the 80-cent rate, the company will rebate the extra 5 cents per 1000 cu. ft. received from its customers since Feb. 1, 1913.

Current News Notes

Examination for Junior Railway Engineer.—The New York State Civil Service Commission, Albany, N. Y., has announced an examination on May 9 for the position of junior railway engineer, Public Service Commission, First District. The duties are to inspect the power houses and equipment of subway, elevated and street railways and of electric companies in New York City. Candidates must have had at least three years' training in a technical school of recognized standing and not less than one year's experience in electric railroad or electric lighting work or in the manufacturing or installation of electrical or mechanical apparatus. The salary is from $901 to $1,200 per annum. Applications should be in the hands of the commissioners before May 1.

* * *

Small Majority in Favor of "Home Rule" at Chicago Election.—A question of public policy presented to the voters of Chicago at the election of April 7 was the following: "Shall the State Legislature amend the act creating a state public utilities commission, approved June 30, 1913, so as to provide for home rule and control by the city of Chicago of public utilities within the city?" Much to the surprise of the politicians, the magic of the "home-rule" cry in public-utility regulation was not so effective as had been contended. The vote was in the affirmative, but the majority was so small that the effect on the Legislature will probably not be great. The figures were: Yes, 176,850; no, 168,682. Women voted as well as men, but their negative votes were almost in the same proportion as those of the men.

* * *

Souvenir Book for Baltimore Jovians.—An interesting feature of the joviation and rejuvenation of the Jovian Order held at the Emerson Hotel in Baltimore on March 31 was a souvenir booklet prepared and distributed by Mr. Melvin H. Jones, twelfth Triton. This booklet, which is possibly unique in the history of Jovianism, contains portraits of the Jovian officers in Baltimore, the names and members of the degree team and committees, the list of toasts, the menu and the songs for the dinner, the program of entertainment for the joviation, a brief outline of the objects of the Jovian Order and something about the Baltimore luncheon meeting, together with a list of Jovians in Baltimore and the names of the candidates. Advertisements of electrical concerns are included, and the whole forms a pamphlet of thirty-two pages bound in a striking cover.

* * *

Senior Engineers from Yale Visit Engineering Industries in East.—To round out their engineering education and obtain an idea of the practical methods of conducting large engineering industries, about 100 electrical and mechanical engineering students of the senior class of the Sheffield Scientific School, Yale University, spent the week April 1 to 8 inspecting some of the larger industries in the East. Among the places visited by the electrical students were the United Electric Light & Power Company's new station at New York, the Interborough Company's station in the same city, the General Electric Company's factory at Schenectady, the Niagara Falls Power Company, the International Paper Company, and the Ontario Power Company at Niagara Falls, the Union Switch & Signal Company, the Edgar Thompson Steel Works, the American Steel & Wire Company, the Westinghouse Electric & Manufacturing and also the Machine Company, the Macbeth-Evans Glass Company and the National Tube Company in the vicinity of Pittsburgh. Entertainments of various sorts were tendered the visiting students in the several cities by local alumni and the industrial firms.

* * *

SOCIETY MEETINGS

Forthcoming Meetings of the Philadelphia Jovians.—On April 23 the Jovian Electrical League of Philadelphia will hold a meeting at which Mr. Gifford Pinchot will deliver an address on "Conservation of Natural Resources." On April 30 Dr. William Draper Lewis, dean of the law school, University of Pennsylvania, will speak on "The Three Kinds of Monopolies. Their Effects and Remedies."

* * *

New York Electrical Society Visiting Meeting.—On Wednesday, April 22, at 3.30 p. m., the New York Electrical Society will hold a visiting meeting, the objective point being the Bush Terminal, Brooklyn. In Building No. 20 Mr. R. E. Ireton will give an illustrated talk on the electrical and other features of the Bush Terminal. Following Mr. Ireton's talk a tour of inspection will be made of this unique plant.

* * *

Jovian Electrical League of Southern California.—At a meeting of the Jovian League of Southern California held in Los Angeles, April 8, Mr. Frederick H. Vose, secretary of the National Credit Men's Association of Chicago, delivered an address on electrical credits. He deplored the lack of harmony and co-operation between the credit and sales departments of the average business house, and classed capital, capacity and character as the three most important factors to be considered in extending credit.

* * *

Brooklyn Edison to Send 100 Men to National Electric Light Association Convention.—At the meeting of the Brooklyn Edison Company Section of the National Electric Light Association held on April 14, the vice-president and general manager, Mr. W. F. Wells, announced that the Brooklyn Edison company had decided to send 100 men to the convention of the National Electric Light Association to be held in Philadelphia during the first week in June. The Brooklyn men will leave early on the morning of June 3 on a special train, arriving in Philadelphia in time for the opening session and remaining over for the public policy meeting on that night.

* * *

Delegates from Commonwealth Edison Section to Philadelphia Convention.—At the meeting of the Commonwealth Edison Company Section (Chicago) of the National Electric Light Association held at the Hotel Sherman on April 7 the result of the election of delegates from the section to the N. E. L. A. convention to be held in Philadelphia during the first week in June was announced. Ten delegates were elected as the result of a keenly contested election, at which all "Class B" members of the section in good standing had an opportunity to vote. The successful candidates were Messrs. Joseph Haas, A. H. Donahoe, W. J. Weyker, E. B. Conklin, James Dawson, E. R. Hansen, John J. Kelly, George Nelson, R. H. Williams and Albert Legge. At the meeting Mr. J. T. Mountain, assistant to the chief operating engineer of the company, gave an interesting lecture on "Egypt," illustrated by 100 colored lantern-slide pictures. Mr. L. H. Rose also gave an illustrated talk on "Over the Matterhorn." The meeting was also the occasion of the first appearance of the Commonwealth Edison Band, which is distinct from the Commonwealth Edison Orchestra.

Richmond's Development of a Historic Water-Power

The falls of the James River, one of the earliest hydraulic sites in America, now used, with steam auxiliaries, to pump water for and to light the city of Richmond, Va. By James M. Purcell

HISTORICALLY the development of water-power on the James River at the present site of Richmond, Va., was one of the earliest in the history of the American colonies of Great Britain. Later on, the city of Richmond became an important flour-mill center, shipping its products to all parts of the world, and these large flour mills were then operated by the water-power of the river.

At present there are thirteen developments at Richmond within the short distance of 2 miles. Two are hydroelectric plants, four supply energy to large paper mills, three others are in flour mills, and the remainder consist of a water-pumping station, two rolling mills and a woodworking plant.

The Early Water-Power Water-Works Plant

Richmond, with a population of 150,000, is situated on the James River at the head of tidewater and at the foot of an extensive series of natural falls. These falls within a distance of 9 miles have a drop of 112 ft. The James River is 450 miles long and drains a watershed of 6900 sq. miles, which receives an average rainfall of 42 in. per annum. There is a wide divergence between the maximum and minimum flow, the minimum running as low as 700 second-ft. at times.

The present article relates to only one of these developments, the Richmond municipal electric station. This plant is interesting in the fact that it is a reconstruction of an old pumping station and affords a good example of the high efficiency which can often be obtained by the redevelopment of a former water-power site. The location of the municipal plant was formerly occupied by an old pumping station of the city water-works. Water was taken from the river and pumped to a reservoir situated on a high bluff at an elevation of 150 ft. This plant has been in operation since 1840 and was equipped with overshot wheels and plunger pumps. The capacity was limited to about 5,000,000 gal. per twenty-four hours, and it was decided to abandon the old equipment in favor of a modern one. With the completion of modern sedimentation basins 4 miles above the plant, the impracticability and cost of running a pipe line from the basins to the plant made it inadvisable to attempt to continue operating the old plant.

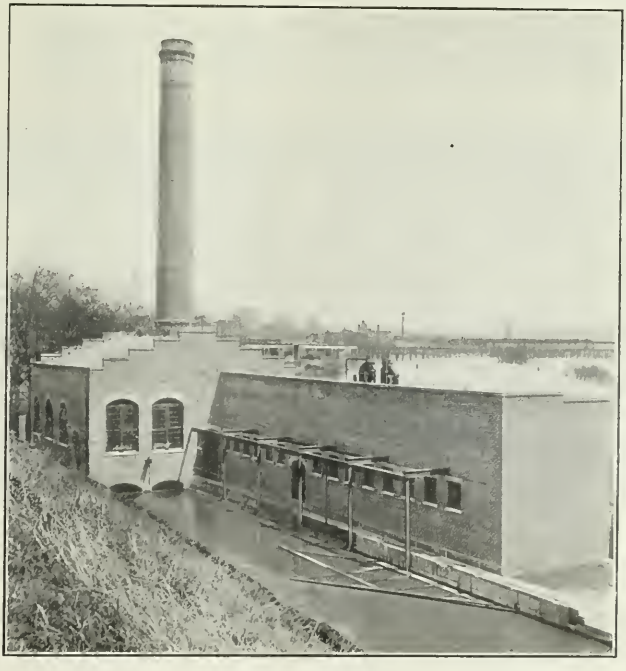

FIG. 1—STEAM-HYDROELECTRIC STATION ON THE JAMES RIVER AT RICHMOND, VA.

After much opposition the plan of constructing a hydroelectric plant on the site was adopted. This permitted the operation of electric pumps in the new pump house, situated 1½ miles above the old station, using energy generated at the electric plant. In addition, it was also possible to furnish street lighting and electric service to the municipal buildings, as the pumping service was mostly a day load. The completion and operation of the plant have amply justified its construction. The average demand for pumping has been about 6,000,000 gal. per day, with a maximum demand at times of 16,000,000 gal. The connected load at the pump house consists of six 200-hp Westinghouse motors, connected to two-stage centrifugal pumps working against a head of 165 ft.

The dam is a monolithic concrete structure, its average height being 15 ft. The total length of the dam is 2200 ft., extending into the stream, however, only about 400 ft. and taking an almost parallel course with the shore line. The dam does not reach across the river, as the riparian rights extend only to the center line of the river. At the center it touches the Belle Isle dam, which takes the other half of the river.

The pondage is very small, being only about 13 acres, and the plant depends almost wholly upon the flow of the river, which averages about 2500 second-ft. At the intake to the headrace eight gates are provided completely to shut off and to regulate the water in the race. The length of the race from the plant to the headgates is about 500 ft. The race level is the same as that of the openings, and the overflow goes over the dam crest. Trash racks are provided at the wheel-pit openings. There is also a drop-gate arrangement, consisting of heavy plates, for completely blocking individual pits in case repairs are to be made to the wheels.

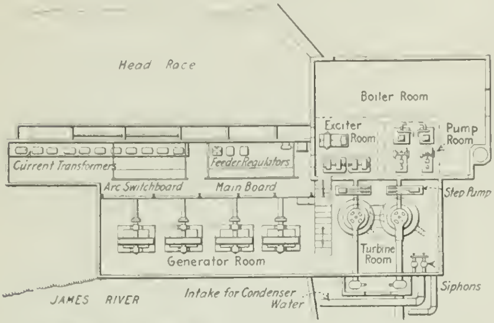

FIG. 2 PLAN RICHMOND MUNICIPAL LIGHTING PLANT

The design of the power house was fixed to a certain extent by the foundations of the old plant. Wherever possible the walls of the old building, which were of dressed granite and in excellent condition, were used. The building is constructed in the shape of an "L" with a length of 168 ft. and a width of 75 ft. The old wheel races were reinforced with steel and concrete and served as chambers for the waterwheels. Some excavating had to be done for the 6-ft. draft tubes, which extended from the wheels under the building and at right angles into the river.

At present there are four Morgan Smith 42-in. wheels directly coupled to General Electric waterwheel-type alternators. The 425-kva alternators are of the three-phase, four-wire, 4000 2300-volt, sixty-cycle, revolving-field type and run at 150 r.p.m. The wheels operate under a normal head of 18 ft. Lombard governors are connected to each machine and are arranged for control from the switchboard.

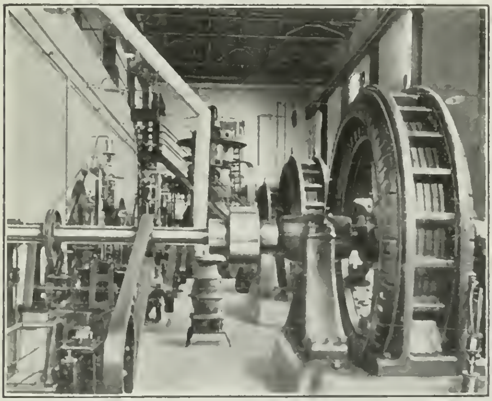

FIG. 3—GENERATOR ROOM, RICHMOND MUNICIPAL STATION

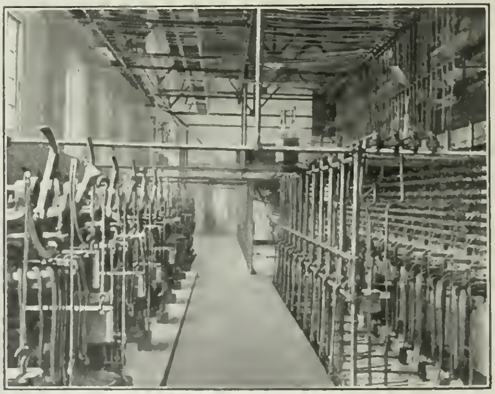

FIG. 4—TRANSFORMERS FOR ARC CIRCUITS, RICHMOND

As there are short periods of low water when the wheels cannot be run at full capacity an auxiliary steam equipment, consisting of two turbines, is provided. These turbines are of the General Electric Curtis vertical type and are coupled to revolving-field generators. The turbines operate at 150 lb. steam pressure and exhaust into a 27-in. vacuum. The generators are rated at 1000 kva at 75 per cent power-factor and produce sixty-cycle, 4000 2300-volt alternating current at 1800 r.p.m. The turbines exhaust into Alberger barometric condensers. Two vacuum and circulating-water pumps are also provided. The circulating pumps are piped so as to be interchangeable on either condenser and have connections, also, for drawing water either from the headrace or the river.

The boiler room is practically the only part of the building in which new walls had to be erected. It is built over two of the old wheel-races, which were reinforced with steel and concrete and now serve admirably for the pump and exciter rooms. The boiler room is about 46 ft. by 62 ft. and has a storage space in front for 150 tons of coal. Two Babcock & Wilcox 400-hp boilers are set up in the boiler room. The stack is built of radial brick and is 120 ft. high, with a diameter of 8 ft. A Locke damper regulator is connected in the flue leading to the stack. Two feed-water pumps are located in the boiler room and arranged either to draw water from the race or from the city mains in case of necessity. The exhaust from the step-bearing pumps, condenser pumps and feed-water pumps passes through a National feed-water heater. All firing is done by hand. Running condensing, with 28-in. vacuum, one boiler has been able to carry full load on the turbine.

All steam and exhaust mains have been lagged with pipe covering. These mains are also painted distinguishing colors. The main steam lines are a buff color, the exhaust pipes are red, the low-pressure lines to the siphons are yellow, and the boiler feed-water lines are white.

As the engine-room floor is at times below the river level, the drainage of the building does not empty into the river but into a tank. In case of high water this tank is drained by means of two siphon pumps. The building is well lighted both naturally and artificially. Altogether there are about 160 16-cp lamps mounted in five-lamp and six-lamp clusters on side-wall brackets and suspended from roof beams.

The exciter equipment consists of two units, which are situated in a room directly under the boiler room and slightly above the level of the engine floor. These exciter sets comprise two 50-kw compound interpole generators directly connected to 4000-volt induction motors. A Pelton waterwheel is set up in the exciter room and belt-connected to the exciters. This wheel is connected to the city water mains, at a pressure of about 80 lb., and is used to start the exciters. The exciter voltage is built up sufficiently to raise the alternating-current voltage so as to have the induction motor, which is connected to the exciters, reach its normal speed. The Pelton wheel is then cut out and the belts shifted to the idle machine. The Pelton wheel is controlled by the operator by a valve from the switchboard gallery.

The switchboard gallery is directly over the wheel and about 15 ft. above the engine room. It contains two switchboards, the main or generating panel and the arc board. The plant is operated on the three-phase, four-wire system at 4000/2300 volts—that is, 4000 volts between phases and 2300 volts between phase and neutral.

The main board at present consists of nineteen panels of blue Vermont marble mounted on pipe and with oil switches mounted directly on back of board. Two induction-motor starting panels are equipped with oil switches and starting compensators. Two Tirrill voltage regulators are also mounted on these panels. The five generator panels are provided with oil switches, field switches, governor control switch, three ammeters, a wattmeter, a voltmeter and a field ammeter.

There are two three-phase and three single-phase feeder panels, each equipped with ammeters, relays and watt-hour meters. In addition to these, the single-phase panels have compensating voltmeters and are arranged to feed through motor-operated automatic feeder regulators. These single-phase lines are connected together through the regulators and distributed as a three-phase, four-wire circuit.

Richmond City Street Lighting

The arc-circuit switchboard consists of eleven blue Vermont panels and has transfer buses and plug switches arranged so as to allow the interchange of any circuit from a damaged transformer to a spare unit. Four buses are arranged back of this board and taps are taken off between one phase and the neutral for 2300 volts, the load being equally divided among the phases. The arc lines are protected by horn-gap arresters and the power lines by multi-gap arresters. A General Electric aluminum arrester is connected to the multiple lines.

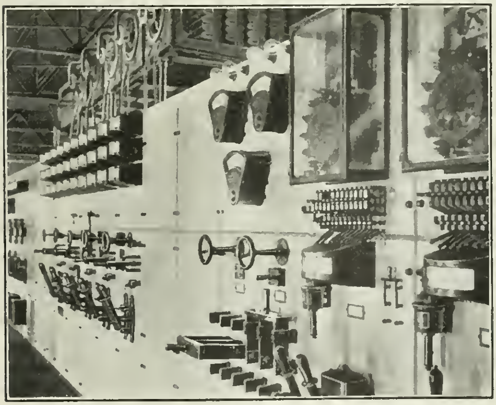

FIG. 5—MAIN SWITCHBOARD, RICHMOND

The present outside street-lighting equipment is as follows: 1189 500-watt inclosed carbon-arc lamps, 137 alternating-current flame-arc lamps, 273 80-cp series incandescent lamps, 145 500-watt tungsten cluster, multiple series (operated until 1 a. m.), and 13 500-watt tungsten cluster, multiple series (operated all night).

Broad Street, the principal retail business street of Richmond, is one of the best-lighted thoroughfares in the country. Ornamental posts with five 100-watt tungsten units mounted on each standard are set up on both sides of the street. In addition to this, pairs of flaming-arc lamps are suspended from 30-ft. poles set up in the center of the streets at each street intersection.

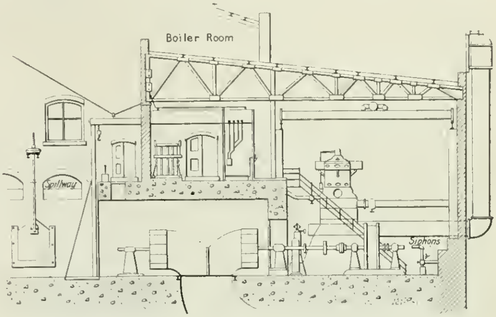

FIG. 6—SECTION OF RICHMOND MUNICIPAL PLANT

At present there are twenty-two arc circuits in operation. These circuits are carried on a trunk line for about one-half mile and are then distributed on 35-ft. poles throughout the city. No. 6 rubber-covered wire is used. In the business part of the town and in the underground districts the lamps are fed through lead-covered cable laid in fiber ducts. The overhead line is connected to the underground circuit through series transformers, thus lessening the insulation strain should the overhead lines be struck by lightning. These series transformers are wound for a current ratio of 7.5 amp to 10 amp. All the lamps in the underground district are of the flame type and take 10 amp each.

Two three-phase 4000-volt transmission lines are run to the new pump house about 2.5 miles distant. These lines supply energy to six 200-hp induction-motor-driven centrifugal pumps. A three-phase, four-wire, 2300-volt line is run to the retail business district, where it is fed through transformers to 145 ornamental poles and to municipal buildings. These poles carry five lamps each of 100 watts rating.

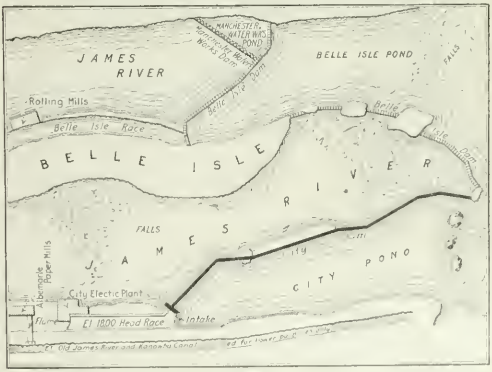

FIG. 7—DAMS AND PONDS, BELLE ISLE, RICHMOND

Mr. E. W. Trafford, who designed the plant, is now in charge of its operation as superintendent and city electrician.

Service Continuity in Grounded Transmission Systems

Notes on new methods that have been tried in actual practice by the Peninsular Power Company, of Iron Mountain, Mich. By Max H. Collbohm

THE question of preference between a grounded and an ungrounded system for high-voltage transmission has come into prominence recently, and a few notes descriptive of some new methods tried in actual practice may be of interest. Dr. C. P. Steinmetz[1] has cautioned against grounding a transformer neutral in systems operating a few feeders only, such as obtain in long-distance transmission, and has advocated that such systems be insulated. In the spring of 1911 the writer designed a transmission plant for operation with a grounded neutral wherein the disadvantages inherent in an ordinary grounded system, as mentioned by Dr. Steinmetz, have been anticipated and means devised to overcome them, thus obtaining all the good features of the grounded system and none of the bad ones.

The disadvantages of a grounded system, the methods worked out to overcome them, and the results obtained in actual operation will be discussed in the following paragraphs.

Service Interruption by Ground on Line

Dead-grounding of the neutral will automatically open a line switch in case of a ground on the line.

Grounding through a resistor will also open the line switch under such conditions either automatically by the combination of load current and ground current actuating the relays, or by the operator after the limit of the heat capacity of the ground rheostat has been reached.

To prevent the line switch from opening automatically the scheme shown in Fig. 1 was developed. It consists of a series transformer in the ground connection of the grounding rheostat the secondary of which is connected to an instantaneous overload circuit-opening type relay, having its contacts inserted in the tripping circuit between the main relays of the line switch and the tripping coil of this line switch. The idea of this scheme is to open the tripping circuit by the instantaneous relays first before the inverse-time-limit relays have closed their contacts. The existence and severity of the ground are indicated by an alarm bell, a signal lamp and an ammeter.

DATA ON LIGHTNING DISTURBANCES IN 1913

Date		Duration, Hours	Number of Interruptions	Total Duration, Seconds	Insulators Damaged
April	2	4.5	0	0	0
May	3	2.0	0	0	0
June	5	6.0	0	0	0
June	18	6.0	1	1	0
July	1	2.0	0	0	0
July	3	3.0	0	0	0
July	4	2.5	0	0	0
July	5	2.5	0	0	0
July	26	6.5	0	0	0
July	31	1.5	2	2	0
August	3	4.0	0	0	0
August	7	3.0	0	0	0
August	8	3.0	1	1	0
August	14	1.5	0	0	0
August	16	2.0	0	0	0
August	28	1.5	0	0	0
September	2	5.0	0	0	0
September	6	1.0	0	0	0
October	10	2.0	0	0	0

This arrangement permits the operator to cut out the line in trouble without service interruption in the following way: If a ground occurs, the operator will trip one of the line switches (of a duplicate line), and if the trouble should be on the line controlled by that switch the reverse-power relays at the substations will open the line from the other end. If, however, the ground is on the other line (the bell continuing to ring), the operator will then again close the first switch and trip the other, which will clear the line in the manner just mentioned without service interruption. For greater reliability the reverse-power relays at the substations may be installed in duplicate.

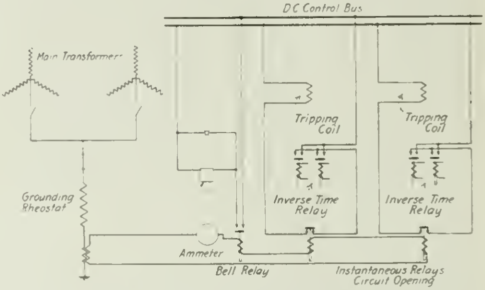

FIG. 1—DIAGRAM OF CONNECTIONS BETWEEN GROUNDING RHEOSTAT AND LINE SWITCHES

If a ground occurs on a single line and does not burn itself free within the allowable heating period of the rheostat, the line conductor in trouble should be grounded over an oil switch and the transformer neutral opened. Repairs could then be made on this grounded conductor and the same placed in normal operation again without service interruption.

Unreliability of Grounding Rheostat

It is extremely difficult to design a self-contained rheostat that will withstand the high voltage of a high-tension transmission system and offer at the same time more than a low factor of safety against flash-over. This difficulty has been overcome by building the rheostat in five separate sections connected in series, each section being placed on high-voltage insulators in a separate brick compartment. This arrangement permits of building each rheostat section for only one-fifth of the voltage in question, and the factor of safety against flash-over and the consequent reliability of the apparatus itself are by the use of this method materially increased.

There is little probability of such a rheostat becoming a source of oscillatory arcing on account of the grounded nature of the system. If any doubt should exist as to the permanency of its reliability, the system could momentarily be changed into an insulated one by opening the transformer neutral with the aid of an oil switch.

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[1] *General Electric Review*, June, 1913.

Damage to Insulators by Arcing

The probability of damage to insulators from an arc in a grounded system is usually greater than in an ungrounded system if the arc is maintained. This feature has been eliminated by the installation of arcing rods (see Fig. 2) above and below the insulators which lead the arc away from the insulators as soon as it is formed. They act further as a relief gap owing to the concentrated electrostatic field at their sharp ends and may therefore be considered individual lightning arresters for each set of insulators where they are installed.

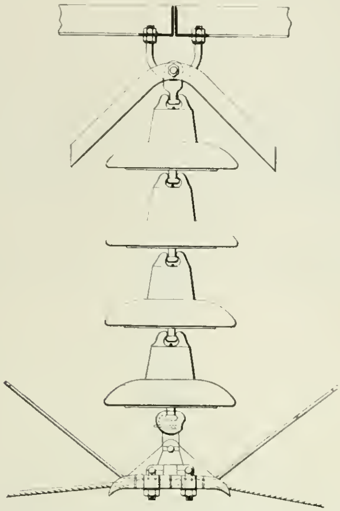


FIG. 2—ARRANGEMENT OF ARCING RODS ABOVE AND BELOW INSULATORS

The various schemes outlined have been put into actual operation in the system of the Peninsular Power Company, of Iron Mountain, Mich., the station wiring of which is shown in Fig. 3. As will be noted, there has been provided beside the equipment above discussed additional protection in the form of choke coils in each circuit connecting to the generator busbars. The choke coils are wound with Swedish iron so as to obtain high ohmic resistance under high-frequency surges entering over the low-tension local feeders. For the same reason each series transformer on the outgoing lines is shunted by a small electrolytic cell and a high-frequency condenser arrester placed on the low-tension busbars in addition to the usual electrolytic arresters and choke coils on the outgoing lines.

The transmission line, which is in duplicate (40 miles, 66,000 volts), is equipped over the entire distance with two copper-clad ground wires of No. 2 B. & S. gage arranged 10 ft. above the main circuit wires and grounded at every tower by special ground plates attached to the tower legs and extending below the concrete foundations.

With the above-mentioned equipment high-tension service was maintained during the lightning season of 1913 with a record of disturbances from lightning as given in the accompanying table, which has been compiled from the station log sheets.

On an examination of the tabulated figures it will be seen to be evident that during nineteen lightning storms, each lasting over three hours on the average, there were only four service interruptions, each of one second duration only, which means practically no interruption at all. A most significant fact is the complete absence of insulator failures, especially in a territory which has become notorious for the severity of its lightning storms.

It may be of interest to note that the grounding rheostat with the above-described interconnection between it and the line switches has also given important service during the construction of the transmission line. This line was originally built with a single three-phase circuit in order to allow of discontinuing steam operation at the substation at the earliest possible moment. Immediately after this first circuit was placed in operation a second circuit was strung on the same towers. By keeping the conductors of the second circuit well grounded no harm befell the linemen and practically uninterrupted service was maintained throughout despite fifty or more accidental grounds caused by the second line coming in contact with the live line due to strong winds.

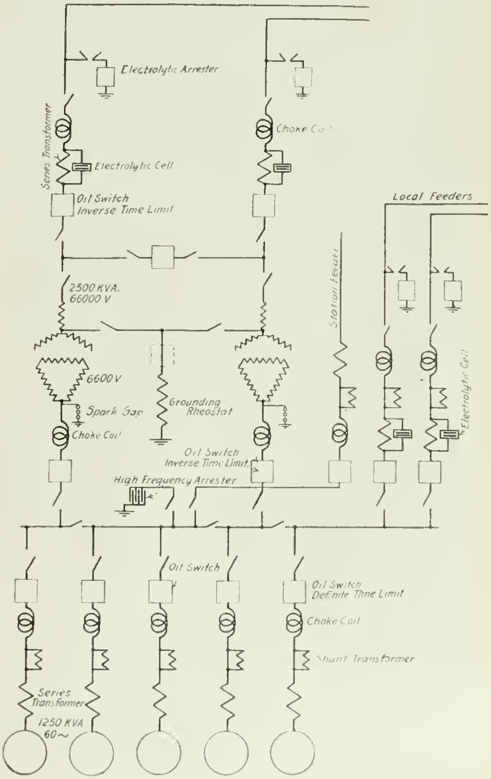


FIG. 3—STATION WIRING DIAGRAM OF PENINSULAR POWER COMPANY

From the above it appears that with an equipment as described practically absolute continuity of service can be maintained in a grounded system without interfering with the convenience of operation or endangering the equipment.

Design of High-Tension Porcelain Insulators

Mechanical, electrical and commercial considerations which must be taken into account in the design of pin-type and suspension-type insulators—Characteristics of various types. By Walter Claypoole

THE modern high-tension insulator, though far from perfect, is still a very fine product of skilful design, excellent material and careful manufacture. In fact, it may be said that the upper limits of pressure on transmission lines will not be fixed by the limitations of the insulator itself but more probably by prohibitive coronal losses. The design of a high-tension insulator presents peculiar problems which are not rendered any simpler by the fact that the voltage is alternating.

The designer must take account of the following considerations: Dielectric strength of air; dielectric strength of porcelain; surface resistance of porcelain—wet, moist, dirty, etc.; capacity effects within the insulator itself; capacity effects as between the insulator, line and earth; ionization of air in contact with highly charged surfaces. Moreover, the designer should not lose sight of the fact that the insulator must be sound mechanically and capable of production at a reasonable price. However, the question of cost, though of great interest to the financial backers of the line, should not be allowed first place.

The most suitable material from every point of view for the construction of a high-tension insulator is porcelain. It has a high dielectric strength and can be produced in an absolutely non-porous form. Compared with glass its surface is very much less hygroscopic, and it has considerably more mechanical strength. When made of carefully selected materials and under suitable conditions its good qualities are permanent and do not appear to change in the least under continued electric stress.

As is well known, two principal patterns of insulator are used for high-tension work, namely, the pin type, which is useful up to about 60,000 volts, and the suspension type, used for higher pressures. The necessity for the latter type arises from the fact that high pressures call for excessive size and therefore weight, when single units are employed, and it is easier to take care of a high tension, such as 100,000 volts, when it is divided among several insulators in series.

In designing an insulator the point of view should always be the break-down pressure and not the line pressure—what the insulator will withstand, not what it should withstand. The break-down of the line at an insulator may be temporary or complete. When the porcelain suffers puncture the air-flash path of perhaps a foot is reduced to only an inch, so that an insulator which would withstand 100,000 volts becomes a species of arc lamp operating somewhere in the neighborhood of 10,000 volts. Such complete break-down can be remedied only by the replacement of the piece which is defective.

In some cases a "flash-over" followed by a "dynamic arc" may cause interruption and it is often an even chance whether or not the porcelain shells survive the heat of the arc. However, such an accident need not necessarily mean complete disablement. Very often the insulator is adequate for the normal voltage and breaks down again only on the occasion of a surge or other abnormal condition.

Design Tests

The following values arranged in order of increasing magnitude are those usually specified: Wet flash-over pressure; dry flash-over pressure; puncture pressure. Of these the first and third, which are of prime importance, are defined thus: "Wet flash-over" pressure, or "rain test," is the applied pressure at which a spark passes from the line to the pin over the surfaces and edges of the insulator when it is subjected to a fine rain driving at an angle of 45 deg. from the vertical and in quantity equivalent to a precipitation of 1 in. in five minutes. "Puncture pressure" is the voltage at which an actual rupture of the porcelain dielectric occurs. On making a puncture test on a properly designed insulator it must be immersed in transformer oil so that a flash-over cannot take place, the puncture pressure being much higher than the flash-over pressure.

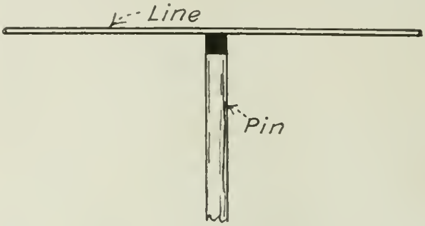


FIG. 1—PORCELAIN BLOCK BETWEEN LINE AND PIN

Opinions as to suitable factors of safety differ. At the higher pressures, especially, a compromise is reached between what is commercially possible and what is demanded by the particular exigencies of the case.

Generally accepted ideals, with the line pressure as unity, are: Wet-test flash-over, 2; dry-test flash-over, 3; puncture pressure, 4.

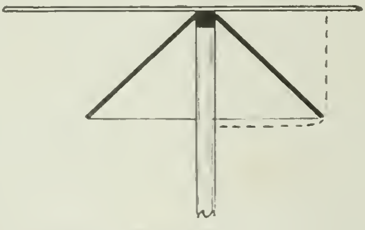


FIG. 2—DEVICE FOR INCREASING FLASH-OVER VOLTAGE

Quality of Porcelain and Its Effect on Design

The design of an insulator involves questions of weight, wall thickness and extent and arrangement of leakage surfaces, the object in view being the attainment of maximum resistance to flash-over and puncture, combined with high mechanical strength and minimum weight. The weight, of course, cannot be unduly diminished, as this would involve mechanical weakness as well as liability to puncture, but, speaking generally, it should be as low as is compatible with safety in these two directions. The weight of an insulator for a specified voltage depends primarily on the resistance to puncture possessed by the porcelain. This figure differs for materials of different origin and manufacture and appears to depend very largely on the quality of the china-clay, one of the three ingredients. Silica and felspar as found in various parts of the world are very much more uniform than is china-clay. The last-mentioned, being a disintegration product, possesses qualities analogous to those brought about by "aging," and the date of the deposits undoubtedly largely affects the character of the manufactured porcelain. The kaolins of Ohio, Germany, France and China are all different and valuable in their several ways. German porcelains possess qualities particularly suiting them for electrical use.

The china-clay that is found in certain deposits in the neighborhood of Carlsbad is remarkably free from metallic deposits and is of a very homogeneous character. These natural attributes are enhanced by special manufacturing methods whereby a still further degree of purity and density of body is arrived at. German porcelain generally has the reputation of possessing extremely high dielectric strength. Certain Bavarian porcelains in plates 1 mm thick will not puncture below 10,000 volts and in 10-mm plates will withstand 80,000 volts. These figures are not possible with porcelains of American manufacture, among which it is rare to find a sample of higher dielectric strength than 55,000 volts for a 10-mm plate.

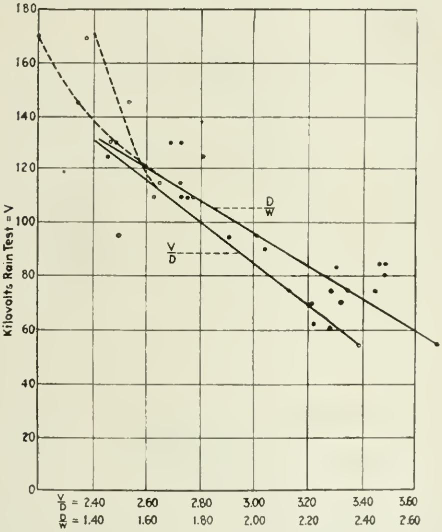


FIG. 3—FLASH AND DESIGN FACTORS OF TWENTY-FIVE PIN-TYPE INSULATORS

Elements of Design

In designing an insulator for a specified voltage the first dimension to be settled is the shell thickness between the live line and the earthed pin. The thickness will depend on the known value of the dielectric strength of the porcelain and should be sufficient to withstand from four to five times the line voltage. Liability to puncture, however, is not confined to the head. The petticoats are also vulnerable, and insufficient thickness here will involve the risk of fracture on the occurrence of a heavy surge.

When material of high specific dielectric strength is available, a lighter construction is possible, and experience has shown that in such cases if the piece be designed with petticoat walls sufficiently thick to insure adequate mechanical strength, the electrical qualities will also be entirely satisfactory.

The next consideration of design is the extent and arrangement of the leakage surfaces.

The shells or petticoats perform two functions:

1. The surface resistance is increased by the increase in the leakage path.

2. The voltage required for flash-over is increased by extending the air-flash path.

Fig. 1 shows diagrammatically a line and a pin separated by a small porcelain block. Suppose this to be 0.5 in. thick and of the same diameter as the pin. The puncture distance, flash distance and leakage distance are in this case all equal, and while 0.5-in. porcelain would withstand a puncture pressure of 100,000 volts, it is evident that with this arrangement flash-over would occur much below 20,000 volts. In any case the small leakage path would soon acquire a film of dirt sufficiently conducting to allow the passage of a pilot current which would be immediately followed by a flash-over and an arc. The flash-over might occur at quite a low voltage if sufficient time were allowed for the growth of the surface film.

The obvious improvement, as shown in Fig. 2, is to extend the porcelain into the form of an umbrella so as to increase both the leakage distance and the air-flash path. The latter is shown dotted. It is obviously quite easy by this means to increase the air-path resistance to a value equivalent to the dielectric strength at the head, thus making it an open question whether break-down will take place through the porcelain or round the edges.

When the porcelain shell is perfectly clean and dry the flash will be entirely through the air, but in any other event it may strike on to the surface, preferring the easier path of the dirt film. When the insulator is exposed to rain, the outside surface of the petticoat becomes a partial conductor and the air-flash path is correspondingly reduced. In the limit, the flash may be considered as taking place between the edge of the shell and the pin, thus reducing the flash-over voltage practically by one-half.

Still further improvement is possible. It will be found that if the insulator in Fig. 2 be put into service its usefulness will decrease with time owing to the inadequate leakage path. Pilot sparks, taking advantage of the semi-conducting film, will enable flash-over to occur at lower and lower voltages. The addition of a second petticoat suitably arranged, while adding nothing to the dry flash-over voltage, will considerably improve the performance when wet and enable the insulator to withstand service conditions which would otherwise be too severe for it. Additional shells mean still greater leakage path, but the very considerable increase in weight is not usually justified.

Design Characteristics of Pin-Type Insulators

Three quantities of prime interest are:

Rain-test voltage = V
Leakage distance = D
Total weight = W

It is convenient to call $D \div W$ the design factor and $V \div D$ the flash factor.

The two elements entering into the production of a first-class insulator are high-grade porcelain and good electrical design. The better the material, the higher it is possible to make $D \div W$, and the better the design, the higher will be the ratio $V \div D$. If for a completed range of insulators the above two ratios are plotted each with respect to V, it is possible to discover which units of the series are correctly and economically designed. It is evident that porcelain of constant electrical quality should permit the construction of a range of insulators the design characteristics of which follow some definite law.

Examine the group of points representing $D \div W$. Assuming perfection of design, it should be possible to draw a curve through all the points. Each insulator should have a mutual relationship with every other in the series. The more erratic the design the more difficult will it be to draw the representative curve.

In Fig. 3 the full points show the ratio $D \div W$ plotted against V for twenty-five different insulators of the same make, covering a range from about 50 kv rain test to 170 kv. The ratio $D \div W$ is expressed as the leakage distance in inches divided by the weight in pounds.

It will be seen at once that the designs are very erratic. There are, for instance, eleven insulators, covering a voltage range from 60 kv to 85 kv, which occupy a considerable area. The center of the group is somewhere in the neighborhood of 75 kv, and $D \div W = 2.34$. As there happens to be an insulator at this point, the curve has been drawn through it.

Further up the series there are two insulators for 130 kv and one for 125 kv, which obviously have little relation to the rest of the series. If a straight line be drawn from the insulator at 54 kv to the intersection of $V = 120$ and $D \div W = 1.60$, it will represent the grouping fairly well.

For those insulators lying near this curve the ratio $V \div D$ is marked by circles. The result shows that a straight line can be drawn to cover the insulators at 54 kv, 75 kv, one of the two at 110 kv, and that at 115 kv. There are thus four insulators out of twenty-five which are covered by both curves, and observation will show that no other regular curves can be drawn to cover any insulators other than these same four. A simple proof of this statement can be obtained by the aid of Fig 4. This gives the ratio of flash-factor to design-factor for each of the twenty-five insulators in the list, and a curve has been drawn through the points representing the above selected four insulators. These are shown in full black. Suppose now any other selection whatever be made of points on Fig. 4 through which a curve can be drawn and the same points located on Fig. 3; it will be found that they can be joined only by zigzag lines. In other words, their design follows no regular law. The author contends that the insulators found on *both* ratio curves are designed on economical and sound lines.

The ratio curves would furnish an equation illustrative of both the excellence of the material and the skill of the designer. Their slope and position would depend partly on the high dielectric strength of the porcelain and partly on the cleverness of the design. Consistency of design would be shown by the large proportion of insulators lying on both curves.

Reverting to Fig. 3, it is instructive to notice one of the three insulators listed at 95 kv. It lies on the $D \div W$ curve, but is very wide of the $V \div D$ curve; whereas the value of $V \div D$ at 95 kv should be 2.86, the flash-factor is only 2.50. This insulator would seem to be very badly designed. According to dimensions given in the manufacturer's catalog, it has a leakage distance of $95 \div 2.5 = 38$ in., a weight of 19 lb., and flashes wet at 95 kv, whereas a correctly designed unit should withstand the same test with a leakage distance of $95 \div 2.86 = 33.3$ in.

Suppose now an attempt be made to improve this unit and bring it into conformity with the rest of the series. The reduction of D will naturally reduce W if the thickness of the material remains the same. It is probable that the considerably reduced leakage distance, even with improved shape, will involve some reduction in the wet test voltage. Suppose this is now 94 kv. The curve shows that the value of $D \div W$ should be 2.03 and of $V \div D$ 2.88. To satisfy the latter value, D would have to be 32.7 in, and this being supplied in the other ratio $D \div W$ makes $W = 16$ lb.

The first and second designs therefore stand in the following manner:

1. Bad shape: $D = 38$ in. $W = 19$ lb. $V = 95$ kv.
2. Good shape: $D = 32.7$ in. $W = 16$ lb. $V = 94$ kv.

It is evident that the great increase of the flash-factor while keeping the design-factor nearly constant can only be brought about by careful re-design of the insulator. There is another unit in the series which could be greatly improved with a little alteration. One of the three at 130 kv has the following ratios: $V \div D = 2.46$; $D \div W = 1.47$. Its weight is 36 lb. and leakage distance 53 in.

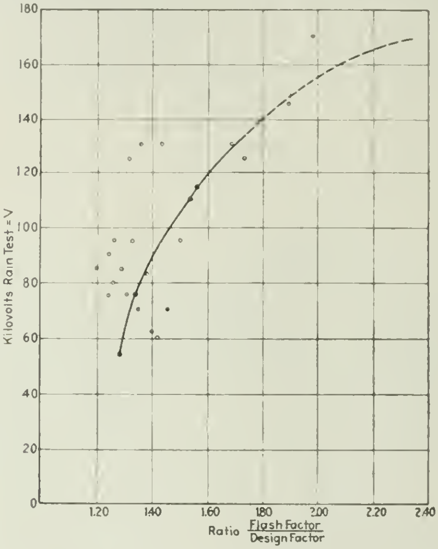


FIG. 4—METHOD OF SELECTING BEST DESIGNS IN A GIVEN SERIES

To put both points on the straight lines representing the respective ratios would mean that D must be 54 in. and W 37.5 lb. Putting about 0.5 in. on the edge of a shell, thus adding 1.5 lb. to the weight, would suffice to place this insulator in its proper location in the series.

Above 120 kv the straight-line ratio laws appear to break down. This result would lend force to the argument that the pin-type insulator is only suitable up to line emf of about 60,000 volts. The $D \div W$ ratio has been continued dotted through the insulators at 130 kv, 145 kv and 170 kv. There is a steady curvature away from the voltage ordinate; that is to say, the $D \div W$ ratio is greater than it should be for any particular voltage. At the same time the corresponding values of the ratio $V \div D$ are not only higher than they should be; they are also erratic.

From what has gone before the following conclusions can be drawn:

1. The leakage distance is much too small ($V \div D$ too high).
2. The weight has been unduly cut down ($D \div W$ too high).
3. The petticoats are unskilfully designed ($V \div D$ points badly placed).

The curve in Fig. 5 has been drawn to represent the relation of weight to rain-test voltage, the weight for each voltage being calculated by reference to the ratio curves in Fig. 3. For instance, at 100 kv Fig. 3 gives the value of $V \div D$ as 2.79, so that D should be 36 in. At the same voltage the value of $D \div W$ is 1.91, so that the weight should be 19 lb. In the same way values of W have been calculated for all other voltages. The actual catalog weights of the insulators were then plotted, the four selected units from Fig. 3 being shown by open circles.

The dotted continuation of the curve in Fig. 5 was laid down on the assumption of straight-line ratio laws carried beyond 130 kw.

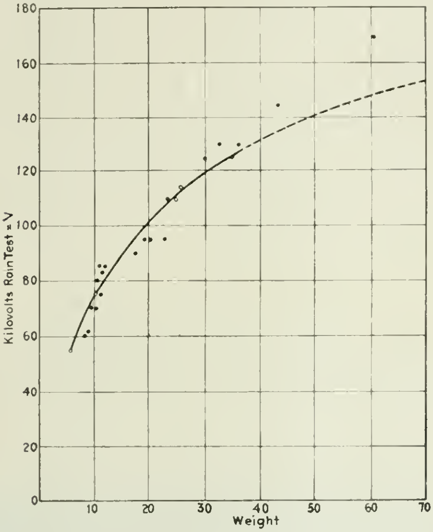


FIG. 5—WEIGHT CURVE APPLYING TO BEST DESIGNS SHOWN IN FIG. 3

Suspension Insulators

There are sufficient arguments in favor of suspension insulators for extra high-tension without dwelling on the ease with which a line can be fitted for higher voltage by adding units to the string. Notwithstanding belief to the contrary, this is not a favorite amusement of distributing engineers.

No line can be made immune from trouble. All that can be done is to adopt systems and designs which costly experience has shown tend in the general direction of that happy state. It is, above all, important to guard against the complete hold-up of the line which follows on the destruction of an insulator. The delays and expense consequent on this event are so serious as to lead to the adoption of heroic measures, such as the installation of arcing rings, the use of a ground wire above the line, and so on. The temporary break-down which accompanies flash-over is unimportant so long as the porcelain survives. Careful design of the units, individually and as a string, will enable heavy arcs to be withstood practically without damage.

Suspension insulators follow three main types—plain disk, corrugated disk, and two-piece cemented. For a given wet "flash-over" test the plain disk has the least weight and the corrugated disk has the least diameter. The cemented two-piece is a heavy pattern, but for extra high voltages fewer units in series are required than if either of the other types is used. The plain disk pattern is simple and appears to hold the arc less than does the corrugated style, but it is hardly suited for use on extra-high-tension lines.

The insulator of the future will have to be capable of doing good service on lines operating at line pressures of at least 150,000 volts. What the upper limit will be for commercial transmission does not appear at the moment to be agreed on, but may possibly be as high as 175,000 volts.

An insulator string suitable for such a line pressure would have to withstand a wet test of 350,000 volts. It is practically certain that there does not exist at present a suspension-type insulator of sufficient stamina to qualify for use on a tension as high as this. It is not merely a question of adding units on a string. That seven times 50,000 equals 350,000 is true for most things, but not for volts across wet insulators in series.

The specifications would have to embody provisions such as these:

1. The individual unit must have a high wet flash-over, perhaps in the neighborhood of 70,000 volts.
2. There should be an extra high safety-factor against puncture. Each unit should withstand a puncture pressure equal to the line voltage.
3. The design must involve a reasonable certainty that puncture will never occur in service owing to the facilities afforded for quick relief by flash-over.
4. The string must withstand the heating effect of heavy arcing.

Motor-Driven Garbage Disposal Plant

An electrically operated garbage-disposal plant recently constructed in San Francisco converts refuse of vegetable or animal composition into useful commercial products. Grease is extracted and sold to soap-manufacturing firms, while the bones and vegetable parts are made into fertilizer. All operations in the plant from the time garbage is received until the converted product is shipped away are performed by individual-motor-driven apparatus.

Refuse is collected at night in 5-ton inclosed-tank-type motor trucks. On arriving at the plant the tanks, which are detachable, are hoisted to the top of the building by a motor-driven crane and dumped into steam-jacketed closed tanks, where the refuse is boiled for five hours. The mass is then compressed to extract the water and oil, which are afterward separated from each other by skimming. To drive off the remaining moisture in the solid matter it is fed through rotating boilers by helical screws.

From the boiler the mass is transferred on a conveyor to tanks containing gasoline, which absorbs all of the remaining oil and grease. By distilling the solution in a small refinery the gasoline is afterward reclaimed and used over again. The dried material, after being passed under powerful electromagnets to remove any nails or can covers, is pulverized and mixed with chemicals making a valuable fertilizer.

The disposal plant is exceedingly well lighted both inside and outside, 25-watt to 100-watt tungsten lamps being used and requiring in the aggregate about 5 kw. Energy for these lamps and for the 100 hp in motors is furnished by the Pacific Gas & Electric Company.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

No Customer Too Small at Warren, Ohio

As examples of the thoroughness with which the new-business department of the Trumbull Public Service Company has combed the city of Warren, Ohio, for electrical customers, the illustrations shown herewith are of interest. No user seems to have been too small to escape the attention of the company's active salesmen. In reality, however, the portable lunchwagon, shown in Fig. 1, furnishes an even more attractive load than might be supposed at first sight, for on the exterior of this tiny shelter about forty 10-watt tungsten lamps have been installed. The interior is also electrically lighted. Not more than 50 ft. away a diminutive news-stand, built on the curb line, receives service over a similar connection. Energy for the lamps is taken from an overhead circuit through an improvised swinging connection, a wooden separator such as is often used in arc-lamp loops being used as an aerial cross-arm from which the service wires drop directly into the shelter. An attachment plug above the portable lunch wagon allows the circuit to be interrupted at this point when the owner is obliged to take his wagon temporarily to another location.

FIGS. 1 AND 2—CENTRAL-STATION CUSTOMERS AT WARREN

Where Individual Drive Would Have Saved Money

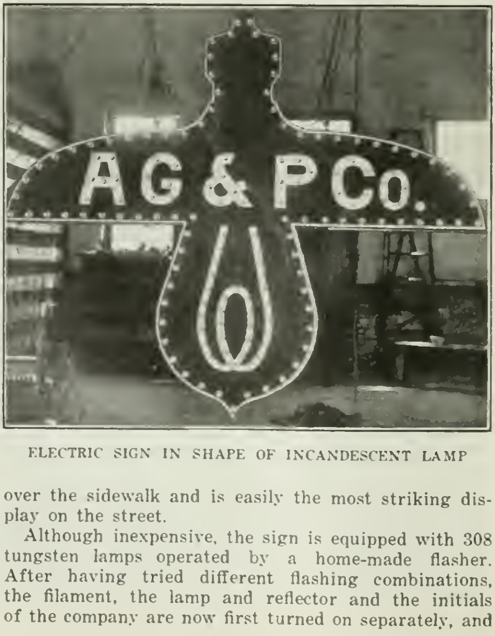
Lack of available funds sometimes prohibits equipping machinery with individual motor drive even when the economies effected by such installation would offset the first cost in a short time. But this reasoning should be modified when the use of line shafting necessitates the remodeling of a building to provide safe hanger supports.

In a certain old machine shop the use of individual motor drive was held to be impossible because of the expense, so line shafting was decided upon. As the building was old and showed signs of failure, it was found that 28-in. by 36-in. ceiling girders would have to be installed independent of the building to support the shaft hangers. Instead of reversing the original decision at this point and using individual drive, the steel work was installed at a total cost of $14,000, or about $215 per hp of shafting required. This shortsightedness in the use of funds can probably be attributed to the red tape which usually attends the issuing of requisitions from a purchasing department.

As has often been pointed out, line shafting costs money and involves a power loss in transmission of between 25 per cent and 40 per cent. Moreover, shafting detracts from the appearance of a shop, shuts off light, decreases the liability insurance rates, and requires considerable upkeep and attention. To operate one machine from a group-drive shaft the entire system has to be kept running, while with individual drive only the active machines require energy, thus eliminating considerable friction loss each day. With individual motors the output per machine attendant has in many cases been increased about 15 per cent to 20 per cent.

At the Sign of the Electric Lamp

Hanging in front of the office of the Alliance (Ohio) Gas & Power Company is an electric sign made in the shape of an incandescent lamp and reflector, which leaves no doubt in the mind of the observer as to the character of the business conducted within. The sign, measuring about 12 ft. from tip to tip, extends well out over the sidewalk and is easily the most striking display on the street.



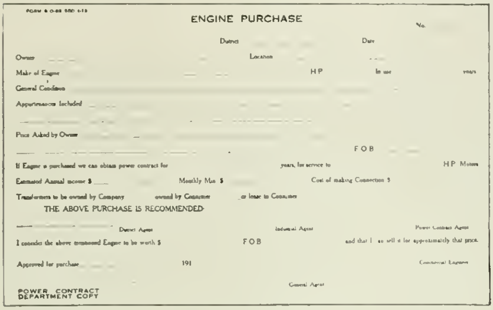
ELECTRIC SIGN IN SHAPE OF INCANDESCENT LAMP

Although inexpensive, the sign is equipped with 308 tungsten lamps operated by a home-made flasher. After having tried different flashing combinations, the filament, the lamp and reflector and the initials of the company are now first turned on separately, and then finally the whole appears. Construction of the flasher has been made as simple as possible, the unit consisting of a small motor driving a bicycle wheel, to which is back-geared a drum carrying the copper contactors.

Removing Obstructions to Business

By S. M. Kennedy

In connection with the development of a motor load for a central station there are two fields for exploitation. The first is the selling of electrical energy for operating the plants of new enterprises, where the owners must decide whether they will use electric drive or generate their power by means of steam or gasoline engines. The second is the displacement of private plants by the installation of central-station service.



ENGINE PURCHASE

No.

District Date

Owner Location

Make of Engine HP In use years

General Condition

Appurtenances Included

Price Asked by Owner

FOB

If Engine is purchased we can obtain power contract for years, for service to HP Motors

Estimated Annual income $ Monthly Min. $ Cost of making Connection $

Transformers to be owned by Company owned by Consumer or lease to Consumer

THE ABOVE PURCHASE IS RECOMMENDED

District Agent Industrial Agent Power Contract Agent

I consider the above mentioned Engine to be worth $ FOB and that I can sell it for approximately that price.

Approved for purchase 191 Commercial Engineer

General Agent

POWER CONTRACT DEPARTMENT COPY

FIG. 1—FORM USED FOR PURCHASING ENGINES

When an electric company has framed properly constructed schedules, adapted to the needs of each class of consumers, and the owners of new enterprises are approached in the right manner, there is usually not much difficulty in closing a contract for electric service, for in such cases no investment has been made by the prospective consumer in engines, boilers and like equipment. But the case is entirely different where there is a more or less effective installation to displace and an investment already made has to be discarded and in its stead the owner must consider the expenditure of new capital. The representatives of the electric company may be able to show the owner of the plant a decided saving in operating costs by means of central-station service, but frequently he must consider seriously the question of loss on present equipment and the additional investment involved in making a change, even though the change may be for the better. With many concerns this condition is the cause of long delay before electric service is finally installed, and private plants are often patched up and held onto long after the period of their normal efficiency has been passed.

The problem of finding means to hasten these changes is one with which many central-station managers have wrestled, and any plans toward this end which have proved successful are usually studied with interest. The longer the prospective consumer who owns a private plant delays in making the change to central-station service, the more it is costing him in unnecessary operating expenses and the more it is costing the electric company in loss of income. In many cases if the old plant were out of the way the change would be easy to make. Then comes the query, How much can the prospective consumer afford to lose on his old plant, in order to make the change to electric drive and how much can the electric company afford to pay in order to obtain the new business? In most cases of this sort, where the original investment is not too heavy, there is some plane upon which the two sides may get together and come to an understanding which will be mutually satisfactory.

Displacing Gasoline Engines

One of the larger companies operating in the West, whose lines cover a wide territory, has been working on a plan for the displacement of engines for the past two years, and the results achieved are reported to be highly satisfactory. In the territory covered there had been installed a great many engines burning gasoline and distillate, which operated fairly cheaply because of the prevailing low prices of these fuels. These engines were largely used in the cities and towns in driving the machinery of industrial plants and in the rural districts for operating pumping plants for water companies and private irrigating systems. Many of the plants were put in before the company's lines had reached the localities, and many others were installed in competition with electricity at a time when rates for service were not as favorable as at present. The gasoline or distillate engine has many advantages and has done excellent pioneer work, but it has its limitations. At times it will balk and kick and even refuse to go at all. As it becomes older it needs many repairs and replacements and usually causes much trouble to its owner. The easy operation of an electric motor is not overlooked by the owner of an engine, and usually he is not hard to convince that a change would be a good thing. But there is that engine which he already owns blocking the way. Along come the persuasive salesmen and practical engineer from the electric company! For the sake of convenience these public benefactors have classified the owners of engines as follows:

(a) The man who can afford to discard his present equipment and investment and forget it.

(b) The man who will install electric drive but likes to hold on to his present equipment for emergency purposes.

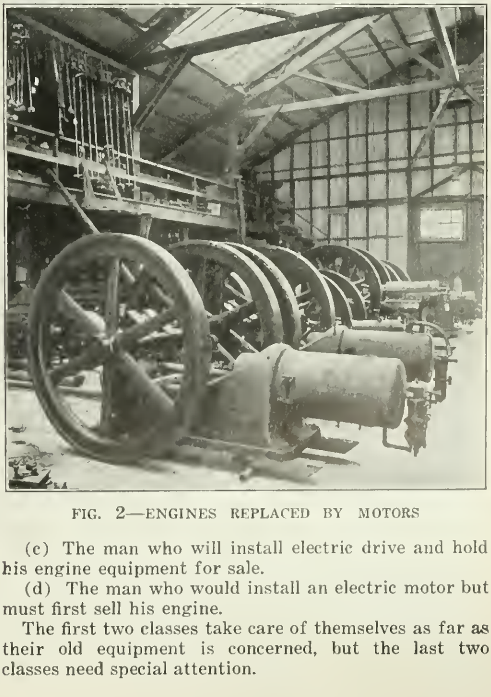


FIG. 2—ENGINES REPLACED BY MOTORS

(c) The man who will install electric drive and hold his engine equipment for sale.

(d) The man who would install an electric motor but must first sell his engine.

The first two classes take care of themselves as far as their old equipment is concerned, but the last two classes need special attention.

Buying Business

The company referred to discovered that a large income was being lost because many more or less feeble engines were standing in the road. Accordingly, a new department was organized and authority was given to tie up a portion of the company's working capital temporarily in the purchase of engines from owners who would use electricity. As a matter of fact, through this department the company was not purchasing engines—it was really purchasing business. The new department bought the engines as nearly as possible at their depreciated value and resold them as nearly as possible at the purchase price. The loss in turning them over was the price paid for the business.

The engine-selling department had two missions, namely, to sell engines on account of owners who had installed electric service and whose engines were held for sale and to resell engines purchased outright by the company. Engines were only purchased by the company when the business could be obtained by no other means.

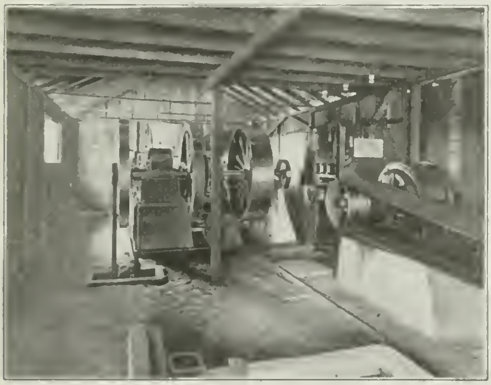


FIG. 3—MOTOR INSTALLATION SUBSTITUTED FOR OLD ENGINES

The accompanying form was prepared, and on one of these every engine purchased had to be reported and approved. It will be noted that many features were taken into consideration in addition to the condition of the engine and the price at which it could be purchased. The principal items were the income value of the business and the investment required to reach it. If these two details were harmonized, it was not a difficult matter to close an agreement covering the purchase of the engine and the installation of electric service in the plant of its former owner.

From March, 1912, to October, 1913, a period of nineteen months, the electric company purchased on its own account a total of 123 engines, with a combined rating of 3228 hp, for the sum of $34,183.83. In place of these engines purchased, the company contracted for service to approximately the same amount of horse-power in electric motors, with an estimated annual income of $64,920. Nearly all of the engines so purchased have been resold at prices which represent an average loss to the company of $22 on each engine, or, rather, that was the average amount paid by the company to buy the business—not a large amount when placed alongside the estimated annual income.

During the same period the company's engine department sold 137 engines on customers' accounts, the company acting solely as agent for the owner of the engine and making no charge for its services in bringing about the sale. The 137 engines sold for customers had a combined rating of 3796 hp. In their stead electric motors of a combined rating of 4044 hp were installed, and the estimated annual income to the company on these installations was $80,119. Summarized, the total sales of the engine-selling department for the period stated were 260 engines having a rating of 7029 hp. In their place, the company installed a like number of motors with approximately the same rating and representing a total estimated annual income for service equal to $145,039.

The foregoing figures do not cover all the engines displaced by the company for the period referred to. There were many others which were disposed of by their owners or held for emergency purposes. The sales mentioned were all made through the company's own organization.

Disposing of Old Engines

Engines purchased by the company are usually assembled in a warehouse provided for handling and selling them. Considerable care had to be exercised to see that all the parts and appurtenances were shipped in with each engine, otherwise deductions had to be made for missing parts when reselling. The average price at which the department aims to resell is on the basis of $10 per hp. All engines are sold for spot cash and no commission is paid in connection with any sale. The engine-selling department advertises engines for sale in papers which circulate in the communities it is desirable to reach. Advertisements are not inserted in the company's name. It not infrequently happens that a prospective purchaser of an engine who is on the company's lines will be induced to change his mind and sign an agreement for electric service to do the work an engine was originally intended to do. When a man calls to inquire about an engine the first question he is asked is where he wants to use it. If his location is beyond the company's sphere of influence, the negotiations proceed. If within the territory supplied with service by the company, the negotiations stop right there and then. No engines are sold by the department where the company's electric service may be obtained.

Where, then, are these engines resold? In the West there are many territories which are opening up into which no electric company has yet extended its lines. In such fields power is needed for development work, and the gasoline engine temporarily meets the requirements. The engine department finds a steady demand for certain sizes and types of engines and has little difficulty in making sales. Sometimes a resold engine may get under the lines of some other company in a distant field, but such sales are not encouraged. Those in charge of the engine department cannot know exactly where each engine is to be installed, but they do know that each engine sold goes away from the particular territory supplied by the company, and to the best of their ability the engines are steered toward territory where electric service is not available.

Cold Storage of Food-Stuffs

BY SYDNEY F. WALKER

In adjusting the temperature of cold-storage compartments the greatest care must be taken to obtain temperatures appropriate for the particular foodstuffs preserved. Some substances may be actually frozen, while others must not. Beef, for instance, may be frozen, but it commands a higher price if it is only chilled. For retail butchers' use such chilling is usually sufficient. Fruit must not be frozen. Fish, on the other hand, should be subject to a special method of freezing, being first allowed to assume the condition of "rigor" and then subjected to a low temperature, though not actually frozen. If it is subjected to a low temperature before the rigor sets in, it will not keep well, and if the rigor is allowed to pass before the low temperature is applied it will not keep at all.

One should also constantly remember that cold storage will not make bad produce good. Cold storage will preserve the qualities of good produce, but it is not every kind of fruit that can be cold-stored. Not every apple, for example, is suitable for such preservation. Nearly every kind of soft fruit has been kept in cold storage with success, but so far as the writer is aware tomatoes have never been successfully handled in this way.

New Business Activities at Canton, Ohio

A canvass to discover the number of customers already using electric service and the number of "prospects" available has just been completed by the new-business department of the Canton (Ohio) Electric Company. With the data obtained from this canvass as a basis, the company is now circularizing the prospective customers besides inaugurating both a better-lighting crusade and an electric-sign campaign.

If it is possible to secure the co-operation of Canton manufacturers using central-station service, each will be asked to exhibit his particular line of manufactured products in the electric-service company's windows for one week. As Canton is the home of many factories, these window displays promise to be both interesting to the passing public and profitable to the central station. Mr. R. E. Lane is in charge of lighting solicitors in the company's contract department.

Central-Station Service in New Chicago Hotel

The newest of the large "downtown" hotels of Chicago is the Fort Dearborn Hotel, at the corner of West Van Buren and South LaSalle Streets. This hotel was opened on March 23. The building is eighteen stories high and contains about 500 rooms all with private baths or lavatories. With equipment the hotel is said to have cost $1,250,000. It is operated by the Hotel Sherman Company as a moderate-priced hotel built in accordance with modern ideas.

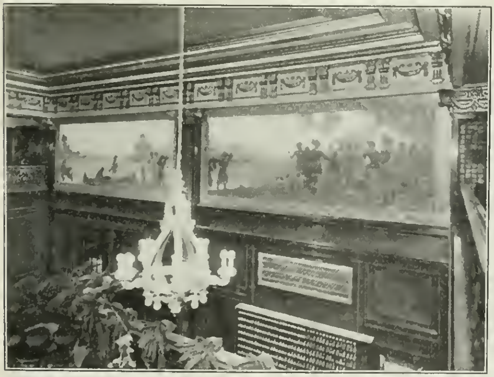


FIG. 1—CONCEALED LIGHTING OF MURAL PAINTINGS

Electricity for this hotel is supplied by the Commonwealth Edison Company. About 5200 25-watt tungsten lamps are required for lighting, in addition to about 600 10-watt lamps used in electric signs and decorations. There are three electric passenger elevators, as well as a freight elevator and a service elevator running from the kitchen to the main dining room on the mezzanine floor. The total rating of electric motors used to operate these elevators is 140 hp. Electric motors used for general purposes are rated at 110 hp, so that the total rating of motors in the establishment is 250 hp. Direct current is used.

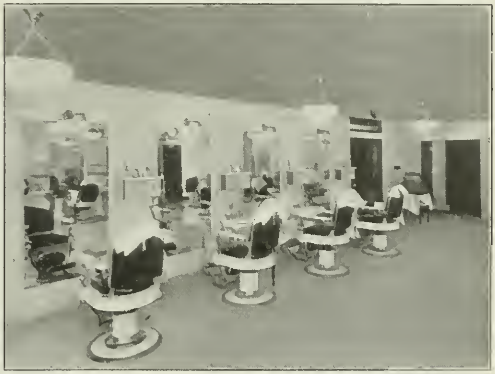


FIG. 2—BARBER SHOP, SHOWING LIGHTING FIXTURES

On the first and second floors there are a number of artistic lighting fixtures, all of which were furnished by the T. W. Wilmarth Company, of Chicago, which specializes in hotel lighting fixtures. The entrance is on South LaSalle Street, fronting the LaSalle Street station of the Lake Shore and Rock Island railroads. A marquise over this entrance is outlined in electric lamps. Indirect lighting is employed in the barber shop.

In the sub-basement the mechanical equipment consists of high-pressure boilers for steam heating and for supplying steam to such of the pumps as are steam-driven. There are also vacuum pumps for cleaning purposes, a modern refrigerating plant and complete air-washing and ventilating apparatus. The elevator machinery is also placed in the sub-basement.

In the passenger elevators a special safety feature is provided. There is a door in one side of each car, which can be opened by the operator, giving access into another elevator in the adjoining shaft in case of accident by which a car may be caught between floors.

The bedrooms are provided with a central-dome lighting fixture, and beside each bed is a small stand carrying a reading lamp. This stand also serves for the telephone. Above each dresser are two bracket fixtures with pull-chain sockets, and there are also similar bracket fixtures above the mirror in the bathrooms.

All the ventilating fans are electrically driven. The ventilating system has been made as flexible as possible in order to be adjusted to varying conditions of outside weather and temperature and also to provide for economical operation.

Mural paintings in the lobby and bar-room of the hotel add an artistic feature. They represent scenes about old Fort Dearborn at the mouth of the Chicago River, after which the hotel is named, or they have to do with historic incidents in the history of Chicago. Special concealed electric-lighting arrangements are employed with excellent effect for the illumination of these paintings.

Illumination and Wiring

Electric Lighting of the Lynn Shore Boulevard

Electricity has superseded gasoline in the illumination of the famous ocean boulevard at Lynn, Mass. With the change this spacious drive and promenade has achieved a marked increase in popularity. The stretch of boulevard from Washington Street to Monument Square was formerly lighted by forty-four double-unit Welsbach gasoline lamps of the mantle type carried 12 ft. above the street surface on posts 11 ft. high. These gas lamps were rated at about 30 cp each, but the illumination between adjacent pairs of lamps was so dim that it was impossible to take a photometer reading at the mid points. In place of these units there have now been installed twenty-eight 320-watt, 4-amp General Electric ornamental luminous-arc lamps placed at distances of 250 ft. to 300 ft. apart and elevated 18 ft. above the boulevard surface. The distance from Washington Street to Monument Square is about 1.5 miles.

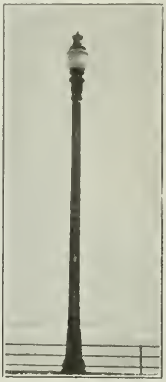


FIG. 1—LUMINOUS-ARC LAMP

The boulevard is under the jurisdiction of the Metropolitan Park Commission of Boston and has a tarred macadam surface with driveway 40 ft. wide, an intermediate planting space 30 ft. wide and a 15-ft. promenade flanked by a seawall. The new lamps are carried on Lundin fluted poles and are supplied with energy by cable run in underground conduit. Inside each pole 15 ft. of duplex No. 10 cable was installed, and in addition to the lamps used on the above section of the drive twelve others were erected in the district adjacent to the state bath house. Five of the latter are to be burned from dusk until midnight between June 1 and Dec. 1, and the remainder of the lamps are to be burned nightly from dusk to dawn throughout the year. The bases and tops of the poles are of iron, the shafts being of wood in accordance with the Massachusetts statute. In the entire installation 9435 ft. of conduit and 10,413 ft. of No. 8 underground cable were used. The Lynn Gas & Electric Company defrayed the cost of installation, and charges for all-night service at the rate of $90 per lamp per year. This is about 20 per cent less than the corresponding cost of operation with the gasoline lamps, which had to be filled daily by a ladderman.

Illuminometer measurements taken down the center line of the drive with the former gas lamps in service gave readings averaging 0.03 ft.-candle opposite the lamps on the edge of the drive and 0.01 ft-candle opposite lamps placed on the promenade. With the present electrical installation readings of 0.37 ft.-candle are obtained opposite the lamps at the center of the drive, and 0.018 ft.-candle halfway between the lamps. Additional tests on the promenade show 0.8 ft.-candle opposite the lamps and 0.027 ft.-candle at points half-way between. In other words, twelve times the former illumination is obtained by the present arc lamps.

The underground conduit construction was greatly facilitated by close attention to the organization of the force, and in the first ten days after the job was started the following work was done: Turf cut and removed. trench dug, conduit laid in trench, drawing-in wire pulled in, joints of conduit cemented, concrete foundations for bases poured, cable drawn in with windlass, and tripod and bases set and leveled. The poles are set on concrete foundations about 18 in. deep. Harrington drive joints are used in the conduit, which is of the single-duct type. The bases of the posts are grouted to the foundation by cement. The pole shafts were erected by a tower wagon. The trench dug was about 1 ft. in width by 18 in. in depth, the turf being cut by a home-made cutter illustrated on the opposite page.

The tool mentioned consists of a hinged frame pivoted at the bearings of two edged wheels of iron plate 1 ft. in diameter, the frame being 3 ft. 6 in. long, 18 in. wide and operated by two men. When not in use the handles are folded. With one line of the proposed trench laid out, the turf can be cut with great speed by pushing the cutter along the trench location with one wheel following the line. Since the completion of the new lighting much appreciation of the improved illumination has been expressed by drivers. Popular enjoyment of the surf on the beach has been enhanced, since under the old arrangement the beach was at night ordinarily too dark for enjoyable bathing or for the purpose of those who like to watch the breaking surf.

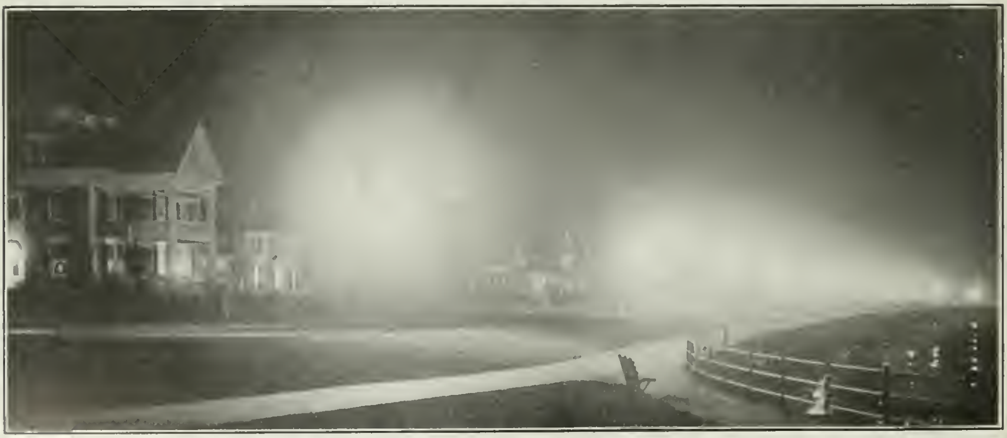


FIG. 2—NIGHT ILLUMINATION OF THE LYNN SHORE BOULEVARD

FIG. 3—SHORE DRIVE LIGHTING, SHOWING REPLACED GAS FIXTURES, LYNN SHORE BOULEVARD

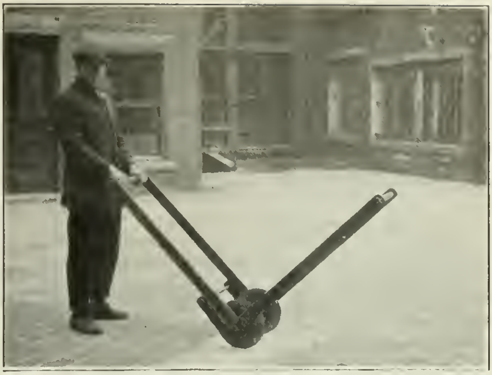


FIG. 4—TURF CUTTER USED IN TRENCHING, LYNN SHORE BOULEVARD

Springfield (Mass.) Street-Lighting Rehabilitation

Prof. Harry E. Clifford, of Harvard University, has been retained by the city of Springfield, Mass., to work out a comprehensive plan of illumination for the municipality in connection with the expiration on May 1 of the present street-lighting contract with the United Electric Light Company. Preliminary studies indicate that magnetite-arc lamps installed on poles of French architectural design will be used extensively. Special attention will be given to the lighting of the down-town district in the vicinity of the new Municipal Group and to the illumination of residential sections by incandescent lamps carefully adapted to the local requirements.

Wiring Already-Built Houses in St. Louis

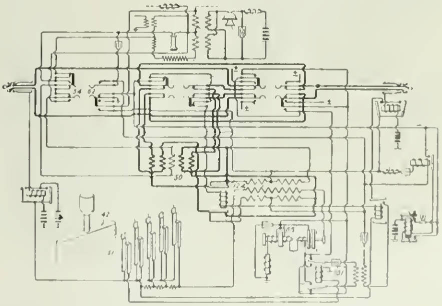
By means of newspaper advertising and circularizing, as well as by personal solicitation, the Union Electric Light & Power Company, of St. Louis, is pushing with energy a campaign to bring about the wiring of "already-built" houses. It announces that the owner can make a start by wiring five rooms on the same floor of his "already-built" house for a sum as low as $17.95, and this may be paid one-tenth when the work is completed and the remainder in twelve monthly instalments. The company has issued an interesting illustrated pamphlet on the subject. With the prefatory remark that the probable reason why the owner of a house does not enjoy the benefits of electricity is because the dwelling was built before electricity had been brought within the reach of the masses of the people, as at the present time, it is pointed out that the wiring will not injure the house, while the benefits and pleasures of using electric lighting and electric appliances are described. Representatives of the company will call on the householder in the evening if desired. A schedule of prices for wiring is given, and these are the actual prices charged by the electrical contractors of St. Louis for doing the work. The company does not add anything to cover interest, labor, advertising or other expenses. The whole of the "personal letter" sent out by the company and bearing a fac-simile of the signature of Mr. F. D. Beardslee, who is the sales manager, is couched in most convincing language, and it is not strange that excellent results are being obtained from this intelligently conducted campaign.

Recent Telephone Patents

Mr. J. G. Blessing, of Chicago, has patented an improvement in automatic systems which consists of combining in one apparatus both a slow-acting and a normal relay. This relay differentiates the quick impulses of the moving sender dial from the slower or longer impulse of the dial when coming to rest. The patent for the system including this improvement is assigned to the Automatic Electric Company.

Repeater Circuit

A complete circuit system for a two-way repeater is described by Mr. H. E. Shreve, of Millburn, N. J., in a patent granted to him and assigned to the Western Electric Company. Provision is made for a supervising telephone instrument and a means for adjusting the apparatus as indications in this supervising receiver demand. The repeater is arranged in a cord circuit as shown in the cut, the repeater being shown at 88. At 124 is shown the repeating coil, through which the repeater acts in the opposite direction. At 50 is a repeating coil dividing the line into two sections for the purpose of repeating. This coil has an extra winding exposed to the coils of both line sections. If the receiver is connected to this winding by the key at 54 interference will be ascertained by means of the receiver. The key at 42, with its co-acting springs, serves to adjust the disturbance by changing the power of the repeater, by inserting resistance and by reversing the polarity of the repeater. The slider of the key has two heights. With one height the resistance spring alone



TELEPHONE REPEATER SYSTEM

is affected, and with the other the reversing springs at 41 are also moved. The reversing springs affect the relays at 131 which make the reversal. At 62 a "talk-and-listen" key is provided, the throwing of which automatically cuts out the repeater.

Letters to the Editors

The Low-Priced Electric Vehicle

To the Editors of the Electrical World:

SIRS: I cannot agree with the conclusions of Mr. John H. Hertner, whose communication was published in the *Electrical World* of Feb. 21, that no demand exists for a low-priced electric vehicle. Such a condition may obtain in Cleveland, but for every city of the size of Cleveland there are twenty-five whose population does not exceed 2500 to 5000 people and in which the average resident lives upon an income of about $1,500 per annum—in other words, the class of people which has been buying Henry Ford's low-priced gasoline car.

Mr. Hertner says that the motor-car purchaser has a tendency toward speed mania. This may be true of the people who have been buying and are buying gasoline cars, but how about the large number who have not been buying gasoline cars and would still like to have a motor car and are able to support one? This class includes the wives and half-grown daughters of Mr. Hertner's alleged speed maniacs, and also another group of still greater value to the one-man electric plant. The group referred to embraces the small-town merchant who has to support one or two delivery wagons and is enterprising enough to acknowledge the superiority of motor delivery over horse delivery. I have no doubt that there are hundreds of small-plant managers like myself who have felt the electric vehicle proposition to be absolutely hopeless in their towns. We have sold one 3000-lb. truck in this territory and may sell two or three more. Three different "prospects" who formerly simply ridiculed the idea of an electric delivery wagon whenever it was broached to them at once "sat up and took notice" of Mr. Ford's proposition. In fact, one of them happened to call my attention to the original announcement in a daily newspaper several days before I received my copy of the *Electrical World* with its confirmation of the facts.

Therefore, I repeat, there is a market, and a very attractive one at that, for a low-priced electric vehicle, and I have faith that Mr. Edison and Mr. Ford between them will give us a dependable car. The same thing was said when the low-priced Ford gasoline car was put on the market, yet I find that over 35 per cent of the gasoline cars in this territory are Ford cars.

H. G. OVERBECK,
Glenwood Springs, Col. *General Manager Glenwood Light & Water Company*

Low-Priced Electric Cars

To the Editors of the Electrical World:

SIRS:—Mr. John H. Hertner in his letter published in the Feb. 21 issue of the *Electrical World* showed the attitude of electric pleasure vehicle manufacturers toward low-priced cars. Perhaps the views of a central station serving a total population of 325,000 people would not be out of place, especially at this time when there seems to be some prospect of such a car being produced.

In Providence and vicinity conditions are quite different from those in the Middle West, with which Mr. Hertner is perhaps more familiar. We not only have a field for a good low-priced electric runabout, but we have learned of at least five customers that are waiting to purchase an Edison-Ford as soon as such a car is available.

It may be true that an electric coupé should sell for $2,000 and upward. Such vehicles represent high-class coach work and can be compared only with gasoline vehicles of the better class. A two-passenger runabout represents quite a different proposition. Such a vehicle may be very light, and in this way the cost of tires, batteries, motors, etc., can be considerably reduced. It should be possible to produce a runabout capable of making 60 miles at 20 miles per hour over ordinary hilly country roads and to place it on the market complete with a 40-A-4 Edison battery at a price not exceeding $1,050. It should also be possible to sell the above car without battery at a price not exceeding $500, and there might be an advantage in allowing the customer to purchase the type of battery best suited for his particular needs.

Providence, and, in fact, New England in general, is waiting for such a car. Our territory abounds with gasoline limousines which are owned by a class of people who would not consider driving their own cars. The electric coupé would not fill their requirements in any case, even were it possible to secure the necessary high speed and mileage which they desire. Professional men usually own only one car and feel the need of a gasoline coupé capable of long mileage at high speeds. Both classes could own to advantage a light, inexpensive electric runabout and by the use of such a vehicle could eliminate a great deal of useless wear on the larger and more expensive gasoline car. It would be the extra car for general family use on all except social occasions, and would be much better adapted for short trips about the city.

Such people do not care to spend upward of $2,000 for an electric roadster, as the mileage and speed obtained from such vehicles does not satisfy them. At a reasonable price they would purchase an Edison-Ford.

It is, of course, true that low-priced gasoline vehicles are now purchased by those who can afford to own only one car. Mr. Hertner feels that electric vehicles would not satisfy them, regardless of what price they might be sold for. Perhaps he is right. Personally, I feel that if Mr. Ford were to produce a low-priced electric runabout he might decide to operate these vehicles on the battery-exchange basis so that every owner of an Edison-Ford might for a very nominal sum exchange an exhausted for a fresh battery at any Ford agency. Our own company would be glad to sell energy at a very low price to the local branch should it wish to take up such a proposition.

Our lighting and motor-service customers seem to demand such a car, and the fact that they will not buy second-hand "Stanhopes" of the vintage of 1907 does not disprove this statement. We try not to expect too much of the electric pleasure vehicle manufacturers, but it would please us to know that they are at least inclined to produce a lower-priced vehicle, which up to the present time has not seemed to be the case. Our company has co-operated with the vehicle manufacturers and with the Electric Vehicle Association of America both toward their advertising fund and in many other ways. We shall continue to do all this, and perhaps more, but it would really seem as if the electric vehicle manufacturer should not try to prevent the production of a successful low-priced electric vehicle, as, from the central-station standpoint, this seems to be the only way in which this branch of the business can be developed at a profit.

H. H. SKINNER.
Providence, R. I. *Narragansett Electric Lighting Company*

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

A 675-hp Diesel-Engine Plant as Adjunct to Hot-Water Heating System

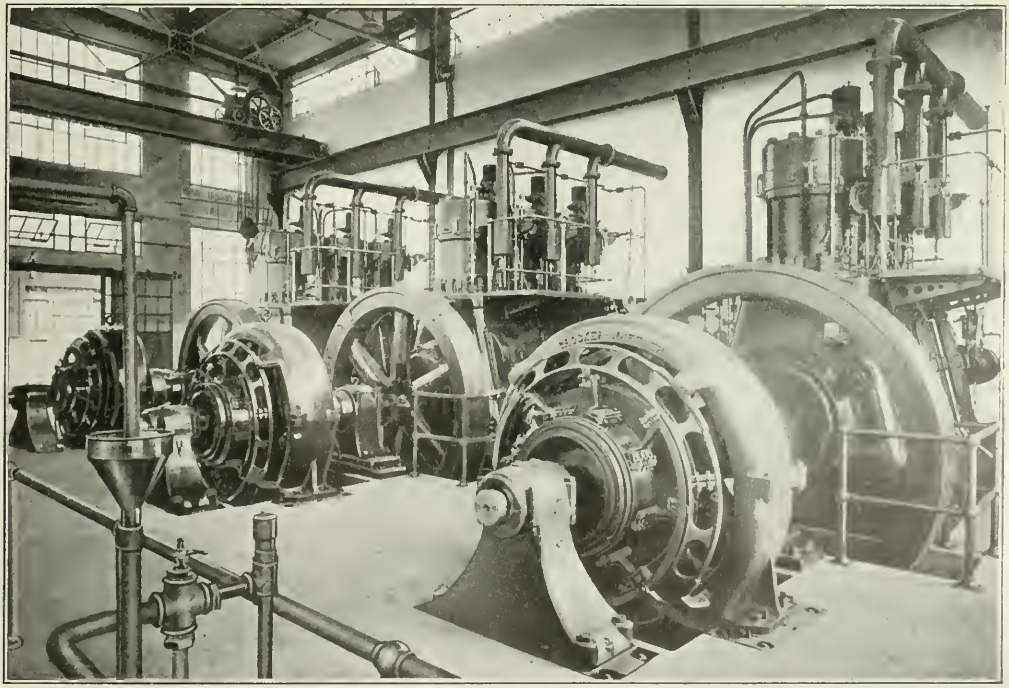
Three four-stroke-cycle 225-hp Diesel internal-combustion engines comprise the present prime-mover equipment in the generating station at the new factory of the Busch-Sulzer Brothers Diesel Engine Company, St. Louis. The ultimate rating of the station, as it now stands is, however, 900 hp, space having been provided for the future installation of a fourth similar engine set. Each of these three-cylinder engine units weighs 90,000 lb. and occupies a space 23 ft. long by 9 ft. 6 in. wide by 12 ft. high.

Two 12,000-gal. fuel-oil storage tanks buried outside the power house near an adjacent railroad siding furnish oil to the engines through pipe lines laid underground. Oil flows by gravity to these storage reservoirs from tank cars on private railroad sidings. Inside the power house this oil is put under pressure and sprayed into the engine cylinder when the piston has completed its compression stroke. This spraying action is sustained over 12 per cent of the working stroke of the piston, the resulting combustion being gradual and not explosive. The engines are started by means of compressed air.

Directly connected to each of these three-cylinder oil engines is a 160-kw, 115/230-volt, three-wire, direct-current Crocker-Wheeler generator operating at 164 r.p.m. Between each engine and generator a 7.5-ton, 9.5-ft. flywheel is mounted, steadying the action of the engines and helping the generators carry instantaneous peaks caused by the starting of large machine tools.

From the generator leads are taken to the seven-panel switchboard which stands about 8 ft. from the north wall of the power house. One panel has been provided for each generating unit and the remaining four panels control the shop motor and lighting circuits. Two air compressors, the cylinder dimensions of which are 10 in. by 6.5 in. by 3 in., are also installed in the station. These units, each belt-driven by 50-hp, 230-volt motors operating at 600 r.p.m., supply air under high pressure for starting the engines and injecting the fuel oil into the cylinders of the engine units in operation. The air-storage tanks stand along the south wall of the room. The entire engine room is served by a 10-ton Whiting hand-operated traveling crane.

In this power house there are two separate systems of water piping. One of these circulates hot water for the heating system, while the other carries cold water to the cylinder jackets of the oil engines. In the latter system water travels by gravity from the roof tank down through the water jackets of the engines, and is



THREE 225-HP DIESEL-ENGINE SETS

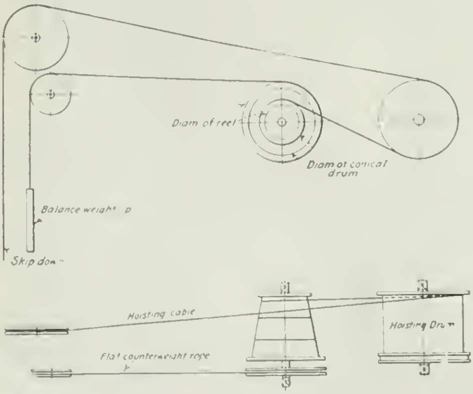
then collected in a 6-in. main and delivered to a motor-driven water cooler. This device, which is something of an innovation, consists of a cylindrical drum, 4 ft. in diameter and 8 ft. long, driven at 6 r.p.m. by a 5-hp, 230-volt motor. The lower side of this cylinder is always immersed in the water returned from the jackets. As the drum revolves it takes up a thin film of water and exposes it to air circulated through the cooler and escaping through a stack. From the rotating cooler the jacket water returns to a concrete jacket-water reservoir to be lifted by motor-driven pumps to the roof tank.

The internal-combustion engines play an important part as pre-heaters for the hot-water heating system which supplies warmth for the factory and office buildings. Gases collected in the exhaust manifolds are conducted into heaters in the boiler room, and water returning from the heating mains is circulated through these gas heaters before entering the steam heaters at the west end of the boiler room. Three 100-hp boilers generate steam at 100-lb. pressure, supplying the hot-water heaters and the steam hammers in the forge shop.

In round figures, the connected motor load of the factory is 1500 hp, the total number of motors being approximately 250. These machines range in rating from a fraction of a horse-power up to 50 hp.

Balancing of Cables for Deep-Shaft Hoists

When electric hoists are operated in shafts more than 3000 ft. deep the weights of the hoisting and counterweight cables become considerably unbalanced and the useless load on the motor is accordingly increased. To compensate for this unbalanced condition the method illustrated herewith may be employed. The hoisting cable passes around the hoisting drum and thence around a conical drum terminating at the smaller end. The counterweight is supported by a flat rope which is wound on a single width reel attached to the same shaft as the conical drum. The conical drum and reel may be designed so that the total travel of the counterweight is less than that of the cage, thereby avoiding the necessity of raising the counterweight entirely to the surface, where it may freeze to the guides in severe winter weather. The operators of the Penn Iron Mines, Vulcan, Mich., where this scheme is employed, recommend that the counterweight exceed the weight of the cage by 800 lb. so that the descending skip will always overhaul the drums. When thus counterbalanced, the loss, neglecting friction, is only about 6.6 per cent of the total energy required to raise a 12,000-lb. cage, as compared with 50.6 per cent when the cables are not balanced.



METHOD OF COUNTERBALANCING IN 3000-FT. SHAFT

Cause of Wrecking of Remote-Controlled Motor

While waiting for the delivery of a centrifugal pump which was to be connected to a 30-hp, 110-volt compound-wound motor, we temporarily connected the motor to a small triplex pump rated at about 8 hp or 10 hp. One day, while operating at this light load and without any warning, the motor was completely wrecked. The brush holders and commutator segments were found about 50 ft. away from the machine and the front bracket was broken. The motor was installed about 575 ft. from the control apparatus and was connected thereto by No. 2 stranded-wire feeders and No. 8 solid-wire field circuits. Is it possible that the commutator exploded and caused the damage? G. G.

The damage was probably caused by the interruption of the shunt-field circuit of the machine with the full 110 volts impressed across the armature. When a break occurs in the field circuit of a direct-current motor (a condition which could easily be brought about by an interruption of your No. 8 line or any of the auxiliary apparatus connected thereto) the current taken by the motor would be limited largely by the resistance of the No. 2 transmission line, 575 ft. in length. As this line has a resistance of say 0.2 ohm, the current could not exceed 550 amp and was probably considerably less. With the shunt-field circuit open the tendency of the machine would be to increase its speed enormously under light load. Probably what happened was that the load allowed the speed to increase until the commutator was thrown apart by centrifugal force.

Temperature Rise of Induction Motor at No Load

We have converted a 20-hp, twenty-five-cycle, three-phase, 550-volt induction motor into a 630-volt machine by rewinding the stator with wire a size smaller and an additional turn per coil. At no load the stator temperature rises from 20 deg. C. to 70 deg. C., while at half load the temperature rises only 5 deg. further after three hours' run. Please explain the cause of heating at no load and state whether 70 deg. is a safe temperature at which to operate a motor. G. W. H

The power-factor of an unloaded induction motor is usually very low and the primary current required to operate it is almost as large as the full-load current, so that heating is not materially different in the two cases. The temperature rise which you quote is not excessively high, 75 deg. C. usually being considered the maximum temperature limit at rated load. It may be possible that one additional turn per coil is not sufficient for the increased voltage and that the magnetizing current is unnecessarily large.

Changing Range of Power Indication

We have a graphic wattmeter which is now capable of recording a maximum of 320 kw when connected to a two-phase circuit through sixteen-to-one series transformers and twenty-to-one shunt transformers. How should the series transformation ratio be changed so that a standard 600-kw chart may be used? H. M

To give full-scale deflection with any chart the power input must be the same for a given graphic wattmeter. The only factor which has to be changed when a different range chart is desired is the meter constant, or product of the series and shunt transformer ratios. To use a 600-kw chart instead of a 320-kw dial, the series transformation ratio will have to be increased in the same proportion provided it is a constant-potential system. Thirty-to-one series transformation will therefore be required with the new chart.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

General Transformer. — Karl Pichelmayer. — A mathematical paper on the theory of the general transformer in its relation to the theory of the ordinary transformer.—*Elek. u. Masch.* (Vienna), March 8, 1914.

General Transformer.—F. Niethammer and E. Siegel.—A further mathematical paper on the transformation ratio of the currents in the general transformer.—*Elek. u. Masch.* (Vienna), March 15, 1914.

Ventilation.—An illustrated article by R. E. Gilman on the essential factors of ventilation of rotating electrical apparatus with illustrations of some of the methods employed in specific cases. In a second article W. W. Stevenson describes the apparatus used for cooling and cleaning the air supplied to two 6000-kva turbogenerators.—*Elec. Journal,* April, 1914.

Lamps and Lighting

Half-Watt Lamp.—H. Remane.—The author discusses briefly the fundamental principles of the nitrogen-filled tungsten lamp. The osram half-watt lamp is now being made commercially in Germany in the following sizes: 300 watts, 600 cp, 50 to 60 volts; 500 watts, 1000 cp, 100 to 130 volts; 1000 watts, 2000 cp, 100 to 260 volts; 1500 watts, 3000 cp, 100 to 260 volts. Diagrams are given showing the distribution of the light from such lamps with and without special reflectors.—*Dingler's Polytechn. Journal,* Vol. 329, No. 4, 1914.

Arc-Lamp Electrodes.—A note on a recent British patent of H. Ayrton (No. 1775, 1913) for negative arc-lamp electrodes. A central core of hard carbon is surrounded by a shell, burning more easily. A closely adhering copper coating is provided.—London *Elec. Eng'ing,* March 26, 1914.

Invisible Light.—W. R. Whitney.—Some brief notes on invisible light in which the author answers a few of the most frequently asked questions about the radiations given by X-ray tubes and radioactive material. Some of the more important characteristics of the electron are cited and its behavior in different media is stated briefly. The similarity and difference between the emissions from radium and X-rays are touched upon.—*Gen. Elec. Review,* April, 1914.

Generation, Transmission and Distribution

Current-Limiting Reactors.—An article by J. N. Mahoney on the effect of limiting reactors on the application of oil circuit-breakers; an illustrated article by J. F. Peters on the construction and design of such reactors; an article by W. M. Dann on the mechanical stresses in the coils. In a further article by F. D. Newburg, W. M. Dann and J. N. Mahoney on generator, reactor and circuit-breaker performances under short-circuit conditions, a full account is given of special tests made primarily to observe the behavior, under actual short-circuit conditions, of current-limiting reactors designed for feeder circuits.—*Electric Journal,* April, 1914.

Electric Supply for the Eastern Provinces of Germany.—Bartel.—An illustrated article on a proposed system of electric supply for three eastern provinces of Germany. It is estimated that Östpreussen needs 60,000 kw, Westpreussen 55,000 kw and Posen 60,000 kw. It is shown that it is out of the question to utilize water-power for this purpose. For Östpreussen and Westpreussen peat is the logical fuel and for Posen lignite. A few large power plants are suggested and an estimate of their cost is given.—*Elek. Kraftbet. u. Bahnen.* Jan. 24 and Feb. 4, 1914.

Electric Hoist.—K. A. Pauly.—An article discussing the advantages of the electric hoist over the steam or air hoist. In the introduction the author points out the fact that since electricity can be far more economically distributed than steam or compressed air it is best adapted to be the motive power in mining. This is especially true when the shafts are widely separated, for individual power-generating stations at each shaft are to be avoided for obvious reasons. Attention is then called to the very low operating efficiency of steam and air engines when carrying such a fluctuating load as a hoist. A full description of the systems of electric drive of hoists then follows; this covers the salient points of safety, reliability, cost of operation and first cost. A table of calculated operating costs of the three kinds of hoist drive, covering a wide range of power and fuel costs, is furnished; and an analytical discussion of this table closes the article.—*Gen. Elec. Review,* April, 1914.

Traction

St. Gothard Railway.—G. Brecht.—The Board of Management of the State Railways of Switzerland has adopted the plan of electrifying a part of the St. Gothard railway. It has been decided that the State should itself erect and operate power plants for the road. The section from Erstfeld to Bellinzona is to be electrified first; it has a length of 110 km (67 miles), of which 28 per cent is tunnel, and it has grades up to 27 per cent. There will be two power plants at Amsteg and Ritom. The speed of the trains is to be considerably increased. The fifteen-cycle, single-phase system will be employed, but no definite decision has been reached as to details. The trolley pressure will probably be 7500 volts for the first section with its many tunnels, but when the electrification has been extended to other sections a pressure of 15,000 volts will be used on the extensions. It is estimated that the annual cost of electric operation will be $1,225,000, against $1,277,500 for steam operation. Electric operation is, therefore, estimated to yield a saving of $52,500 per year. The cost per kilowatt-hour supplied to the locomotives is estimated to be 1.03 cents. The two power plants will be equipped with 8000-hp, 8000-volt generators. For transmission 60,000-volt cables will be employed. For the return current the rails are to be used, connected to a special return circuit. At present electric locomotives will be used throughout, but when the electrification is extended to Lucerne motor cars will also be employed. The high-speed locomotives will be rated at 3000 hp each and will be run at speeds up to 90 km (54 miles) per hour.—*Elek. Kraftbet. u. Bahnen,* Feb. 24, 1914.

Storage-Battery Motor Cars.—M. Büttner.—There are at present in use about 200 storage-battery motor cars on trunk railroads in Germany. This includes 176 motor cars on the Prussian-Hessian state railways. A sketch is given of the development of the storage-battery motor car and the results obtained with it are said to be quite satisfactory.—*Elek. Kraftbet. u. Bahnen*, Jan. 4, 1914.

Automatic Signals.—G. Kemann.—The conclusion of his very long, detailed and profusely illustrated report summing up the preliminary studies made for the introduction of the automatic signal system on the Berlin elevated road and subway.—*Elek. Zeit.*, March 26, 1914.

Installations, Systems and Appliances

Birmingham.—An illustrated article on recent extensions of the electric supply department of Birmingham, England. The supply started in 1889. There is a supply of direct current on the three-wire system at 440 volts for lamp and motor circuits, a direct-current supply at 550 volts for traction, and a three-phase supply at 5000 volts for transmission to the outlying districts, where it is transformed to direct current on the three-wire system at 440 volts for lighting and industrial purposes and to direct current on the two-wire system at 550 volts for traction. The total rating of the station is now 36,500 kw. The last two machines installed were 5000-kw turbo-alternators.—London *Electrician*, March 27, 1914.

Bristol.—An article illustrated by diagrams showing the gradual increase of electricity supply in Bristol, England. The supply was begun in 1892 and a diversified demand exists for industrial, commercial and residential supplies. Three distinct systems of distribution are in operation, single-phase at 210 volts and 105 volts, ninety-three cycles; direct-current at 500 volts and 250 volts, and three-phase at 365 volts, fifty cycles. A series of diagrams showing the gradual development of the business emphasizes a relatively large drop in cost in 1913-14 due to an abnormal increase in energy sold. A considerable acceleration of growth has marked the last three or four years, and this is thought to be the result of the inauguration of an active sales department.—London *Elec. Times*, Feb. 5, 1914.

Electric Heating and Cooking.—Profusely illustrated notes on recent progress in the use of electric heating and cooking in the West End of London. From the results obtained in twenty-one typical electric cooking installations it is stated that the average cost per person, when charging 1 cent per kw-hr., works out at 2.2 cents per day.—London *Elec. Times*, Feb. 19, 1914. Illustrated notes on progress of electric cooking at Derby are given in *Elec. Times*, Feb. 26, 1914. Various special new commercial heating appliances with reference to exposed grill elements versus protected grill elements are given in London *Elec. Times*, March 5, 12 and 19, 1914.

London.—An editorial on proposed schemes of amalgamating the different London electricity supply companies into one company.—London *Electrician*, March 20, 1914. Various notes on the same subject in London *Elec. Times*, Feb. 12, 26, March 5, 12, 1914.

Sheffield.—The conclusion of the illustrated article on electricity supply at Sheffield, describing the new extensions under way at the Neepsend station, the equipment of substations and the rates charged consumers.—London *Electrician*, March 20, 1914.

Protective Resistances.—Bruno Bauer.—A theoretical article on the use of series protective resistance in connection with high-tension oil switches.—*Elek. Kraftbet. u. Bahnen*, March 14, 1914.

Electromagnetic Brakes. — Ernst Schwarz. — A mathematical article on the calculation of electromagnetic brakes for cranes and hoists.—*Elek. u. Masch.* (Vienna), March 18, 1914.

Electrophysics and Magnetism

Magnetic Properties of Iron When Shielded from the Earth's Magnetism.—A note on a recent (British) Royal Society paper by E. Wilson in which the author stated that when iron is subjected to a considerable magnetizing force a species of polarization is produced which has the effect of reducing the permeability and increasing the dissipation of energy due to magnetic hysteresis for given values of the magnetic induction. The residual effects can be removed by careful demagnetization or annealing. It was thought by analogy that the earth's magnetic force would also have a polarizing influence upon exposed iron, and this was the subject of the present paper. An effort was made to remove the residual effects of the earth's magnetism by placing the specimen, which was of ring form, in a magnetic shield and carefully demagnetizing it. The magnetic properties of the material were then examined in the usual manner with a ballistic galvanometer, and a comparison was made with those obtained from the exposed or unshielded specimen. It was found that the permeability of freshly demagnetized and shielded iron, corresponding to a given value of the magnetic induction, was considerably larger than in the case of the unshielded specimen. In stalloy the ratio of the permeabilities has a maximum of 1.79 when the magnetic induction is 172. The permeability rises to a maximum of 5900, and one would anticipate a considerably larger initial permeability than is generally supposed. The permeability was examined after varying periods of rest when the specimen was in a carefully demagnetized condition, and it was shown that its values gradually decrease as the duration of rest increases. The dissipation of energy due to magnetic hysteresis was examined when the magnetic induction had values as low as 0.68. It is well known that the Steinmetz index tends to increase as the lower forces are approached. The experiments indicate that the index tends again to diminish both in shielded and unshielded iron.—London *Electrician*, March 27, 1914.

Units, Measurements and Instruments

Convection Galvanometer.—W. H. Eccles.—In an article on some instruments for high-frequency currents and voltages the author describes some convection galvanometers. These are instruments in which the energy dissipated in a resistance wire is measured by allowing the wire to warm the air surrounding it and then observing the convection currents set up. In the author's instrument the microbalance is applied to the measurement of minute convection currents in gases. The horizontal torsion fiber *AB* (Fig. 1) was of glass about 18 cm long. A tapering tubular glass lever *CD* was about 12 cm long. This was balanced on the torsion fiber and fixed to it by aid of a minute plate of mica and thin shellac varnish. Beneath the thin end of the lever was placed the wire carrying the current under measurement. It is essential to have the convector wire adjustable laterally so that the lever may be in the middle of the convection current. Perhaps the best form for the heater is an isosceles triangle of

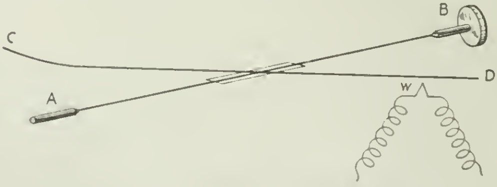


FIG. 1—CONVECTION GALVANOMETER

about 15 deg. vertical angle. If the heater is a piece of platinized quartz fiber, this forms one side of the triangle and a very thin piece of copper wire the other side. It is not good to have the heater wire horizontal. When using the instrument the movement of the end of the lever must be observed by means of a horizontal microscope provided with an eyepiece scale. With such an instrument the full deflection is attained in less than half a second, and on stopping the current the lever returns to its zero accurately in three or four seconds. The calibration curve of a particular instrument is shown in Fig. 2. The converter was a platinized quartz fiber of 4140 ohms resistance; its upper end was between 1 mm and 2 mm below the lever. Using a microscope magnifying only twenty diameters, the smallest readable deflection was produced by a current of about 10 microamp, which corresponds to an energy consumption of four ergs per second. This instrument was unable to perceive the energy of a single discharge of a condenser even when this was raised to 1000 ergs. The necessary convection current does not become established in the short time of the discharge. With a more recent instrument which the author has not yet thoroughly tested, a fraction of a microampere can be detected.—London *Electrician*, March 27, 1914.

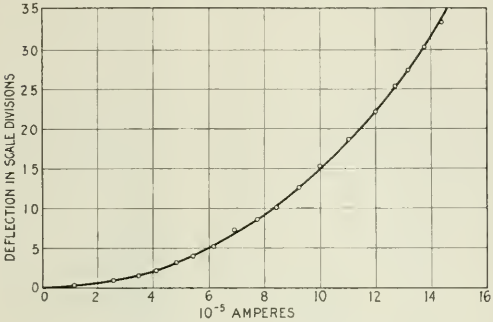


FIG. 2—CALIBRATION CURVE OF GALVANOMETER

Measuring Transformers.—H. GEWECKE.—A long article illustrated by diagrams in which the author discusses the operation of measuring transformers and especially the variation of the transformation ratio and the angle between primary and secondary currents or emfs. The discussion is based on the general transformer diagram, from which special vector diagrams are derived. Several zero methods are discussed by means of which the transformers can be tested carefully. Some practical hints are added.—*Elek. Kraftbet. u. Bahnen*, March 14, 1914.

Testing Iron.—J. F. VAN LONKHUZEN.—After a brief reference to several laboratory methods for magnetic iron tests, the author describes a differential method for commercial purposes. He emphasizes that especially with the new special silicon steels for electrical purposes continuous control by magnetic tests is very important.—*Mitteil. Siemens & Halske*, January, 1914.

Telegraphy, Telephony and Signals

Gott System of Submarine-Cable Telegraphy.—An illustrated article on the method of telegraphy through long submarine cables devised by John Gott, whose death recently occurred. The principle of the method is that the direction of the current is changed after each signal by means of a polarized relay, through which the cable is discharged. Fig. 3 shows a cable arranged for duplex working. The cable itself is shown at *a* and the artificial cable at *b* with its unconnected end earthed. Between the real and the artificial cable is inserted the receiving instrument *v*, as in the ordinary duplex system. The transmitting key *d*, however, is arranged so as to connect *e* either with *g*, as when at rest, or when depressed at *f* with *j*, as when sending a signal. Both these connections lead to the polarized relay *h*. On pressing the key the cable is put into connection with the movable tongue *h''*, and through it with one of the stops *h'*, each of which is connected with one pole of the split battery at *l* or *l'*, the center of the battery being earthed at *M*. Thus depressing the key charges the cable with a polarity depending upon which of the stops *h'* the movable tongue *h''* is touching. On permitting the key to return to its normal position contact is made at *g*, causing the cable to discharge through the polarized relay, and the direction of the current is always such that it causes the movable tongue to pass from one step to the other, reversing the polarity of the battery connection in readiness for the next signal. Thus successive impulses are always of different polarity, and the discharge from the cable is utilized to effect this reversal, at the same time restoring the cable to a natural condition, so that rapid signaling is possible. A modification of the sending method involves the use of a transformer in connection with the polarized relay, as shown in Fig. 4. The condenser and cable are earthed directly at *g'* after each signal and while the key is open. The split battery is earthed at *E* through the primary coil *P* of the transformer. The coils of the polarized relay are in connection with the secondary of the transformer *S*, and the contact point of the key *f* is connected through the movable tongue *h''* with the stops that in turn are connected with the split battery. The function of the transformer is to induce in the secondary coil, which is connected with the coils of the relay, a current that will send the tongue over against one of the stops and hold it there. Releasing the key will cause a current of opposite polarity to flow through the relay, sending the tongue over against the opposite stop, as

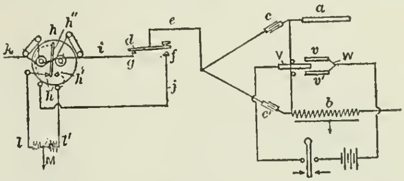


FIG. 3—APPARATUS ARRANGED FOR DUPLEX OPERATION

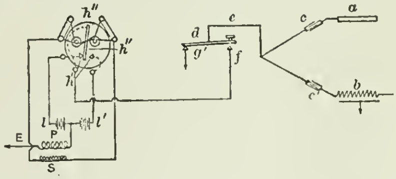
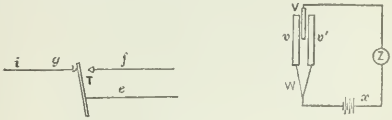


FIG. 4—MODIFICATION OF SENDING EQUIPMENT



FIGS. 5 AND 6—RELAY, AND RECEIVING SYSTEM

described above. An advantage claimed for this method is that on making contact with the key to charge the cable the battery contact in the relay is reinforced at the moment the key is depressed, thus insuring perfect transmission. To substitute for the hand key the tongue of the relay of a land line is very simple, as is shown in the diagram (Fig. 5), where *T* takes the place of the key *d*. Automatic transmission is also possible, using the Wheatstone transmitter. To understand the receiving system the diagram (Fig. 6) should be examined in connection with that of the sending station. At *v*, where the siphon recorder ordinarily is placed, a similar instrument provided with a contact-making tongue attached to the moving coil is used. This tongue or arm makes contact with either *v* or *v'*, depending upon the polarity of the current coming through the cable. These plates in the instrument are connected at *w* and are in circuit with the local battery *x* and a sounder or recorder at *z*, which, however, may be a relay or any desired instrument. While the contact piece at *v* will move from one side to the other, depending upon the polarity of the arriving current, the effect on the local circuit will be the same in either case, and the dot or dash is sounded or recorded just as in ordinary Morse working.—London *Elec. Review*, March 20, 1914.

Effect of Meteorological Phenomena of Wireless Telegraphy.—PAUL LUDEWIG.—An account of an extended investigation, the chief results of which are as follows: The intensity of signals received at a receiving station from the same transmitting station is practically constant during the day. During the night it varies enormously and is greater than during the day, sometimes four or eight times as great. During the day wireless messages can be transmitted over longer distances by the use of longer wave-lengths; no such relation holds good during the night. At sunrise and sunset the amplitudes of the signals vary very considerably. All these phenomena manifest themselves the more clearly the greater the distance between the two stations. An eclipse of the sun acts in a way similar to sunset. The intensity of the waves received during the day is little affected by the season of the year. The influence of the moon and of the aurora borealis is not yet sufficiently explained. The latter is said to dampen sometimes the effect and sometimes to increase it; it certainly has a considerable effect. The damping of the transmitting station varies during the day by 20 to 30 per cent.—*Elek. u. Masch.* (Vienna), March 8, 1914.

Miscellaneous

Protective Devices.—W. WOLF.—An article, illustrated by diagrams, on recent progress in protective devices for protecting switchboard and measuring instruments against high voltages.—*Elek. Kraftbet. u. Bahnen*, Jan. 24, 1914, and Feb. 4, 1914.

German Electrical Industries.—A continuation of the concise reviews of the status of the different electrical industries of Germany in 1913. C. Buschkiel deals with the uses of electricity in agriculture, A. Kussler with electric hoisting and transportation installations, W. Philippi with electricity in mining and metallurgy, Stauch with the use of electricity on board ship.—*Elek. Zeit.*, March 26, 1914.

Pichelmayer.—A review by Ossana of the life and work of the late Karl Pichelmayer, professor of the Institute of Technology of Vienna, with his portrait.—*Elek. u. Masch.* (Vienna), March 8, 1914.

Waltenhofen.—An account with portrait, of the life and work of the late A. von Waltenhofen, formerly professor of physics and electrical engineering at Innsbruck.—*Elek. u. Masch.* (Vienna), March 15, 1914.

Book Reviews

ELEMENTARY THEORY OF ALTERNATE-CURRENT WORKING. By Capt. G. L. Hall. London, England: The Electrician Printing & Publishing Company, Ltd. 196 pages, 130 illus. Price, $1.50.

An elementary textbook on alternating currents and alternating-current machinery, intended for the use of students acquainted with the principles of direct-current machinery and circuits. The mathematics employed are simple and reliance is placed upon mechanical analyses to explain many of the phenomena of alternating-current circuits. Vector diagrams are also used to advantage. The eleven chapters of the book relate to the following subjects: Alternating currents; inductance; capacity; resonance; power measurement; polyphase systems; transformers; generators; synchronous motors; induction motors; commutator motors. In spite of the elementary character of the treatment the book is characterized by a directness and precision of statement and definition which more advanced textbooks might well imitate. The chapters on alternating-current motors are particularly helpful and well prepared. The book will commend itself to a large circle of electrical students.

PUBLIC UTILITIES: Their Cost New and Depreciation. By Hammond V. Hayes. New York: D. Van Nostrand Company. 262 pages. Price, $2.

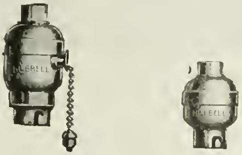
Writing from the standpoint of the engineer, the author still feels that the engineer must have sufficient knowledge of the legal questions at issue to enable him to obtain the figures needed by courts and commissions that determine fair present value. He argues that the appraiser should not ascertain fair present value, as that is a function of court or commission, but should ascertain accurately the necessary figures of value and loss of value; that original cost can be obtained without inordinate difficulty and is important to those who determine fair present value, and that "depreciation is affected only indirectly by inefficiency and that, as a necessary consequence, depreciation is dependent wholly upon the relation of the age to the life of the perishable property." The author, however, qualifies his limitation upon the ascertainment of fair present value, which he considers as the function, not of the engineer, but of the court or commission. In his extended discussion of fair present value he says that the legislature, commission or undertaking itself should consider this value as the amount of money expended in good faith and with reasonable judgment in construction of the property in use and serviceable for the public at the time of investigation, provided that value has been maintained by proper reserves for renewals. This value then would be used as a basis for rate-making to yield a fair return. If "proper reserves for renewals" had not been maintained, would "fair present value" be reduced by the amount that, in the judgment of the final authority, should have been set aside for that purpose but was not? A plant may be operating at full efficiency, yet be without reserves and therefore obtain a valuation less than enough to yield a fair return upon the cost determined as to other respects in accordance with this definition. The difficulty which has been experienced so often in the effort to determine original cost arises from incompleteness of records. There are so many elements of depreciation that it is impossible, within the scope of a brief review, to discuss them adequately. Much of the discussion of the author is admirable and, although every treatment of the great topics involved is open to question from some standpoint, the work is an important contribution to public-utility literature.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Pull and Keyless Sockets

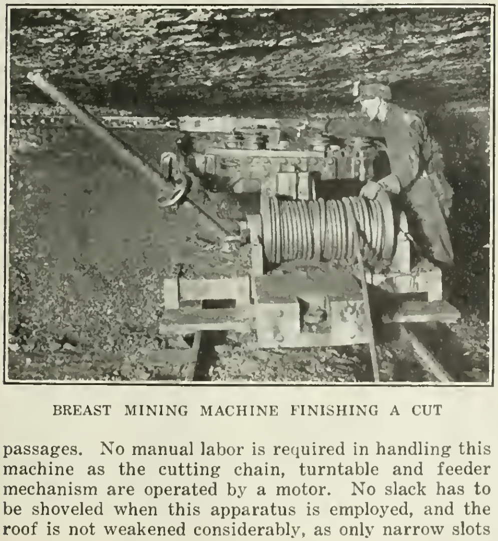
Small pull and keyless sockets with bases designed particularly for use in and about automobiles and motor boats have been put on the market by Harvey Hubbell, Inc., Bridgeport, Conn. The mechanism of the pull socket is similar to that of other pull sockets of this manufacturer. The device is equipped with double-plunger contacts, which, when depressed by inserting the lamp, cause sufficient tension against the base of the lamp to prevent its jarring loose. Double phosphor-bronze springs working in opposite directions and having sufficient rigidity to hold the lamp securely in the offset slots are used with the keyless sockets. The shell and cap of the pull sockets are fastened together by screws, and those of the keyless socket by a sliding catch.



FIGS. 1 AND 2—PULL AND KEYLESS SOCKETS

Motor-Driven Top-Cutting Mining Machine

In the accompanying illustration is shown a recently developed motor-driven top-cutting machine for use in coal mines. It consists of a breast machine mounted on a turntable truck so that it can be employed in narrow passages. No manual labor is required in handling this machine as the cutting chain, turntable and feeder mechanism are operated by a motor. No slack has to be shoveled when this apparatus is employed, and the roof is not weakened considerably, as only narrow slots are cut in the wall. Machines of this type can be inverted to cut away a dirt band at the top of a seam. A gathering locomotive is required to transfer this cutter from one place to another, but similar apparatus is manufactured which is self-propelling. The type shown herewith, employing a gathering locomotive to make transfers, will cut as many as forty 12-ft. walls in ten hours, while self-propelling machines will cut twenty-four to thirty places in the same time. This machine is built by the Jeffrey Manufacturing Company, Columbus, Ohio.



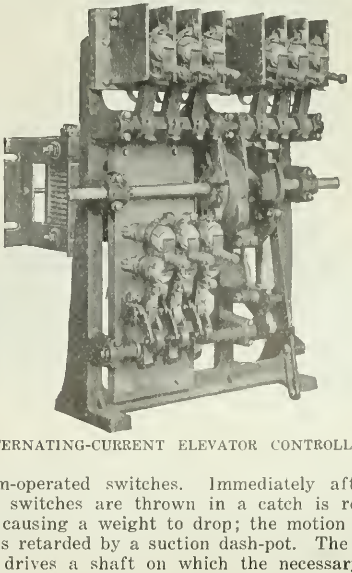
BREAST MINING MACHINE FINISHING A CUT

Alternating-Current Elevator Controller

A mechanical-type elevator controller for alternating-current equipment is being placed on the market by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. This controller is designed for polyphase slip-ring induction motors. No electromagnets or sliding contacts are employed. The device can be worked from the car by rope or lever, the shaft being provided with an extension at each end so that the controller can be adapted for either right-hand or left-hand operation.

The primary circuit is controlled by two sets of switches, each set consisting of three single-pole switches equipped with arcing shields. Each set of primary switches is operated by a special internal cam, which is designed to give an absolute "knock-out" to the switches when opening and an absolute "lock-out" for the second set of switches when the first set is thrown in.

The secondary resistance is cut out by three triple-pole cam-operated switches. Immediately after the primary switches are thrown in a catch is released, thereby causing a weight to drop; the motion of this weight is retarded by a suction dash-pot. The weight in turn drives a shaft on which the necessary cams

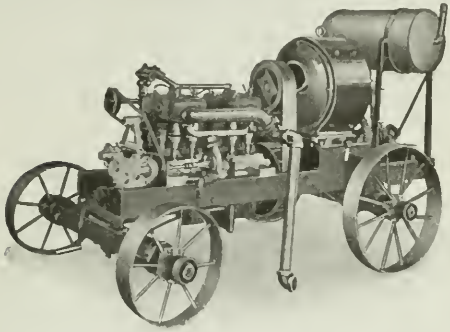


ALTERNATING-CURRENT ELEVATOR CONTROLLER

are mounted for throwing in the secondary switches. The secondary resistance is cut out simultaneously in all three phases of the rotor circuit, thus insuring a balanced condition at all times. The secondary resistance is reinserted upon the opening of the primary switches. A latching arrangement is provided for preventing accidental operation of the controller when the operating mechanism is not thrown to the central position.

Generator for Lighting Amusement Devices

A portable generating equipment for the illumination of amusement devices is shown herewith. The outfit consists of a 115-volt compound-wound, direct-current generator which is connected by a short belt with an idler-pulley attachment to an automobile engine. Both engine and generator are mounted on a steel-frame truck. The switchboard is placed directly in front of the generator and is equipped with switch, fuses and a Ward-Leonard wall-type rheostat. Generators of 2-kw, 3-kw, 5-kw, 7.5-kw and 10-kw rating are used. The outfit has been designed and is being placed on the market by Mr. C. W. Parker, Leavenworth, Kan. The generators are manufactured by the Robbins & Myers Company, Springfield, Ohio.



LIGHTING OUTFIT FOR AMUSEMENT DEVICES

Electric Welding in the Construction of Drills

Electric arc welding with metallic electrodes is being applied by the Dulles-Baldwin Electric Drill Company, New York, in the manufacture of an electric piston rock drill similar to that described in the *Electrical World* of Feb. 9, 1911. The service requirements of motors for use with this kind of drill are very severe, and on account of excessive vibration the commutator is liable to be affected. By means of electric welding commutator troubles are said to be almost entirely eliminated.

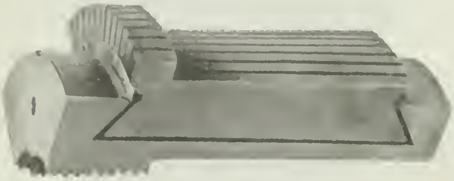


FIG. 1—OUTSIDE VIEW OF COMMUTATOR SUBJECTED TO ELECTRIC WELDING

The commutator segments, which are insulated from each other, are assembled about a sleeve and are insulated from the sleeve itself by a layer of mica which extends along the entire bottom of the segments as shown in the illustrations. When assembled upon this sleeve a clamping ring is forced over the outside and the sleeve is pressed firmly against the segments from the end. A bevel ring is then clamped over the other end and welded to the sleeve. The welding material which is deposited by the metallic arc method is built up on the end of the sleeve. On contracting, the metal grips the segments between the end rings, which form one integral part with the sleeve. The contractive force produced by this method is so great that the segments are forced down to the bottom of the bevels and rest upon the outer wall of the sleeve throughout their entire length. Instead of the cast-iron frame formerly employed, use is made of a pressed-steel ring with pressed-steel ends and feet, the different parts of which are welded together. Similar changes have been made in the drill itself by using pressed-steel tubing and welding the parts together. The welding for this drill is being done by the Electric Welding Company, New York.

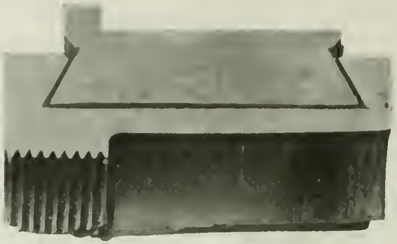
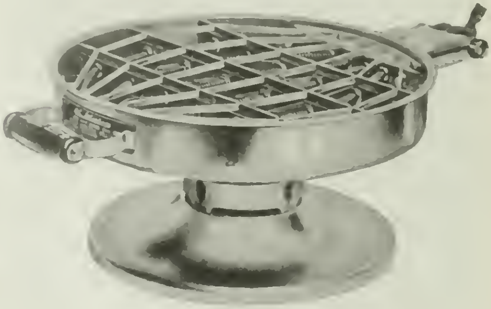


FIG. 2—INSIDE VIEW OF COMMUTATOR SUBJECTED TO ELECTRIC WELDING

Reflector-Type Glowing Electric Stove

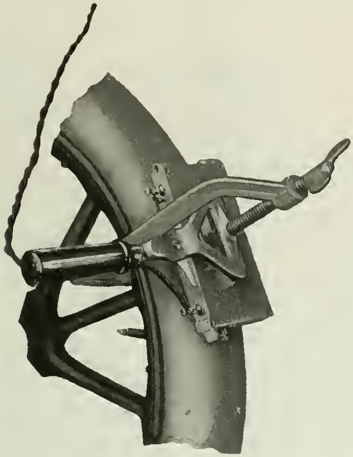
An electric stove of the glowing-coil type equipped with a reflector has been put on the market by the Hotpoint Electric Heating Company, Ontario, Cal. This device, which weighs only 2 lb., has a diameter at the top of 7.25 in. and at the base of 6 in., and it is 4 in. high. The frame is made of pressed steel and the heat reflector of burnished brass. The stove is patterned after a chafing dish and is finished with polished nickel. The heating element can be easily removed; it consumes 600 watts. The stove can be operated from any lamp socket.



GLOWING-COIL ELECTRIC STOVE

Electric Vulcanizer for Automobile Tires

The greatest damage to automobile tires is said to be caused by the neglect of cuts, sandpockets, stone and glass in the casings. Unless the cuts and sandpockets are sealed at once, dirt and water work into the fabric, thereby causing it to rot, with the result that a blowout eventually occurs.


APPARATUS FOR VULCANIZING AUTOMOBILE TIRES

The vulcanizing apparatus illustrated herewith is designed to seal cuts and pockets in rubber tires with a weld of live Para rubber. A uniform temperature of 265 deg Fahr. is maintained by means of a thermostat which is in series with the heating element. The heating unit completely fills the interior of the vulcanizer, thus conducting the heat evenly to every portion of the repair so that it cannot be "over-cured" in one place and "under-cured" in another. Current may be obtained from any lighting circuit. The vulcanizer is attached to the tire by means of the clamp shown. This vulcanizer is manufactured by the C. A. Shaler Company, Waupun, Wis.

Instrument for Locating Faults in Power Cables

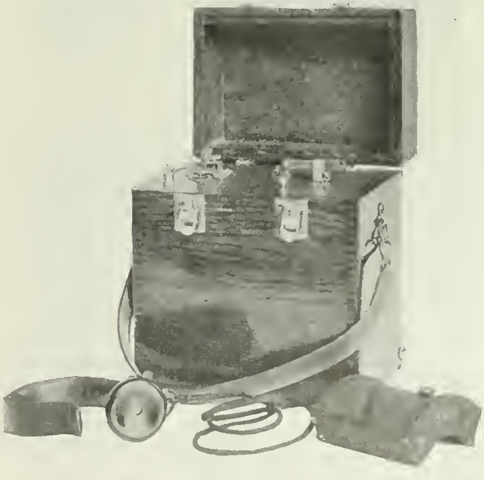
For many years telephone linemen have been tracing and locating cable troubles by means of a coil and telephone receiver designed to respond to magnetic fields created about cables by pulsating currents. Only recently, however, in an instrument marketed by W. N. Matthews & Brother, St. Louis, has this principle been successfully worked out for power cables. This device, known as a "telefault," consists of a generator of high-frequency current, a specially designed exploring coil, and an attached telephone receiver.

The sending instrument or generator consists of four dry cells, a non-inductive resistance, an unbalanced coil, an interruptor and a condenser. One pole of the set of four dry cells is brought out to a terminal post which may be connected directly to the cable in trouble. From the other battery terminal a lead is conducted through the unbalanced coil and the non-inductive resistance, and this lead is connected to the lead sheath of the cable. A tap taken off at a predetermined point in the unbalanced coil is connected in multiple across the unbalanced coil, the battery, and the interruptor or buzzer which creates the pulsating current in the cable under test.

The particular improvement in the apparatus lies in the design of the exploring coil, to which is attached a telephone receiver. These two devices form the portable part of the set carried by the lineman tracing the trouble. The exploring coil consists of two laminated cores built up of non-aging steel plates, each core being insulated from the other by means of a fiber block performing the dual function of separating the magnetic cores and acting as a headboard for connections. Three separate and distinct windings are placed on each core. The first or bottom coils on the magnetic core are connected in series with the open ends brought out to terminals on the fiber block. At a predetermined point the second coil is connected to the winding of the bottom coil, is wound in parallel with it, and has its free ends brought out to a short-circuiting device on the fiber headboard. The third coil, a differential winding, has its length so proportioned that its resistance is intermediate between the first and the second coil. Its free ends are connected on the headboard so that its magnetic field will oppose the fields of the first and second coils.

As will be noted from the accompanying illustration, the windings are so arranged in the exploring coil as to form an arc of a circle about the conductor under test. Thus in locating a case of trouble after the generator has been connected to the defective lead repairmen have but to open manholes and apply the exploring coil to the cable in question. The presence of noise in the receiver will then inform the inspector whether he is beyond the case of trouble or not. If his exploring coil picks up the pulsating current, the repairman at once knows that the fault is not between him and the station at which the sending instrument is in operation. Pressing the button which controls the short-circuiting device on the exploring coil changes the tone of the instrument and eliminates the possibility of the repairman being led astray because of the presence of "sneak currents."

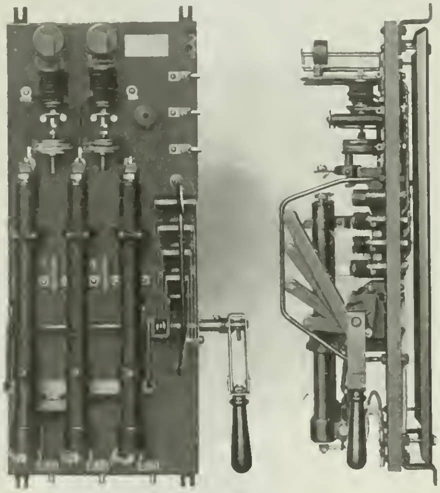
The use of this instrument eliminates the older and more expensive method of cutting the cable at frequent intervals in order to locate the fault and is also said to be quicker and more economical than the Wheatstone-Bridge method. The device, it is said, will locate within a few inches any cross or ground in the cable.


APPARATUS FOR FINDING FAULTS IN POWER CABLES

Alternating-Current Motor Starters

A resistance-type starter for squirrel-cage and slip-ring motors is being manufactured by the Allen-Bradley Company, 495 Clinton Street, Milwaukee, Wis. The resistance is of the graphite compression type and consists of graphite disks piled in columns having imperfect contact with each other. The resistance varies with the pressure applied. The columns of disks are inclosed in air-tight insulated steel tubes, as shown in the accompanying illustration, one column being supplied for each phase.

A no-voltage release is provided which consists of weighted levers held in an upright position by magnets and so connected that each phase has an individual magnet in series with it. If the circuit is interrupted, the magnets are de-energized and the weighted levers swing down and release a latch which returns the starter to the "off" position. This is also accomplished if trouble is encountered in only one phase; in this case only the coil belonging to that phase is de-energized and the weighted lever is released as before.



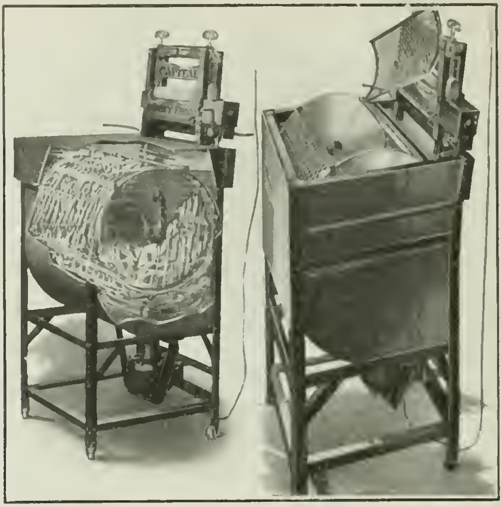
ALTERNATING-CURRENT RESISTANCE STARTER

Two adjustable relays can be provided to take the place of fuses. When an overload occurs, one or both of the relays operate and stop the motor. The relays are provided with time limits. These type H starters, as they are known, are inclosed in steel cabinets.

Electric Washer with Non-Geared Drum

An electric washing machine recently placed on the market by the Capital Electric Company, Insurance Exchange Building, Chicago, Ill., embodies a principle new to mechanical washers. A 0.25-hp motor swung beneath and at the rear of the tub is directly connected to a propeller in the bottom of the tub, so that the revolving propeller blades will force a stream of hot, soapy water upward with considerable velocity. Clothes placed in the perforated cylinder shown in Fig. 2, being in the path of this stream, are cleansed by the passage of water through them. The cylinder itself has no connection with the motor but is revolved by the force of the stream of water, which is applied somewhat off center. When the washing has been finished the cylinder may be lifted to a higher support, placing the clothes where they will be accessible for wringing. The wringer which is attached to the machine is driven from the motor by the utilization of a rod and bevel gears.

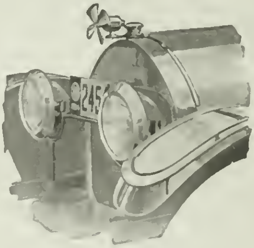
It is said that the washing for an ordinary family can be accomplished with this machine in about ten or twelve minutes after soap and water have been prepared, the cost for electrical energy being approximately 2 cents. The machine complete stands 39 in. above the floor and can be set in a space measuring 24 in. in width by 24 in. in depth.



FIGS. 1 AND 2—ELECTRIC WASHING MACHINES

Automobile Novelty Fan

A small novelty fan, symbolic of the electric industry, which can be mounted on the radiator of an automobile as shown in the accompanying illustration, has been designed by the Robbins & Myers Company, Springfield, Ohio, as an advertising aid for electrical dealers and contractors. The air currents caused by the movement of the car operate the fan. The base of the fan is tapped for a stud bolt. The usual method of mounting the device is to tap the cap which covers the opening to the radiator and attach the fan directly to this cap. Another method is to mount the fan on an iron strap, which is clamped around the cap in the method illustrated.



NOVEL FORM OF ELECTRIC FAN DESIGNED FOR USE ON AUTOMOBILES

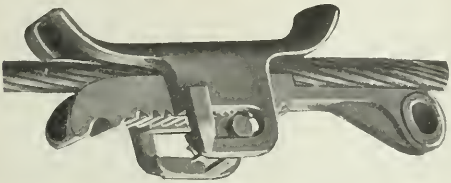
Nitrogen-Filled Street Lamp

A tungsten lamp of the so-called "arc" type has been designed by the Philadelphia Electrical & Manufacturing Company, 1228 North Thirty-first Street, Philadelphia, Pa., for street-lighting purposes. The lamp is not of the arc type, properly so called, use being made of high-efficiency nitrogen-filled incandescent lamps. The unit is equipped with either series or multiple sockets. Proper glassware for obtaining the best lighting effect is employed in the making of this fixture. This tungsten "arc" lamp is shown in the accompanying illustration.

TUNGSTEN STREET LAMP WITH LARGE GLOBE

Boltless Automatic Strain Clamp

A boltless automatic cable strain clamp for high-tension transmission lines is shown in the accompanying illustration. It consists of three pieces and is designed for use with cables ranging from the No. 2 size up to the No. 0000 size, either stranded or solid. The clamp takes the strain as soon as placed in position, and the greater the strain the greater the clamping power. The manufacturers claim that the clamp will not slip under any strain nor will it let loose until the cable itself breaks. Owing to the fact that the clamping area is lengthwise of the cable and the dead-end eyelet is practically in line with the axis of the cable, kinking is avoided.



BOLTLESS STRAIN CLAMP

This clamp, which is manufactured by the Automatic Cable Clamp Company, Donara, Pa., is designed for dead-ending at strain towers, for jumpers, for anchorage at walls of power houses, for sharp turns in transmission lines, for various kinds of central-station work and for catenary construction of electric railways. The clamp is sherardized and is rust-proof.

Recording Synchroscope

A synchroscope which makes a permanent record of each operation of switch closing when paralleling units is manufactured by Messrs. Schweitzer & Conrad, 1770 Wilson Avenue, Chicago, Ill. The instrument consists of a paper-holding and shifting device, an insulated ring in the synchroscope dial and a spark coil with a vibrator. With the energizing of the spark coil at the time the control switch coil is closed, a succession of sparks jump from the insulated ring to the electrode on the pointer, puncturing the paper and thereby forming the record.

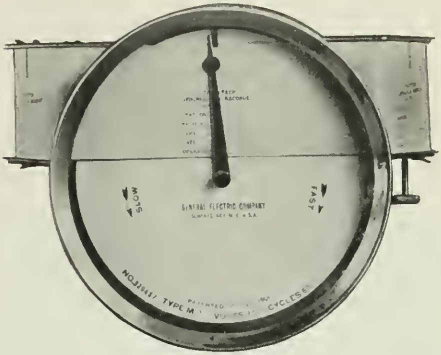
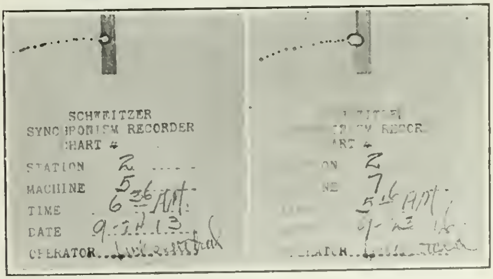


FIG. 1—SYNCHROSCOPE WITH RECORDING ATTACHMENT

A continuous ribbon of paper is fed from a metal spool on the left along guides and across the upper half of the synchroscope dial to the right, as shown in Fig. 1. A brass ring is set in flush with the surface of the dial plate, which is made of insulating material. The length of the radius of this ring is somewhat less than that of the instrument pointer. An insulated stud extends through to the back of the indicator case. A platinum point is attached to the under side of the pointer and directly in front of the ring.

One of the leads from the spark-coil secondary is connected to the insulated stud and the other to a stud screwed into the instrument case. The primary leads are connected through an auxiliary contact to a direct-current circuit. The purpose of the auxiliary contact is to close the circuit to the spark coil primary simultaneously with the closing of the control switch, and to keep it closed until opened by the operator.



FIGS. 2 AND 3—CHARTS ILLUSTRATING GOOD SYNCHRONIZING

For a perfect operation the record will be a very short row of quite large punctures. All of these are on one side of the synchronous position when the machine runs faster than the system frequency, and all on the other side if slower. If the operator closes the control switch too early for perfect synchronizing, the record shows a succession of almost uniformly spaced punctures between the time the control switch is closed and the instant the oil switch closes and then a much wider spacing as the pointer is jerked quickly to the synchronous position (see Figs. 2 and 3). If the operator closes his control switch too late, the record will extend beyond the synchronous position. A change in beat or in the rate of rotation of the synchroscope is shown by both the difference in spacing and the size of the puncture.

Outdoor Substations

The advent of the small consumer in the vicinity of transmission lines has brought much attention and effort to the design of small outdoor substations. Outdoor substations are made in a great variety of designs and are mounted on wooden poles, wooden towers or steel towers, according to the requirements of each installation. On the primary side the equipment usually includes switches, choke coils, fuses and transformers, and on the secondary side it varies from one comprising oil switches, watt-hour meters and instrument transformers to one utilizing a lever switch with fuses.

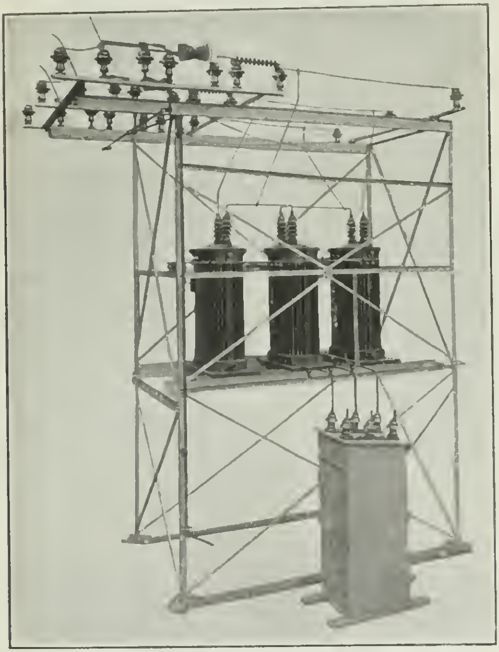


FIG. 1—OUTDOOR SUBSTATION ON STEEL TOWER

The primary switches are of the air-break type and are made in three designs, one in which the switch opens upward and is operated by hand or by a motor which is usually at the bottom of the pole below the switch blades, another where a lever switch opens downward and is operated by the usual switch hook, and a third type with contacts moving in the direction of the line, the operation being by hand or by a motor. The high-voltage switches are equipped with horn deflectors which assist in rupturing the arc when the branch line is opened under load. The primary fuses are mounted vertically and make contact with clips in closing like the ordinary knife switch. These fuses are a modification of the expulsion type and are designed either to take the place of the primary switch or to be used for horizontal mounting without the switch feature. They are made up in three-pole units and are operated from the ground by a rod or a rope.

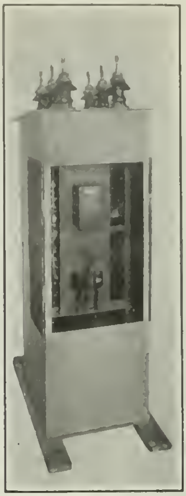


FIG. 2—STEEL SWITCH HOUSE

The transformers are single-phase and are designed especially for outdoor service. The choke coils are either of the hourglass type or of a new design known as the suspension type. For the secondary circuit the oil switches, watt-hour meters, etc., are of standard construction for indoor service and may be mounted on a panel in a wooden or steel house. They are furnished completely wired and ready for immediate service.

Two styles of houses are made. In the one a slate or steel panel carries an oil switch provided with a series trip coil for protection from overloads and also a watt-hour meter. The instrument transformers are mounted on the side walls and the buses are attached to the roof. In the other style, which is used for 440-volt distribution, a comparatively small house suitable for mounting on a pole of the transmission line is used. This house contains a small panel with a lever switch and inclosed fuses for overload protection.

In Fig. 1 is shown an installation of high-tension switching and protective apparatus and three single-phase transformers on a steel tower for supplying energy to rural consumers from a 35,000-volt transmission line. Fig. 2 shows the type of steel switch house used. These substation have been developed by the General Electric Company.

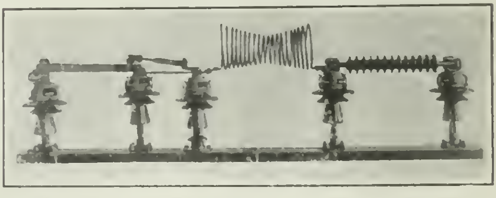


FIG. 3—35,000-VOLT SWITCH, CHOKE COIL AND FUSE

Jobber, Dealer and Contractor

Chicago Arrangements for Atlantic City Jobbers' Convention

While the detailed program for the convention of the Electrical Supply Jobbers' Association to be held at the Hotel Chalfonte, Atlantic City, on May 12, 13 and 14 had not been made out by the secretary at the time this paragraph was written, there is no doubt that an attractive series of events will be arranged. It is expected that a party will go from Chicago, and arrangements have been made for a special car on the train over the Pennsylvania Railroad leaving the Union Station in Chicago at 5:30 p. m. on Sunday, May 10. Mr. Franklin Overbagh, of 411 South Clinton Street, Chicago, is the general secretary of the association.

Co-operating with the Contractors at Boston

A vigorous electric-toaster campaign was started a few days ago by the Edison Electric Illuminating Company of Boston in co-operation with about fifty electrical contractors in its territory, and these devices are being sold at the rate of about 1000 a fortnight at a special price of $2.95 each. The toasters are of the Landers, Frary & Clark "Therwax" type, being rated at 3.1 amp at 110 volts, and ordinarily retail for $4. In planning the campaign the company got in touch with all the contractors in its 700 sq. miles of territory who have responded to the house-wiring opportunities lately afforded by the company and secured contributions of from $1 to $10 toward the cost of newspaper advertising in four prominent Boston dailies for a two weeks' period. The company buys all the toasters and places them with the contractors at a price which yields the latter a small profit on each toaster, taking back any unsold outfits. In the advertisements run on the co-operative basis the names and addresses of the local contractors carrying these devices are printed, and the company furnishes free of charge special signs and cuts for use in suburban papers by contractors carrying local "ads." The success of the plan will lead to further special appliance campaigns in the near future.

Cost of Miniature Christmas-Tree Bulbs

Details regarding the cost of making fancy electric lamp bulbs in Germany were revealed in a decision of the Board of United States General Appraisers handed down recently. The case decided was that of A. Wolff & Company, of New York, who imported the goods for Christmas tree decorative purposes. The bulbs were colored to represent twenty-four varieties of fruits. The collector classified the goods as articles in chief value of blown glass, under paragraph 98, tariff act of 1909, while the importers claimed 45 per cent, under the provisions for manufactures in chief value of metal. The contention of the importers was that metal predominated in the make-up of the bulbs and should rule in the classification. One of the witnesses testifying on this point gave the relative values as follows: Metal base, 0.6 cent; leading-in wire, 0.02 cent; nickel wire, 0.05 cent; platinum, 0.5 cent; four joints of platinum and copper and nickel alloy, 0.12 cent; joints of the filaments, which are nickel, 0.3 cent; filament, 0.35 cent; solder, 0.2 cent; while the breakage cost of putting the materials together, or the waste, amounted to about 10 per cent. It was stated that the globes are manufactured in this country at the price of $1.25 per 100, while in Europe the cost is 95 1-5 cents per 100. The cost of painting the globes amounted to 0.25 cent each. The judge in his decision sustained the claim for lower duty and overruled the collector's adjustment.

Cleveland Company Co-operates with Contractors in Store Wiring

The Cleveland (Ohio) Electric Illuminating Company, long a pioneer in the field of co-operation with wiring contractors, has recently put into effect a contract carrying a definite unit-outlet schedule for commercial wiring. Contractors do the soliciting and are paid 10 per cent of the cost of the wiring by the illuminating company as a bonus for the solicitation work, with the stipulation that in no case shall the bonus be less than $5 or more than $10. The accompanying table, taken from the contract, shows the cost of wiring any number of outlets from five to twenty.

CLEVELAND COMMERCIAL WIRING SCHEDULE

Number of Outlets	Concealed Work or Wood Molding	Metal Construction
5	$22.10	$30.85
6	25.35	35.85
7	28.60	40.85
8	31.85	45.85
9	35.10	50.85
10	38.35	55.85
11	41.00	60.25
12	43.65	64.65
13	46.30	69.05
14	48.95	73.45
15	53.00	77.85
16	54.25	82.25
17	56.90	86.65
18	59.55	91.05
19	62.20	95.45
20	64.85	99.85

The practice of paying contractors for soliciting wiring has been a marked success in Cleveland as shown by the fact that during the past year 2500 houses were wired. Where the central station has a large foreign population to serve the success of the plan is particularly assured, for while a foreign-born citizen may resist all efforts of a good American salesman, a wiring contractor who can speak the prospective customer's own tongue will be able to gain his confidence and can secure often business otherwise impossible. It is estimated that the sixty-five contractors in Cleveland will be able to secure 100 commercial wiring jobs a month as a result of the new schedule.

Electrical Contracting in Old New England

"I have not done more than $125 worth of electrical work in the last three years, so I am planning to sell out this spring and get entirely out of the electrical business," is the text of a letter written by a discouraged contractor living in a New England town of 8000 population, the history of which antedates the Revolutionary War.

"This action on my part has been forced as the result of the attitude taken by the lighting company, the labor unions and unscrupulous contractors. I refused to do work that would not pass the Underwriters' requirements, while at the prevailing price for work there is no profit. About five years ago the local manager of the electric company went into business as an electrical dealer and succeeded in keeping afloat for about three years. At the end of that time he failed and paid about 20 cents on the dollar. This put the electrical business 'on the hog,' and it has been so ever since.

"The lighting company tried for a time making wiring installations on the instalment plan, getting two sidewalk contractors to do the work for them. However, under this arrangement only three jobs were secured. One of the sidewalk contractors is now in jail for sixty days on the charge of stealing from the ruins of a recent fire.

"Concerning provisions for electrical inspection here, the town has a paid fire department, the chief of the department acting as building inspector and the assistant chief as wiring inspector. Neither of them has had any previous experience in the work they are called upon to do so far as can be learned."

Meeting of Electrical Contractors' Association of Wisconsin

At a special meeting of the Electrical Contractors' Association of Wisconsin held at Milwaukee April 6 and 7 Mr. Thomas M. Ferguson, a member of the Plumbers' Examining Board of Wisconsin, spoke on "What Organization Has Accomplished for Us"; Mr. W. R. Johnson, Wausau, outlined a cost-accounting system; Mr. Taylor Frye explained the Wisconsin apprenticeship law, and Mr. H. G. D. Nutting, Milwaukee, gave a talk on the mutual interests of the central-station man and the electrical contractor. Routine business of the association was also taken up, but owing to the lack of sufficient time, discussion of the employers' liability law and the lien law was postponed for a future meeting.

In his talk Mr. Thomas M. Ferguson outlined the steps which had been necessary to secure a plumbers' license law in Wisconsin. Organization, he said, was in a large measure responsible for the success attending their efforts.

In his talk on accounting, Mr. W. R. Johnson, president of the Electrical Contractors' Association of Wisconsin, outlined the method which his firm was employing in Wausau to stop the small "leaks" which develop in the contractors' business. Mr. Johnson said that the first attempt at accounting made by his company showed that the amount of money saved by an accounting system more than paid for the extra expense involved in keeping a correct set of records.

The apprenticeship law of Wisconsin as outlined by Mr. Taylor Frye requires that minor apprentices who enter into contracts with employers must be allowed five hours each week for schooling. Continuation schools in each principal city of the State have been provided for the accommodation of apprentices and others. Fifty-five hours is given as the total time that any master can require a minor apprentice to work. In addition to these provisions, the law requires that the master agree to give some time to teaching the apprentice something of the business in which he is working.

On the authority of President P. H. Korst and Secretary George Allison of the Wisconsin Electrical Association, Mr. H. G. D. Nutting gave a candid talk on co-operation of central stations and electrical contractors, showing wherein each party is dependent upon the other. The central-station men realize that the hustling contractor is an asset and are always anxious to help this type of man, but if the contractor is not progressive and does not live up to his business agreements, the central station must refuse to deal with him in order to protect itself.

Speaking on the question of "Who is a legitimate contractor?" Mr. Nutting suggested that perhaps membership in the contractors' associations was as good an indication as could be had. Sometimes, however, it is the so-called "curbstone" contractor who brings most business to the central station, and as a matter of self-preservation the electric-service interests must co-operate with those who are able to secure the majority of the wiring contracts.

As a part of the routine business, a resolution was passed approving the bill, H. R. 14,288, now before the second session of the Sixty-third Congress, providing that separate bids for government electrical work, steamfitting and plumbing shall be submitted when the amount of the contract exceeds $1,000.

Mr. Herman Andrae, of Milwaukee, was elected state director of the National Electrical Contractors' Association to replace Mr. George F. Rohn, who has resigned that he may have more time for other business interests. Mr. Albert Petermann, Milwaukee, is secretary of the Electrical Contractors' Association of Wisconsin.

Practical Results of Window Displays

Window displays have been an important factor in the success of the Electric Shop, as the accompanying analysis of sales in relation to representative weekly exhibits shows. In one week when various sizes of tungsten lamps were displayed, with appropriate advertising, the sales of these lamps increased $72 over those of the preceding week. A count of the number of persons visiting the shop totaled 2299 in one week, and another count showed that 25,100 persons paused in front of the Electric Shop window during the week's display of a Hylo miniature theater. On "Hotpoint Day," May 10, the company sold 235 "tostovos." Other activities included moving-picture shows at schools, appliance demonstrations, mailing circular letters to telephone subscribers, lectures before church and fraternal organizations, an electric tea-party in the suburbs, and newspaper advertising.

WINDOW DISPLAYS AND SALES

Dates of Display	Character	Sales	Previous Yearly Sales	New Yearly Rate
Sept. 1-8	Portable lamps, ornamental, business	19	186	988
Sept 8-15	Fireless cooker	1 "prospect"	0	
Sept. 15-22	Luminous radiator	19	22	988
Sept. 29-Oct. 6	Toasters	20	283	1040
Oct. 6-20	Hylo lamps	142	253	7384
Nov. 3-8	Portable lamps	12	186	624
Nov. 10-17	Radiators	3	24	156

An interesting analysis by the sales department compares the holiday business in 1912 with that of 1913, the company having had no store in the former year and exhibiting appliances only in a limited way in its old offices, which were up one flight in an office building. After the establishment of the Electric Shop 739 appliances were sold in the holiday season, against 170 during the Christmas week of 112. Some of the comparisons are: Flatirons, 117 and 57; percolators, 50 and 15; heating pads, 39 and 18; toasters, 119 and 51; portable lamps, 180 and 1; vibrators, 6 and 1; egg-boilers, 4 and 1; curling irons, 14 and 2; water boilers, 45 and 7; small stoves, 26 and 4; grills, 61 and 3; chafing dishes, 23 and 7. A special line of lamps was put on sale Dec. 19 and resulted in the sale of 65.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Lecture by Samuel Insull in New York.—On the evening of April 20 Samuel Insull, president of the Commonwealth Edison Company of Chicago, will lecture before the finance forum of the Young Men's Christian Association, 318 West Fifty-seventh Street, New York City, on the subject "Concentration of Power Supply."

American Searchlamps Shipped Abroad.—Among the larger searchlamps recently sold by the Carlisle & Finch Company, of Cincinnati, Ohio, there were fifty ranging in size from 7 in. to 24 in. in diameter. A number of these were shipped abroad to England, Italy, Central America, British Honduras and the Philippines. These searchlamps are used largely on yachts, launches and river steamers.

Electrical Equipment for Bakery.—The Schulze Baking Company, of Chicago, is a large concern with several bakeries throughout the city. One of these, at South Wabash Avenue and East Fifty-fifth Street, has been recently equipped and will be electrically operated. The Commonwealth Edison Company has secured a contract for supplying electricity to 600 hp in motors and 2500 incandescent lamps in this large baking establishment.

Change in Control of Hart & Hegeman Manufacturing Company.—Since the death of Alfred H. Pease, president of the Hart & Hegeman Manufacturing Company, Hartford, Conn., in November last, the majority of stock has been owned by his widow, who last week sold all her holdings to local interests in Hartford. For the present at least no change will be made in the officers, and Shiras Morris will continue as president of the company.

Fair Demand for Power Plant Equipment Observed.—The Alberger Pump & Condenser Company, of 90 West Street, New York, is finding business conditions in its line satisfactory, with the greatest activity in the South and West. At present numerous orders for small apparatus are being received. The company is supplying condensing equipment for the new station under construction at the present time by the Montreal Light, Heat & Power Company.

T. C. White Company's Business to Go on Without Interruption.—Following the recent death of Thomas C. White, proprietor of the T. C. White Company, of St. Louis, announcement is made that the business will be conducted under the same name by the sons of the decedent, O. K. White and W. H. White. The T. C. White Company has its office at 1124 Pine Street, St. Louis. It manufactures railway and lighting specialities, including line insulators, line-suspension material and appliances of that character.

Sale of Corliss Engines Not Active.—Through Olney & Warrin, of 66-68 Centre Street, New York, recently appointed agents of the Murray Iron Works Company in the metropolitan district, it is learned that the sale of that company's line of small and medium-sized Corliss engines has not been particularly active lately. A good part of the present business consists of small units for generator drive, and the most important recent shipments have consisted of two 150-kw units and two 400-hp units, the latter going to Cuba.

Views of an Electric-Crane Manufacturer on Present Industrial Conditions.—In reply to an inquiry as to the industrial outlook in his field, George A. True, president of the Northern Engineering Works of Detroit, Mich., says that raw-material supplies at present available in that line of manufacturing are of reasonably good quality and the deliveries of the same are fairly good. Current conditions in regard to the labor supply are satisfactory, but during rush seasons there is a demand for all-around crane men. The larger part of this company's force has been with it for a long time and is trained to the work. The company finds transportation conditions good, its rail shipments are handled satisfactorily, and it is able to use the parcel-post service to decided advantage. Concerning general industrial conditions, Mr. True believes that there is need for wider information as to costs and for a more uniform method of distributing overhead shop and general expense accounts over prime factory cost. He thinks that the large discrepancies in prices are largely due to a lack of such methods.

Active Fan Sales Not Yet Noticed.—The Hunter Fan & Motor Company, of 114 Liberty Street, New York, has not yet experienced the usual spring rush of business in fans. This condition is not viewed with alarm, however, as the duration of cold weather is thought to account for it in a large measure. The company's line is practically the same as it was last year, its particular specialty being a combination ceiling fan and four-lamp cluster, which finds good sale for hotel, restaurant and similar service. This unit is arranged so that in cold weather the fan blades can be removed, leaving a sightly lighting fixture.

Electric Stove Manufacturer Finds Season Dull.—The Hughes Electric Heating Company, of Chicago, which is represented in New York by the George Drake Smith Company, of 1204 Broadway, is finding local trade in its line rather dull at the present time. This is compensated for in part by activity in other sections of the country, particularly in Winnipeg and vicinity, where a good sale has been enjoyed, and by prospects for increased activity within the next month or two. The company has developed two new types of electric ranges with ovens placed above the cooking surface, but local energy rates have been a bar to any extensive sale of these ranges.

Russian Tires for Electric Vehicles.—Everett P. Stroup gave a talk on pneumatic tires for electric vehicles at the luncheon of the Chicago Section of the Electric Vehicle Association on April 7. He said that resiliency is the most important characteristic of electric-vehicle tires, as it economizes the consumption of energy. He described the Prowodnik pneumatic tires made in Riga, Russia, and contended that they are particularly adapted for electric-vehicle use owing to the fact that the body of the tire is made up of a peculiar fabric, close-woven yet elastic. These tires are now under test by the Baker Motor Vehicle Company, of Cleveland. Foreign tires pay a customs duty of 10 per cent of their value as manufactured rubber goods. Mr. Stroup said that there is no likelihood that the Prowodnik tires will ever be made in the United States, although they are imported by a New York company.

Electric Dish Washer Being Marketed.—The Electric Dish Washer Company, Inc., of 42 Pearl Street, Buffalo, N. Y., was formed recently to manufacture and sell the "Geyser" electrically operated dish-washing machine. This apparatus is made in two sizes, the smaller, or single, machine being intended for family use and the larger, or double, one for use in hospitals, sanitariums, restaurants and similar service. Both types are self-contained units of non-rusting metal construction throughout, with connections for hot-water supply and electricity. The company is planning to market the machines through the electric light and supply companies, architects and builders throughout the United States. In the small and medium-sized cities it is planned to give exclusive sales agencies. Mr. Eugene Cary, of Niagara Falls, N. Y., is president of the new concern; Mr. Richard Cary, formerly with the International Acheson Graphite Company, is its vice-president and sales manager, and its treasurer is Mr. George W. Hewitt, formerly connected with the Stone & Webster Engineering Corporation.

New England Specialty Manufacturer on Present Conditions.—The Blake Signal & Manufacturing Company, of Boston, Mass., maker of insulated wiring staples, railway signals, tube flux and compressed cleats, finds the present conditions in the raw material and labor markets satisfactory, and its president, Edmund J. Burke, states that in his opinion the parcel-post service has been a great benefit. He thinks the present freight rates ample for the service rendered and that the ruling of the railroads that their minimum charge is their first-class rate per 100 lb. is unreasonably discriminatory against small shipments.

Some Interesting Results of a Power Census in Brooklyn.—For some time the need has been felt for a more accurate knowledge of the extent to which electricity is used in Brooklyn for motor purposes and of the classification of this use by industries. Finally, to obtain this information the Edison Electric Illuminating Company of Brooklyn undertook a census limited to consideration of plants where 25 hp or more is in use for industrial purposes. Because of insufficient data on them sixty-five plants were omitted from the final summaries. Out of the total of 847 plants, 245 have installations ranging from 25 hp to 50 hp, 412 have installations ranging from 50 hp to 200 hp, and 190 use over 200 hp. The aggregate for the 782 plants considered was found to be 110,042 electrical hp, in use in forty-one different industries. Iron foundries were found to be in the lead in the number of plants using electricity, and they were followed by the wood-turning, stone-cutting, varnish and paint, furniture and provision industries, in the order named. Rated according to the amount of energy used, the first six industries were rope-making, machinery, paper, varnish and paint, chemicals and clothing. Within an area of 4 square miles in the busiest part of Brooklyn there are 281 plants with installations of over 25 hp each, seventy-two of which have over 200 hp in use.

Electrical Manufacturing Conditions in the South.—A Southern company making electric motors has given out a statement of the conditions in that line of work in its own territory. This company has in the past found some difficulty in obtaining satisfactory supplies of sheet-iron stampings for armature and field cores, but at present it has a connection which gives full satisfaction in this respect and it has found recent conditions in the copper market favorable. In the locality where its factory is placed this company has difficulty in securing plenty of first-class machinists, but all of the employees in its winding department have had to be specially trained by it for that service. The greatest difficulty experienced is in getting intelligent young men for its testing department. The company in question is not of sufficient size to undertake extensive educational work in order to improve the efficiency of its force. Express service in this maker's experience has been very poor, and the parcel-post service has replaced it in a large measure. The railroad service afforded to the company in question has been entirely satisfactory, and it strongly favors a general increase in freight rates for the railroads, believing that the latter are not now paid enough in view of increased labor and material costs.

Recent Westinghouse Orders Indicate Activity in Mining Industry.—A number of important orders have been received recently by the Westinghouse Electric & Manufacturing Company for apparatus to be used in the metal-mining industry. Among the more important of these orders are the following: A twenty-four-panel switchboard for the new Clarkdale smelter of the United Verde Copper Company; two 55-hp direct-current, back-geared motors for operating Stillwell-Bierce converters at the plant of the El Paso (Tex.) Smelting Company; six 150-kva transformers for the Washoe smelter and fourteen alternating-current motors, aggregating 290 hp, for driving mine-ventilating fans on the properties of the Anaconda (Mont.) Copper Mining Company; one 4-ton bar-steel electric locomotive for tandem operation with a similar locomotive previously furnished to the National Copper Mining Company, of Wallace, Idaho; one 5½-ton storage-battery locomotive for 30-in. gage, equipped with two type V-50 motors and sixty-eight cells of Westinghouse type A-10 battery, and two 18-ton bar-steel electric locomotives for underground and surface work at the mine of the Alaska Gastineau Mining Company, Juneau, Alaska. The latter units were specially designed for low height in order to permit them to enter the mine. The Utah Copper Company, Magna, Utah, has lately placed orders with the Westinghouse company for three 100-kw transformers, two 50-kw motor-generator sets, with switchboards, and four 15-hp slow-speed, vertical motors for direct connection to agitators, used in the oil flotation process. This is a new application, specially developed by the manufacturer after considerable experimentation. The Magna Copper Company, Superior, Ariz., has ordered from the same concern nine squirrel-cage induction motors, with a total rating of 267 hp and transformer capacity of 90 kva, for operating its copper-concentrating mill now under construction. Energy for this plant will be supplied from the Roosevelt Dam power project.

Electric Heating Apparatus to Be Sold at Half Price for One Week.—As part of its merchandising plan, the Hotpoint Electric Heating Company is planning a "sale week" for its latest cooking appliance from May 11 to 16, inclusive, during which time this piece of apparatus can be purchased at any of the company's distributing points in the country at half price. This is the fourth annual special sale feature that the Hotpoint company has inaugurated, the previous sales being for one day only. Accompanied by extensive magazine advertising, large poster displays and circularizing of dealers, this special sale seems to produce satisfactory results from the standpoint of the manufacturer. The device to be offered at the coming sale is the Hotpoint "El Glostovo," an exposed-coil-type heating unit, with a polished metal reflector below the coils and a grill above them, adapted to the ordinary cooking utensil of any character.

Action Imminent on Electric Bus System for New York.—Some time ago preliminary hearings were held on the application of the People's Five Cent Bus Line for franchises covering the operation of an extensive electric bus service in New York City. The main details concerning this proposed system appeared in the July 19, 1913, issue of the *Electrical World*. During the last few days information was obtained from Mr. E. P. Hulse concerning the status of the project at the present time. He stated that on Nov. 13 last the matter was considered by the Board of Estimate and Apportionment and by that body referred to its franchise committee. Mayor Kline, owing to his limited tenure of office, made no attempt to push the matter, and the franchise committee of the new administration was not announced until early in February and has not been so far officially convened. Mayor Mitchel, chairman of this committee, has given notice that the project is receiving his attention, and non-official expressions of interest in the plan have been obtained from President McAneny of the Board of Aldermen and from Borough President Mathewson of the Bronx, the other two members of the franchise committee. Mr. Hulse believes that the committee has an expert investigating the problem and that his findings will have an important bearing on the decision of the committee and of the Board of Estimate as a whole.

NEW YORK METAL MARKET PRICES

	Apl. 7		Apl. 14	
Copper.	Bid	Asked	Bid	Asked
Standard spot*	13.87½	14.37½	13.50	14.20
	Selling Prices £ s d		Selling Prices £ s d	
London, standard spot*.	65 15 0		64 5 0	
Prime Lake	14.75	to 15.00	14.62½	to 14.87½
Electrolytic	14.45	to 14.55	14.30	to 14.40
Casting	14.25	to 14.35	14.10	to 14.20
Copper wire base	15.75	to 15.87½	15.75	to 15.87½
Lead	3.80		3.80	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.32½	...	5.25	
Tin, spot	36.55	to 36.85	36.45	to 36.75
Aluminum				
Prompt delivery	18.00	to 18.25	18.00	to 18.25
Future	18.00	to 18.25	18.00	to 18.25

*OLD METALS

Heavy copper and wire	13.62½	13.62½
Brass, heavy	8.62½	8.62½
Brass, light	7.62½	7.62½
Lead, heavy	3.80	3.80
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to Apl. 14 .... 13.131

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*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Jersey Power Company Extension.—The construction of a new transmission line for the Jersey Power Company, a subsidiary of the Atlantic Gas & Electric Company, which has been authorized by the Board of Public Utility Commissioners of New Jersey, will, it is expected, reduce operating costs. The supply of power available for the Dover and Bernardsville section will be increased and officials of the company anticipate considerable new business as the result of the completion of the new line within the next four or five weeks. The new line will extend from Boonton, N. J., via Fox Hills to Millbrook and Dover, and from Dover to Wharton, including a branch on that part of the Rockaway line extending from Fox Hills to Millbrook, a total of 15.25 miles.

Lackawanna & Wyoming Valley Power Operations.—The report of the Scranton & Wilkes-Barre Traction Corporation refers to operations of the subsidiary Lackawanna & Wyoming Valley Power Company. Earnings from the sale of energy were $98,426, of which $88,999 was received from the Lackawanna & Wyoming Valley Railroad. This shows an increase in energy sold to commercial customers of $2,394. A decrease of $726 in operating expenses is due to a reduction in the cost of fuel per kilowatt-hour. W. E. Higgins, vice-president and general manager, states that additions, betterments and renewals mentioned in the report of last year were carried to a finish and a depreciation reserve was established on July 1 to cover apparatus charged to capital account. There is being charged up the sum of $100 a month, which will cover the cost in about fourteen years. The output for 1913 was 11,575,944 kw-hr., as compared with 11,279,972 kw-hr. in 1912 and 12,096,551 kw-hr. in 1911.

Consolidation of Properties in Ohio.—Authority has been granted by the Public Utilities Commission of Ohio to the Ohio Light & Power Company to issue $2,255,000 bonds, to be sold at not less than 85. The proceeds are to be used for the purchase of electric light and power plants in nine cities of Ohio, as well as to retire $800,000 outstanding bonds. The commission stated that in approving this application it is not approving valuations fixed on the properties purchased or rates that have been established upon which the valuations are believed to have been partially based. The plants purchased are the Fremont Yaryan Company, the F. W. Swezey property at Fostoria, the Licking Light & Power Company of Newark, the Frank B. Ball Electric Light Company of Mount Vernon, the Lancaster Electric Light Company, the Logan Light & Power Company, the George M. Tidd property at New Lexington, the People's Electric Light & Power Company at Shawnee and New Straitsville, and the Perry Electric Company at Crooksville.

United Railways Investment Company Power Development.—During the year 1913 the United Railways Investment Company had a total income of $2,134,224, of which $1,998,849 was received as dividends on stocks owned. Total expenses were $63,727. Charges for interest amounted to $1,164,159. Net income for the year was $906,338. The report includes the statement of income of the Sierra & San Francisco Power Company for the year. Gross earnings of this company were $1,088,774. Operating expenses and taxes were $506,796, leaving net earnings of $581,978. Deductions for interest on the first mortgage bonds and second mortgage bonds, series A, and other cash charges, less credits, were $373,594, leaving a balance of $208,384. There was payable as interest on the second mortgage bonds, series B, under the terms of the indenture, $369,440. The sum of $5000 was written off for depreciation. The excess of the interest and depreciation charges over the amount applicable was $166,056. Mason B. Starring, the president, referred in the annual report to stockholders to the fact that during the year the Sierra & San Francisco Power Company suffered from shortage of water for its hydroelectric plant. This forced the company to fall back on its steam generating plant. This involved additional expense. The demand upon the company for energy by the United Railroads of San Francisco increased 5.56 per cent. Outside of the contract with the United Railroads the gross earnings of the company from business with the general public increased to the amount of 39.31 per cent.

Operations in the Puget Sound District.—Results of operation of the Puget Sound Traction, Light & Power Company and its subsidiary companies for the calendar year 1913 show total earnings of $8,613,599, an increase of 3.6 per cent over the preceding year. Earnings of the light and power department were $2,244,705, an increase of $67,162, or 3.1 per cent, over 1912. The Stone & Webster Management Association, the general manager of the property, states in the report to shareholders that the increase in gross earnings is very gratifying owing to the fact that business conditions in the Pacific Northwest during 1913 were but fair. Operating expenses increased 2 per cent while taxes showed an increase of 25.6 per cent owing to greatly increased tax rates brought about by many public improvements, some of which will ultimately benefit the company. Owing to the growth of the light and power business during the year, a large number of short line extensions were made and new meters and transformers were installed to care for this additional business. The report says that 1914 opens with business sentiment much more hopeful in the Northwest than it has been during the past year, although no great activity in general business is looked for until well into the year. Any improvement in general business conditions will have a direct effect upon the business of the companies. Already the railway department earnings are showing large increases over the early part of 1913. It is expected that the light and power department results for 1914 will be very gratifying.

Canadian Westinghouse Company Operations.—The tenth annual report of the Canadian Westinghouse Company, Ltd., covering the year ended Dec. 31, 1913, shows that the net earnings were $1,002,618. Deductions were as follows: Dividends, 9 per cent, $445,027; bank interest, $28,700; reserve for insurance fund purposes, $50,000; written off property and plant account, $250,000; total, $773,727. The balance was $228,891, which was added to the surplus, making a total surplus as of Jan. 1, 1914, of $1,531,491. The report to stockholders, signed by H. H. Westinghouse, vice-president, calls attention to the deduction from property account and says that it follows the company's established prudent course in regard to depreciating the book value of the physical properties when opportunity offers in prosperous years. The cost of the year's product absorbed all expenditures for maintenance and replacements and for engineering development. In speaking of business conditions during the year Mr. Westinghouse states that the year opened with a good volume of orders brought forward from 1912 and with a satisfactory influx of new business during the earlier months, which together carried the year's shipment to a new maximum notwithstanding a falling off in activity during the closing months. The later reduced rate of activity was the company's share in the widespread and cumulative curtailment of trade which, starting in the West, had by the end of the year made its influence felt by practically every industry in Canada. Consequent reduced forces and shortened hours of manufacture operated to reduce somewhat the ratio of profit. The diminution in the receipt of orders was accompanied by little if any cessation in activity of the departments having to do with inquiry and quotation. This with the growing tendency to easier money conditions was the favorable feature at the time of the report. A tract of land containing 35 acres was acquired in the West End of the city of Hamilton. This is suitable ultimately for an extended general plant, but it was utilized in part immediately for the erection of an improved foundry. The construction of this building is far enough advanced to make it available some time during the coming summer or autumn.

Annual Report of the Philadelphia Electric Company.—Gross earnings of the Philadelphia Electric Company in the calendar year 1913 amounted to $7,815,615, an increase of $764,118, or 10.8 per cent, over 1912. The fourteenth annual report, issued to stockholders, shows in one item all operating expenses, taxes, fixed charges and depreciation, for which $5,887,372 was expended. This was an increase of $502,065, or 9.3 per cent, over 1912. The net income remaining applicable to stock dividends after the deductions mentioned was $1,928,243 in 1913, as compared with $1,666,189 in 1912. Cash dividends aggregated $1,180,815, as compared with $974,669 in 1912. The surplus from the operations of 1913 amounted to $747,428, as against $691,520 in 1912. The surplus at the beginning of the year was $1,818,913. With the surplus for the year the total surplus was $2,566,341. A stock dividend of $1,499,265 was paid on Dec. 1, 1913, and charged to surplus, leaving the total surplus as of Dec. 31, 1913, at $1,067,076. Charges to construction account during the year aggregated $3,382,064. This was divided among the various departments as follows: Aerial, $458,246; underground, $414,175; electrical, $965,716; meters, arc lamps and transformers, $208,719; boilers, engines and steam apparatus, $473,230; real estate and buildings, $383,107; miscellaneous, $478,871; total, $3,382,064. The total number of consumers on Dec. 31, 1913, was 52,085, an increase of 6958. The total commercial connected load was 3,127,456 standard 50-watt lamps in addition to the current supplied to street-railway companies for 37,467 electric hp, making a total increase in the connected load of 627,672 50-watt lamps. Joseph B. McCall, the president, calls attention to the fact that a reduction of $65,120 was made in the contract with the city of Philadelphia for street lighting for 1914, making the average rate $84.35 per light per year without taking into consideration the amount of free current supplied to the city. The Philadelphia company will extend its Christian Street station and install two additional units, one of 40,000 and one of 46,000 electrical hp, which will be the final installation in this station and will make the ultimate station capacity over 200,000 electrical hp. Anticipating future demands, the company has purchased a new site of about 8½ acres on the Delaware River for $400,000 as the site for the next generating station in Philadelphia. The balance sheet as of Dec. 31, 1913, shows $450,000 notes payable. The insurance fund, which was not included in the figures of the report, contains $625,288 in cash and securities, market value.

Earnings of Southern California Edison Company.—On account of unexpected changes in the business situation, gross earnings of the Southern California Edison Company were not so large in 1913 as had been anticipated at the beginning of the year. Gross earnings reached a total of $4,779,279, an increase of $441,838, or 10.2 per cent over 1912. Operating expenses were $2,430,290, as compared with 2,329,085 in the preceding year. Net earnings aggregated $2,348,989 in 1913, an increase of $340,634, or 11.9 per cent, over 1912. Charges for interest and amortization last year were $813,969, while in 1912 they were $708,796. The balance was $1,535,020 in 1913, an increase of $235,461 over 1912. Against the balance there were charged as reserves for depreciation $700,000 in 1913 and $650,000 in 1912. The surplus remaining was $835,020 last year, as compared with $649,559 in 1912. Dividends were declared on both the common and preferred stock at the rate of 5 per cent last year, or a total of $620,000, leaving a balance of $215,020 for the surplus account. In the annual report to stockholders W. A. Brackenridge, vice-president and general manager, says that since the last report the generating capacity has increased about 27,000 hp, making a total capacity of 119,800 hp. During the present year changes are contemplated at Kern River No. 1 hydraulic plant. This will result in an additional output of approximately 5000 hp. Permits have been issued for the development of four additional power plants on the Kern River. The grants specified a period of twelve years for the completion of a possible development of 111,000 hp. Kern River No. 3 plant provides for an installation of 33,000 hp, and as it is the most desirable in point of amount of power and cost of construction, this has received first consideration, and work on this project is now in progress. The steel-tower transmission line completed in 1912 from Long Beach to Los Angeles and Colton has given entire satisfaction. Mr. Brackenridge refers to the development of water-power by the city of Los Angeles. Little progress has been made on the project of the city to deliver power developed along the line of the Los Angeles aqueduct Negotiations are pending between the city officials and the companies operating within the city for the purchase or lease of the distributing systems by the city, with a view to satisfactory arrangements for an equitable and economical utilization of the power proposed to be generated by the city. The number of incandescent lamps, 50-watt equivalent, installed on Jan. 1, 1914, was 1,634,185, as compared with 1,436,617 one year previous. The number of electric meters was 96,851, as compared with 80,995 one year before. The number of motors was 7485, as compared with 6452. The aggregate horse-power of the motors was 118,610 on Jan. 1, 1914, as compared with 94,478 one year previous. The number of municipal arc lamps was 1043, as compared with 966. The number of commercial arc lamps was 1119, as compared with 1530. The certificate of Price, Waterhouse & Company, covering the profit and loss account, states that miscellaneous charges aggregating $67,389 net, for which no provision was made in the expense accounts prescribed by the Railroad Commission of California, were charged direct to surplus.

Northern Texas Bonds Offered.—Collateral trust and 5 per cent gold sinking-fund bonds of the Northern Texas Electric Company to the amount of $1,000,000 are being offered by Parkinson & Burr and Estabrook & Company, of Boston and New York. The bonds are part of an issue dated Jan. 1, 1910, and due Jan. 1, 1940. The circular letter of the bankers offering the bonds includes a letter describing the property, written by Henry G. Bradlee, president of the Stone & Webster Management Association.

Earnings and Prospects of the Montana Power Company.—Gross earnings and other income of the Montana Power Company, covering operations of the Great Falls Power Company, the Thompson Falls Power Company and the Montana Reservoir & Irrigation Company, for the year ended Dec. 31, 1913, amounted to $3,539,198. This is an increase of $516,234, or 17.1 per cent, over the preceding year. The annual report issued to stockholders shows that of the amount stated as gross earnings $7,036 was received as interest from banks and outside sources. Operating expenses and taxes in 1913 aggregated $1,117,774. This compares with $974,828 in 1912. Net earnings in 1913 were $2,421,424, as compared with $2,048,136 in 1912. Interest charges in 1913 were $901,478, while in 1912 they were $1,252,913. The surplus over charges therefore was $1,519,946 in 1913, as compared with $795,223 in 1912. Operating expenses and taxes amounted to 31.6 per cent of the gross earnings in 1913 and to 32.2 per cent in 1912. The total charges for interest included $36,980 bond discount. President John D. Ryan states in the report that the growth in business has been general over the entire system. Practically one-quarter of the new business has been done in contract with mining, smelting and railroad companies and three-quarters in general commercial power and lighting The number of customers on the books is 26,620, or a gain of 3211 during the year. There was an increase in the connected load of 18,568 kw over 1912. Mr. Ryan says that the outlook for a steadily increasing business for 1914 is very bright. It is hoped to have the Great Falls hydroelectric plant in partial operation early in 1915 and to complete it during that year. Until that plant can deliver power to the system, however, the net earnings are not likely to show the usual proportion of increase, for the reason that the hydroelectric power now developed and available is sufficient to take care only of existing business. The growth during the year may necessitate operation of one of the steam reserve plants during the last few months of the year, and in that event the extra expense of steam operation may result in a somewhat smaller rate of increase in net earnings. Mr. Ryan says that development of water-powers in Montana and transmission of cheap electric power to sections heretofore considered inaccessible or too remote to be reached at reasonable cost are materially aiding the prosperity and development of the State. There are many possibilities in the direction of irrigation by pumping which will tend to the upbuilding of communities. The Great Falls plant will have a capacity of 80,000 hp. It is expected that the hydroelectric plant at Thompson Falls on Clark's Fork of the Columbia River will be in partial operation at the end of 1915 and will be completed in 1916. A capacity of 40,000 hp will be installed at this plant. At the end of last year the company had a total capacity of 102,080 hp, of which 94,000 hp was obtained from hydroelectric plants and 8080 hp from steam reserve plants. Of the total of $75,000,000 of common stock authorized, $27,057,600 has been issued and is entitled to share in dividends and $22,500,000 has been issued but is not entitled to share in dividends until certain new hydroelectric plants are completed, and then only on gradual instalments of stock each year.

Business Notes

The Allis-Chalmers Manufacturing Company has moved its Atlanta (Ga.) office to 1104-6 Healy Building, effective April 1.

The Fort Wayne Engineering & Manufacturing Company has recently opened a New York office at 110 West Thirty-fourth Street, in charge of Mr. O. L. Rimoldi.

The Wagner Electric Manufacturing Company, of St. Louis, Mo., has opened an office in Suite 524, Syracuse University Block, Syracuse, N. Y., in charge of Mr. J. W. Bryant.

Meikleham & Dinsmore.—W. H. Padgett, of Philadelphia, has recently become associated with Meikleham & Dinsmore, bankers, New York, his headquarters being at 1421 Chestnut Street, Philadelphia.

The Asbestos Protected Metal Company, of Beaver Falls, Pa., has moved its New York office to more commodious quarters at 52 Broadway. P. M. Stewart continues as district manager in charge of this office.

Elliott H. Whitlock has opened an office at 1506 West 112th Street, Cleveland, Ohio, as consulting and efficiency engineer and carbon expert. Mr. Whitlock has had eighteen years' experience in the carbon industry and in plant management in other lines.

The Dearborn Chemical Company, of Chicago, Ill., has transferred its Southeastern branch office from Birmingham, Ala., to 1407 Candler Building, Atlanta, Ga., where C. H. Everett and J. F. Boutelle, representing the Dearborn company in that territory, will have their headquarters.

The Alpha Electrical Supply Company, of 116-118 West Twenty-ninth Street, New York, has been purchased by Michael Coleman, who will conduct the business hereafter at the same address and with increased facilities for taking care of its customers' wants. The change involves no organization changes.

Munning-Loeb Company.—The interest of Mr. W. L. Loeb in the Munning-Loeb Company, of Matawan, N. Y., maker of electroplating apparatus, has been purchased by Mr. C. E. Watrous, who is now vice-president of that concern. Mr. Watrous previous to this connection was manager of the New York office of the Cutler-Hammer Manufacturing Company.

The United States Light & Heating Company has moved its Chicago branch sales office to 2335 State Street, bringing it into the same building with its service station. The railway department at this office is under the supervision of H. A. Matthews, while R. E. Stuntz has charge of the battery and starter department, and H. M. Emerson looks after the service department.

The Roller-Smith Company, 203 Broadway, New York City, announces that, in addition to its branch offices at 740 Monadnock Block, Chicago, and 711 Williamson Building, Cleveland, it now has the following representatives: The Tompkins-Stoddard Company, 77 Franklin Street, Boston; H. I. Shire, 1310 Majestic Building, Detroit; the W. W. Geisse Company, McKnight Building, Minneapolis; John S. Black, 908 Hennen Building, New Orleans; G. L. Priest, 229 Sherlock Building, Portland, Ore., and the H. B. Squires Company, 579 Howard Street, San Francisco.

Brown, Williams, Bell, Hanson & Boettcher, Chicago patent lawers well known to electrical men, announce a dissolution of partnership by mutual agreement to take effect on April 1. Charles A. Brown, Harvey L. Hanson and Arthur H. Boettcher will continue in partnership in the practice of patent and trade-mark law at 1550 Monadnock Building, 53 West Jackson Boulevard. Lynn A. Williams will continue in practice in the same branches of the law, with offices in the same building. Albert C. Bell will continue in practice in partnership with Henry M. Huxley, with offices at 208 South La Salle Street.

The Freeman-Sweet Company, of 538 South Dearborn Street, Chicago, which does a general electrical contracting business, has established a new department for the purpose of undertaking underground electrical construction work. For a number of years the company has done interior and overhead work and is now prepared to lay conduits and cables underneath the ground. Ornamental street-lighting systems, manhole construction and expert cable splicing will be among the classes of work undertaken by the new department. Ernest Freeman, the president of this company, is also president of the National Electrical Contractors' Association of the United States.

New Industrial Companies

The Railway Electric Manufacturing Company, of Chicago, Ill., has been incorporated by Max Zabel, Otto M. Wermick and H. A. Jones. The company is capitalized at $25,000 and proposes to manufacture and deal in new mechanisms.

The Dennison & Buck Company, of Newark, N. J., has been incorporated with a capital stock of $50,000 to manufacture and deal in electrical goods. The incorporators are I. Simon, B. Strauss, of New York, N. Y., and M. Cohen. of Brooklyn, N. Y.

The Pfanstiehl Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $300,000 to manufacture motors, generators, etc. The incorporators are H. E. Latter, W. J. Maloney and O. J. Reichard, of Wilmington, Del.

The American Model & Instrument Company, of Worcester, Mass., has been incorporated by W. W. Johnson, J. V. Critchley and C. J. Rohland, of Worcester, Mass. The company is capitalized at $50,000 and proposes to manufacture electrical and mechanical devices.

The Sterling Switchboard Company, of Camden, N. J., has been incorporated with a capital stock of $125,000 by J. S. Low, F. N. Humphreys, Jr., of Merchantville, and W. A. Forman, Jr., of Camden. The company proposes to manufacture electrical machinery, switches, etc.

The Fisk Battery Box Company, of Cleveland, Ohio, has been incorporated by A. W. Thomas, E. M. French, L. A. Pejau, J. L. Fairbanks and William E. Patterson. The company is capitalized at $10,000 and proposes to manufacture and deal in electrical equipment of all kinds.

The Rochester Electric Contracting Company, of Rochester, N. Y., has been chartered with a capital stock of $10,000 to do a general contracting and electrical engineering business. The incorporators are Richard Finucane, Bernard E. Finucane and John J. Finucane, of Rochester, N. Y.

The Rollings Company, of Boston, Mass., has been granted a charter with a capital stock of $10,000 to manufacture electrical fixtures. The incorporators are William L. Everett, of Auburndale; William H. Locke, of Everett, Mass.; Paul D. Everett, of Boston, Mass., and Ralph G. Locke, of Everett, Mass.

The Lycoming Transit Company has filed articles of incorporation under the laws of the State of Delaware for the purpose of manufacturing electrical apparatus and machinery. The company is capitalized at $25,000, and the incorporators are J. L. Wolcott, J. H. Hughes and O. M. Roach, of Dover, Del.

The Automatic Ignition Company has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $600,000 and proposes to manufacture spark plugs, ignition apparatus, motors, etc. The incorporators are C. E. Wayman, S. A. Braden and E. J. Stebick, of Pittsburgh, Pa.

The Progressive Electric Welding Company, of New York, N. Y., has been incorporated with a capital stock of $30,000 to manufacture and deal in boilers and dynamos and to do also welding and repairing work. The incorporators are E. Von der Heyde and E. Wellesky, of New York, N. Y., and C. L. White, Jr., of Passaic, N. J.

The National Transportation & Electric Service Corporation has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $2,500,000, to manufacture and sell trucks operated by electricity for transportation of passengers, freight, etc. The incorporators are H. E. Latter, W. J. Maloney and O. J. Reichard, of Wilmington, Del.

Trade Publications

Lightning Arresters.—Bulletin 45600 has been issued by the General Electric Company to describe aluminum lightning arresters for use in connection with railway signal circuits.

Ball Bearings.—The Hess-Bright Manufacturing Company, of Philadelphia, Pa., has just issued a series of sheets showing diagrammatically, with accompanying descriptions, the various types of vertical, horizontal and thrust bearings in which its ball bearings are used.

Distributing Boards.—A large mailing card is being sent out by the Metallic Seamless Tube Company, Ltd., Corporation Street, Birmingham, Ala., referring to its fuse and distributing boards. The illustration shows a "double-door" type. The card contains price list.

Electric Signs.—A small folder issued by Harvey Deschere & Company, 50 Church Street, New York, gives data relating to their Argus miniature electric signs. Miniature tungsten-filament lamps, rated at 4 volts, are used in these signs, and the letters are interchangeable.

Anchors.—The Faultless Anchor Company, Fostoria, Ohio, has brought out a small folder in which four illustrations of its "Faultless" anchor are shown and the four-fin and the two-fin types described. Unusual holding power is claimed for this anchor, which can be installed without any special tools.

Electric Tools.—The Stow Manufacturing Company, Binghamton, N. Y., has issued a number of illustrated leaflets referring to its electric tools, among them leaflets on an electric bench grinder, electric breast drill, tool post grinder and flexible boring machine. A separate folder has been issued on the company's portable tools.

Condulets.—House-number condulets made by the Crouse-Hinds Electric Company, Syracuse, N. Y., are the subject of an illustrated four-page leaflet. These condulets can be so mounted as to show the house number clearly and at the same time throw ample light on the walk. The advantages of such a device for house-numbering are obvious.

Fans.—The 1914 fan catalog of the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York, is being distributed. Almost every fan requirement seems to have been provided for. The publication shows numerous illustrations of direct-current and alternating-current fans in desk, ceiling, column and exhaust types.

Portable Drill.—The general construction of the model D electric portable drill manufactured by the Temco Electric Motor Company, Leipsic, Ohio, is described and illustrated in a large folder recently issued by the company. This drill operates on either direct current or alternating current and can be attached to any ordinary drop cord. Its specifications are given in the circular.

Strain Insulators and Clamps.—Bulletin A4200, issued by the General Electric Company, is devoted to strain insulators and strain clamps suitable for insulating and supporting power-house wiring and overhead distributing cables and wires. The construction of these insulators and clamps is illustrated and described, and the bulletin contains also catalog numbers and prices of the various articles.

Meters.—"Esterline Efficiency Ideas" is the title of Folder No. 312, recently sent out by the Esterline Company, Indianapolis, Ind. A full description of the meters and a number of illustrations showing various types are given. The outside front and back covers contain a full-size Esterline graphic meter chart. New sections for the company's loose-leaf graphic meter data book and price list have also been issued recently.

Electric Percolator.—The Hotpoint Electric Heating Company, Ontario, Cal., has added another broadside to its advertising literature addressed to dealers. The present one refers to the company's new El Perco aluminum percolator. Attention is called to the national advertising to be given to this coffee-pot. This publicity will educate the public and create for this household necessity a demand by which the dealer will benefit.

Matthews Telefault.—W. N. Matthews & Brother, 3777 Forest Park Boulevard, St. Louis, Mo., have issued a large broadside which contains on one side a full-size picture of the "telefault," an instrument for finding faults. A complete description is given of the device and a trial proposition offered to any telephone or cable using company. The reverse side of the sheet contains a number of testimonial letters from satisfied users.

Steel Lockers and Shelves.—Terrell's Equipment Company, Grand Rapids, Mich., has issued an illustrated eight-page folder calling attention to its steel wardrobes and lockers, steel cupboards for storing stationery, valuable stock, supplies, tools, etc.; sectional steel shelving for vaults and storerooms, steel stools and steel chairs, etc. The Eastern representative of the company is Stanton M. Child, 806 Evening Post Building, 20 Vesey Street, New York.

Outdoor Substations.—The Delta-Star Electric Company, of 617-631 West Jackson Boulevard, Chicago, has reprinted in pamphlet form, by special permission, the address of its president, Mr. H. W. Young, on "Moderate-Capacity Outdoor High-Tension Substations." This paper was read before a joint meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers on Dec. 29, 1913.

Devices.—"Electric Household Helps" is the title of a little folder (No. 4197) issued by the Westinghouse Electric & Manufacturing Company, illustrating the application of electrical devices in the household. The reading matter describes the cooking of breakfast, dinner, supper and luncheon, and also treats of the uses of these devices in the boudoir, sewing room and other rooms about the house. A complete price list is included, and the number of watts consumed by each device is shown.

Electric Cooking.—The new catalog of the Hughes Electric Heating Company, of 211-233 West Schiller Street, Chicago, is an interesting pamphlet, with a frontispiece portrait of George A. Hughes, the president of the company, and an attractive cover in colors. Mr. Hughes also contributes a foreword under the title "Life Is Just What You Make It." The advantages of electric cooking are described, and there are descriptions of the various types of Hughes electric stoves, ranges and hot plates. A number of interesting testimonial letters are given.

Lamps.—The fifth edition of the Western Electric Company's copyrighted bulletin, entitled "How to Figure Illumination—Also a Complete Catalog of Sunbeam Mazda Lamps," is just off the press and is being distributed. This bulletin gives complete information for planning the illumination of interiors. Numerical tables necessary in laying out lighting installations for different classes of business are given in this bulletin, as well as other illumination data, such as figures giving efficiencies of lamps and comparative efficiencies of various types of reflectors, both glass and steel.

Grounding of Electrical Systems.—The Fairmount Electric & Manufacturing Company, Philadelphia, Pa., has issued in pamphlet form Mr. H. P. Liversidge's paper on "Grounding of Electrical Systems" which was presented at the eighteenth annual convention of the International Association of Municipal Electricians. The paper discusses briefly the practical side of the subject, as it relates to the methods which have proved most effective. Several diagrams of connections are shown, as well as a photograph of an improved type of grounding device for use on electrical circuits.

Diesel Engines.—The Diesel engine is the subject of an exceptionally well-prepared publication, both as to contents and mechanical features, recently brought out by the Busch-Sulzer Diesel Engine Company, St. Louis, Mo. A brief history of the engine is followed by chapters on the efficiency, economy, life, construction, operation and fuel of this modern prime mover. Its application to various lines of industry is described, and Diesel installations in twenty-six states of the Union are illustrated. The publication is printed with brown ink on lusterless paper, artistically inclosed within brown pasteboard covers, and is a worthy example of fine trade literature.

Personal Mention

Mr. E. J. Cooper, of Edwardsville, has been elected superintendent of the Catawissa (Pa.) municipal lighting plant.

Mr. E. R. Adams has succeeded Mr. W. R. Stewart as superintendent of the municipal lighting and water plant at Blakely, Ga.

Mr. R. U. Steelquist has been appointed manager for the Oregon Power Company at Corvallis, succeeding Mr. A. L. Martin, transferred.

Mr. A. E. Carpenter, of the Eastern Wisconsin Railway & Light Company, has been appointed general manager of the Lomira lighting plant.

Mr. G. W. Skow has been appointed general manager of the Coal & Gas Belt Electric Company, Huntington, Ark., to succeed Mr. L. M. Gazin, resigned.

Mr. Fred Williams has been appointed superintendent of the municipal electric light plant and water-works, Wilmot, S. D., succeeding Mr. K. Hegna, resigned.

Mr. A. L. Martin, formerly manager for the Oregon Power Company at Corvallis, has been appointed manager of the Dallas division of the company, succeeding Mr. J. L. White, transferred.

Mr. J. L. White, for several years manager of the Dallas division of the Oregon Power Company, has been transferred to Albany, Ore., as manager for the company in that city, succeeding Mr. H. E. Morton, resigned.

Mr. Newcomb Carlton has been elected president of the Western Union Telegraph Company to succeed Mr. Theodore N. Vail, who resigned as a result of the sale of stock of the Western Union company by the American Telephone & Telegraph Company. Mr. Carlton has been vice-president in charge of operation.

Mr. J. H. Stewart has resigned as superintendent and contract agent of the municipal electric-light plant of Logansport, Ind., to take charge of the electrical department of the Logansport (Ind.) Heating Company, which recently obtained a franchise to provide electrical energy to factories and homes in the rural districts.

Mr. E. H. Beil, recently connected with the engineering firm of Dodge, Day & Zimmerman, of Philadelphia, has returned to Youngstown, Ohio, and taken the position of manager of the light and power department of the Youngstown Consolidated Gas & Electric Company. Mr. Beil is a former president of the Ohio Electric Light Association.

Mr. Jean Bart Balcomb, who left Chicago to become the executive engineer of the Buena Vista Power & Irrigation Company of Andrews, Ore., and who was afterward elected its president, has assumed the additional duties of executive engineer for the Wild Horse Power & Milling Company, to have charge of the construction and operation of its hydroelectric plant, plans for which are practically completed.

Mr. Sidney Diamant has opened an office at 15 East Fortieth Street, New York, as a consulting engineer. Mr. Diamant is a graduate of Columbia University, and since 1902 has been engaged in the design and erection of steel, timber and reinforced-concrete structures, comprising office and loft buildings, warehouses, schools, public buildings, railway structures, carhouses and power plants. He was connected with the Pearson Engineering Corporation in the erection of the power stations at Necaxa, Mexico, and at Niagara Falls, Ont.

Mr. Nicholas F. Brady, president of the New York Edison Company and head of the Brady syndicate, which owns and operates a number of public utilities in various parts of the country, has been appointed chairman of the industrial committee of the Merchants' Association of New York, as successor to Mr. Henry Morgenthau, now American Ambassador to Turkey. Engaged with Mr. Brady on this committee are a number of other men also interested in public utilities as follows: Messrs. F. H. Bethell, vice-president New York Telephone Company; J. F. Calderwood, formerly of the Brooklyn Rapid Transit Company; Frank Hedley, vice-president of the Interborough Rapid Transit Company, and C. G. M. Thomas, president of the New York & Queens Electric Light & Power Company.

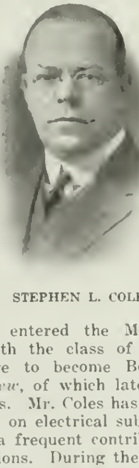
DUDLEY FARRAND

Mr. Dudley Farrand will next month commence his twenty-eighth year of active service in the electric-light industry. Mr. Farrand, who is a past-president of the National Electric Light Association and is general manager of the Public Service Electric Company of Newark, N. J., has had heaped upon him many honors for a man of his years. He was born and brought up in Essex County, N. J., and was educated at the Newark Academy and also attended Princeton University for a time, discontinuing his studies there because of poor health. Twenty-seven years ago he entered the employ of the Newark (N. J.) Electric Light & Power Company, which at that time was a very small organization with a connected load of approximately 150 arc lamps and 365 incandescent lamps. His position was that of general office assistant. During 1889 and 1890 the company took in two other Newark companies. These companies in due course of time and after some changes became a part of the Public Service Electric Company. Mr. Farrand's advancement has kept pace with the growth of the companies with which he has been connected for all of his business life. As general manager of the company he has supervision of the design, construction and operation of all the stations and substations of the system, which include thirty-two generating stations and fifty-six substations. The system is one of the largest in the country, the output last year being approximately 401,000,000 kw-hr. The company serves 178 municipalities with electrical energy and its lines extend from Jersey City on the Hudson River to beyond Camden on the Delaware River.

FRANCIS JEHL

Mr. Francis Jehl, electrical engineer of the General Electric Company of Budapest, Hungary, has been decorated with the Knight's Cross of the Order of Francis Joseph by the Emperor of Austria-Hungary. Mr. Jehl has been connected with the work of the Budapest company for the past seventeen years and has been prominently identified with developments in the electrical art in Europe and America ever since the early work on the Edison electric incandescent lamp at Menlo Park, N. J. Mr. Jehl was at that time one of Mr. Edison's assistants and took part in the epoch-making experiments leading to the development and perfection of the incandescent lamp, the Edison system of electrical distribution, the Edison electric railway, etc. In 1881 he equipped and superintended the testing department of the Edison Machine Works on Goerck Street, New York, and early the next year he was sent to England by Mr. Edison to install the Edison electrolytic meter in the Holborn viaduct station, which had been constructed for the English Edison Company by Mr. E. H. Johnson, general manager, and Mr. W. J. Hammer, chief engineer. This station, which is said to have been the first established anywhere in the world, began operations Jan. 12, 1882. After equipping the meter department for the English company, Mr. Jehl went to France to undertake similar work for the French Edison Company, and about that time prepared the first book ever written upon the electric meter. He later traveled extensively in Europe, introducing the Edison electric-lighting system, and installed the lighting plant in the Brünn Theatre at Brünn, Austria. Mr. Jehl made a similar installation in Bucharest, Roumania, and in 1883 had charge of the Edison exhibit at the Vienna Electrical Exhibition. At one time Mr. Jehl was associated with the Hardtmuth Carbon Company of Austria. While in Vienna in 1899 he wrote a book on carbon manufacture and took out a number of patents upon various inventions, such as carbon economizers, continuous furnace for carbon manufacture, electric meters and a Faraday disk type of dynamo, known as the Jehl-Rupp disk dynamo. While at Menlo Park Mr. Jehl invented a very simple type of mercury pump which was extensively used for exhausting incandescent-lamp bulbs, and during his stay in Austria he established a small lamp factory in order to protect the Edison lamp patents in that country. Mr. Jehl has been a frequent contributor to the technical press both here and abroad.

Mr. C. A. Ablett, who was recently appointed general manager of the Siemens Company of Canada, Ltd., has had a wide experience as an electrical engineer in Europe and on the North American continent. He was manager of the steel works and rolling-mill department of the Siemens Brothers Dynamo Works, Ltd., London, England, and had charge of the installation of some of the largest electrical plants in European steel works. Prior to 1906 he was with the General Electric Company and was engaged in electrical work in Canada and the United States. He has contributed papers to the Institution of Civil Engineers, the Iron and Steel Institute and the Institution of Electrical Engineers and was joint author with Mr. H. M. Lyons of a paper on the "Electrical Driving of Winding Engines and Rolling Mills," read March 12 before the Canadian Society of Civil Engineers and the Canadian Mining Institute. He is an associate member of the Institution of Civil Engineers and has been made the recipient of the Bayliss and Miller prizes of that institution.



STEPHEN L. COLES

Mr. Stephen L. Coles has resigned the secretary-treasurership of the Society for Electrical Development, effective April 15. As of the same date he has joined the engineering staff of M. W. Thompson, 111 Broadway, New York City, specialist in litigated engineering matters and in reports on railroad and other large properties. Mr. Coles will devote his attention principally to electrical public utilities having problems of service, policy and competition to solve. He has grown up with the electrical industry, his first work having been with the old New England Wiring & Construction Company, of Boston, in installing an isolated electric-lighting plant at Springfield, Mass., in 1889, for the Boston & Albany Railroad. He was educated in the public schools, including the famous Woodward High School, of Cincinnati, Ohio, his birthplace. He entered the Massachusetts Institute of Technology with the class of 1891 and in his fourth year left college to become Boston correspondent of the *Electrical Review*, of which later he was managing editor for several years. Mr. Coles has been a prolific writer for the secular press on electrical subjects treated in a popular manner and is a frequent contributor to technical and engineering publications. During the past five years he has made a special study of service and public-policy questions affecting central stations. At the last annual meeting of the Canadian Electrical Association his brief paper on "Service" created a great deal of valuable discussion. In January, 1913, Mr. Coles was employed by the Harrisburg Board of Trade to make a report on the industrial conditions of Harrisburg, Pa. His work was highly commended by the local newspapers, and he received a special letter of thanks from the Board of Trade. Last summer his services were loaned by the Society for Electrical Development to the Toronto Electric Light Company, Ltd., of Toronto, Canada, to assist the executives of that company in working out certain constructive policies of importance. Since Aug. 1 last Mr. Coles has been acting secretary-treasurer and secretary-treasurer of the Society for Electrical Development and has concentrated his well-known energies on doing his share toward making the society an accomplished fact and a working reality. One of his latest efforts in behalf of the society was an article under his signature in the "Public Utilities Number" of the *Evening Post*, New York, March 30, giving data regarding the objects and formation of the society and the educational work it expects to do.

Obituary

Thomas R. Fernald, for fifty years connected with the electrical contracting house of the Seth W. Fuller Company, Boston, Mass., died suddenly at his home in Somerville, Mass., on April 8. Mr. Fernald was one of the pioneer electricians of the country and in the course of his career was occupied in the wiring of many of the most prominent buildings in America.

Sir William Whyte, formerly vice-president of the Canadian Pacific Railway and Premier of Manitoba, died in Los Angeles, Cal., April 14. Sir William Whyte was also vice-president of the Winnipeg Electric Railway Company, which owns the electric railway of Winnipeg and operates the municipal system in opposition to the municipal plant recently started in Winnipeg.

Thomas C. White, proprietor of the T. C. White Company of St. Louis, manufacturer of railway and lighting specialties, died in that city on March 22. Mr. White had been engaged in electrical manufacturing enterprises for twenty years or more, having been in business for himself for the last ten or twelve years. Before that time he was connected with the Central Union Brass Company of St. Louis.

Lincoln S. Risley, manager of the United Electric Light & Water Company of New Britain, Conn., died on April 5 of heart trouble. Mr. Risley entered the employ of the New Britain Railway & Light Company in 1893 as clerk, and soon rose to the superintendency of the company. He followed the lighting company through its various changes, when it was acquired by the late A. M. Young, and then by the New Haven railroad. When the railway and lighting interests were divorced, Mr. Risley became superintendent of the New Britain plant.

L. N. Peart, general superintendent, and **J. E. Burgess,** construction superintendent, of the San Joaquin Light & Power Company, of Fresno, Cal., were drowned in the San Joaquin River on March 28, when the automobile in which both were riding slid from the Crane Valley bridge. Mr. Burgess, whose body was recovered on March 31, was a graduate of the University of California and was twenty-six years old. Prior to his connection with the San Joaquin Light & Power Company he was engaged in business in Los Angeles. He was a native of Michigan.

Delancey H. Louderback, a financier who had been prominent in Chicago public utility affairs, particularly in street-railway and elevated-railway enterprises as a lieutenant of the late C. T. Yerkes, died on April 9. Back in 1888 Mr. Louderback was general manager of the Chicago Edison Company, predecessor of the Commonwealth Edison Company. Before that he had been secretary of the old Western Edison Light Company. He was also connected with telephone enterprises in the early days and was then associated with the Central Union Telephone Company. He was also at one time an officer of the Western Electric Company. Of late years he had given his attention to his real estate investments.

Maurice B. Peugnet, of St. Louis, died in Detroit on April 12, while on a visit to that city. Mr. Peugnet was a man of brilliant scientific attainments. He was born in New York City forty-three years ago and was a descendant of a noted French family. He was a graduate of the United States Naval Academy and served as an officer in the United States Navy. He took post-graduate work at Harvard and was made professor of gas engineering at that university. He was gifted with unusual inventive ability, but being a reticent man possessed of ample means and having no taste for commercial exploitation, he did not bring his inventions to the attention of the public. One of his inventions, for which he took out a patent, was an electric drill. Mr. Peugnet was much interested in automobile design and his visit to Detroit was largely to inspect the automobile factories in that city.

Construction

New England

CONWAY, N. H.—A committee has been appointed to make a contract with the Conway El. Lt. & Pwr. Co. for lighting the streets of the village, provided satisfactory arrangements can be made.

RICHFORD, VT.—The Richford Pwr. Co. has filed a certificate showing an increase of capital stock to the amount of $21,000 with the Secretary of State, the proceeds to be used for developing water-power, electric lighting, etc. The property of the company is located at Stevens Mills, about 3 miles above Richford. S. R. Boright is president of the company.

BROCKTON, MASS.—The highway commission is planning the removal of 80 arc lamps in the street-lighting system and the substitution of about 300 incandescent lamps.

FITCHBURG, MASS.—Plans are being prepared by the Putnam Machine Co., of Fitchburg, for the construction of a machine shop and power house, to cost about $300,000.

HOLYOKE, MASS.—It is reported that bids will be received by the Gas and Electric Department of the city of Holyoke, Mass., until April 21 for gem and tungsten lamps. Bids will also be received by the department until April 28 for electric and gas meters. Specifications may be seen at the office of the department. John J. Kirkpatrick is manager.

PLYMOUTH, MASS.—The proposed extension to the system of the Plymouth El. Lt. Co. is a high-tension transmission line (30 miles, 22,000 volts) running from Plymouth to Wareham and Marion. It also means a small addition to power house and the installation of a 1000-kw turbine. Contracts have been placed for all material. E. P. Rowell is manager.

RUTLAND, MASS.—At the annual town meeting held April 7 it was voted to instruct the Selectmen to enter into a 10-year contract with the Gardner El. Lt. Co., of Gardner, for lighting the streets of the town with 40 lamps of 60 cp and 45 lamps of 40 cp, at a cost of $800 per year. It was also voted to instruct the water commissioners to equip the pumping station with electrical machinery at a cost not to exceed $2,500, and to contract with the Gardner company for electricity to operate same for a period of ten years. The Gardner El. Lt. Co. has applied for a franchise here.

WAKEFIELD, MASS.—The citizens have voted to make extension to electric service on several streets in the town, and also to extend the street-lighting service into Montrose Avenue.

MERIDEN, CONN.—Preliminary plans are being prepared by the Meriden El. Lt. Co. for the installation of an underground conduit system. C. A. Learned is general manager.

WILLIMANTIC, CONN.—The Willimantic Gas & El. Lt. Co. expects to purchase material for distribution system and electrical supplies and appliances within the next few months to meet requirements. J. F. Ahern is agent.

Middle Atlantic

JAMESTOWN, N. Y.—The lighting commission has awarded the contract for construction of new boiler house and fan house at the municipal electric-light plant to S. T. Benson & Co., of Falconer, at $9,575.

MEDINA, N. Y.—Preparations are being made by the A. L. Swett El. Lt. & Pwr. Co., of Medina, to make extensive improvements to its power plant at Medina Falls, including the installation of a 450-hp generating unit, consisting of a new Morgan Smith waterwheel directly connected to a General Electric generator. The cost of the work is estimated at $6,000.

NEW ROCHELLE, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 16 for construction, complete (including mechanical equipment, interior lighting fixtures and approaches) of the United States post office at New Rochelle, N. Y. Drawings and specifications may be obtained from the above office or from the custodian of site at New Rochelle. O. Wenderoth is supervising architect.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until April 20 for installing electric equipment in addition to and making alterations in Public School 169, on Audubon Avenue, between 168th and 169th Streets, borough of Manhattan. Blank forms, plans and specifications may be obtained at the office of the superintendent.

RICHMOND HILL, N. Y.—A contract for electric equipment for Richmond Hill High School has been awarded by C. B. J. Snyder, superintendent of school buildings, to the Doncourt Construction Co., of Flushing, at $3,444.

NEW CASTLE, PA.—An ordinance has been introduced into the Council providing for a curb lighting system on Washington Street from County Line Street to Greenwood Avenue, a distance of about a mile. The city will own the lamps and standards and will purchase electricity. Three-lamp clusters will be used except at intersection of streets, when five-lamp clusters will be used. The city engineer and electrician have been authorized to prepare plans.

PHILADELPHIA, PA.—Bids will be received until May 7 for furnishing electric arc street lamps, which includes maintenance service complete with use of equipment for year 1915. Morris L. Cooke is director of public works

BOONTON, N. J.—The Jersey Pwr. Co., Boonton, has closed a contract with the Morris County Traction Co., of Morristown, to furnish electricity to operate the electric-railway system of the traction company, extending from Boonton to Lake Hopatcong and from Danville to Morris Plains, a total distance of about 25 miles, for a period of ten years.

BUTLER, N. J.—The Council has decided to submit to the voters in the near future the proposal to issue $35,000 in bonds for the installation of a municipal electric-light plant.

LAUREL, DEL.—Within the next 30 days the Sussex Lt. & Pwr. Co., of Laurel, expects to purchase 180 ft. No. 4, three-wire submarine cable to carry 13,000 volts. H. L. Richardson is superintendent.

BALTIMORE, MD.—Plans have been prepared by the electrical commission for a general extension of the electrical conduit system, to cost about $500,000.

LONACONING, MD.—The plant of the Lonaconing El. Lt. & Pwr. Co. was recently damaged by the bursting of a large flywheel, causing a loss of several thousand dollars.

NEWELL, W. VA.—The Newell Wtr. & Pwr. Co., it is reported, is contemplating increasing the output of its plant, work on which will soon begin. The work will include the erection of a new building and the installation of a low-pressure steam turbine; a triple pump will be installed in the water-works plant. The cost of the work is estimated at $35,000. F. B. Lawrence is general manager.

FRONT ROYAL, VA.—Bids will be received until May 15 for construction of public buildings, including steam heat, electric-lighting and plumbing, on reservation at Remount Depot, Front Royal, Va., as follows: One barrack, administration building and storehouse, one commanding officer's quarters, two junior officers' quarters, one veterinarian's quarters, two double N. C. O. quarters, one dispensary, three colt stables, one wagon shed, one shop building, one veterinary storehouse, subsoil drainage system. A deposit will be required on plans to insure return of same. Further information may be obtained upon application to constructing quartermaster at Front Royal.

RICHMOND, VA.—The management of the Mutual Assurance Society Building, it is reported, contemplates the installation of a storage battery to be operated in conjunction with an isolated plant. Plans are being prepared by A. Lankstaff Johnston, Jr., American National Bank Building, Richmond.

WASHINGTON, D. C.—Bids will be received at the Engineer Depot, United States Army, Washington Barracks, D. C., until May 7, for furnishing two 10-kw, 115-volt direct-current motor-generator sets, together with necessary starting compensators and field rheostats. Further information may be obtained upon application to Lieut. Col. Joseph E. Kuhn.

WASHINGTON, D. C.—Bids will be received at the office of the purchasing agent of the District of Columbia, Washington, D. C., until April 24 for furnishing miscellaneous fuses, branding irons, etc., for the Central High School. Bids will also be received until April 27 for furnishing one voltmeter, two ammeters and one millivoltmeter, 10 battery jars, copper wire, magnet wire, 50 electric carbon lamps, 100 lamp receptacles, four large primary and secondary coils, and four dynamos for the Business High School. For further information address the purchasing agent, District of Columbia.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 5, to furnish at the various navy yards and naval stations supplies as follows: Annapolis, Md., Schedule 6640—one absorption dynamometer. Norfolk, Va., Schedule 6641—one portable, oil-burning, heat-treating furnace. Philadelphia, Pa., Schedule 6642—annual supply of tool, carbon and tungsten steel. Washington, D. C., Schedule 6639—one copper still, seven tanks. Bids will also be received until May 12 as follows: Mare Island, Cal. Schedule 6633—two 20-hp fire-tube vertical boilers. Schedule 6635—air compressor, etc. Puget Sound, Wash., Schedule 6634—four hoists, three 2000-lb. and one 4000-lb. Bids will also be received until May 19 for the following: Mare Island, Cal., Schedule 6638—one motor-driven engine lathe, one motor-driven double emery grinder, one motor-driven upright motor-driven drill press, one motor-driven column shaper; Schedule 6637. —refrigerating plant. Bids will also be received until April 28 for furnishing 10,250 rubber gaskets at Washington, D. C., as per Schedule 6643.

North Central

FLINT, MICH.—An ordinance has been introduced into the City Council compelling all wires to be placed in the business district.

LAPEER, MICH.—The Lapeer Gas-El. Co. expects to install a 150-kva or 200-kva direct-connected unit in the near future. C. W. Smith is manager and C. D. Hulbert, superintendent.

NORTHVILLE, MICH.—It is reported that a large part of the power dam built by the city at a cost of $8,000 has been washed away.

BELLEFONTAINE, OHIO.—Contracts have been awarded by the Board of Control for equipment of the municipal electric-light plant as follows: For steam turbine to the General Electric Co., of Schenectady, N. Y., at $8,000; Babcock & Wilcox Co., of New York, N. Y., for two Stirling 250-hp boilers at $7,200; switchboard to the Fort Wayne El. Works, at $1,745. The clerk of the board of control has been instructed to advertise at once for all auxiliaries necessary for installation of the new plant.

GREENVILLE, OHIO.—The Public Utilities Commission of Ohio has granted the Greenville El. Lt. & Pwr. Co. permission to issue $12,000 in capital stock, the proceeds to be used for the purpose of erecting a transmission line from its plant in Greenville to the works of the Greenville Gravel Co. in Neave Township, a distance of about 7 miles.

MOUNT VERNON, OHIO.—The Ohio Lt. & Pwr. Co., of Mount Vernon, will soon begin work on the erection of a transmission line from Mount Vernon to Frederickstown to furnish electricity in that village. A. J. Darrah is local manager.

PAINESVILLE, OHIO.—The Council has voted to issue $5,000 in bonds for lighting purpose, which will include the installation of an ornamental street-lighting system.

PLAIN CITY, OHIO.—The Board of Public Affairs is contemplating changing the municipal electric-light system from single-phase to three-phase, 60 cycles; also installing a motor-driven centrifugal pump for supplying the village with water. Frank Currier is clerk.

PORT CLINTON, OHIO.—As a result of a tangle over the election held last fall, when the proposal to issue $30,000 in bonds for the installation of a municipal electric-light plant was carried by a small majority, a committee of nine citizens will be appointed to determine what steps are necessary. The Council is ready to advertise the sale of bonds as soon as the matter is settled. The proposition to purchase the distributing system of the Northern Ohio Lt. & Pwr. Co. will not be considered unless a price more satisfactory than the one of $47,000 is given by the company.

WEST UNION, OHIO.—A committee has been appointed to make investigations in regard to the installation of a municipal electric-light plant. S. S. Jones is a member of the committee.

BOWLING GREEN, KY.—The Kentucky Pub. Ser. Co. has submitted a proposal to the City Council offering to furnish electricity to maintain an ornamental street lighting system and other lamps for $3,714 per year on a moonlight schedule.

HODGENVILLE, KY.—The local electric-light plant, owned by D. E. Patterson, is reported to have been purchased by Dr. O. L. Herron, of Liberty. It is understood that the new owner will enlarge the plant and establish a day service.

HOPKINSVILLE, KY.—The City Council, it is reported, has entered into a contract with the Kentucky Pub. Ser. Co for the installation of a new street-lighting system, to replace the lamps now in use.

LOUISVILLE, KY.—Investigations are being made by engineers for H. M. Byllesby & Co., of Chicago, Ill., who operate the Louisville Gas & El. Co., of a project to utilize the water-power of the Ohio Falls at Louisville. The plans provide for the use of the old Louisville and Portland Canal, which is not now used, having been replaced by modern canal locks at the falls. It is estimated that sufficient power can be developed to supply electricity for all purposes in Louisville at a cost not to exceed $1,500,000.

HUNTINGTON, IND.—The Public Service Commission has authorized the city of Huntington to enlarge and improve its municipal electric-light plant and to furnish electricity for commercial lighting; also to issue $30,000 in bonds to provide funds for same.

INDIANAPOLIS, IND.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 27, for installation complete of an electric sidewalk type mail lift, etc., in the United States court house and post office at Indianapolis, Ind., in accordance with specifications. For details see proposal columns. O. Wenderoth is supervising architect.

MARTINSVILLE, IND.—The city of Martinsville is planning to install ornamental cluster lamps in the public square, at a cost of about $1,000; it is also proposed to make extensions to the municipal street-lighting system.

NEW ALBANY, IND.—The Louisville & Northern Ry. & Ltg. Co., of New Albany, is reported to be contemplating extending its system between Louisville and Charleston, to Madison; also to extend its transmission line from Charlestown to Sellersburg, for the purpose of furnishing electricity in the latter place, and also to the farmers between the two towns.

BLOOMINGTON, ILL.—The Bloomington & Normal Ry. & Lt. Co., of Bloomington, contemplates erecting a transmission line from Chenoa to Lexington during the coming year. When the line is completed it is proposed to close down the Lexington plant and supply energy from the central station in Bloomington.

CHENEYVILLE, ILL. — Arrangements are being made by J. E. Leach, of Cheneyville, to install an electric-light plant here.

MATTOON, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, expects to erect within the next 30 days a high-tension transmission line from Camp Point to Clayton. H. M. Brooks is statistician.

SPRINGFIELD, ILL.—Estimates of the cost of the installation of an ornamental street-lighting system on Adams Street from Lewis Street to Tenth Street have been completed by W. D. Seeley, city engineer. The plans provide for 86 ornamental cast-iron standards, 73 carrying five-lamp clusters and 13 three-lamp clusters. 500 ft. No. 4, 4000 ft. No. 6, 4000 ft. No. 8 and 2000 ft. No. 10 three-conductor, 600-volt park cable, and six 4-kw transformers. The cost of the system is estimated at $7,998.

STERLING, ILL.—Preparations are being made for the installation of an ornamental street-lighting system in Sterling, to cost about $9,015. The present plans provide for 82 single-unit steel lamp-posts, equipped with high candle-power tungsten or nitrogen lamps (300 watt), maintained by underground wires; about 9000 ft. of armored cable will be required and constant-current transformers. Contracts will be awarded about May 15. H. S. Green, of Sterling, is engineer, and **A. J. Platt** is chairman of light committee.

URBANA, ILL.—The lighting committee, it is said, will recommend to the Council the annulling of the present street-lighting contract with the Urbana Lt., Ht. & Pwr. Co. and the execution of a new contract for lighting the streets of the city for a period of ten years. If granted a new contract, the company will remove the present arches and install a cluster-lamp system in the business district. Under the new contract the company will furnish 125 4-amp metallic flame arc lamps.

ASHLAND, WIS.—Bids will be rereceived at the office of the light house inspector, Post Office Building, Detroit, Mich., until April 21 for furnishing steel and iron work and submarine electric cable for light and fog signal station at Ashland, Wis. Blank proposals and further information may be obtained from the above office.

POUND, WIS.—The Coleman-Pound Lt. & Pwr. Co., recently incorporated, will begin work as soon as possible on the erection of a transmission line between the two towns. It is expected that connection will be made with the high-tension lines of the Wisconsin Pub. Ser Co. from the High Falls plant about Aug. 1. Otto Koenig, of Pound, is interested in the company.

ALBERT LEA, MINN.—Bids will be received by the Board of County Commissioners of Freeborn County, at the office of the county auditor in Albert Lea, until April 28 for furnishing materials and installing heating plant, plumbing system, electric wiring, water and lighting system for the county poor farm building of Freeborn County, situated about 4 miles north of Albert Lea. Plans and specifications are on file in the office of the county auditor. Separe bids must be submitted for each system C E. Brainerd is county auditor

COMFREY, MINN.—The Council has engaged W. S. Buck, of Minneapolis, as consulting engineer in connection with the construction of a municipal electric-light plant, for which bonds to the amount of $8,000 have been voted. Bids will be asked for same as soon as plans are completed, which will probably be ready the latter part of this month. G. W. Schaffer is recorder.

COTTONWOOD, MINN.—The village of Cottonwood has granted a franchise to W. F. Mullaney, of Marshall, Minn., for the installation of an electric-light plant here. W. A. Sisson is village recorder.

MADELIA, MINN.—Steps have been taken by local business men to install an ornamental street-lighting system. C. S. Christiansen is chairman.

ARNOLDS PARK, IA.—A special election will soon be held to submit to the voters the proposal to grant a franchise to A. L. Peck to construct and operate an electric-light plant in Arnolds Park.

CLARINDA, IA.—The Lee El. Co., of Clarinda, has been reorganized under the name of the Lee El. Lt. & Pwr. Co., with a capital stock of $500,000. The company controls franchises in Clarinda, Gravity, New Market, Corning, Blanchard, College Springs, Bradyville and Shambaugh, and will sell electricity to the Bradford Lt. & Pwr. Co.

GOWRIE, IA.—A special election will be held April 24 to submit the proposal to grant the Central Iowa Lt. & Pwr. Co. a franchise to construct and operate an electric-light plant in Gowrie for a period of 20 years.

MANILLA, IA.—At an election held April 3 the proposal to issue $20,000 for the installation of a municipal electric-light plant was carried.

TOLEDO, IA.—Bids will be received by J. H. Ross, secretary of the independent school district of Toledo, until May 4 for the construction of a new building, including installation of heating and ventilating system, and electric wiring. Plans and specifications may be obtained from Proudfoot, Bird & Rawson, architects, of Des Moines.

GRAND FORKS, N. D.—Bids will be received by county auditor, Grand Forks, N. D., until May 7 for furnishing and installing electric fixtures in the Grand Forks county court house, according to plans and specifications now on file in the office of the county auditor, prepared by Buechner & Orth, architects, St. Paul, Minn. Hans Anderson is county auditor.

GRAND FORKS, N. D.—Bids will be received by the board of directors of the Scandinavian American Bank and Northwestern Trust Co., of Grand Forks, until April 29 for the erection of a bank, store and office building at Grand Forks. Separate bids will be received as follows: (a) General work, including the erection of the structural steel; (b) furnishing structural steel; (c) heating; (d) plumbing; (e) electric work. Plans and specifications can be seen at the office of Buechner & Orth, architects, Shubert Building, St. Paul, Minn. the Builders' Exchange, St. Paul, Minneapolis and Duluth, Minn., and at the office of the Northwestern Trust Co., Grand Forks.

ELK POINT, S. D.—Bids will be received by A. Smythe, city auditor, Elk Point, until April 30 for the construction of an electric-lighting system as follows: (1) brick building for power station; (2) for furnishing and installing equipment, consisting of two 125-hp anthracite gas producers, one 125-hp gas engine and one 75-hp gas engine, directly connected to a 75-kva and a 50-kva alternator respectively, with directly connected exciters, necessary piping and accessories, switchboard, etc.; (3) furnishing and erecting poles, wires, street lamps, transformers, etc., for the electrical distribution system. Plans and specifications are on file in the office of the city auditor, Elk Point, S. D., and at the office of Earle D. Jackson, consulting engineer, Capital Bank Building, St. Paul, Minn.

MITCHELL, S D.—The city of Mitchell is contemplating the construction of a municipial telephone system, to cost about $60,000.

PARKER, S. D.—At an election held April 3 the proposal to issue $20,000 in bonds for the installation of an electric-light plant was carried. As yet an engineer has not been engaged. C. L. Jones is city auditor.

PRATT, S. D.—At an election held recently the proposal to issue $50,000 in bonds for the installation of a municipal electric-light plant was carried.

MINATARE, NEB.—The installation of a municipal electric-light plant, to cost $6,000, in Minatare, is under consideration.

SUPERIOR, NEB.—The Southern Nebraska Pwr. Co., of Superior, successor to Guthrie & Co., has submitted to the State Railway Commission estimates of a hydroelectric plant to furnish electricity in 20 central Nebraska towns. Electricity is to be generated at a plant on the Republican River, near Superior, and transmission lines erected to Harvard and Sutton, Red Cloud and Fairmont, via Chester. Among the towns to be supplied are Guide Rock, Nelson, Edgar, Fairfield, Clay Center, Harvard, Sutton, Hardy, Byron, Chester, Hebron, Belvidere, Carleton, Strang and Shickley, Geneva and Fairmont. The company has been incorporated with a capital stock of $300,000 and has asked for permission to issue $100,000 in stock and $200,000 in bonds.

LARNED, KAN.—At an election held April 7 the proposal to issue bonds for the installation of an electric-light plant and water-works system was carried. Worley & Black, consulting engineers, Reliance Building, Kansas City, Mo., have charge of the engineering work.

LEAVENWORTH, KAN.—W. J. Squire and O. B. Taylor, both of Kansas City, Mo., the former an electrical engineer, are interested in a project to build a 6000-hp power plant to furnish electricity in Leavenworth and adjacent towns. It is proposed to reopen the Brighton coal mine to provide fuel for the proposed plant, option on which has already been secured. Steps have been taken by the company to secure a franchise to furnish electricity in Leavenworth. The cost of the plant is estimated at $360,000

Southern States

OLD FORT, N. C.—The White Coal Co., recently incorporated, is planning to build a hydroelectric power plant at Catawba Falls, Old Fort. The equipment will include one 800-hp impulse waterwheel, Lombard oil-pressure waterwheel governors, one 600-kva generator, with switchboard equipment, and transformers. One substation will be erected and 4 miles of copper or aluminum wire will be used. Contracts for construction of plant will be awarded about July 1. Daniel W. Adams, Legal Building, Asheville, N. C., is engineer in charge.

WINSTON-SALEM, N. C.—The Board of Aldermen has called an election, to be held June 23, to submit the proposal to issue $750,000 in bonds of which the proceeds of $250,000 are to be used for the installation of a municipal electric-light and heating plant in the twin cities.

COLUMBIA, S. C.—The City Council is contemplating extending the street-lighting system into North Columbia, as well as into Shandon and Waverly. The Columbia Ry., Gas & El. Co. furnishes the street-lighting service in Columbia.

BLAKELY, GA.—Within the next six months the town of Blakely expects to purchase one boiler-feed pump and a motor-driven fire pump and incandescent series lamps (number not yet decided): also to purchase within the next two months several station-type recording wattmeters, together with current and potential transformers for same. E. R. Adams is superintendent.

MACON, GA.—A movement has been started to form a new company to establish an electric plant to furnish electricity to business houses in the down-town district. Nicholas Christophulos is interested in the project.

MANSFIELD, GA.—At an election to be held April 20 the proposal to issue $5,000 for the installation of an electric-lighting system will be submitted to the voters.

VALDOSTA, GA.—The South Georgia Pwr. Co., recently incorporated with a capital stock of $2,500,000, proposes to construct a hydroelectric plant on Willachoochee River, 4 miles from Valdosta. Electricity generated at the plant will be transmitted throughout the Valdosta district. The incorporators are Frank Roberts, A. S. Pendleton, C. I. Harrell and John T. Roberts, of Valdosta, and B. S. Rucker, of Charlotte, S. C.

FLORA, MISS.—The City Council is contemplating the construction of a municipal electric-light plant, plans for which have been submitted by Massena L. Culley, engineer, of Jackson, Miss.

GREENVILLE, MISS.—The Delta Lt. & Trac. Co., recently incorporated with a capital stock of $200,000, by R. B. Claggett, E. J. Lenz and F. N. Robertshaw, has purchased the property of the Delta El. Lt., Pwr. & Mfg. Co., of Greenville. The new owners, it is understood, will make improvements to the plant.

DANVILLE, ARK.—Within the next two months W. W. Winters, who has leased the Danville electric light plant for a term of five years, expects to install a new plant in a nearby town and to purchase a new turbine outfit complete.

JONESBORO, ARK.—The water and light commissioners expect to erect at once an addition to the power house and to purchase within the next 60 days a new switchboard for the municipal electric-light plant, and within three months a carload of poles. The commission has recently placed orders for a 500-kva generator. J. F. Christy is manager.

GUEYDAN, LA.—The Town Council, it is reported, has awarded contracts for the installation of a municipal electric plant.

LAFAYETTE, LA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 18, for construction, complete (including mechanical equipment, lighting equipment and approaches) of the United States post office at Lafayette. Drawings and specifications may be obtained from the above office or from the custodian of site at Lafayette. O. Wenderoth is supervising architect.

CARLSBAD, TEX.—Among the improvements contemplated by the commissioners for the Texas Tuberculosis Sanitarium at Carlsbad is the installation of an electric-light system, at a cost of about $9,000; this would include boilers which could be used for heating purposes.

DALLAS, TEX.—Estimates are now being received by the Continental Gin Co. for electrical work in connection with extensions and improvements now being made to its property. The equipment will include three 200-hp Frost return tubular boilers, one 330-hp Harrisburg engine, directly connected to a 250-kw Westinghouse, two-phase, 60-cycle, 220-volt, 200-r.p.m. generator, switchboard complete, 75-hp compressor, feed pumps, feed-water heater and injector, etc. The electric-light and power mains will be underground and will be of the usual lead-cable type; the remainder of the wiring of the plant will be of the rigid conduit type. The cost of the electrical work is estimated at $20,000. All equipment except motors and generators will be contracted for. M. G. Farrell, of the Suffern Engineering Corpn., is chief engineer.

DAYTON, TEX.—The installation of an electric-light plant is under consideration. J. B. Sterling and associates are reported to be interested.

FRANKLIN, TEX.—Bonds to the amount of $17,500 have been voted for the installation of a municipal electric-light plant and water-works system to replace the plants recently destroyed by fire.

HOUSTON, TEX.—Plans are being considered by J. M. Barnes to install an electric-light plant at Magnolia Park.

SAN ANTONIO, TEX.—It is reported that sufficient funds have been raised to pay for the maintenance of the new lighting system on Houston Street. The San Antonio Gas & El. Co. has agreed to install the ornamental lighting system provided the city and merchants will pay to maintain same.

TERRELL, TEX.—The Terrell El. Lt. Co. has rebuilt its plant and is now furnishing electrical service. The plant was destroyed by fire on March 20, and four days later the company was giving temporary service to most of its patrons. Fourteen days after the fire the plant was running. M. A. Joy is president.

Pacific States

BUCKLEY, WASH.—The property of the Buckley Electrical Co. has been purchased by the Puget Sound Trac., Lt. & Pwr. Co., of Seattle. The new owners will erect a transmission line from the power station in Deringer to Buckley in the near future.

COLVILLE, WASH.—The Stevens County Lt. & Pwr. Co. is negotiating with the City Council for lighting the streets of the city. If granted a contract, the company will make several extensions and improvements to its system this spring.

ANDREWS, ORE.—Plans have been completed and surveys made for the construction of a hydroelectric power plant on Wild Horse Creek during the summer and fall. Electricity generated at the plant (three phase, 60 cycles, 220 volts) will be used for operating pumps for irrigating purposes and for lamps and motors. Contracts have already been secured for the entire output of the initial installation. Jean Bart Balcomb, of Andrews, as executive engineer, will have charge of construction and operation of the plant.

FALLS CITY, ORE.—Within the next six months the Falls City El. Lt. & Pwr. Co. expects to purchase a generator, transformers, also arc and incandescent lamps. H. C. Brown is vice-president and manager.

PORTLAND, ORE.—The City Commission has authorized Municipal Purchasing Agent Wood to advertise for bids (date of closing not announced) for the installation of an electric-light system along the Terwilliger Boulevard, from Hamilton Avenue northward to Sheridan Street.

BAKERSVILLE, CAL.—The Kern County Highway Commission is planning to install a rock-crushing plant at Keene, near Woodford, on the Southern Pacific Railroad. Bids and competitive designs are requested for the complete equipment of an electrically operated plant, which shall have an output of 1000 tons in eight hours. The equipment to include one primary and two secondary crushers with motors, screens, conveyors, bins, air compressor, tripod and hammer drills, together with all necessary apparatus for a first-class plant. Each crusher is to be driven by a medium or low-speed motor with three adjustable dust-proof bearings. All electrical apparatus to be protected by overload relay coils. There shall be no fusible safety devices used. The county will furnish energy at the quarry site, at 440 volts, three-phase, 50 cycles. It is expected that bids will be opened the second week in May. Contour maps of quarry site and specifications for plant may be obtained at the office of the commission, County Court House, Bakersfield. P. H. Everett is chief engineer.

DOWNEY, CAL.—The Southern California Edison Co. and the Downey Lt., Pwr. & Wtr. Co. have joined in an application to the State Railroad Commission for authority to transfer the Downey company to the Southern California company for $50,938. The latter company has furnished electricity to the Downey company.

DURHAM, CAL.—Within the next three months the Durham Lt. & Pwr. Co. expects to purchase electrical appliances, including cooking apparatus, household devices, washing machines, etc.

ELSNORE, CAL.—The Southern Sierras Pwr. Co. is installing a new substation in Elsinore. E. E. Robinson is local superintendent.

KINGSBURG, CAL.—The city trustees have adopted a resolution authorizing the installation of 30 electroliers carrying five-lamp clusters on Draper Street, to cost about $3,000.

OXNARD, CAL.—H. E. Huntington, president of the Los Angeles Ry. Corpn., has purchased the controlling interest of the Ventura County Pwr. Co., of Oxnard, and will begin at once the development of a large distributing system in Ventura County.

SACRAMENTO, CAL.—Bonds to the amount of $113,000 will be sold at once, the proceeds to be used for the installation of street lamps.

ST. HELENA, CAL.—The State Railroad Commission has granted the Napa Valley El. Co., of St. Helena, permission to serve consumers in Napa Valley, from Bale Station to the northernly limits of Napa County, except in the town of Calistoga.

TERRA BELLA, CAL.—The Mount Whitney Pwr. & El. Co., of Visalia, is planning to build a substation about 1 mile east of Terra Bella, work on which will soon begin.

FILLMORE, UTAH.—A proposal has been submitted to the City Council by Messrs. Yates and Richards, of Salt Lake City, for installing an electric-light plant to light the city, at a cost of about $17,500. They have filed on water rights in the canyon near Fillmore.

LEHI, UTAH.—Application has been made to the City Council by C. W. Earl to erect an electric-light plant in Lehi.

MESA, ARIZ.—Within the next three months the South Side Gas & El. Co. expects to install frequency station equipment to increase the output of its plant by 250 kw. H. L. Chandler is manager.

HARDIN, MONT.—The Big Horn Canyon Irrigation & Pwr. Co. has completed surveys for an electric railway, 68 miles long, and is now surveying for the dam site and reservoir. When this is completed the survey for the irrigation system will be started. The project includes the construction of a hydroelectric plant on the Big Horn River to develop 25,000 hp at a minimum flow; construction of an electric railway, 68 miles long, penetrating a very fertile valley; irrigation by gravity of 100,000 acres and by electricity generated at the dam of 35,000 acres. The railroad will be constructed first and used to transport building material to the dam site. Edward Lawlor is secretary.

HELENA, MONT.—Bids will be received at the office of the city clerk, Helena, Mont., until May 4 for the installation of an ornamental street-lighting system, consisting of 391 lamp-posts, on the west side of the city. Plans and specifications are on file in the office of William Jordan, Jr., city engineer, 14 Kohrs Blocks, Helena. For details see proposals columns. D. J. McConnell is city clerk.

LAUREL, MONT.—The Council is reported to be considering the installation of a street-lighting system in Laurel.

MAXVILLE, MONT.—The operating plant of the Royal Basin Mining Co. in Maxville is to be equipped with electrically operated machinery. Energy will be supplied by the Montana Pwr. Co. The new concentrator is among the units to be run by electricity. Surveys have been made for the transmission line, and construction work will begin as soon as possible.

LANDER, WYO.—A hydroelectric plant, to cost about $200,000, it is reported, is being erected on the Popo River, about 10 miles from Lander. The plant when completed will furnish electricity in Lander and adjacent country.

DENVER, COL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 23, for mechanical equipment for the United States post office building in Denver, Col. Further information may be obtained from the above office. O. Wenderoth is supervising architect.

Canada

FORT SASKATCHEWAN, ALTA. — Within the next five months the managers of the municipal electric-light plant expect to install a new street-lighting system and to purchase a large transformer. E. G. Ferguson is electrician and chief engineer.

WINNIPEG, MAN.—Tenders will be received by the City Light and Power Department of the city of Winnipeg until April 30 for furnishing and erecting two three-phase synchronous condensers. Plans and specifications may be obtained from the city Light and Power Department.

BRANTFORD, ONT.—Tenders will be received by F. W. Frank, secretary and treasurer of board of water commissioners, until April 30, as follows: (B) For fireproof pump house; (G) pumping machinery (a) two 4,000,000-gal. turbine pumps and two motors to operate same; (b) two 4,000,000-gal. motor-driven booster pumps for fire service; (c) steam turbine alternative for operating booster pumps. Bidders may submit bulk offers for "B" and "G." Plans and specifications may be seen at the City Hall, Brantford, or at the office of Chipman & Power, engineers, 204 Mail Building, Toronto.

MOUNT FOREST, ONT.—The Town Council, it is reported, will make an application to the Hydro-Electric Power Commission of Ontario for 500 hp hydroelectric power, to be supplied from Eugenia Falls.

WINDSOR, ONT.—The Sandwich, Windsor & Amherstburg Ry. Co., controlled by the Detroit United Ry. Co., of Detroit, Mich., has refused the offer of $155,000 by the Ontario Hydro-Electric Commission for its power plant in Windsor. The plan of the commission was to purchase the plant of the railway of the company and use it in connection with Niagara power. It probably now will erect a system of its own here.

REGINA, SASK.—Tenders will be received by the city commissioners, Regina, Sask., until April 27, for material for street railway system as follows: (A) 100 tons 7-in. steel T-rails (Lorain section 80/335), 1000 track bolts and nuts (¾ in. by 3¾ in.), 1200 copper rail bonds (10⅛ in.), 60 copper rail bonds (42 in.), 60 copper rail bonds (72 in.); (B) 9000 barrels Canada Portland cement; (C) 3 miles 500,000 circ. mil. triple-braid, weatherproof, 19-strand feeder wire, 2 miles 0000 triple-braid weatherproof, 19-strand feeder wire, 10,000 ft. 00 hard-drawn, round trolley wire; (D) trolley frogs, crossovers, line cars, insulators, hangers and pole line hardware. All material to be delivered f.o.b. Regina, and duty paid. Copies of specifications, form of tender, etc., may be obtained upon application to H. Doughty, superintendent, Regina municipal railway.

DAWSON, Y. T.—The Civic League has undertaken to raise $200,000 for the purpose of establishing a municipal electric-light plant, telephone and water-works systems in Dawson. The cost of the work is estimated at $165,000.

Miscellaneous

CORDOVA, ALASKA.—James J. Godfrey, president of the Mother Lodes Mines Co., has announced that extensive development plans are under way, including the installation of a large power plant.

New Incorporations

PORTLAND, MAINE.—The Carrabassett Lt. & Pwr. Co. has been incorporated with a capital stock of $50,000. The company proposes to develop water-powers and construct power plants to furnish gas and electricity in the towns of Anson, Embden and New Portland. The officers are: George H. Hinckley, president; J. Frank Conner, treasurer, and Benjamin G. Ward, clerk, all of Portland.

SENATH, MO.—The Senath Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by Alvin Chapman, W. W. Watson and J. L. Davis.

WEST LIBERTY, OHIO.—The West Liberty Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 for the purpose of supplying electricity for commercial purposes. It is understood that the company will secure electricity from the Ohio El. Ry. Co. The incorporators are M. J. Kehoe, H. S. Gilham, Morgan Doolan, P. C. Martin and J. F. Shafer.

ELLOREE, S. C.—The Elloree El. Lt. Co. has been incorporated with a capital stock of $5,000 by E. F. Irich, J. F. Ulmer, S. D. Montgomery and others.

ALPINE, TEX.—The Alpine Lt. & Ice Co. has been chartered with a capital stock of $20,000. The incorporators are J. D. Jackson, S. D. Harman and George C. Miller.

SCOTTSVILLE, TEX.—The Scottsville El. Lt. Co. has been incorporated with a capital stock of $5,000 by J. D. Read, J. B. Dodson and H. L. Hendrick.

WILSON CREEK, WASH.—The Grant County Pwr. Co. has been incorporated with a capital stock of $40,000 by D. O. Fried, S. W. Roberts and Barton Morgan.

WINDSOR, ONT., CAN.—The Windsor Pwr. Building Co. has been incorporated with a capital stock of $100,000 by R. J. Fox, C. H. Collins and F. Rogers.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 7, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,092,141. Electropneumatic Brake Apparatus; E. H. Dewson, New York, N. Y., and W. V. Turner, Edgewood, Pa. App. filed May 9, 1910. Means operated both electrically and pneumatically for locally venting air from the train pipe.

1,092,153. Cartridge Fuse; E. B. Mallory, Chicago, Ill. App. filed Sept. 9, 1912. Refillable fuse with special means for aligning the contact blades.

1,092,245. Electric Switch; G. W. Cravens, Chicago, Ill. App. filed July 30, 1910. Pullman-car upper-berth switch.

1,092,252. Method of Constructing Secondary of Storage Batteries; G. L. and G. J. A. Fuller, Bow, London, Eng. App. filed Nov. 15, 1912. Electrodes in block form fitted together.

1,092,253. Secondary or Storage Battery; G. L. and G. J. A. Fuller, Bow, London, Eng. App. filed Sept. 4, 1913. Electrodes in block form or taper form in cross-section.

1,092,266. Electric Signal Mechanism; W. R. Howe, Rochester, N. Y. App. filed Dec. 3, 1909. Electric semaphore motor operates as a brake during return of semaphore to danger position.

1,092,267. Process of Making Storage-Battery Electrodes; H. C. Hubbell, Newark, N. J. App. filed July 17, 1911. Briquettes and reduces a nickel oxide.

1,092,281. Combined Motor Starter and Circuit-Breaker; A. C. McWilliams, Chicago, Ill. App. filed June 19, 1912. Automatic starter for direct-current motors.

1,092,283. Relay; M. S. Morse, Oakland, Cal. App. filed Aug. 22, 1912. For controlling signals at railway crossings.

1,092,295. Process and Apparatus for Absorbing Nitrous Vapors in the Dry and with Heat by the Aid of a Base Such as Lime; A. T. Schloesing, Paris, France. App. filed May 25, 1912. Employs no external heat.

1,092,323. Electric Recorder; J. L. Zander, Irvington, N. J. App. filed Nov. 7, 1912. Records the measure in voltage or temperature in connection with a plurality of thermocouples.

1,092,333. Refillable Fuse; F. D. Bryan, Middletown, Pa. App. filed Aug. 27, 1913. End disks clamp ends of fuse strips in place.

1,092,354. Fortune-Telling Apparatus; W. M. Hamilton, Philadelphia, Pa. App. filed July 22, 1913. Controllable magnet moves a cylinder up an inclined path having fortune-telling designations.

1,092,369. Process of Making Chlorates and Apparatus Therefor; G. Kolsky, Niagara Falls, N. Y. App. filed April 4, 1913. Electrolysis of saline solutions.

1,092,370. Electric Ignition Generator; B. Lawrence, Leyton, England. App. filed June 3, 1913. Starting trip accelerates generator movement when cranking engine.

1,092,383. Safety and Signaling Device for Railroads; D. C. Newton, Owego, N. Y. App. filed Oct. 23, 1912. Ramp rails at ends of blocks.

1,092,388. Water-Level Indicator; N. Podgoursky, St. Petersburg, Russia. App. filed March 30, 1912. For indicating presence or absence of water in the compartments of a ship.

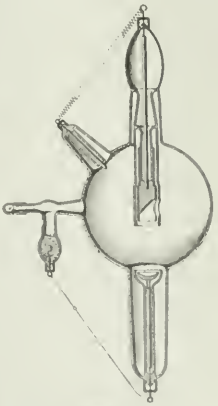
1,092,398. High-Tension Discharge Apparatus; G. D. Rodgers, Cleveland, Ohio. App. filed May 31, 1913. For producing discharges for therapeutical purposes from ordinary lamp socket.

1,092,401. Sheet-Music-Perforating Device; A. D. Saumell, New York, N. Y. App. filed Feb. 15, 1912. Operated by usual piano keyboard or a dummy keyboard.

1,092,410. Means for Rating Incandescent Lamps; A. J. Sweet, Newark, Ohio. App. filed May 16, 1910. Rating in terms of the watts per candle-power and the corresponding voltage for any particular lamp obtained expeditiously with one set of instrument readings.

1,092,411. Electric Railway and Signaling System Therefor; L. H. Thullen, Edgewood, Pa. App. filed March 3, 1906. Protects the inductive bonds and other apparatus from dangerous unbalancing of the resistance in the track rails to the flow of propulsion current therealong.

1,092,415. Automatic Service Switch; R. E. Wetter, Dallas, Tex. App. filed Aug. 3, 1912. Circuit including interior wiring of a building automatically broken when voltage increases to dangerous degree.



1,092,489.—X-Ray Tube

1,092,417. Ignition Apparatus; J. A. Williams, Cleveland, Ohio. App. filed March 5, 1913. Improved vibrator construction designed to prevent tampering and maladjustment of the same.

1,092,420. Dynamo-Electric Machine; E. F. W. Alexanderson, Schenectady, N. Y. App. filed June 19, 1913. High-frequency alternating-current machine with mechanically rigid field member.

1,092,430. Fuse Clip; R. C. Cole, Hartford, Conn. App. filed March 17, 1913. High-current-capacity clip for knife-blade fuses.

1,092,453. Device for Amplifying Variations in Electrical Currents; P. M. Rainey, West Hoboken, N. J. App. filed Oct. 14, 1913. Telephone relay or repeater.

1,092,459. Railway Signaling; J. B. Struble, New York, N. Y. App. filed Nov. 16, 1901. Alternating current in track circuits and direct current in propulsion circuit.

1,092,460. Railway Signaling; J. B. Struble, San Francisco, Cal. App. filed March 4, 1904. Direct-current propulsion and alternating-current signalling circuits, with one rail electrically continuous and the other rail divided into insulated block sections.

1,092,466. Locomotive Fireman's Coal-Shoveling Recorder; G. G. Weston, St. Louis, Mo. App. filed April 11, 1913. Records number of times fire door is opened and length of time it is kept open during a trip.

1,092,472. Connecting Clip for Electrical Conductors; J. H. Breaznell, New York, N. Y. App. filed Sept. 21, 1912. Has pair of pivoted hook-shaped clip members of spring material.

1,092,489. X-Ray Tube; H. M. Kesselring, Chicago, Ill. App. filed Oct. 17, 1912. To prevent the puncturing of the tube at points adjacent to the electrodes.

1,092,498. Refillable Cartridge Fuse; E. B. Mallory, Wilkinsburg, Pa. App. filed Oct. 3, 1911. Fuse strip clamped at ends so as to expose its capacity marking and manufacturer's trade-mark.

1,092,510. Lightning Arrester; A. Allendorf, Harvard, Ill. App. filed Oct. 9, 1912. For protecting telephone lines has automatically replaced fuses.

1,092,513. Electrical Window Alarm Lock; M. Barros, New York, N. Y. App. filed April 28, 1913. Closes alarm circuit when window is raised and holds window locked against further upward movement.

1,092,526. Moisture-Removing Device; W. G. Hassel and R. W. Zedlitz, Waterbury, Conn. App. filed May 16, 1913. Slotted tubular heater surrounds wind shield or window pane for evaporating moisture thereon.

1,092,589. Connector; L. C. Nichols, Milwaukee, Wis. App. filed Nov. 20, 1909. Interfitting screw members held together by a nut engaged on the interfitting screw portions of said members.

1,092,600. Primary Battery; C. B. Schoenmehl, Waterbury, Conn. App. filed Dec. 9, 1910. Special means for suspending the assembled positive and negative electrodes.

1,092,627. Locking Device for Electric Lamps, etc.; A. D. Bartlett, Washington, D. C. App. filed June 9, 1913. Has an electromagnetically operated locking bolt.

1,092,724. Motor Starter for Rectifier Systems; M. Kushlan, Boston, Mass. App. filed Dec. 21, 1911. As resistance is cut out of the motor circuit resistance is cut into the storage-battery circuit.

1,092,732. Signal Device; J. H. McCarthy, Stafford Springs, Conn. App. filed Jan. 20, 1913. Notifies wireless operator when message is coming in, thus eliminating need for continuously wearing the receivers.

1,092,754. Thermostatic Circuit Closer; R. L. Shannon, Ripley, Miss. App. filed June 7, 1913. Relatively stationary contact carried by an adjustable pointer.

1,092,797. Electric-Speed-Controlling Means; H. A. Mavor, Glasgow, Scotland. App. filed Sept. 20, 1909. For body having an induction motor drive.

1,092,805. Electric Safety Fuse; E. Weissberg, Cassel, Germany. App. filed June 4, 1913. Has closed oil chamber in which melting spark is extinguished.

Electrical World

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Compensation Acts and the Utilities New workingmen's compensation acts in various states are creating new problems for utility companies. A recent instance of the truth of this statement comes from California, where an employee who was required to inspect gas meters and to turn on and turn off gas was injured on his way home because of being run into by an automobile. The insurance company refused compensation, but the Industrial Accident Commission held that, from its character, the man's employment was continuous and that he was at all times, except when at home, under the protection of the workingmen's compensation act. It should, perhaps, be added that the man's duties were such that at any time when he observed customers moving in or out of houses he was supposed to stop and look after the company's and the consumers' interests. The increased cost of doing business and the new liabilities that are created under recent compensation acts deserve very careful attention by all utility companies in states where these acts have recently been adopted.

Mr. Insull on Regulation Mr. Insull's far-sighted optimistic views as to the electrical future are not less fascinating because he has expressed them before. They lose none of their interest in repetition. Instead, they gain added importance because of the added conviction which experience brings. His address on the centralization of energy supply, made before the Young Men's Christian Association in New York this week, was designed to acquaint the public with an important phase of electrical development—the economy of monopoly—but it also provided material for the thoughtful consideration of the industry at large. Because of the prominence of the public service commission issue the ideas expressed in regard to regulation are of leading importance, and for the moment they merit more attention than the encouraging technical outlook upon monopoly in energy supply on which so great emphasis was placed. They are not a grudging acceptance of the policy of commission regulation with monopolistic supply to which the country and most of the states are now irrevocably committed. They are an outspoken acceptance of the wisdom of the policy from the standpoint of all concerned. The electrical industry will do less than its fair part in the great public work of the country if it fails to do its utmost to make regulation a success. Since it might drift to the wrong side of this issue it needs strong guidance to keep it in the ways that will promote wholesome regulation. Such guidance should come from and be supported by the recognized leaders, who have developed and still have in their care large interests that are bound to be affected. These men should speak their views in certain tones and thus help to place the industry in the right attitude. If commission regulation fails, the failure should not arise from the fault of electrical supply industries. Accepting the sound economic doctrine that centralization in production and transmission through monopoly is practicable, reasonable and desirable, from both the public and the corporate standpoint, the industry lacks an argument against sane regulation. There is no middle ground. Wise regulation is the best policy.

Regulation and Education It is not a new idea for the people to have a part in operating any business on which they depend. The more dependence, the more imperative is regulation—hence the attention to utilities at present. Regulation is not a modern fad; it has centuries of English law back of it. While the public may not have the moral or legal right to fall back on the "agency theory" in order to reconstruct the past, it has ample precedent and authority to invoke it at any time for the future. The community has the right at any time to turn over its facilities to an agent to act for it, and all the agent can ask is, first, a definite contract and, second, a proper regard for the contract by both contractors. A danger lies in the present tendency by many utility men to control or regulate regulation through the courts. Nothing could be more futile. The power to regulate belongs to the legislature, and for convenience the legislature delegates its power to a commission. But the legislature, and therefore the commission, represents the people. It is evident, therefore, that, if they are to be upheld, the courts must finally reflect preponderating public opinion in their decisions, even to the extent of interpreting a written constitution. To obviate the real danger, the people must be educated. Public opinion must be formed and then properly translated into law. Not only for their own private interests, but as a patriotic duty, public utility men must undertake this educational work, which must be done frankly—in the open. Incidentally the teacher will have nearly as much to learn as the pupil. More than all, it must be so done that the public will acquire an increasing amount of respect for the honesty of purpose of the public utility men. When properly carried out regulation is of great benefit to both the utilities and the public, their interest being identical in almost all respects. The necessity and desirability of regulation by commissions having been established firmly, the problem of the moment is the education of the public and the utilities concerning each other's needs, in order that the commissions may determine what is of greatest benefit for all.

Combination Gas and Electric System

It often falls to the lot of a public utility to combine the distribution of electricity and that of gas. Instances in which an electric company has taken over gas plants are not very frequent. Those of the opposite kind are fairly common, one notable example, of which we furnish some account in the present issue, being the Laclede Gaslight Company of St. Louis. As a gas company it covers the whole city. As an electric company it has a wide area of distribution, but does not cover the entire municipal territory. Were it possible for a great utility to make a fresh start and go into the business of supplying all the gas and electricity in a modern city, some very wonderful economies could unquestionably be carried out, and the result might be made gratifying in the extreme; but there is no example of such practice on any considerable scale. While united gas and electric plants are often operated with great success, they have not yet been able to reap the full advantages of the combination, and the installations can therefore do no more than display a highly commendable amount of skill and ingenuity in the adaptation of means to ends.

The electric service of the Laclede Gaslight Company consists in the main of an up-to-date turbo-generator station of 8000-kw rating. The generators are star-wound, with neutral connection, giving either 2400 volts or 4150 volts and furnishing directly a single-phase distribution for lighting and a three-phase distribution for motor service. It is one of the few stations in which these two distributions are in use independently, a peculiarity probably due to the earlier history of the enterprise and to local conditions. A feature of the generating equipment worth mentioning is the triplicate excitation system. The main generators can be supplied with exciting current from an independent steam turbine and generator, from a motor-generator set, or from a storage battery. Another unusual feature of the system is a considerable 550-volt direct-current motor distribution system in the central part of the city. A large part of the energy for this is furnished by a pair of 500-kw three-bearing motor-generator sets in the main station. The motors used are synchronous machines, so that the best can be made of the necessity of having such sets by utilizing them not only to furnish energy but also to regulate the power-factor. There are two substations for feeding energy for the 550-volt circuits, one with a motor-generator set and the other with a rotary converter having a voltage regulator to assist in controlling the voltage of the direct-current system.

As a part of the same system a very neat special generating station, of a character altogether unique, is installed at the gas works. A battery of engine-driven compressors is used for pumping gas into the extensive high-pressure mains of the company. The steam from these engines exhausts into a low pressure turbine driving a 300-kw generator which is tied solidly to a rotary converter and thus feeds energy into the direct-current network so long as the compressors are in operation, which is for a large part of the day. Incidentally, the electric distribution of the company renders good service in operating the conveying machinery for the gas plant. Taken altogether, the equipment is of a somewhat unusual character, displaying well the art of making the most of the existing circumstances.

Economics and Esthetics

In his presidential address before the American Electrochemical Society Dr. E. F. Roeber discussed in a very fascinating way certain psychological and esthetic aspects of electrochemistry which are of great importance, although they are apt to escape the notice of the multitude. He pointed out that in an age like ours, of machinery and scientific applications, the popular sense of what is beautiful necessarily becomes extended to include things which are mechanically and scientifically beautiful by reason of either their structural relations or their skilful application of fundamental principles to a purpose. The sense of these latter kinds of beauty comes only with a training of the mechanical and physical powers of the mind, just as the sense of beauty in pictorial art comes with a training of the mental perceptions of form, color and artistic design. The new age does not destroy the older types of beauty. It merely adds new types to the list.

The wholly untrained eye sees nothing particularly interesting in the "Mona Lisa." The wholly untrained ear listens not with any languishing to Beethoven's symphonies. The primeval redskin warrior of Fenimore Cooper would only see "big medicine" in the works of an automobile. So, in every art and accomplishment of the wide world, the eye that sees beauty must bring beauty to the vision from within. Not in vain has the poet declared that beauty is in the eye of the gazer. With the ever-increasing complexity of production and manufacture there is a correspondingly increasing multitude of potential opportunities for admiration. No single mind possesses the resources or has ever been dowered with the keys to that knowledge which should perceive all of the countless types of beauty which exist.

Dr. Roeber's address is a plea for the redemption of the Niagara waste. We believe that not only engineers but also a large percentage of the public will support his contention that the legislative restriction of the Niagara Falls as a spectacle, to the detriment of industrial applications, is a waste, a blunder and a sinful extravagance. No one possessing intelligent eyesight can help admiring that great cascade of water. A gigantic waterfall is a majestic sight. If, however, we are all determined to preserve what remains of this

DETAILS OF TRANSMISSION SYSTEMS OF THE WORLD OPERATING AT AN

Compiled for the ELECTRICAL WORLD by Selby Haar

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
				RATING OF PLANT, KW			TURBINES						GENERATORS					STEP-UP TRANSFORMERS							STEP-DOWN TRANSFORMERS									
																				Conn.					Line Voltage		Conn.						Span	
	Name	Operating Voltage	Frequency Cycles	Present	Ultimate	Beginning of Operation	Hydr. or Steam	H.P.	Head Ft.	R.P.M.	Shaft Hor. or Vert.	Manufacturer	Kva.	Kw.	P.F.	Voltage	Manufacturer	Kva.	Phases	L. T.	H. T.	Y Gr. Dir. or with Res.	Total Kva. Connected to Transmission Lines	Manufacturer	L.T.	H.T.	L. T.	H. T.	Termini	Dist. of Trans., Mi.	Steel Towers or Wood Poles	Height, Ft.	Normal Ft.	Max. Ft.
1	Pacific Light & Power Co.	150,000	60	59,500	300,000	1913	H.	2x10,000	1780 1900	375	H.	Al. Ch.	17,500	14,875	.85	6,600	W. G.E.	5,633	1	Δ	Y	D.	70,000	W. G.E.	72,000 18,000	150,000	Δ	Δ	Big Creek–Los Angeles, Cal	241	S.T.	Ca. 48–	660	2900
2	Au Sable Elec. Co	140,000	60	19,000	86,500	1912	H.	3,500 4,150	26 35 40	120 164 180	H.	Al. Ch.	2,200 3,333 3,333	2,000 3,000 3,000	.90	2,500	G.E.	3,000	1	Δ	Δ	No	19,000	G.E.	5,000 22,000 44,000	140,000	Δ	Δ	Au Sable–Battle Creek, Mich	245	S.T.	40–167	500	600
3	Southern Sierras Power Co	140,000	60	8,750	40,000	1915	H.	3,300	814 and 258	300 164	H.	Henry Pelton Doble	2,250 2,000	2,250 2,000	1.	2,200	C.W. Al. Ch.	750 2,000	1	Δ	Y	R.	8,250	W.	33,000 to 4,000	138,500 140,000	Δ	Y	Bishop–San Bernardino, Cal.	239	S.T.	70–	660	1500
4	Utah Power & Light Co	130,000	60	33,000	84,000	1914	H.	16,500 15,000	482 140	514 180	V.	I. P. Morris	12,222 11,111	11,000 10,000	.90	6,600	W. G.E.	4,000	1	Δ	Δ	No	24,000	G.E.	44,000	120,000	Δ	Δ	Grace, Idaho–Salt Lake City, Utah	135	S.T.	82–	650	2300
5	Pacific Gas & Electric Co	125,000 to 110,000	60	25,000	142,500	1913	H.	2x8,500	1375	360	H.	Pelton Doble	12,500	10,000	.80	6,600	W.	4,250	1	Δ	Y	D.	25,500	Al. Ch.	60,000	100,000	Y	Y	Drum–Cordelia, Cal	110	S.T.	82– 50–	800	2350
6	West Penn. Trac. & Water Power Co	125,000	60	32,000	105,000	1914	H.	12,000	82	144	V.	W.S.M.	10,000	8,000	.80	6,600	Al. Ch.	10,000	3	Δ	Δ	No	40,000	Al. Ch.	22,000 6,000	120,000	Δ	Δ	Cheat Haven–Butler, Pa	106	S.T.	44– 80	528	.....
7	Tennessee Power Co	120,000	60	15,000	75,000	1914	H.	10,000	250	360	H.	I. P. Morris	9,376	7,500	.80	6,600	W. G.E.	9,375	3	Δ	Δ	No	18,750	W. G.E.	13,200	120,000 to 95,000	Δ	Δ	Cleveland–Nashville, Tenn	140	S.T.	50–210	663	1903
8	Connecticut River Transmission Co	120,000	60	14,400	14,400	Ca. 1914	H.	Ca. 3,300	57 to 64	257	H.	W.S.M.	2,000	1,600	.80	2,300	G.E.	3,000	3	Δ	Y	D.	18,000	G.E.	13,200	110,000	Δ	Δ & Y	Shelburne Falls–Millbury, Mass	60	S.T.	75–	600	1200
9	Inawashiro Hydroelectric Power Co	115,000	50	42,000	73,500	1914	H.	Ca. 10,000	350	375	H.	Voith	7,700	7,000	.91	6,600	Dick Kerr	4,400	1	Δ	Δ	No	52,800	W.	11,000	100,000	Δ	Δ	Lake Inawashiro–Tokio, Japan	144	S.T.	70–220	550	1530
10	Au Sable Electric Co	110,000	30	9,000	45,000	1906	H.	14,400	40	225	H.	Leffel	3,000	3,000	1.	6,600	W.	3,750	1	Δ	Δ	No	11,250	W.	19,000 7,200	....	Δ	Δ	Croton–Grand Rapids and Muskegon, Mich	35	S.T.	53– 60	528	...
11	Hydro-Electric Power Commission of Ontario	110,000	25	100,800	175,000	1910	H.	12,500 12,600 13,400	175	187½	H.	Voith W.S.M.	7,500 8,950 9,700	7,500 8,950 9,700	1.	12,000	W. G.E.	3,500	1	Δ	Y	R.	42,000	W.	26,400 13,200 6,600	110,000	Δ	Y	Niagara Falls–Toronto and St. Thomas, Canada	135 00	S.T.	61.3–170	550	1100
12	Lauchhammer, A. G	110,000	50	15,000	20,000	1911	S.	......	....	1000	H.	A.E.G. M.A.N.	14,300 6,250	10,000 5,000	.70 .80	5,000 5,000	A.E.G. S.-S.	6,250	3	Y	Y	No	20,000	S.-S.	60,000 15,000	110,000	Y	Y	Lauchhammer Mines–Riesa, Germany	35	S.P.	60– 65	550	900
13	Georgia Ry. & Power Co	110,000	60	50,000	63,000	1912	H.	17,000	580	514	V.	S.M. Smith	12,500	10,000	.80	6,600	G.E.	3,333	1	Δ	Y	R.	60,000	G.E.	22,000 11,000	110,000	Δ	Δ	Tallulah Falls–Lindale, Atlanta, Ga., etc.	210	S.T.	66–105	550	120
14	Alabama Power Co	110,000	60	48,000	300,000	1913	S.	17,500	68	100	V.	I.P. Morris	14,000	12,000	.85	6,600	W.	4,667	1	Δ	Y	R.	56,000	W.	22,000	110,000	Δ	Δ & Y	Coosa River–Birmingham, etc., Ala	150	S.T.	65– 68	600–700	900–12
15	Mississippi River Power Co	110,000	25	112,500	225,000	1913	H.	10,000	32	57.7	V.	I.P. Morris W.S.M.	9,000	....	......	11,000	G.E.	9,000	3	Δ	Y	D.	72,000	G.E.	66,000 33,000 13,200	05,000	Δ	Δ	Keokuk, Ia.–St. Louis, Mo	144	S.T.	79–231	800	3300
16	Lehigh Navigation Electric Co	110,000	25	30,000	100,000	1914	S.	......	....	1500	H.	G.E.	12,500	11,250	.90	11,000	G.E.	3,350	1	Δ	Y	R.	30,160	G.E.	22,000	110,000	Δ	Δ	Hauto–Siegfried, Pa	24	S.T.	78.5	600	2000
17	Cedar Rapids Mfg. & Power Co	110,000	00	90,000	135,000	1914	H.	10,800	30	55.4	V.	I.P. Morris W.S.M.	10,000	7,500	.75	6,600	G.E.	4,000 8,000	1	Δ	Δ	No	72,000	......	6,600	110,000	Δ	Δ	Cedar Rapids, Can.–Massena, N. Y	60	S.T.	70	660	... .
18	Mexican Northern Power Co	110,000	60	26,000	....	1914	H.	10,000	230	360	H.	Esch. W.	7,600	7,630	.85	4,000	G.E.	2,500	1	Δ	Y	R.	22,500	G.E.	13,200	110,000	Δ	Y	Boquila–Parral, Chihuahua, Mexico	167	S.T.	65– 90	575	1100
19	Ebro Irrigation & Power Co. Ltd	110,000	50	50,000	200,000	1914	H.	14,500	164	250	V.	Esch. W.	16,666	10,000	.60	6,600	G.E.	4,444	1	Δ	Δ	No	66,666	W.	25,000 6,000	100,000	Y	Δ	Segre River–Barcelona, Spain	105	S.T.	65–	750	1500
20	Chile Exploration Co	110,000	50	40,000	160,000	1915	S.	......	....	1500	H.	Esch. W.	10,000	10,000	1.	5,000	S.-S.	10,000	3	Y	Y	No	40,000	S.-S.	5,000	Ca. 100,000	Y	Y	Tocopilla–Chuquicamata, Chile	86	S.T.	47–	656	....
21	Sierra Elec. Power Co	110,000	..	......	22,600	....	H.	......	....	....	..	....	......	......	.....	......	....	......	...	...	...	...	......	.....	......	....	...	...	Mill Creek–Oakland, Cal	....	....	....	....	......
22	Sierra & San Francisco Power Co	104,000	00	34,000	....	1910	H.	11,750	1500	400	H.	Pelton	8,500	8,500	1.	4,000	G.E.	2,233	1	Δ	Y	D.	26,800	G.E.	11,000	104,000	Δ	Y	Stanislaus–San Francisco, Cal	138	S.T.	65–	850	1600
23	Great Falls Power Co	102,000	60	21,000	125,000	1910	H.	6,000	105	225	H.	S.M. Smith	3,500	3,500	1.	6,600	G.E.	1,200	1	Δ	Δ	No	21,600	G.E.	2,500	91,800	Δ	Δ	Great Falls–Butte, and Anaconda, Mont	160	S.T.	45–	600	3034
24	Yadkin River Power Co	100,000	60	24,000	....	1012	H.	5,900 5,200	45	164	H.	S.M. Smith	6,000 4,500	4,500 3,500	.75 .76	4,000	G.E.	6,250	3	Δ	Y	D.	37,500	G.E.	60,000	100,000	Δ	Δ	Blewitts Falls–Raleigh and Lumberton, N. C	96	S.T.	72.6–	650	1455
25	Colorado Power Co	100,000	60	10,000	10,000	1909	H.	9,000	170	400	H.	I P. Morris	5,000	5,000	1.	4,000	G.E.	3,333	1	Δ	Δ	No	15,000	G.E.	6,600	90,000	Δ	Δ	Glenwood–Denver, Colo	152	S.T.	44.2–	660	2900
26	Great Western Power Co	100,000	60	50,000	100,000	1909	H.	18,500 16,000	450 525	400	V.	I.P. Morris	12,500 10,000	10,000 10,000	.80 1.	11,500 11,000	G.E	10,000	3	Δ	Δ	No	60,000	G.E.	11,000	90,000	Δ	Δ	Big Bend–Oakland, Cal	154	S.T.	75–210	750	2740
27	Southern Power Co	100,000	60	75,000	....	1909	H.	5,200	69	225	H.	Holyoke Mach. Al.Ch.	3,000	2,550	.85	2,400	W.	4,000	1	Δ	Y	R.	24,000	W.	44,000 13,000 2,400	100,000	Δ	Δ	Great Falls, S. C.–Durham, N. C	210	S.T.	75–	600	1400
28	Shawinigan Water & Power Co	100,000	60	45,000	80,000	1911	H.	16,500	145	225	H.	I.P. Morris	15,000	12,500	.86	6,600	W.	14,000	3	Δ	Y	R.	26,000	G.E.	12,800	85,000	Δ	Δ	Shawinigan Falls–Montreal, Can	87	S.T.	70.6–	530	[illegible]

STEMS OF THE WORLD OPERATING AT AND ABOVE 70,000 VOLTS

Compiled for the ELECTRICAL WORLD by Selby Haar

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
STEP-UP TRANSFORMERS						STEP-DOWN TRANSFORMERS				TRANSMISSION LINES																				LTG. PROT.		
	Conn.					Line Voltage		Conn.						Span		Circuits		Conductors						Insulators				Overhead Ground Wires per Tower				
																								Ordinary		Strain						
Phases	L. T.	H. T.	Y Gr. Dir. or with Res.	Total Kva. Connected to Transmission Lines	Manufacturer	L.T.	H.T.	L. T.	H. T.	Termini	Dist. of Trans., Mi.	Steel Towers or Wood Poles	Height, Ft.	Normal Ft.	Max. Ft.	Per Tow'r	Total	Section-Gage and Sq. In.	Material	Strands	Core	Arrangement	Spacing, In.	Sections and Type	Manufacturer	Sections and Type	Manufacturer	Mat.-Size	Number	Type, Al. Cell, Horn, Res., Etc.	Manufacturer	Switchplant, Mfr.
1	Δ	Y	D.	70,000	W. G.E.	72,000 18,000	150,000	Δ	Δ	Big Creek–Los Angeles, Cal.	241	S.T.	Ca. 48–	660	2900	1	2	605,000 Circ. M. 0.475. 78,000 Circ. M. 0.061	Al.	54 7	St.	H.	210	9-Susp.	Locke	11-Susp.	Locke	St. ⅜ In.	1	Al.	W. G.E.	W. G.E.
1	Δ	Δ	No	19,000	G.E.	5,000 22,000 44,000	140,000	Δ	Δ	Au Sable–Battle Creek, Mich.	245	S.T.	40–167	500	600?	1	1	O. B. & S. 0.083	Cu.	7	Cu.	·:	208 Slant 144 Vert.	10-Susp.	Oh. Br.	10-Susp.	Oh. Br.	No	No	Al.	G.E.	G.E.
1	Δ	Y	B.	8,250	W.	33,000 to 4,000	138,500 140,000	Δ	Y	Bishop–San Bernardino, Cal.	239	S.T.	70–	660	1500	2	2	211,160 Circ. M. 0.166. 34,970 Circ. M. 0.027	Al.	6 1	St.	·:	134 Min.	6-Susp.	Locke Oh. Br.	6-Susp.	Locke Oh. Br.	St. ⅜ In.	1	Al.	G.E.	W. Bow- ie
1	Δ	Δ	No	24,000	G.E.	44,000	120,000	Δ	Δ	Grace, Idaho–Salt Lake City, Utah	135	S.T.	82–	650	2200	2	2	250,000 Circ. M. 0.196	Cu.	12	Cu.	V.	156 Min.	9-Susp.	Thomas Oh. Br	11-Susp.	Thomas Oh. Br.	St. ⅜ In.	2	Al.	G.E.	G.E.
1	Δ	Y	D.	25,500	Al. Ch.	60,000	100,000	Y	Y	Drum–Cordelia, Cal.	110	S.T.	82– 50–	800	2350	1 and 2	1	00000 B. & S. 0.210	Cu. Al.	7 19	Cu. Al.	H and V.	162 120	7-Susp.	Oh. Br.	8-Susp.	Oh. Br.	No	No	No	......	P.G. & El.
3	Δ	Δ	No	40,000	Al. Ch.	22,000 6,600	120,000	Δ	Δ	Cheat Haven–Butler, Pa.	106	S.T.	44– 80	528	....	2	2	O. B. & S. 0.083	Cu.	6	Cu.	V	60	5-Susp.	Penna. China Co.	5-Susp.	Penna. Co.	Cu.- Clad 4	2	Al.	W.	W.
3	Δ	Δ	No	18,750	W. G.E.	13,200	120,000 to 95,000	Δ	Δ	Cleveland–Nashville, Tenn.	140	S.T.	50–210	663	1903	1 and 2	2	00 B. & S. 0.105	Cu.	7	Cu.	H.	126	7-Susp.	Oh. Br.	8-Susp.	Oh. Br.	St. 5-16 In.	1	Al.	G.E.	W. G.E.
3	Δ	Y	D.	16,000	G.E.	13,200	110,000	Δ	Δ & Y	Shelburne Falls–Millbury, Mass.	60	S.T.	75–	600	1200	2	2	00 B. & S. 0.105	Cu.	7	Cu.	V.	120	6-Susp.	Locke	7-Susp.	Locke	St. ⅜ In.	1	Al.	G.E.	G.E.
1	Δ	Δ	No	62,800	W.	11,000	100,000	Δ	Δ	Lake Inawashiro–Tokio, Japan	144	S.T.	70–220	550	1530	2	4	100 Sq. Mm. 0.155	Cu.	7	Cu.	·:	122 Slant 120 Vert	7-Susp.	Special Thomas	8-Susp.	Special Thomas	St. ⅜ In.	2	Al.	W.	W.
1	Δ	Δ	No	11,250	W.	19,000 7,200	....	Δ	Δ	Croton–Grand Rapids and Muskegon, Mich.	35	S.T.	53– 60	528	....	1	2	2 B. & S. 0.052	Cu.	6	Hemp	·:	06	5-Susp.	G.E.	5-Susp.	G.E.	No	No	Al.	G.E.	W.
1	Δ	Y	R.	42,000	W.	26,400 13,200 6,600	110,000	Δ	Y	Niagara Falls–Toronto and St. Thomas, Canada	135 90	S.T.	61.3–170	550	1100	2	2	0000 B. & S. 0.166 000 B. & S. 0.132	Cu. Al.	7	St. Cu. Al.	∴ and V.	128 96	8-Susp.	Locke Oh. Br. Hermsdorf	10-Susp.	Locke Oh. Br. Hermsdorf	St.	2 and 3	Al.	W. G.E.	W. G.E.
3	Y	Y	No	20,000	S.-S.	60,000 15,000	110,000	Y	Y	Lauchhammer Mines–Riesa, Germany	35	S.P.	60– 65	550	900	2	2	42 Sq. Mm. 0.066	Cu.	7	Cu.	·:	70	5-Susp.	Hermsdorf	6 7-Susp.	Rosenthal	St. 100000 Circ. M.	1	Horn and Res.	S.-S.	S.-S.
1	Δ	Y	R.	60,000	G.E.	22,000 11,000	110,000	Δ	Δ	Tallulah Falls–Lindale, Atlanta, Ga., etc.	210	S.T.	66–105	550	1200	2	2	0000 B. & S. 0.166 00 B. & S. 0.105	Cu.	7	Cu.	V.	108	4 5-Susp.	Thomas Oh. Br.	5-Susp.	Thomas	St. 7-16 In.	2	Al.	G.E.	W. G.E.
1	Δ	Y	R.	56,000	W.	22,000	110,000	Δ	Δ & Y	Coosa River–Birmingham, etc., Ala.	150	S.T.	65– 68	600–700	900–1200	2	2	00 B. & S. 0.105	Cu.	7	Cu.	·:	122 Slant 120 Vert.	6-Susp.	Locke Thomas Oh. Br.	7-Susp.	Locke Thomas Oh. Br.	St.	2	Al.	W. G.E.	W. G.E.
3	Δ	Y	D.	72,000	G.E.	66,000 33,000 13,200	95,000	Δ	Δ	Keokuk, Ia.–St. Louis, Mo.	144	S.T.	79–231	800	3300	2	2	300,000 Circ. M. 0.235	Cu.	19	Cu.	V.	120	7-Susp.	Locke Oh. Br.	8-Susp.	Locke Oh. Br.	St. ⅜ In	1	Al.	G.E.	G.E.
1	Δ	Y	R.	30,150	G.E.	22,000	110,000	Δ	Δ	Hauto–Siegfried, Pa.	24	S.T.	78.5	600	2000	2	2	250,000 Circ. M. 0.196	Cu.	7	Cu.	V.	120	6-Susp.	Locke	Susp.	Locke	St. ⅜ In.	2	Al.	W.	W.
1	Δ	Δ	No	72,000	......	6,600	110,000	Δ	Δ	Cedar Rapids, Can.–Massena, N. Y.	60	S.T.	70	660	....	2	2	500,000 Circ. M.	Al.	....	St.	V.	120	....	....	....	....	....	1	Al.	......	......
1	Δ	Y	R.	22,500	G.E.	13,200	110,000	Δ	Y	Boquila–Parral, Chihuahua, Mexico	157	S.T.	65– 90	575	1100	2	2	Equi. Cu. 0000 B. & S. 0.166	Al.	7	Al.	·:	122 Slant 120 Vert.	5 7-Susp.	Locke Oh. Br.	9-Susp.	Oh Br.	St. ⅜ In.	3	Al.	G.E.	G.E.
1	Δ	Δ	No	66,666	W.	25,000 6,000	100,000	Y	Δ	Segre River–Barcelona, Spain	105	S.T.	65–	750	1500	2	4	0000 B. & S. 0.166	Cu.	7	Cu.	Δ	96	Misc. Pin	Several	7-Susp.	Several	St. ⅜ In.	1	Al.	G.E.	G.E.
3	Y	Y	No	40,000	S.-S.	5,000	Ca. 100,000	Y	Y	Tocopilla–Chuquicamata, Chile	86	S.T.	47–	656	....	1	1	000 B. & S. 0.132	Cu.	7	Cu.	H.	155	Susp.	Locke	Susp.	Locke	St. ⅜ In.	2	Horn and Res.	S.-S.	S.-S.
....	....	....	....	....	......	....	....	....	....	Mill Creek–Oakland, Cal.	......	......	......	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	......	......
1	Δ	Y	D.	26,800	G.E.	11,000	104,000	Δ	Y	Stanislaus–San Francisco, Cal.	138	S.T.	65–	850	1600	2 and 1	2	00 B. & S. 0.105	Cu.	6	Hemp	V.	96	5-Susp.	Oh. Br. Locke	5-Susp.	Oh. Br. Locke	No	No	Al.	G.E.	G.E.
1	Δ	Δ	No	21,600	G.E.	2,500	91,800	Δ	Δ	Great Falls–Butte, and Anaconda, Mont.	150	S.T.	45–	600	3034	1	2	0 B. & S. 0.083	Cu.	6	Hemp	H.	124	6-Susp.	Oh. Br.	12-Susp.	Oh. Br.	St.	2	Al.	G.E.	W. G.E.
3	Δ	Y	D.	37,500	G.E.	60,000	100,000	Δ	Δ	Blewitts Falls–Raleigh and Lumberton, N. C.	96	S.T.	72.6–	650	1455	2	2	0 B. & S. 0.083	Cu.	6	None	V.	108	7-Susp. 6-Susp.	Thomas	7-Susp.	Thomas	St. ⅜ In.	1	Al.	G.E.	[illegible]
1	Δ	Δ	No	15,000	G.E.	6,600	90,000	Δ	Δ	Glenwood–Denver, Colo.	152	S.T.	44.2–	660	2900	1	1	0 B. & S. 0.083	Cu.	6	Hemp	H.	132	4-Susp. 5-later	G.E.	4 5-Susp.	G.E.	No	No	No	No	G.E.
3	Δ	Δ	No	50,000	G.E.	11,000	90,000	Δ	Δ	Big Bend–Oakland, Cal.	154	S.T.	75–210	750	2740	2	2	000 B. & S. 0.132	Cu.	7	......	V.	120	5-Susp.	Oh. Br. Thomas	Susp.	Oh. Br. Locke Thomas	St. ⅜ In	1	Al.	G.E.	G.E.
1	Δ	Y	R.	24,000	W.	44,000 13,000 2,400	100,000	Δ	Δ	Great Falls, S. C.–Durham, N. C.	210	S.T.	75–	600	1800	1 and 2	2	00 B. & S. 0.105	Cu. Al.	7	Cu. Al.	V.	124	4-Susp. 6-Susp. 4-Susp.	Thomas Oh. Br. Locke	5-Susp. 8-Susp. 5-Susp.	Thomas Oh. Br. Locke	St. ⅜ In.	1	Al.	W. G.E.	G.E. W.

D.	26,800	G.E.	11,000	104,000	Δ	Y	Stanislaus–San Francisco, Cal.	138	S.T.	65–	850	1600	and 1	2	00 B. & S. 0.105	Cu.	6	Hemp	V.	96	5-Susp.	Oh. Br. Locke	5-Susp.	Locke	No	No	Al.	G.E.	G.E.
No	21,600	G.E.	2,500	91,800	Δ	Δ	Great Falls–Butte, and Anaconda, Mont.	150	S.T.	45–	600	3034	1	2	0 B. & S. 0 083	Cu.	6	Hemp	H.	124	6-Susp.	Oh. Br.	12-Susp.	Oh. Br.	St.	2	..	G.E.	G.E.
D.	37,500	G.E.	60,000	100,000	Δ	Δ	Blewitts Falls–Raleigh and Lumberton, N. C.	96	S.T.	72.6–	650	1455	2	2	0 B. & S. 0.083	Cu.	6	None	V.	108	7-Susp. 6-Susp.	Thomas	7-Susp.	Thomas	St. ⅜ In.	1	Al.	G.E.	G.E.
No	15,000	G.E.	6,600	90,000	Δ	Δ	Glenwood–Denver, Colo.	152	S.T.	44.2–	660	2900	1	1	0 B. & S. 0.083	Cu.	6	Hemp	H.	132	4-Susp. 5-later	G.E.	4 5-Susp.	G.E.	No	No	No	No	G.E.
No	50,000	G.E.	11,000	90,000	Δ	Δ	Big Bend–Oakland, Cal.	154	S.T.	75–210	750	2740	2	2	000 B. & S. 0.132	Cu.	7	......	V.	120	5-Susp.	Oh. Br. Thomas	Susp.	Oh. Br. Locke Thomas	St. ⅜ In	1	Al.	G.E.	G.E.
R.	24,000	W.	44,000 13,000 2,400	100,000	Δ	Δ	Great Falls, S. C.–Durham, N. C.	210	S.T.	75–	600	1800	1 and 2	2	00 B. & S. 0.105	Cu. Al.	7	Cu. Al.	V.	124	4-Susp. 6-Susp. 4-Susp.	Thomas Oh. Br. Locke	5-Susp. 8-Susp. 5-Susp.	Thomas Oh. Br. Locke	St. ⅜ In.	1	Al.	W. G.E.	G.E. W.
R.	28,000	G.E.	12,800	85,000	Δ	Δ	Shawinigan Falls–Montreal, Can.	87	S.T.	70.6–	520	1400	2	2	250,000 Circ. M. 0.196	Al.	19	Al.	V.	98	7-Susp.	Oh. Br.	8-Susp.	Oh. Br.	St. ⅜ In.	2	Al.	G.E.	W.
D.	28,350	W.	33,000 16,500	....	Δ	Y	San Francisquito–Los Angeles, Cal.	47	S.T.	50–	650	1750	2	4	250,000 Circ. M. 0.196. 300,000 Circ. M. 0.235	Cu.	19	Cu.	V.	120	7-Susp.	Oh. Br.	8-Susp.	Oh. Br.	St.	1	Al.	......	W.
No	40,000	G.E.	6,600	85,800	Δ	Δ	Khopoli–Bombay, India.	43	S.T.	66–160	500	1175	2	2	0.095	Cu.	....	......	·:	128	6-Susp.	Bullers	7-Susp.	Bullers	Yes	......	Al.	G.E.	G.E.
..	......	......	......	......	...	...	Germany	166 65	......	......	645	....	....	....	....	Cu.	....	......	......	....	5-Susp.	Hermsdorf	6-Susp.	Hermsdorf	....	......	......	......	......
o	32,400	Br. Bov.	9,800	72,000	Δ	Y	Pescara River–Naples, Italy	124	S.P.	59.4–65	656	1174	1	2	66 Sq. Mm. 0.102	Cu.	7	Cu.	......	85	1-Pin	Richard Ginori	1-Pin	Richard Ginori	No	No	Horn & Water Jet	Br. Bov.	Br. Bov.
o	24,000	G.E.	13,200	88,000	Δ	Δ	New River–Roanoke, Va., Coalwood and Bluefield, W. Va.	75	W.P.	39–	250	1200	1	1	0 B. & S. 0.083	Al.	7	Al.	·:	98	4-Susp.	Thomas	6-Susp.	Thomas	St. ⅜ In.	1	Al.	G.E.	G.E.
o	55,600	W.	6,000	80,000	Δ	Δ	Lages River–Rio Janeiro, Brazil	61	S.T.	56– 71	400 500	1936	2	4	000 B. & S. 0.132	Cu.	6	Hemp	Δ	96	Misc. Pin	Thomas	5-Susp.	Locke	St. ⅜ In.	1	Horn and Liq.	W. G.E.	W.
	30,000	W.	25,000	80,000	Y	Δ	Sorocaba–Sao Paulo, Brazil	58	S.T.	65	750	1200	2	4	00 B. & S. 0.105	Cu.	7	Cu.	Δ	96	Misc. Pin	Several	5-Susp.	Several	St. ⅜ In.	1	Al.	G.E.	G.E.
.	13,500	W.	6,600	88,000	Δ	Y	River Ouse–Hobart, Tasmania	84	....	....	....	....	....	....	....	......	....	......	......	....	....	....	....	....	....	......	Al.	W.	W.
.	70,000	G.E.	3,000 210	81,000	Δ	Y	Necaxa–Mexico City, Mexico	169	S.T.	52–	500 750	1500	2	4	0000 B. & S. 0.166	Cu.	0	Hemp	∴	72	3-Pin	Thomas	3-Pin	Thomas	St.	1	Al.	G.E.	G.E.
	51,000	G.E.	12,000	80,000	Δ	Δ	Niagara Falls–Toronto, Canada	80	S.T.	52– 65–	400 650	800	2	4	190,000 Circ. M. 0,149	Cu.	7	Cu.	Δ	72 96	Misc. Pin	Locke Thomas	5-Susp.	Locke	St. ⅜ In.	1	Horn	G.E.	S.-S. G.E.
	81,000	S.-S. A.E.G W.	20,000	Ca. 60,000	Y	Δ	Vereenigung–Johannesburg, South Africa	30	S.T.	53– 71	600	....	2	4	60 Sq Mm. 0.093	Cu.	Yes	......	·:	110	6-Susp.	G.E.	8-Susp.	G.E.	St. 35 Sq.Mm.	3	Horn & Res. Al.	A.E.G. G.E.	S.-S. A.E.G. W.
	....	W. G.E.	4,400 22,000	....	....	...	Hannawa Falls–Potsdam, N. Y.	60	S.T.	....	650	....	....	....	O. B. & S. 0.083	Al.	....	......	......	108	5-Susp.	Locke	6-Susp.	Locke	Yes	2	......	......	......
	.. ...	....	11,000	....	....	....	Spain	......	......	......	......	....	....	2	....	......	....	......	......	....	Susp.	....	Susp.	....	....	......	......	......	......
	....	......	15,000	....	....	....	Porjus–Kiruna, Sweden	73.4	S.P.	......	Ca. 640	....	4	4	50-80 Sq. Mm. 0.077-0.124	......	....	......	......	....	Susp.	....	Susp.	....	....	......	......	......	......
	31,500	G.E.	11,000	70,000	Δ	Y	Komabashi–Tokio, Japan	48	S.T.	....	450	850	1 and 2	2	18-No 12 B.W.G. 0.168	Cu.	18	Hemp	Triangular	84	4-Pin	Nippon Toki G. K.	....	....	St. 3 B.&S.	1	Al.	G.E.	G.E.
	20,000	G.E.	30,000 15,000 2,300	....	Y Y Δ	Y	Kern River–Los Angeles, Cal.	117	S.T.	30– 60	700	1500	2	2	0000 B & S 0.166	Cu	7	Cu	∴	72	4-Pin and Susp.	Oh. Br. Thomas Locke	Pin	Oh. Br.	No	No	Multiplex Al.	G E.	G.E.
	3,600	W.	6,600	66,000	? Δ	? Δ	Rogers Dam–Muskegon, Mich.	86	W.P.	35-75	132	....	1	1	2 B. & S. 0.052	Cu.	No	Cu	Δ	60 Av.	3-Pin	Locke	3-Pin	Locke	St. No. 10	1	Stat. lot. & M. G.	W.	W.
.	25,650	Br. Bov.	8,650	66,000	Δ	Y	Grossoto–Milan, Italy	93,	S.P.?	65.8	658	1066	2	4	80 Sq. Mm. 0.124 Sq. In.	Cu.	19	Cu.	∴	63	Pin	Richard Ginori	Pin	Richard Ginori	No	No	H&R., W.J., Cyl.	Several	Br. Bov.
o	40,500	G.E.	13,000	60,000	Y	Y	Cedegolo–Milan, Italy	72	S.P.	60–	607	....	1	2	79 Sq. Mm. 0.122	Cu.	....	......	·:	75	4-Pin	Osculati and Carini	4-Pin	Osculati and Carini	No	No	Horn and Res.	A.E.G.	A.E.G.
o	25,000	W.	2,400	60,000	Δ	Δ	Canyon Ferry, Hauser Lake–Butte, Mont.	100	W.	40–	110	200	1	2	0 B. & S. 0.083	Cu.	7	Cu.	∴	72	1 Pc. Glass	Hemingray	Glass	Hem.	No	No	Al.	W.	W.
o	27,000	S.-S.	6,000	60,000	Y	Y	Molinar–Madrid, Spain	168	W.P.	40– 50	328	....	2	2	50 Sq. Mm. 0.155	Cu.	1	Cu.	∴	71	Pin	Hermsdorf Rosenthal	Pin	Hermsdorf Rosenthal	No	N.	Horn and Res.	S.-S.	S.-S.
t.	71,500	G.E. W.	13,000	60,000	Y	Δ	Holtwood, Pa.–Baltimore, Md.	40	S.T.	40–	500	1750	2	4	300,000 Circ. M. 0.235	Al.	....	Al.	V.	84	5-Susp. 7-Susp.	Oh. Br.	6-Susp. 8-Susp.	Oh Br.	St. ⅜ In.	1	Al.	G.E. W.	G.E.
o	12,000	S.-S.	20,000 3,000	67,500	Y	Y	Compania Hidro-Electricia e Irrigadora del Chapala S. A.	160	S.T.	59	645	1,000	2	2	99,000 Cm. 0.098 50 Sq. Mm.	Cu.	....	Cu.	·:	185	3-Susp.	Hermsdorf	6-Susp	Hermsdorf	....	1	Horn & Resist	S.-S.	S.-S.
R.	60,000	A.E.G.	12,000	....	Y	Y	S. Damasso–Novi, et al., Italy	165	S.P.	39.4	494	2300	2	4	78 Sq. Mm. 0.121 Sq. In.	Cu.	....	Cu.	Δ	65	Pin	Richard Ginori	Pin	Richard Ginori	No?	.....	Horns, W.J., Con.	A E G. Friburg	A.E.G. Br. Bov.
D.	11,000	......	....	....	....	....	Porjus–Kiruna, Sweden	73.4	S.T.	....	826	740	2	2	40 Sq. Mm. 0.062	Cu.	....	......	H.	158	6-Susp.	....	6-Susp.	....	35 Sq. Mm. Iron	1	Horn and Res.	......	......
...	18,000	W.	12,000	60,000	Δ	Δ	Point Dubois–Winnipeg, Can.	77	S.T.	42-90	600	939	2	2	278,600 Circ. M. 0.219	Al.	19	Al.	Δ	72	4-Pin	Locke	4-Pin	Locke	Yes in exp. places	1	Al.	W.	W.

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20																															
21	Sierra Elec. Power Co	110,000	..	......	22,500	....	H.	......	....	....	..	....	....	......	....	......	......	......	...	...	...	...	......	......	......	......	...	...	Mill Creek–Oakland, Cal	......	......	......
22	Sierra & San Francisco Power Co	104,000	80	34,000	....	1910	H.	11,750	1500	400	H.	Pelton	8,500	8,500	1.	4,000	G.E.	2,233	1	Δ	Y	D.	26,800	G.E.	11,000	104,000	Δ	Y	Stanislaus–San Francisco, Cal	138	S.T.	65–
23	Great Falls Power Co	102,000	80	21,000	126,000	1910	H.	6,000	105	225	H.	S.M. Smith	3,500	3,500	1.	6,600	G.E.	1,200	1	Δ	Δ	No	21,600	G.E.	2,600	91,800	Δ	Δ	Great Falls–Butte, and Anaconda, Mont	150	S.T.	45–
24	Yadkin River Power Co	100,000	60	24,000	....	1912	H.	5,900 5,200	45	164	H.	S.M. Smith	5,000 4,500	4,500 3,500	.75 .78	4,000	G.E.	6,250	3	Δ	Y	D.	37,500	G.E.	60,000	100,000	Δ	Δ	Blewitts Falls–Raleigh and Lumberton, N. C.	96	S.T.	72.6–
25	Colorado Power Co	100,000	80	10,000	10,000	1909	H.	9,000	170	400	H.	I P. Morris	5,000	5,000	1.	4,000	G.E.	3,333	1	Δ	Δ	No	15,000	G.E.	6,800	90,000	Δ	Δ	Glenwood–Denver, Colo	152	S.T.	44.2–
26	Great Western Power Co	100,000	80	50,000	100,000	1909	H.	16,500 18,000	450 525	400	V.	I.P. Morris	12,600 10,000	10,000 10,000	.80 1.	11,500 11,000	G.E	10,000	3	Δ	Δ	No	50,000	G.E.	11,000	90,000	Δ	Δ	Big Bend–Oakland, Cal	154	S.T.	75–210
27	Southern Power Co	100,000	80	75,000	....	1909	H.	5,200	69	225	H.	Holyoke Mach. Al.Ch.	3,000	2,550	.85	2,400	W.	4,000	1	Δ	Y	R.	24,000	W.	44,000 13,000 2,400	100,000	Δ	Δ	Great Falls, S. C.–Durham, N. C	210	S.T.	75–
28	Shawinigan Water & Power Co	100,000	60	45,000	80,000	1911	H.	18,500	145	225	H.	I.P. Morris	15,000	12,600	.86	6,600	W.	14,000	3	Δ	Y	R.	28,000	G.E.	12,800	85,000	Δ	Δ	Shawinigan Falls–Montreal, Can	67	S.T.	70.6–
29	Los Angeles Aqueduct	100,000	50	22,500	138,000	1914	H.	14,000	870	200	H.	Doble	9,375	7,500	80	6,600	W.	3,150	1	Δ	Y	D.	28,350	W.	33,000 16,500	....	Δ	Y	San Francisquito–Los Angeles, Cal	47	S.T.	50–
30	Tata Hydroelectric Co	100,000	50	40,000	64,000	1914	H.	11,000	1661 to 1727	300	H.	Esch. W.	10,000	8,000	.80	5,000	S.-S.	3,333	1	Δ	Δ	No	40,000	G.E.	6,600	85,600	Δ	Δ	Khopoli–Bombay, India	43	S.T.	66–160
31	Pfalzwerke, A. G	100,000	50	10,000	50,000	1915	S.	......	....	....	..	....	....	....	.....	....	....	....	...	...	...	...	....	.....	....	....	...	...	Germany	155 65	....	....
32	Societa Italiana di Elettrochimico	88,000	42	23,280	29,100	1912	H.	8,200	249	420	H.	Riva	7,300	6,820	.80	6,600	Brown Boveri	3,600	1	Δ	Y	No	32,400	Br. Bov.	9,600	72,000	Δ	Y	Pescara River–Naples, Italy	124	S.P.	59.4–65
33	Appalachian Power Co	88,000	60	20,610	75,000	1912	H.	6,000 3,500	51 37	116 97	V.	I.P. Morris	4,000 2,300	3,600 2,070	.90	13,200	G.E.	6,000	3	Δ	Δ	No	24,000	G.E.	13,200	88,000	Δ	Δ	New River–Roanoke, Va., Coalwood and Bluefield, W. Va	75	W.P.	39–
34	Rio Janeiro Tramway, Light & Power Co	88,000	50	48,800	90,000	1913	H.	16,000 8,700	1017	300	V.	Esch. W.	12,500 6,000	10,000 4,600	.80	6,300	W.	4,167 1,700	1	Δ	Δ	No	55,600	W.	6,000	80,000	Δ	Δ	Lages River–Rio Janeiro, Brazil	51	S.T.	56– 71
35	Sao Paulo Electric Co	88,000	60	30,000	50,000	1914	H.	14,600	600	600	H.	Voith	12,500	10,000	.60	6,300	W.	3,333	1	Δ	Δ	No	30,000	W.	25,000	80,000	Y	Δ	Sorocabe–Sao Paulo, Brazil	56	S.T.	65
36	Tasmania Hydroelectric & Metal Co	88,000	50	......	50,000	....	H.	......	....	....	..	....	1,350	1,700	.....	....	W.	....	1	Δ	Y	D.	13,500	W.	6,600	88,000	Δ	Y	River Ouse–Hobart, Tasmania	64	....	....
37	Mexican Light & Power Co	65,000	50	58,500	100,000	1910	H.	7,000 13,000 to 14,000	1200 to 1300	300	V.	Esch. W.	7,500 12,500	6,000 11,250	.80 .90	4,000	S.-S. G.E.	2,000 6,000	1	Δ	Y	D.	70,000	G.E.	3,000 210	81,000	Δ	Y	Necaxa–Mexico City, Mexico	169	S.T.	52–
38	Toronto Power Co	65,000	25	80,000	95,000	1914	H.	13,000 to 15,000	133 to 135	250	V.	Esch. W. I.P. Morris	7,500 10,000	6,000 8,000	.80	12,000	GE.	2,666 6,000	1 3	Δ	Δ Y	No	51,000	G.E.	12,000	80,000	Δ	Δ	Niagara Falls–Toronto, Canada	80	S.T.	52– 65–
39	Victoria Falls & Transvaal Power Co	84,000	50	40,667	40,667	1913	S.	......	....	1000	H.	A.E.G.	12,500 18,000	8,333 12,000	.67	5,000	A.E.G.	12,500 9,000	3	Δ	Y	R.	61,000	S.-S. A.E.G W.	20,000	Ca. 80,000	Y	Δ	Vereenigung–Johannesburg, South Africa	30	S.T.	53– 71
40	Northern Power Co	80,000	60	......	....	.	H.	....	....	....	..	....	....	....	.....	....	....	....	...	....	....	....	....	W. G.E.	4,400 22,000	....	...	...	Hannawa Falls–Potsdam, N. Y	60	S.T.	....
41	Energia Electrica de Cataluna	80,000	....	......	Over 100,000	? 1913	H.	....	2620	....	..	....	......	......	....	......	....	......	...	..	..	..	......	....	11,000	....	...	...	Spain	....	....	....
42	Swedish State Railways	80,000	15	26,400	52,800	1915	H.	12,500	164	225	H.	....	10,500	....	.....	4,000	All. Sv. El. Akt.	....	...	....	....	....	....	......	15,000	....	....	....	Porjus–Kiruna, Sweden	73.4	S.P.	.....
43	Katsuragawa Denryoku Kabushiki Kaisha	77,000	50	22,400	66,000	1912	H.	8,000	470	500	H.	Voith	7,000	5,600	.80	11,000	G.E.	3,500	1	Δ	Y	R.	31,500	G.E.	11,000	70,000	Δ	Y	Komahashi–Tokio, Japan	48	S.T.	....
44	Southern California Edison Co.	75,000	50	20,000	....	1907	H.	2x5375	874	250	H.	Al. Ch.	5,000	6,000	1.	2,300	G.E.	1,667	1	Δ	Y	D.	20,000	G.E.	30,000 15,000 2,300	....	Y Y Δ	Y	Kern River–Los Angeles, Cal	117	S.T.	30– 60
46	Au Sable Electric Co	72,000	30	3,000	3,000	1906	H.	7,000	38	225	H.	Leffel	1,500	1,500	1.	6,600 (6,000)?	W.	1,200	1	Δ	Δ	No	3,600	W.	6,600	66,000	? Δ	? Δ	Rogers Dam–Muskegon, Mich	66	W.P.	35–75
40	City of Milan	72,000	42	21,000	....	1910	H.	12,000	1040	315	H.	Riva	8,750	7,000	.80	10,000	Br. Bov.	2,850	1	Δ	Y	R.	25,050	Br. Bov.	8,650	65,000	Δ	Y	Grossoto–Milan, Italy	93	S.P.?	65.5
47	Societa Generale Elettrica dell' Adamello	72,000	42	Ca. 45,000	Ca. 75,000	1910	H.	6,500 5,000	2985 1542	420	H.	Esch. W. Riva	7,333 5,000	5,500 4,000	.75 .80	13,000 12,000	Br.-Bov. A.E.G.	2,700	1	Δ	Δ	No	40,500	G.E.	13,000	60,000	Y	Y	Cedegolo–Milan, Italy	72	S.P.	60–
48	Montana Co	70,000	60	21,500	60,000	1901	H.	1,000 4,000	40 65	157 225	H.	Day-Sm. S.M. Smith	750 2,600	750 2,800	1.	550 2,400	W.	1,250 2,000	1	Δ	Δ	No	26,000	W.	2,400	60,000	Δ	Δ	Canyon Ferry, Hauser Lake–Butte, Mont.	100	W.	40–
49	Hidroelectrica Espanola Molinar	70,000	50	27,000	27,000	1910	H.	7,200	217	428	H.	Voith	6,750	5,400	.80	7,000	S.-S.	6,750	3	Y	Y	No	27,000	S.-S.	6,000	60,000	Y	Y	Molinar–Madrid, Spain	158	W.P.	40– 50
50	Pennsylvania Water & Power Co.	70,000	25	71,500	Over 100,000	1910	H.	13,500 to 17,000	53 to 63	94 116	V.	I.P. Morris	7,500 10,000 12,000	7,500 10,000 12,000	1.	11,000	G.E. W.	7,600 10,000	3	Δ	Y	R.	71,500	G.E. W.	13,000	60,000	Y	Δ	Holtwood, Pa.–Baltimore, Md	40	S.T.	40–
51	Guadalajara, Mexico	70,000	50	Ca. 8,000	8,000	Ca. 1911	H.	4,000	215	375	H.	Esch. W.	3,600	3,600	1.08	10,000	S.-S.	4,000	3	Y	Y	No	12,000	S.-S.	20,000 3,000	67,500	Y	Y	Compania Hidro-Electricia e Irrigadora del Chapala S. A.	180	S.T.	59
52	Societa Elettrica Riviera di Ponente	70,000	50 16⅔	27,000	60,000	1911	H.	10,000	230	500	H.	Riva	....	7,500	......	6,000	A.E.G. S.-S.	4,600 3,100	3 1	Y	Y	R.	60,000	A.E.G.	12,000	....	Y	Y	S. Damasso–Novi, et al., Italy	155	S.P.	39.4
53	Swedish State Railways	70,000	25	17,600	52,300	1915	H.	11,000	164	250	H.	....	11,000	8,800	.80	10,000	All. Sv. El. Akt.	3,670	1	Δ	Y	D.	11,000	......	....	....	....	....	Porjus–Kiruna, Sweden	73.4	S.T.	...
54	City of Winnipeg	65,000 to 72,000	60	15,000	48,000	1911	H.	5,200	45	164	H.	Boving	3,750	3,000	.80	6,600	Vickers	3,000	1	Δ	Δ	....	18,000	W.	12,000	60,000	Δ	Δ	Point Dubois–Winnipeg, Can	77	S.T.	42–90

cataract as a moving picture, for perpetual public inspection, twenty-four hours a day, let us admit frankly to ourselves the spectacular extravagance of the decision. As a show-piece it is costing us hundreds of thousands of dollars a day, in the sense that the ultimate selling price of the wasted energy should aggregate such a cost. Every ton of water deflected from the falls means the retention of a corresponding quantity of coal for the needs of a later period. The pressure of economic necessity among a population growing rapidly will finally force the popular will to utilize more and yet more of the available Niagara power. Even then, however, it should be possible to close most of the wheel-pit gates daily for the noon hour, thus restoring the cataract for the visitors' hour. It would at least be more reasonable to grant fresh water rights under such a proviso than to keep back all of the power all of the time.

High-Voltage Plants of the World

We publish this week a chart with descriptive comment gathered by Mr. Selby Haar on the transmission plants throughout the world which operate at exceptionally high voltage. No one who has not attempted some terrific task of this kind can realize in the least the enormous amount of labor required to obtain exact information regarding even a few transmission plants, let alone all which are operated at or above 70,000 volts. The thoroughness with which Mr. Haar has done his work is well attested by the small number of gaps in the table. It is very easy to find the complete details regarding one or two plants, or a portion of them concerning a large number of plants, but to make really thorough an undertaking like that referred to is quite another matter. We congratulate the author on the result of his very searching investigation.

The line between high voltage and extra high voltage was drawn somewhat arbitrarily at 70,000 volts. The primary reason for this is that to include plants at 40,000 to 70,000 volts would enormously complicate the table without leading to particularly valuable conclusions as to high-voltage practice, since many of the systems of less impressive voltage are old and small, and to include them would give an inaccurate idea of the present situation. Moreover, 70,000 volts is about the line at which the pin-type insulator reaches the limit of its usefulness. One cannot pass this figure far without reaching a point where the design of an insulator which will withstand the working voltage in a drizzle becomes extremely difficult. In point of fact, only a few of the plants operating above 70,000 volts are not equipped with suspension insulators. Looking over the table as a whole, it furnishes extremely striking evidence of the progress that has been made. There are thirty-one plants operated at or above 100,000 volts working pressure. All but half a dozen of these are on this continent and most of them in the United States. All but one are three-phase plants, although the criterion adopted of rating the voltage on the working point for which the plant is designed would certainly force the inclusion of the constant direct-current transmission system from Moutiers to Lyons, which at full load goes above the required figure.

As to frequency, about 40 per cent of the total list of plants are operated at sixty cycles, 30 per cent at fifty cycles, and the rest at other periodicities, mostly 25 cycles. There seems to be a strong tendency to use single-phase units in the transformers, although quite a few plants use the three-phase type. As to the connection of these transformers there is no general agreement in practice under these extreme conditions of voltage in spite of much discussion and many learned papers regarding the advantages of one or another connection. Rather more plants use the straight delta connection than any other complete combination, but there are numerous examples also of star connection on the high-tension sides. It is very apparent that none of the objections to either practice carries any great weight.

With respect to line construction, with rare exceptions steel towers are used for this work of the first magnitude, with spans ordinarily running from 500 ft. to 700 ft. In most instances there are two complete circuits per tower, a few plants relying on a single circuit and a few others having duplicate tower lines each with a single circuit. Most of the line conductors are of stranded copper, and the usual spacing between wires is in the vicinity of 10 ft. at voltages over 100,000 and from 6 ft. to 8 ft. below that figure. Without exception the insulators are of the suspension type for all voltages of 100,000 and over, and often for voltages below that limit. Nearly all the plants have overhead ground wires of stranded steel, usually one, rarely two, and in a very few instances three. Except in a few cases, the lines are protected by aluminum lightning arresters, although in some plants use is made of horn arresters of various types and an occasional plant is found without any lightning protection at all.

The arrangement of conductors is worth a word of mention. The earlier practice was almost exclusively in the line of the equilateral triangle arrangement. Experience seems to have shown that the gain from this symmetrical position is not of much practical importance, and in recent tower lines the tendency has been toward a vertical arrangement slightly modified so that the three wires will not be absolutely in line, although in some important systems the wires are run in the same horizontal plane. The general experience throughout seems to have been that with modern construction these extremely high-voltage lines are much easier to operate than would have been deemed possible even a very few years ago. At each upward step in voltage difficulties once feared seem to have retreated before the march of progress. The main question to be asked to-day when a project for transmission over very long distance and at extreme voltage comes up is not, "Can it be successfully done?" but, "When we have done it successfully will it pay?" And the answer generally is, "Yes."

The News of the Week

Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.

Hearings on Oldfield Patent Bill

The committee on patents of the House of Representatives had expected to begin hearings at Washington on April 22 on the Oldfield bill revising and amending the laws relating to patents. However, as the House of Representatives was in session that day in order to act on the Mexican resolution, the committee held only a brief meeting and did not hear any testimony on this subject. According to the present plans of the committee, hearings will be started next week.

At its short meeting the committee heard testimony from manufacturers of stoves and stove parts on the Oldfield bill providing for the registration of designs.

A Million a Year Offered for Los Angeles Aqueduct Power

The electric generating companies of Los Angeles, the Southern California Edison Company, the Los Angeles Gas & Electric Corporation and the Pacific Light & Power Corporation have agreed to buy all of the energy generated by the Los Angeles aqueduct power plants. In a formal offer the companies agreed to pay the city a wholesale price to be set by the State Railroad Commission amounting to at least a million dollars. This is with the full understanding that the City Council will protect the people by fixing a low retail rate. As an alternative the companies have offered to enter into a co-operative arrangement with the city for the public use of their complete distributing systems for five years, the city to make all rates, all contracts with consumers, read all meters, handle all money and collect all bills. The companies will receive only the sum determined by the State Railroad Commission as equitable. It is pointed out that either of the offers will materially reduce tax burdens and that co-operation between the city and the companies for five years will greatly improve Los Angeles' financial standing.

Worcester Electric Light Company Progressing

Expansion all along the line is under way on the system of the Worcester (Mass.) Electric Light Company. Construction has begun upon the underground distribution lines for the ornamental magnetite-arc-lamp installation to be completed throughout the business center of the city by early summer, and an enlargement of the Webster Street generating station is being made to house a new 7200-kw turbo-alternator which is required by the rapid increase in the load. A substation is being built at the plant to raise the pressure of the company's tie-line circuits between Webster Street and the Faraday Street and Southbridge Street substations from 2300 volts to 13,200 volts. An important power contract was obtained a few days ago, when the Crompton & Knowles Loom Works, one of the oldest and largest manufacturing plants in the city, decided to shut down their steam plant and purchase energy of the company. The connected load will be about 1600 hp in 550-volt, three-phase induction motors and about 200 kw in lighting apparatus. Thirty motors will be installed at first, and extended studies will be made by the Worcester Electric Light Company leading toward future subdivisions of the power installation. The power engineering department has prepared a monthly log sheet, 15 in. by 28 in. in dimensions, for use in following the daily performance of the Crompton & Knowles installation, including nearly fifty items relating to fuel, weather, temperature, steam pressure, labor, production, repair, electrical and other conditions bearing upon operating economy. The addition of this establishment will bring the connected motor load to 15,600 hp, a gain of about 10 per cent. A 500-hp motor installation has recently superseded a steam-engine drive of many mechanical complications in the factories of the Merrifield estate.

Pittsburgh Holding Company Insures Its Employees

The Philadelphia Company of Pittsburgh has made a group insurance arrangement with the Equitable Life Assurance Society of the United States effective April 1. This is one of the largest insurance transactions ever negotiated, and carries with it life insurance equal to the amount of one year's salary to the employees of the following companies: Philadelphia Company, Philadelphia Company of West Virginia, Pittsburgh & West Virginia Gas Company, Allegheny Heating Company, Equitable Gas Company, Monongahela Natural Gas Company, Consolidated Gas Company of the City of Pittsburgh, and the South Side Gas Company. The cost of insurance is borne entirely by the company and is issued on the group plan. Employees in the service from one to less than two years will be insured for the equivalent of six months' wages, and those in service two years or more for the equivalent of the previous full year's salary.

Mr. J. H. Reed, president of the Philadelphia Company, has fixed a maximum amount of insurance on any one employee at $200 any one month for one year, saying that the company was prompted in the matter of this insurance by desire to protect the families of the rank and file of faithful employees. The Philadelphia Company is a holding company and employs about 5000 persons. Among the properties it controls are the electric light and railway companies in Pittsburgh, Pa.

Pupin A. I. E. E. Lectures

Dr. Michael I. Pupin, professor of electromechanics at Columbia University, will deliver two lectures "On the Relation of the Electromagnetic Theory to the Science of Electrical Engineering of the Present Day" at the Engineering Societies Building, New York, on Wednesday evenings, April 29 and May 6. These lectures will be given under the auspices of the committee on technical lectures of the American Institute of Electrical Engineers. In these lectures Dr. Pupin will show how far electrical science could have developed without Clerk Maxwell's work and along what lines there would have been no development without this work. The recent advances in electrical engineering, including radio-telegraphy and radio-activity, he finds are much more dependent upon Maxwell's work than that type of engineering which may be called heavy-current engineering. The lectures are intended to bring out the points of contact between Maxwell's electromagnetic theory and the ordinary or less broad electromagnetic theory which serves as the foundation of electrical engineering to-day. The meetings will be open to the general engineering public, including non-members as well as members of the Institute.

Educational Conference at N. E. L. A. Headquarters

On April 20, 1914, there was held at the headquarters of the National Electric Light Association a conference for the purpose of promoting closer co-operation between the technical schools and the electric-lighting industry. The conference was called by Mr. John F. Gilchrist, of the committee on relations with educational institutions. To it were invited a number of engineers interested in the practical and the educational side of their profession and the heads of departments of a number of important technical schools. These men composed a committee to consider and apply methods for fostering helpful relations between college committees and leaders in the central-station business.

The meeting was attended by Messrs. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company; L. A. Ferguson, Commonwealth Edison Company; W. W. Freeman, vice-president Cincinnati Gas & Electric Company; C. A. S. Howlett, General Electric Company; J. F. Gilchrist, Commonwealth Edison Company; J. W. Lieb, Jr., New York Edison Company; T. C. Martin, secretary N. E. L. A.; H. H. Norris, *Electrical World;* S. A. Sewall, assistant secretary N. E. L. A.; Paul Spencer, United Gas Improvement Company; Arthur Williams, New York Edison Company; C. Beebe, University of Wisconsin; H. C. Clifford, Harvard University; O. J. Ferguson, University of Nebraska; A. F. Ganz, Stevens Institute of Technology; C. F. Harding, Purdue University; P. M. Lincoln, University of Pittsburgh; C. F. Scott, Yale University, and G. D. Shepardson, University of Minnesota.

The net result of the conference, in addition to promoting a general spirit of co-operation, was the passing of a motion that the work of the committee should be subdivided, each section taking up a special phase of the work in which the members are particularly interested. The sub-committees will be appointed shortly by Chairman Gilchrist.

Progress on Boston "Tech" Buildings

Rapid progress is being made in the construction of the new buildings of the Massachusetts Institute of Technology on the Cambridge side of the Charles River Basin at Boston. About 400 men are now at work on the site, and the force is being steadily increased. Concrete was first poured for foundations on April 9. Three pile-drivers are at work with a capacity of 300 piles per day, and an extensive lumber yard and construction mill equipment are in use. The well of the hydraulic laboratory is practically completed and the aeronautical laboratory is ready for service. An experimental span is being erected for the electrical laboratory for transmission investigations, with two steel towers similar to the Big Creek (Cal.) installation, the span being 500 ft. Thesis work by Institute students is being pushed along civil-engineering lines, including tests of full-size concrete beams. Electrical energy for construction service on the grounds is being supplied by the Cambridge Electric Light Company, a 90-kw transformer installation having been erected for present requirements. The buildings are being erected by the Stone & Webster Engineering Corporation, of Boston.

Annual Report of the General Electric Company

The business of the General Electric Company in the year 1913 exceeded in volume the record of any previous year. The twenty-second annual report, issued to stockholders this week, shows that the value of orders received was $111,819,142. The amount of sales billed was $106,477,439. Profits from the sales were $10,269,605, while the income from other sources amounted to $3,796,184. From the total income of $14,065,789 there were deducted $1,007,910 for interest and discount on debentures and notes payable and $8,149,205 for dividends, or a total of $9,157,115. The balance carried to the surplus account was $4,908,674.

Mr. C. A. Coffin, chairman of the board of directors, says that the tendency toward an increase in the number of orders and a reduction in their average value continued during the year. More than 600,000 orders were received. This feature of the business, together with increased competition, caused an unavoidable addition to the expense of securing and filling orders. The number of employees of the company engaged in factories, offices and subsidiary companies at the close of the year exceeded 65,000. Following the previous practice of the company the expenditures for the purchase of patents, for applications and licenses under patents and for miscellaneous expenses in connection therewith, amounting to $662,925 for the year, were charged to income account and the patent account is still carried at $1. The valuation of $1 represents on the balance sheet "patents, franchises and good-will."

The valuation placed on stocks and bonds owned is $25,964,317, of which $17,574,844 represents stocks of subsidiary companies and $8,389,473 stocks and bonds of public utility and other companies. The current accounts and notes receivable are carried at $26,210,459. Mr. Coffin says that they have been carefully reviewed and conservatively valued, abundant provision having been made for possible losses. The rapid growth of subsidiary companies has required substantial advances during the year to provide additional facilities and for increased working capital. The total amount due from these companies is now $6,817,563, making the aggregate balances of all accounts and notes receivable $33,028,022.

During the year 1,740,000 sq. ft. of additional manufacturing floor space was provided, making a total of 13,900,000 sq. ft. at the close of 1913. Expenditures for additions and improvements to manufacturing plants aggregated $11,373,118, while the amount written off was $6,502,060, making a net increase of $4,871,058. Information in regard to changes in the book value of the plants is furnished. On Jan. 31, 1893, the book value of the Schenectady, Lynn and Harrison plants was $3,958,528. During the twenty-one fiscal years ended Dec. 31, 1913, expenditures were made, including the cost of the Pittsfield, Erie, Fort Wayne, Sprague and National Lamp plants, aggregating $69,314,630, or a total of $73,273,158. During the period of twenty-one years $43,845,990 was written off, leaving the book value of the plants at the close of 1913 at $29,427,168.

The amount of capital stock outstanding on Jan. 1, 1913, was $101,202,000. During the year $20,000 debentures of 1892 and $159,200 debentures of 1907 were converted into stock, making a total issued amount of $101,381,200. Quarterly dividends at the rate of 8 per cent per annum were paid during the year. An issue of $8,000,000 of nine months' notes maturing on April 16, 1914, was sold in July, 1913, at a discount rate of 6¼ per cent per annum for the purpose of meeting demands due to a large increase in business during the first half of the year and other burdens incident to the very unsettled financial conditions existing then. Money was deposited out of current funds for the payment of these notes at maturity. The company has no other notes payable and there is no paper outstanding bearing its indorsement.

In speaking of his election as chairman of the board, Mr. Coffin refers thus to his successor: "Mr. E. W. Rice, Jr., senior vice-president, whose term of service has been of equal length with my own and who has intimate familiarity with the important interests of the company, was elected to the presidency."

PROFIT AND LOSS ACCOUNT

Sales billed			$106,477,438
Less: Cost of sales, including all operating, maintenance and depreciation charges			96,207,833
			$10,269,605
Interest and discount, royalties and sundry profits		$1,478,721	
Income from securities owned		1,281,463	
Increase in value of securities of companies owned, due to additions to the surplus of those companies		1,036,000	
		$3,796,184	
Less:			
Interest on debenture bonds	$576,432		
Balance of discount on debenture bonds issued in 1912	37,438		
Discount and expenses on note issue	394,040	1,007,910	
			2,788,274
			$13,057,879
Dividends paid			8,149,204
Net surplus for the year			$4,908,674
Surplus at Jan. 1, 1913			12,031,145
Surplus at Dec. 31, 1913			$16,939,819

The company's balance sheet shows merchandise inventories of $37,790,738, of which $31,697,055 was at factories, $4,010,538 at district offices, in transit, etc., and $2,083,145 in consignments. Real estate, buildings, warehouses, etc., other than manufacturing plants, amounted to $1,058,386. Furniture and appliances, other than in factories, are carried at $2. Installation work in progress amounts to $2,012,514. The condensed profit and loss account is published herewith.

Marwick, Mitchell, Peat & Company, the chartered accountants who examined the accounts, said in their certificate that the valuations at which the stocks and bonds are carried are conservative and have been approved by a committee of the board of directors. The notes and accounts receivable are shown at their realizable value, due provision having been made for possible losses through bad and doubtful debts. Certified inventories of work in progress, merchandise and materials and supplies have been submitted to the accountants, who have satisfied themselves that the inventories have been taken in a careful manner, that they have been valued at or below cost price, and that full allowance has been made for old or inactive stocks. Provision has also been made for possible allowances or additional expenditures on recently completed contracts and on installation work in progress. The accountants add that all expenditures capitalized in the property and plant accounts during the year were properly so chargeable as representing additions or improvements and that ample provision has been made in the operating accounts for repairs, renewals and depreciation.

Magnetic-Survey Yacht "Carnegie" Has Completed 100,000 Miles

From 1909 to 1913 the Carnegie Institution's ship *Carnegie* traveled 100,000 miles while her staff was engaged in the work of charting the magnetic lines of force and other phenomena of the oceans. Dr. L. A. Bauer, director of the department of terrestrial magnetism of the Carnegie Institution, told of the work of this famous non-magnetic vessel at a joint meeting of the American Geographical Society and the Association of American Geographers at New York on April 3.

During her four-year cruise the *Carnegie* has sailed in all the oceans and has traversed a distance equal to seven times the circumnavigation of the globe. During 1914 the ship will begin a cruise in the North Atlantic Ocean, and next year she will pass through the Panama Canal and patrol the South Pacific and South Atlantic.

Dr. Bauer reported that the Carnegie Institution had established about 3000 land stations for taking magnetic observations. These stations range from Greenland on the north to New Zealand on the south, and are established at average intervals of 100 miles.

All materials used in the construction of the observation yacht *Carnegie* are non-magnetic. The vessel is equipped with sails, brigantine-rigged, but has an auxiliary engine built entirely of brass and copper. Under full canvas she can make 300 knots a day. All metal parts of the ship are of bronze or copper so as to produce absolutely no effect on the delicate magnetic measuring instruments. "The cutlery was of Mexican silver," said Dr. Bauer; "the anchors were of heavy bronze; the sailors' sheath knives were of non-magnetic manganese steel, and even the sailors themselves were bronzed."

Uniform Accounts Discussion in Missouri

Considerable apprehension was aroused among the private-company utility men of the State of Missouri, particularly those operating the smaller companies, by the orders of the Missouri Public Service Commission, dated March 9, 1914, in the matter of adopting a uniform system of accounts for electric, gas, water and heating public-service companies, as well as municipalities operating utilities of this description. Every corporation and municipality in the State engaged in these utilities was made a defendant in the proceeding relating to the proposed adoption of the uniform systems of accounts for the utilities enumerated. A public hearing was set for April 15. The Missouri Electric, Gas, Street Railway and Water-Works Association "got busy" at once. A meeting was held in St. Louis April 1. Committees were appointed to consider various aspects of the subject and these reported at an adjourned meeting held in St. Louis on April 14. Following this meeting the reports of the committees, duly adopted and authorized by the association, were laid before the Public Service Commission of the State at the hearing of April 15, which took place in the Senate Chamber of the Capitol at Jefferson City.

The public hearing proved to be a pleasant and harmonious one. All of the members of the Public Service Commission were present except Commissioner Wightman. Chairman John M. Atkinson presided and did the talking for the board, the other sitting members being Messrs. William F. Woerner, John Kennish and Howard B. Shaw. Mr. Richard Yates, a member of the State Public Utilities Commission of Illinois, sat with the commission and was an interested spectator of the proceedings. The upshot of the meeting was that Chairman Atkinson expressed himself as much gratified by the co-operation of the utility men and suggested that they appoint a committee to represent them to take up with the commission's department of statistics and accounts various modifications of the schedules which had already been practically agreed to. This committee was appointed, and after it confers with the accounting department of the commission a report is expected.

Photometric Tests of Lamps for Street Lighting

A lawsuit involving the candle-power of gasoline mantle street lamps and the accuracy of photometric measurements has been on trial in Philadelphia recently. The Welsbach Street Lighting Company of America had the contract for operating about 18,000 gasoline mantle street lamps in outlying districts. The contract specifications were peculiar in that they called for "lamps to be tested photometrically as to actual street illuminating power, . . . and the minimum illuminating power they shall be required to furnish on the street at all times, under conditions herein specified, will be 60 cp," and further that "this illuminating power shall be determined by horizontal measurement, at the city's photometric stations or elsewhere," at the discretion of the director of public works, "using any method sanctioned by standard practice." The specifications provided that the test should "be made with the clear glass globe which incloses the lamp on the street removed, but otherwise under the same conditions as exist when the lamp is taken down, the object of the test being to determine that the actual illuminating power as contracted for is given on the street." No less than twenty-five lamps in each of five districts, or 125 lamps in all, were to be tested each month and deductions made from the rate of $29 per lamp a year by whatever percentage the lamps tested for each district averaged below 60 cp.

Soon after the contract was awarded the city authorities found it impracticable to move mantle burners to a laboratory for test. Two plans were adopted for testing lamps during the first six months of 1913. One was to attach a Sharp-Millar photometer to the lamp-post and by means of mirrors to reflect the horizontal candle-power of the lamp into the photometer. These tests were made with lantern globes, and a deduction was made for the loss of light due to the globe by taking 125 lamp globes off the street and testing them at the Drexel Institute. A globe absorption averaging 13.4 per cent was measured by this process, and the readings were corrected by that amount to determine the candle-power with the globes removed. Beginning with March, use was made of a laboratory photometer bar with Lummer-Brodhun head, on an automobile truck, carefully housed in with tarpaulins. After testing each lamp on the post it was very carefully removed from the post while burning and taken into this "floating photometric station," as it was called, and tested both with and without the globe. All of the testing was done by the Electrical Testing Laboratories of New York, with Mr. W. F. Little in charge. The results for the four months during which both methods of test were used averaged as follows:

Sharp-Millar photometer, globe on, 43.9 cp; globe off (by correction of 13.4 per cent), 50 cp.

Laboratory bar instrument, globe on, 43.6 cp; globe off, 50.3 cp.

There were considerable variations above and below averages in the 500 tests covered by these figures, and in many cases the lamps fluctuated badly in candle-power.

On the basis of these tests the city deducted an amount proportional to the shortage in candle-power from the company's charge, amounting in six months to about $53,000. The company brought suit to recover the amount deducted. Early in the trial the judge ruled out the tests with the globes in place as not being according to the contract in spite of the efforts of the city to show that they were the fairest that could be devised under the circumstances. The city then resorted to the tests made with the floating photometer with the globes removed. Expert witnesses on both sides agreed that the photometric bar and head were "sanctioned by standard practice" but that the method of removing from the post to the truck for the test was new.

The company has made much of the possibility that drafts of air might affect the readings of the truck. The city presented the average figures given above, which show little difference between lamps tested on the post and on the truck. The company pointed out the implications in the contract that removal to a laboratory was contemplated and also brought in correspondence to that effect. The case was decided by the jury in favor of the company.

Messrs. C. O. Bond, F. V. Westermaier and Claude W. Jordan, of the United Gas Improvement and Welsbach companies, and Dr. Louis Bell, consulting engineer, appeared as expert witnesses for the company. Messrs. E. C. Crittenden, Bureau of Standards; J. R. Cravath, consulting engineer; Judson C. Dickerman, chief Philadelphia Bureau of Gas; Prof. James A. Evans, Pennsylvania Department of Agriculture; Prof. H. S. Hower, Carnegie Institute of Technology; Professor Hoadley, Swarthmore College; Charles F. Lacombe, New York City; Prof. H. J. Rowland, Drexel Institute, and A. H. Taylor, Bureau of Standards, as witnesses, with Prof. J. M. Bryant, University of Illinois, and Prof. A. H. White, University of Michigan, in a consulting capacity, constituted the city's array of experts in the case.

Suggestions to Congress Regarding Trust Legislation

A letter addressed by Mr. Wade H. Ellis to Chairman Adamson of the committee on interstate and foreign commerce of the House of Representatives in regard to pending trust legislation has been made public by the committee. The letter suggests a change in phraseology of the trades relations bill. It is suggested that the form used in a decree entered in October, 1911, in the case of the United States vs. the General Electric Company in the Circuit Court of the United States for the Northern District of Ohio, Eastern Division, be employed. Mr. Wade conducted this case for the government.

In conformity with the general principle of this decree, the following is suggested by Mr. Wade for inclusion in the trade relations bill to cover price restrictions: "It shall be deemed an attempt to monopolize trade or commerce among the several states or with foreign nations or a part thereof for any person selling goods in interstate or foreign commerce to offer or make more favorable prices or terms of sale in such commerce to the customer of any competitor than such person shall at the same time offer or make to his established trade where the purpose or intent is to injure or destroy such competitor; provided, that it shall not be unlawful for any person selling goods in interstate or foreign commerce to make or offer any price or terms of sale in order to meet or compete with any price or terms previously made by any competitor, whether such competitor is or is not selling in interstate or foreign commerce."

Another Tax on Canadian Central Stations

The present political party in power in the Province of Ontario, Canada, recently found it necessary to secure additional income with which to carry on the government. The method adopted was to increase the tax on various corporations such as insurance companies, banks, gas and electric companies, etc. The authority requisite for the imposition and collection of the increased tax is contained in Bill No. 169, of 1914, entitled "An Act to Amend the Corporation Tax Act." This bill has gone to a second reading, and, as it is a party measure and as the Ontario Parliament will adjourn in a very few days, it is almost a foregone conclusion that the bill will become a law.

The section of Bill No. 169 which is of interest to the privately owned central stations in Ontario is No. 11, under the sub-title "Gas and Electric Companies." It reads as follows:

"Every gas company and every electric company or company supplying or dealing in light or power by gas or electricity in a city shall pay a tax of one-tenth of 1 per cent on the paid-up capital thereof, and every gas company and every electric company or company supplying or dealing in light or power by gas or electricity shall pay a tax of 1 per cent calculated on the net revenue of the company earned within Ontario, but this shall not apply to any gas or electric works owned and operated by a municipal corporation."

The privately owned central stations of Ontario are now paying the tax of one-tenth of 1 per cent on their capital. The added tax is the 1 per cent on the net earnings of the companies within Ontario. The added burden is the fact that their competitors, the Ontario Hydro-Electric System and its various subsidiaries owned and operated by municipalities, are exempted from the new tax.

The preparation, introduction and advancement of this bill to a second reading was very quietly accomplished. The central-station interests had no warning of its impending passage until late last week. At the earliest opportunity telegrams were sent to most of the privately owned central stations in Ontario to send representatives to Toronto on Saturday, April 18, to appear as a committee of protest before the Cabinet of the Province of Ontario. On Saturday morning it was announced that the Cabinet would grant an audience to the committee at 2 o'clock that afternoon. This was the first opportunity the interests affected had had to appear in opposition to the bill.

The committee which was received by the Cabinet consisted of Messrs. D. H. McDougall, of the Toronto Electric Light Company, Ltd.; A. A. Dion, of the Ottawa Gas & Electric Company; E. P. Coleman, of the Dominion Power & Transmission Company, Hamilton, and Mr. Caldwell, of the Electric Power Company, Peterborough. This committee and the Canadian Electrical Association were represented by Mr. Hellmuth, K.C., of Toronto, as counsel.

Mr. Hellmuth made the principal address to the Cabinet, in the course of which he inquired if it was the purpose of the Ontarion government to break the privately owned central-station companies and force them into liquidation. One of the ministers replied that Mr. Hellmuth's question was a joke. Mr. Dion, in a brief but forceful address, made the point that competition fixes rates and that under the proposed bill, therefore, there would be no opportunity to raise the rates so as to include the additional tax of 1 per cent. Mr. McDougall had prepared a brief in opposition to the proposed tax. The following are extracts from it:

Electric-light companies of the Province of Ontario owned and operated by private interests represent capital invested of $110,000,000. The pay-rolls of these private companies for the year 1913 totaled over $2,000,000.

A very large percentage of this invested capital was secured from England and from outside the Province and was obtained on the faith of the contracts entered into by various municipalities giving exclusive rights within their boundaries, or, if not exclusive, then the statutes of Ontario at the time the franchises were granted provided that in case a municipality desired to enter the electric lighting, gas or street-railway business it was first compelled to buy out the existing company to which it had given a franchise.

The Hydro-Electric movement first of all annulled this provincial act as detrimental to the progress of the municipalities in compelling the observance of the conditions under which the franchises were granted. The government fostered and financially supported the municipalities in violating their contracts with the companies and in starting opposition and duplication of the companies' plant and distribution systems.

The private companies have always been compelled to pay taxes on their assessed values, whereas the plant of the municipality escapes taxes, which exemption is not an exemption of a municipal enterprise in the ordinary sense of the word, such as water-works, etc., which is of benefit to all classes of citizens, but is an exemption in favor of the few using the service of the municipality and a charge on a large majority of the ratepayers and citizens who do not avail themselves of the municipality's electric system.

In addition, the transmission of power by the provincial commission has been carried on by means of lines built mainly along the highways of the Province and operated at very high voltage. Notwithstanding this, the provincial commission refuses to pay any taxes whatever to the various municipalities through which they operate and refuses to contribute to the upkeep of the highways they use to a larger extent probably than any individual resident.

On the other hand, the transmission lines of the private companies are assessed for their full value, and these companies are compelled to procure in many cases a private right-of-way, which is also subject to assessment. The result is that before the electricity can reach the consumer in the municipality the capital invested to get it there is taxed for the transmission line and for the distribution in the municipality, whereas the Hydro equipment is exempted in both cases.

The Hydro propaganda was introduced with the avowed intention and announced program of doing business at cost regardless of the investment of legally operating companies. The earnings, therefore, at the present time where the Hydro competition exists do not give a fair return to the private companies, representing an investment of $110,000,000 which any government should be interested in protecting. The addition by the Province of a further tax of 1 per cent on the private companies' income would be not only unfair to the companies but an additional bonus or exemption to the few consumers of the Hydro-Electric Commission's electric energy and a charge indirectly on every other citizen of the Province who is not connected with its lines.

O. E. L. A. New-Business Meeting at Dayton

At Dayton, Ohio, on April 15, commercial members of the Ohio Electric Light Association held a meeting for the discussion of new-business topics. Mr. Thomas F. Kelly, sales manager of the Dayton Power & Light Company, presided, and Mr. Robert Montgomery, new-business manager of the Louisville Gas & Electric Company, read a paper, "A Successful House-Wiring Campaign," which had been prepared by Mr. E. F. Callahan, new-business manager for H. M. Byllesby & Company, Chicago.

At Louisville this situation was first approached by inviting the contractors to attend a noonday luncheon and conference, when figures were laid before them showing the large field of operation in sight. The contractors were requested to submit specifications and quotations on a flat-rate basis, making a price per outlet for the wiring and also a flat price for each fixture, including 40-watt tungsten lamps. The Louisville central-station proposed to bear all the expense of a vigorous advertising campaign and to devote the services of five salesmen to securing house-wiring contracts. After due deliberation the contractors submitted their specifications and quotations as requested, but these were found to be too high to make the campaign a success. The company then compiled a price schedule and made up an application blank which took the form of a contract between the electrical contractor and the customer. By the terms of this the contractor agreed to do the work on a time-payment plan of 25 per cent cash on completion of the work, the balance to be paid in twelve equal monthly payments.

Only one contractor accepted the proposition, and in addition to the large number of jobs turned over to this contractor by the company's salesmen he also receives practically an equal volume of house wiring without solicitation. All the other contractors are also doing much more business since the campaign started than they were theretofore. The sale of appliances has also increased materially. The official contractor has had to expand and specialize his own organization and now has an outside superintendent in charge of his forty-two wiremen. The capital required by him to carry on this business has been approximately $25,000. As evidence of his satisfaction with the price schedule followed, it may be noted that each week he gives $10 to be awarded as prizes to the two central-station salesmen closing the greatest number of contracts.

Mr. Callahan's paper was discussed at length by Chairman Kelly, Mr. R. H. Wright of Cleveland, Mr. Parker H. Kemble of Cincinnati, Mr. Fred Morrison of Newark, Mr. O. Wessel of Columbus and Mr. J. E. North of Springfield.

Mr. Parker H. Kemble, Cincinnati, opened the round-table discussion on "Handling the Chronic Kicker" and told how by having such complainants taken care of by able representatives the "kickers" could be eliminated. He described systems of card indexes and other methods used by some companies to keep track of this class of people, but questioned whether a large organization could afford the money required for this purpose.

During luncheon brief addresses were heard from Messrs. Charles Wuichet of Dayton, Ohio, and Frank M. Tait, general manager of the Dayton Power & Light Company and past-president of the National Electric Light Association.

The feature of the afternoon session was an address by Mr. R. H. Grant, sales manager of the National Cash Register Company, on the subject of "Salesmanship." In the evening a number of the delegates attended a dance given in their honor by the Dayton Power & Light Social Club.

Mr. Insull on the Centralization of Energy Supply

A large audience, including many men notable in the electrical industry, heard the address of Mr. Samuel Insull, president of the Commonwealth Edison Company of Chicago, on the "Centralization of Power Supply," at the West Side Branch of the Young Men's Christian Association in New York on April 20. The meeting was one of those in the series held by the Finance Forum for discussion of the subject of public utilities. The speaker of the evening presented earnestly and in language that the layman could understand an argument for the treatment of the electric central station as a monopoly in order that there might be the fullest measure of conservation of energy, but said that this monopoly should be subject to regulation by the public. Mr. C. A. Coffin, chairman of the board of directors of the General Electric Company, presided as chairman of the evening. After speaking with warm praise of the work of the association, he paid high tribute to the ability and character of Mr. Insull. Among those who were on the platform were Messrs. E. W. Rice, Jr., O. D. Young, Arthur Williams, J. W. Lieb, Jr., J. B. McCall, Frank A. Vanderlip, W. W. Freeman, E. P. Russell, L. A. Ferguson, N. F. Brady, Thomas E. Murray, E. W. Burdett, Herbert A. Wagner, John F. Gilchrist and Gen. George H. Harries.

In his discussion of the subject Mr. Insull remarked that the topic was one that he had had the privilege of discussing a great many times. His remarks were illustrated by stereopticon views depicting charts and data which were the basis of the address. At the outset Mr. Insull said that he wanted to have it understood that the business in which he is engaged is essentially a monopoly business. It would be as absurd for every householder to have his own water supply, gas-producing apparatus, means of sewage disposal, transportation and communication by wire as for him to have his individual method of producing electrical energy. The economics of the situation demand a centralized supply of energy if the most economical results are to be obtained, if capital and labor are to be conserved, and if the prime sources of power, whether coal or water, are to yield the very best possible results for the user in low price and for the producer in yielding a proper, fair return on capital. It would seem that the day will come when regulating bodies will question the waste of capital, fuel and efficiency that goes on where the production of energy is not centralized.

Continuing, Mr. Insull said that one great trouble is that speakers who discuss the subject usually view it from their individual standpoint. They do not take the broad view, but discuss the matter from the point of view of pride and satisfaction with the power station with which their particular interests are concerned. Another class of men who discuss the subject do so without adequate knowledge of general conditions.

In beginning his references to statistics, the speaker said that they necessarily related in the main to the Chicago company, but he hoped to show that on broad economic grounds it is for the best interest of the whole community that this class of business should be run as a monopoly, with one system of distribution and one central authority of production. Necessarily, such a property should be regulated; so treated, the property will be the greatest conserver of the product at the lowest price to the consumer and the greatest possible profit within reasonable limits to the producer. The first chart displayed was that of a block of apartment buildings with 193 apartment customers and 34 hall-lighting and garage customers. The average number of lamps per customer was twelve and the total consumption per year was 49,620 kw-hr. Mr. Insull explained that the investment supplying the individual services would not be used more than 7 per cent of the time, but that the combination of many customers having diversified demands would increase the percentage use of the total investment. He said that the Chicago company was the pioneer in the use of Wright demand meters, and traced the development therefrom of rate-making schemes based on the percentage of connected load. The company has been installing, as fast as possible, meters showing a record of consumption. A number of the charts were based upon load conditions at 5:30 p. m. on Jan. 6, and showed the experience of the company with different classes of customers, as department stores, public garages, steel, iron and brass works, office buildings, stockyards and packing houses, telephone exchanges, offices, ice manufacturers, hotels, etc. In referring to the chart based on the experience with seventeen public garages Mr. Insull said that 854 vehicles were charged at an average cost of $109 per annum, or roughly 30 cents a day. "The charts," he said, "show the extreme desirability of knowing all that you possibly can about your own line of business."

In discussing the annual income from the sales of electrical energy and the sales per capita in different cities, the speaker said that where there is a low price per kilowatt-hour there is a high figure of sales per capita. He gave some statistics of sales of gas per capita to show that the per capita sales of electricity have passed those of gas. He showed that the income per kilowatt-hour is very high in London, England, and that the sales per capita are low and the load-factor relatively poor. The rule is almost invariable that as the income per kilowatt-hour goes down the output per capita goes up. Cost follows the line of income and the load-factor shows a decided improvement. After showing how the highest output per capita and the lowest income per kilowatt-hour of the points indicated were reported at Niagara Falls, Mr. Insull said that Chicago, with steam production of energy, is pretty close as to low income per kilowatt-hour and high sales per capita and good load-factor to the districts of hydroelectric power. To demonstrate the figures in another way, the speaker referred to statistics of the 1912 census. It was found that, although these figures show results by states, they indicate that relatively the same rule prevails as in the cities. It was also shown that all the great water-power states in the West are in the category of properties which show a low income per kilowatt-hour and high output per capita and an extremely high load-factor. In the development of water-powers it has been necessary in most cases to make a large investment. The territory served usually is sparsely populated and industries are relatively few in number. These plants had to take every class of business within reach. No one would think of producing his own power if a transmission line of a water-power company was anywhere within reach. The results shown by some of the hydroelectric companies are due in part to the very high prices of fuel in some states and in part to the very low prices quoted for energy. In most of the districts where hydroelectric plants operate steam plants are unknown except as they are used on the lines of railroads. Now mountain lines are undergoing electrification, and it is a matter of only a few years when this use of energy will be extended.

In referring to the fact that coal is relatively cheap east of the Mississippi River, Mr. Insull said that the coal supply is being used at a rate that seriously jeopardizes the resources of the country. The character of business that is done in the water-power states of the West should be done in the Eastern States in practically the same way with coal as the basis of energy. Particular attention was drawn in the address to the relatively unimportant proportion of lighting in the entire gross revenue of the central station. Mr. Insull also presented a chart showing a division of revenue. One-half of the expenditure represents the cost of money and the right to do business, that is to say, the taxes. Interest and dividends together represent a sum of about 6 per cent on the total cost of the money. The "saturation of the dollar" was mentioned and explained by the speaker. The sources of capital for additions to plants were explained. About $3 has been expended for additions from reserves for every $2 from new capital. In discussing the conservation of coal the speaker showed how greater output has been obtained. The consumption was 6.9 lb. per kw-hr. in 1900 as compared with 2.87 lb. in 1913. In his discussion Mr. Insull purposely refrained from references to the sale of energy for use by railway companies, as he wanted to show how it is possible to obtain a great diversity of business in districts where it does not seem practicable to sell the energy for transportation purposes. He showed a map of Illinois and, to emphasize his argument, indicated some of the results obtained in that State in the centralization of the energy supply, which he expressed as the benefits of massing all classes of business if it is desired to obtain the highest possible efficiency of apparatus and the highest possible efficiency of earning power. Demonstrating that it is possible to get the highest measure of centralization in a single large community, Mr. Insull said that he could not see why the principle does not apply to small places.

In conclusion the speaker expressed strong views in regard to commission regulation of public utilities. He said that it is unreasonable to expect that the community should allow a business of the kind described to go on without regulation. Assuming that regulation is intelligent, the investor and the user have nothing to fear from it. If the companies are not managed well enough to square with public opinion, the commission is there to protect the public. If the community is so ill advised as to treat the company unfairly, the commission is there to protect the company. Admitting that commission regulation is an inconvenience to men who deal with large properties, Mr. Insull still maintained that regulation is the best thing that has happened to the electrical industry in the last few years. He believes that in the long run regulation means protection. That does not seem to be a very popular statement in view of the treatment or assumed treatment that the railroads are receiving from the Interstate Commerce Commission. Still, Mr. Insull believes that regulation is the best thing for the securities, for the widows and orphans who are largely represented in the ownership of securities and for all interests. The business is a natural monopoly, and if it is a monopoly it should be regulated. The companies should get fair treatment, but in order to get fair treatment they must be fair to the people with whom they deal. It is the judgment of Mr. Insull that in the next few years there will be scarcely a spot in the settled districts of the country and especially east of the Mississippi Valley where it will not be possible to get electrical energy for all purposes at all hours from one central station. The central station has closer relations to more classes of people than any other line of industry. More can be done in the conservation of resources, in lessening the severe conditions of labor, in improving the condition of poor people and in opening up districts for settlement. There is scarcely a direction in which one can look without seeing new possibilities. The electrical industry is the greatest one engaged in public service. Mr. Insull told his hearers that they could do no greater injury to themselves than to deal unfairly with the industries that have built up the country.

Public Service Commission News

Illinois Commission

The constitutionality of the law creating the State Public Utilities Commission of Illinois has been attacked by the city of Chicago. The municipality of Berwyn, Ill., a suburb of Chicago, has petitioned the commission to compel the Chicago Railways Company to grant a 5-cent fare to the center of Chicago. Inasmuch as the city of Chicago is virtually in partnership with the street-railway company, receiving 55 per cent of the "net divisible receipts" under the 1907 traction settlement ordinances, it is made a party to the proceeding. This gave Mr. Sexton, the corporation counsel of the city, an opportunity, in his answer, to attack the validity of the law. Governor Dunne, who was formerly a judge, has expressed the belief that the law is constitutional. Counsel for Mr. Samuel Insull, receiver for the Chicago & Oak Park Elevated Railroad Company, have questioned the authority of the commission to compel the receiver (appointed by the federal court) to elevate the tracks in the suburban community of Oak Park. In a statement Mr. Insull said that he thinks the tracks should be elevated; the question is the ability to provide the means therefor. Mr. Insull says this question is for the court, and he is careful to say that no "defiance" of the commission is intended.

New Jersey Commission

The Public Service Electric Company has appealed to the Supreme Court from the recent order of the Board of Public Utility Commissioners directing it to furnish electric service free of charge to the municipal buildings of Plainfield, in accordance with the contract under which its charter was received. The company claims that such enforcement violates both the state and federal constitutions and the act of 1911 prohibiting free service, and that such act abrogates the contract between the city and company.

Wisconsin Commission

After an extended investigation into the rates and service of the Stevens Point Lighting Company, the Wisconsin commission has issued an order adjusting the rates and demanding a fuller compliance with the commission's rules of service. The former rate for electric lighting is 13.5 cents per kw-hr. The rates prescribed are as follows: Primary rate, 12 cents per kw-hr. for the first thirty hours' use per month of the active connected load; secondary rate, 7 cents net for the next sixty hours' use per month of the active connected load; excess rate, 5 cents net per kw-hr. Lighting consumers are to be divided into classes A, B and C, in accordance with the usual practice of the commission. The following motor-service rates were prescribed: Primary rate, 10 cents net per kw-hr. for the first 15 kw-hr. used per active kilowatt connected per month; secondary rate, 4 cents net for the next 45 kw-hr. per active kilowatt connected; excess, 2 cents net. The active connected load is to range from 90 per cent of the first 10 hp to 50 per cent of the connected load over 60 hp. The minimum bill will consist of a charge of 50 cents for the first 2 active hp connected and a charge of 25 cents for each additional horse-power. The rate for street lighting was reduced from $78 per lamp per year to $54. The effect of this rate adjustment will be to increase the revenue from the motor service while materially reducing the income from commercial lighting and street lighting. The revenue as a whole will be reduced.

The McGowan Water, Light & Power Company has been authorized to establish a minimum charge of 75 cents per month.

Ohio Commission

The Cleveland Electric Illuminating Company will soon ask the Ohio commission to review the new ordinance recently passed by the City Council of Cleveland fixing the rate for service at 3 cents per kw-hr. It is said that the company will resist the ordinance and endeavor to show that a city has no right to fix a rate which is unreasonably low. It is possible that the matter of a city's authority to fix rates at all will be questioned also.

The Union Gas & Electric Company, of Cincinnati, has agreed to the request of the commission to make a physical valuation of its properties. A committee will be appointed to work with the representatives of the commission in making the valuation.

Washington Commission

The third annual report of the Public Service Commission of Washington covers the period from Dec. 1, 1912, to Nov. 30, 1913. It refers to various activities of the commission.

The engineering department has been engaged in gathering data for physical valuation of a large number of public service properties. About $20,000,000 of properties were valued during the year. The more important are the properties of the Pacific Power & Light Company, some of the subsidiary corporations of the Puget Sound Traction, Light & Power Company, and the Grays Harbor Railway & Light Company. During the ensuing year it is expected to complete appraisals and rate investigations of the Seattle Lighting Company, the Washington Water Power Company, the long-distance lines of the Pacific Telephone & Telegraph Company and the Puget Sound Traction, Light & Power Company, in addition to such miscellaneous investigations of smaller plants as will come up incidentally in the ordinary course of the work.

The Pacific Telephone & Telegraph Company presented and filed tariffs covering toll-line charges throughout the State. For the first time these tariffs were based upon a scientific plan, the rates being determined by an initial charge plus an air-line toll mileage. The commission declined to pass upon the reasonableness of the rates and continued the matter, with the new rates in effect, until such time as a study can be made of the actual operation of the rates and initial time.

The new act relating to electrical construction set out a number of rules and provided that these could be amended and supplemented by the commission. A number of matters of construction were not covered by the rules set out in the act, so the commission held a hearing at which proposed changes and supplementary rules were discussed. The law which gave the commission jurisdiction over this work carried no appropriation, so the expense of enforcing the statute must be borne by the general appropriation made by the Legislature for the expenses of the commission.

Indiana Commission

The Indiana Railways & Light Company, of Kokomo, has just had its supplementary schedule of rates approved by the Public Service Commission of Indiana. The changes made are of significance in that they are all "downward" and that the revision came voluntarily from the company. The discount on individual consumers' bills which range from $1 to $5 a month was increased from 5 per cent to 10 per cent. In certain residence lighting rates the new schedule provides for a reduction of prices from 11 cents per kw-hr. to 10 cents per kw-hr. Mr. T. C. McReynolds is secretary and general manager of the Indiana Railways & Light Company.

Current News Notes

AUTOMOBILE ENGINEERS PLAN TRIP TO EUROPE.—The Society of Automobile Engineers is arranging a European trip for its members, which is to include visits to the principal motor-car exhibits of the year in London and Paris. The present intention is to leave New York Oct. 9, returning from Southampton Nov. 15.

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ABSTRACTS OF ENGINEERING ARTICLES.—"A Bulletin of Abstracts" of articles from domestic and foreign publications relating largely to the gas and electrical engineering fields is being published bi-monthly by the American Gas Institute. Each issue contains about 160 pages punched and arranged to be separated and filed in accordance with a uniform filing classification.

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MINERS DEMAND ELECTRICAL EQUIPMENT IN COLLIERIES.—At a recent conference held in Philadelphia between the miners and operators of Pennsylvania the representatives of the miners demanded that the cars which move in and out of the collieries of the mine should be operated by electricity, asserting that the task of pushing the heavy cars in and out of the mine was too much for the men. The operators objected to this demand on the ground that it would increase the cost of production from 7 cents to 14 cents a ton

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WIRELESS TOWERS FOR PANAMA.—The United States government is erecting three 600-ft. steel towers near the Gatun Locks, Canal Zone, Isthmus of Panama, which will be used to support the antennas of the Panama wireless-telegraph station. The towers will be of triangular section, measuring 150 ft. at the base and tapering to 10 ft. at the top. The three towers will require about 1000 tons of steel. The steel work is now being fabricated at Toledo, Ohio, and will be erected by the Childers Construction Company, of Columbus, Ohio.

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SOCIETY MEETINGS

COMING DAYTON REJUVENATION.—Statesman Thomas F. Kelly announces that the next rejuvenation and joviation of the Jovian Order in Dayton, Ohio, will be held at the Dayton Club on May 9.

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ELECTRIC CLUB TO GIVE ENTERTAINMENT.—The Electric Club of Chicago will give an entertainment and smoker on the evening of April 29, and has appropriated an amount not to exceed $600 for the purpose. No admission fee will be charged to members.

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DUQUESNE SECTION, N. E. L. A.—The Duquesne Light Company Section of the National Electric Light Association held its annual banquet at Pittsburgh, Pa., April 16, with 500 members present. Mr. E. C. Stone, chairman of the section, introduced the speakers, Mr. F. E. Harper, who described the electrical equipment in Kaufmann's new store, Pittsburgh, and Mr. E. D. Dreyfus, who talked on the topic "Electric Service—Prospective and Retrospective."

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ANNUAL MEETING OF THE SOCIETY FOR ELECTRICAL DEVELOPMENT.—The annual meeting of the Society for Electrical Development, Inc., will be held at the Bellevue-Stratford Hotel, Philadelphia, June 1. The object of calling the meeting at that time is to enable those attending the N. E. L. A. convention to attend the annual meeting of the society also. New directors will be elected, and immediately following the board of directors will elect officers for the coming year.

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NEW JERSEY JOVIANS TO CELEBRATE.—The first Jovian rejuvenation in New Jersey will take place on Tuesday evening, May 19, at 8 o'clock, at Stetter's Restaurant, 842 Market Street, Newark, N. J. The rejuvenation will be in charge of Statesman W. C. Andrews, Edison Storage Battery Company, Orange, N. J., and Alternate Statesman S. H. M. Agens, of Agens & Hopper, Newark, N. J. The champion New York degree team, on which Statesman Andrews formerly took the part of Jupiter, has promised to officiate.

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JOVIAN RALLY IN TOLEDO.—A Jovian rally of unusual interest and proportions was held in the Zenobia Theater, Toledo, on the evening of April 17. A large audience was present. The master of ceremonies was Mr. H. F. Adams, and speeches were made by Messrs. Sam A. Hobson, Chicago; A. A. Gray, Chicago; H. H. Cudmore, Cleveland; S. E. Doane, Cleveland; Thomas Valentine, Atlantic City; H. E. Niesz, Chicago; Henry L. Doherty, New York; E. H. Haughton, Chicago, and Elbert Hubbard, East Aurora, N. Y. The purposes of the Jovian Order were explained and the speakers of the evening also made several references to the work undertaken in Toledo by Mr. Doherty. Telegrams were received from Messrs. C. A. Coffin, Thomas A. Edison, G. E. Tripp, C. P. Steinmetz and others. All present were entertained at a buffet luncheon by the Toledo Railways & Light Company at the conclusion of the proceedings in the theater.

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CHICAGO ELECTRIC-VEHICLE MEN IN SESSION.—At the meeting of the Chicago Section of the Electric Vehicle Association held on April 21 it was decided to abandon the weekly luncheon meetings, for a time at least. It is planned to hold an evening meeting once a month, the members taking dinner together and afterward holding a business meeting with some social features. Mr. W. H. Metcalf, of the Woods Electric Garage, Philadelphia, gave a talk on the work of the Philadelphia Section of the Electric Vehicle Association. In that city there are 640 electric trucks and 446 electric pleasure cars, the figures relating to the city of Philadelphia proper and not including the suburbs. Mr. Metcalf spoke also of the development of small electric industrial trucks, such as are used in and about factories. The annual meeting of the Chicago Section will be held at the Hotel Sherman on May 5, beginning with a dinner at 6:30 p. m.

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MINNEAPOLIS ELECTRICAL FRATERNITY.—Promoted by the Jovian Order, the Minneapolis Electrical Fraternity has been organized at Minneapolis, Minn., to foster good fellowship among local electrical men and to encourage electrical, technical and scientific education. The organization will meet every Tuesday at the Hotel West. The officers are as follows: President, Mr. O. M. Frykman; vice-president, Mr. F. G. Dustin; treasurer, Mr. G. G. Fletcher, and secretary, Mr. W. T. White. The committees are: Ways and means committee—Messrs. T. D. Crocker (chairman), T. W. Findley and A. W. Zahm; educational committee—Messrs. L. N. Cooper (chairman), R. F. Geeseka and O. A. Rofelty; entertainment committee—Messrs. C. E. Hansing (chairman), Paul Joslyn and W. H. Reker; membership committee—Messrs. Guy See (chairman), C. R. Becker and R. S. Chase; executive committee—Messrs. O. M. Frykman (chairman), F. G. Dustin, W. T. White, G. G. Fletcher, L. H. Cooper, T. D. Crocker, C. E. Hansing and Guy See.

Electric System of Laclede Gas Light Company

High-pressure steam turbo-generating plant, auxiliary low-pressure station and substations of a combined gas and electric utility in St. Louis, Mo.

LIKE a considerable number of other public-utility companies in American cities, the Laclede Gas Light Company, of St. Louis, sells both gas and electrical energy to its customers. Its activities as a distributer of gas are city-wide, but it serves only a portion of the city with electrical energy. Alternating-current electrical energy is distributed over single-phase feeders for lighting, while there is a separate three-phase alternating-current service for motors. The company has a considerable number of industrial customers in the central portion of the city, and these are supplied with 550-volt direct current obtained by means of rotary converters. All electrical energy is generated as alternating current.

Turbine-Room Apparatus in Main Station

Two 3500-kw and one 1000-kw General Electric alternator, delivering energy at 4150/2400 volts, sixty cycles, from a Y-connected three-phase winding, compose the main alternating-current equipment of the new generating station. Excitation for these three units may be furnished from any one of three sources, namely, a steam-turbine-driven 75-kw, 3300-r.p.m. General Electric generator; a 100-hp, 4150-volt, 75-kw induction motor-generator set, or a 320-amp-hr. storage battery. The battery has tanks large enough to permit of doubling the number of plates and hence the rating. With the present plate equipment, the battery will carry the entire exciter load for one-half hour.

A considerable portion of the company's 550-volt direct-current load is carried by two three-bearing motor-generator sets in the main station. Inasmuch as the motor ends of these machines consist of 565-kva, 4150-volt synchronous motors operating at 720 r.p.m., the power-factor of the main buses in the station can be regulated by varying the excitation of the synchronous motors. The generators are 500-kw, 550-volt commutating-pole General Electric direct-current machines.

The circulating water for the two large condensers is supplied by two 16-in. tri-rotor volute pumps driven by Curtis turbines, and that for the small one by a 10-in. volute pump driven by a Terry turbine. These pumps are installed in a pit in the middle of the turbine room

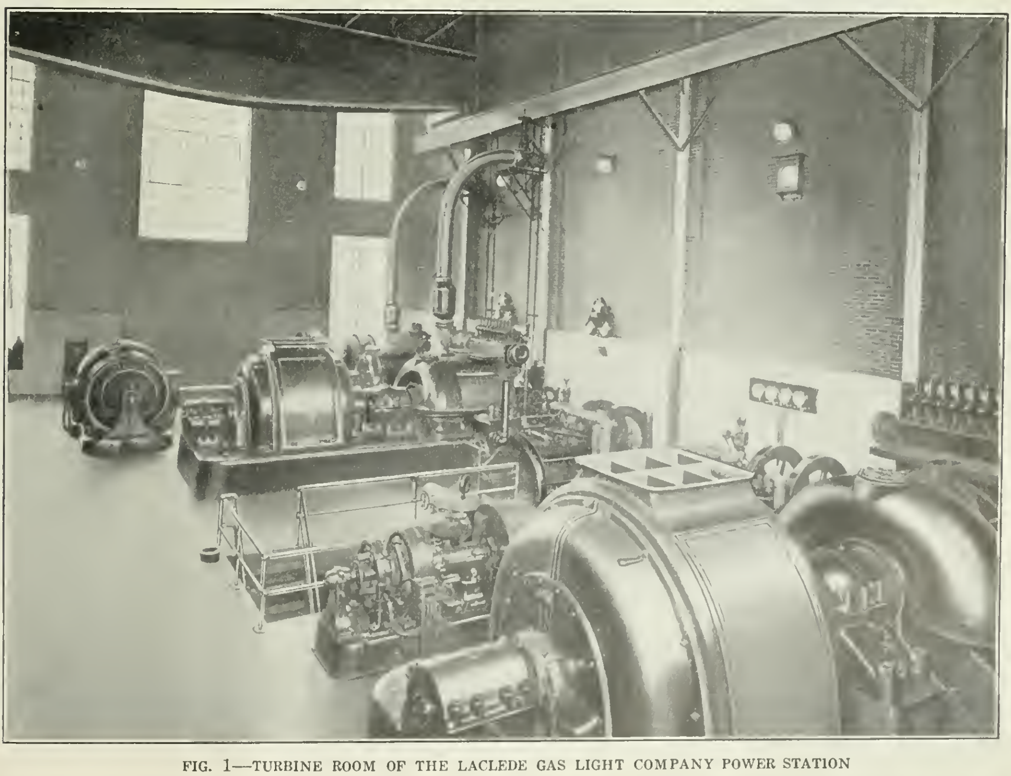


FIG. 1—TURBINE ROOM OF THE LACLEDE GAS LIGHT COMPANY POWER STATION

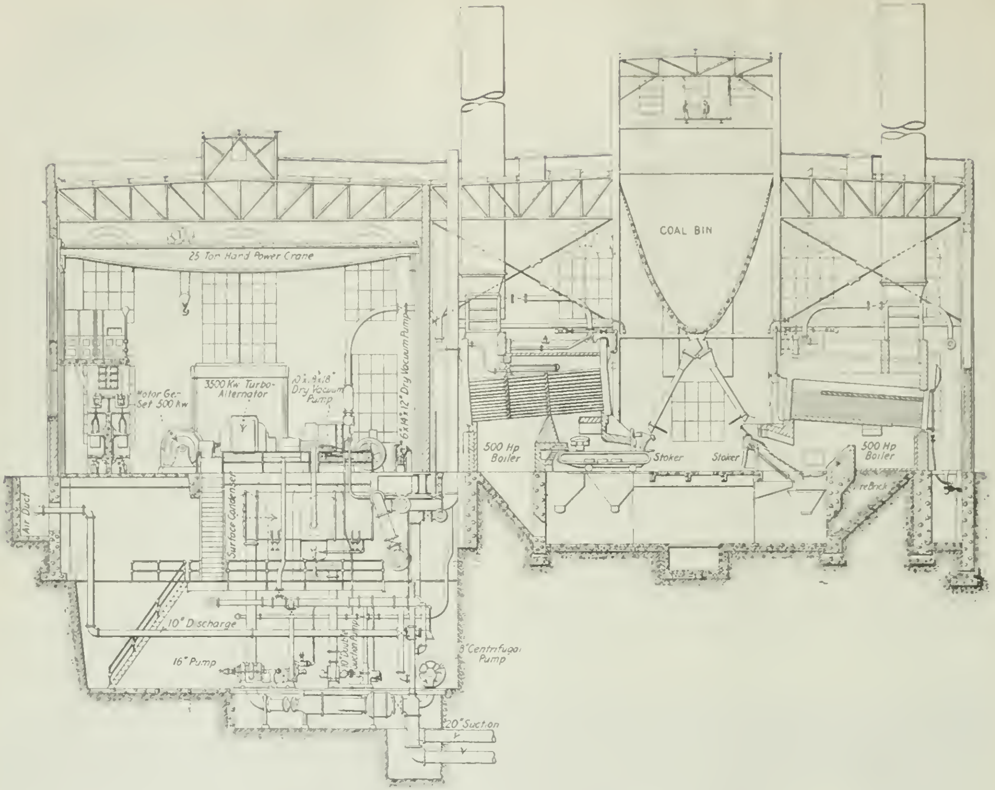


FIG. 2—CROSS-SECTION OF GENERATING STATION LOOKING EAST

and draw their water supply from the Mississippi River through two 20-in. pipe lines. After passing through the condensers the water is returned to the river through a 30-in. line sealed off in the river to have a siphon effect, which aids in circulating the water. In addition to this pumping equipment, there are two 12-in. volute pumps of 6000-gal. a minute capacity on the river bank. These pumps are driven by 150-hp, 440-volt induction motors and are available for emergency service.

Three two-stage hot-well pumps serving the condensers are driven by two 10-hp and one 5-hp, 440-volt induction motor. The dry-vacuum pumps, however, are steam-driven. All the auxiliaries in the turbine room are operated from a 6-in. header which loops the condenser pit and is fed from the main header in the boiler room.

The Steam-Generating End of the Station

On the south side of the firing aisle in the boiler room have been placed four 500-hp Heine boilers equipped with superheaters and delivering steam to the header at 185-lb. pressure with 100 deg. superheat. Across the aisle is a battery of four 500-hp Edge Moor boilers with Foster superheaters delivering steam at the same temperature and pressure. Stokers on the former boiler equipment are of the Ross type and are driven by a small auxiliary steam engine, while the Edge Moor boilers are fired by Green chain-grate stokers driven by a 5-hp, 440-volt induction motor.

Boiler-feed water is supplied through a 3000-hp open heater to two Alberger four-stage turbine-driven centrifugal pumps capable of delivering 400 gal. of water a minute. These pumps supply water to the boilers through a 6-in. feed main which is built so as to loop the boiler room.

For supplying natural draft to each pair of boilers 6-ft. by 150-ft. steel stacks have been erected. Each stack stands behind its respective battery of boilers so that all breechings are short. In addition to generating steam for the turbo-generator units in the electric station, these boilers supply steam for the gas works near by, the quantity of steam being measured by a General Electric flow meter which is placed in the boiler room.

Coal arrives at the company's premises over the tracks of the Wiggins Ferry Railroad and is dumped outside the plant into hoppers constructed under a spur track. An apron conveyor driven by a 5-hp, 440-volt induction motor carries the coal from these hoppers through a crusher operated by a 15-hp motor, from which it falls directly into a Peck conveyor to be taken to the overhead bins. As is shown from the cross-sectional drawing of the station, the overhead parabolic bunker is suspended from heavy girders above the firing aisle.

Fine coal and ash falling from the grates drop into separate bunkers beneath the boiler room. Helpers about the plant open the gates of the ash and fine-coal hoppers alternately and shovel their contents into the Peck conveyor, which takes the fine coal to the bunkers overhead or the ashes to the ash bin as the case may be. A large yard is available for coal storage between the electric plant and the company's gas works.

Switching and Station Control

The twenty-six-panel black-slate switchboard controlling the station is situated on top of the oil switch and bus structure. Different panels of the board have been arranged in groups according to the nature of the apparatus they control. The first seven panels at the left control the direct-current generators and ten outgoing direct-current 550-volt circuits, while each of the next six panels in order controls two single-phase, alternating-current lighting circuits. The distribution system of the company is rather unique in that most of the motor service is on three-phase circuits completely separated from the lighting distribution lines, and these motor-service circuits are controlled from the three panels next in order along the board. Following a blank panel left for the installation of a future turbo-generator are three panels controlling the electrical equipment of the 1000-kw and the two 3500-kw alternators. The remaining panels carry respectively control apparatus for two synchronous motors of the motor-generator set, a Tirrill regulator, switches and instruments for the induction motor for the 75-kw exciter, and the direct-current 125-volt machines furnishing excitation.

Three buses are carried along the top of the bus and switch-cell compartments, and beneath these are arranged the disconnecting switches. In the lower part of the structure are the oil switches. Beneath the blank panels of the switchboard empty cells have been arranged so that the installation of future apparatus will not complicate the switching arrangement. Energy for the solenoid-operated switches is taken from the 125-volt direct-current excitation bus.

Totaling instruments for the station have been placed upon a separate switchboard standing at the end of the main board at right angles to the bus structure. Two curve-drawing meters, two watt-hour meters and two recording voltmeters make up the instrument equipment. Inasmuch as there are many more lighting feeders than there are recording voltmeters, the operators have resorted to an interesting wiring "kink" enabling them to obtain voltage records from any feeder. To accomplish this, plug socket receptacles have been installed in multiple upon the voltmeter circuits and one receptacle has also been installed in each lighting-feeder circuit. Thus, by attaching two plugs to the ends of a two-conductor cable, any feeder may be connected to the voltmeter circuit. A similar arrangement at the totaling board allows either meter circuit to be plugged to either of the recording voltmeters.

Wiring and Special Equipment

All high-tension wiring, connecting the machines and the bus structure and extending from the bus structure to the outgoing conduit ducts, is carried on iron pipe racks swung from the basement ceiling and along the station walls in fiber pipe conduit. Outgoing lighting feeders are carried through a bank of eleven induction regulators in the basement of the station. The

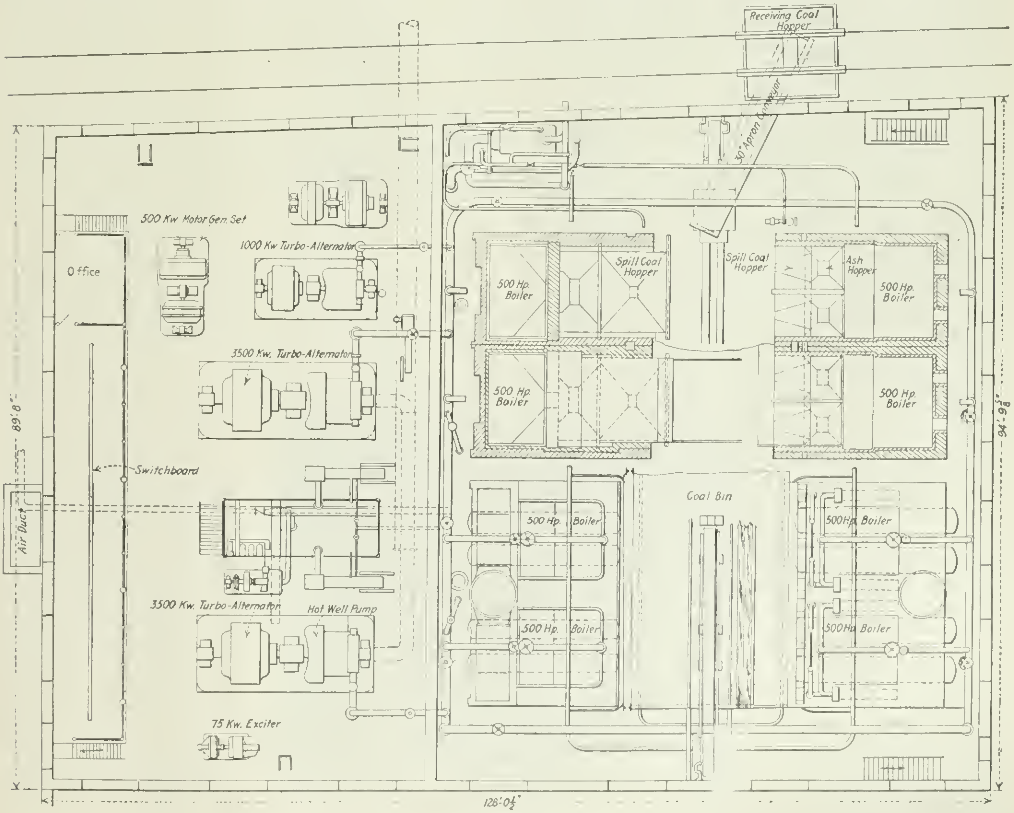


FIG. 3—FLOOR PLAN OF LACLEDE COMPANY'S STATION, ST. LOUIS

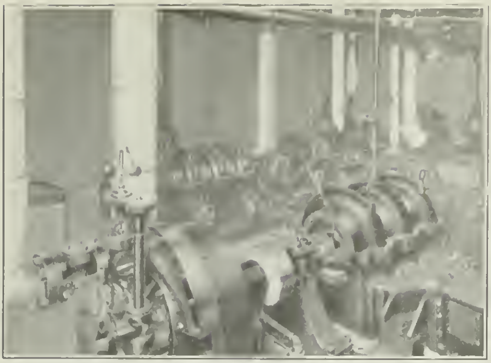


FIG. 4—TURBINE-DRIVEN TRIROTOR

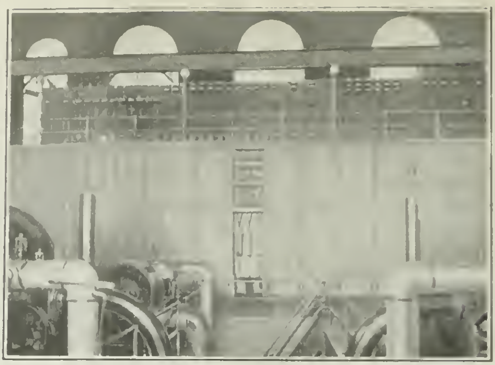


FIG. 5—SWITCHBOARD, SHOWING BUS STRUCTURE

connections of these regulators have been so arranged that each of them may be taken out of the circuit at any time for inspection or repairs by manipulating the disconnecting switches.

In the main generator room of the station a new and less exciting use has been found for the deep-toned Klaxon horn, which is so often used on automobiles. This instrument is mounted upon the gage board and is used to summon operators to various parts of the station or to notify them when a machine is to be placed on or taken off the line. On the same gage board are recording steam gages and vacuum gages for the turbines and condensers. Three sets of red and white pilot lamps on this board tell at all times whether or not the hot-well pumps are in operation.

Direct-Current Station Operating on Exhaust Steam

Besides its main generating station, the Laclede Gas Light Company has an interesting direct-current generating station situated in its gas plant at Second and Rutger Streets. Here are a number of Ideal steam engines engaged in pumping gas from the plant to the company's high-pressure gas system. These engines operate throughout the greater part of the day, sending gas to outlying holders. The exhaust steam from these units is gathered into a header and feeds a 300-kw, three-phase, sixty-cycle, 3600-r.p.m. Westinghouse turbo-alternator set which generates energy at 367 volts and is connected by a solid tie line without switches to a rotary converter. By this combination the company is able to secure 550-volt direct-current energy for its distribution system without the disadvantages of the high-speed direct-current generator. By connecting the alternating-current end of the rotary and the turbo-generator with a solid tie line the entire system of units is started and stopped as one.

500-Volt Substations

In addition to the 550-volt motor-generators in the main generating station and the converter in the gas plant on Second Street, the company has two other substations, one of which is situated at the corner of Sarah Street and Evans Avenue, while the other is in the Dominion Building on Seventh Street. In this latter plant a rotary converter has been installed. Between the transformer secondary windings and the rotary converter a three-phase induction regulator arranged for 10 per cent buck and boost has been connected so that the voltage of the direct-current system may be varied from 400 volts to 600 volts by varying the potential of the alternating-current energy supplied to the converter. This substation is installed in a building next to the Railway Exchange Building and the switchboard is equipped with the necessary switching and metering apparatus to control energy supplied during the summer to this building (see *Electrical World*, Aug. 16, 1913).

The substation at the corner of Sarah Street and Evans Avenue contains a 340-kva motor-generator set receiving alternating current at 4150 volts and delivering energy to the direct-current system in that neighborhood. This station is also equipped with induction regulators and switching apparatus to control the lighting service in the West End residence territory.

Electrically Operated Gas Works

The company has just completed two machine-operated retort houses which, together with a third finished about two years ago, are completely equipped with electrically operated charging and discharging machines and machinery for handling coal and coke. The total connected motor load at the gas-manufacturing plants of the company amounts to between 600 hp and 700 hp.

Mr. C. Holman is president and general manager of the Laclede Gas Light Company, and Mr. G. B. Evans is assistant general manager and chief engineer. In the electrical department the chief engineer is assisted by Mr. William Bradford, electrical engineer; Mr. William Gallaher, superintendent of electrical department, and Mr. C. S. Peters, assistant electrical engineer in charge of substations. Mr. W. T. Daniel is chief engineer of the main generating station.

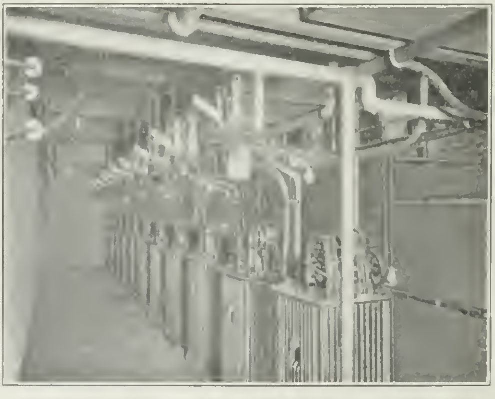


FIG. 6—FEEDER-VOLTAGE REGULATORS

High-Voltage Transmission Systems of the World

Plants in operation or under construction in every quarter of the globe which are designed to work at voltages of 70,000 or more. By Selby Haar

The purpose underlying the compilation of the table printed in the form of a supplement accompanying this issue of the *Electrical World* was to assemble data covering all the transmission plants in the world intended to operate at 70,000 volts or more which are either in operation or under construction. It is confidently believed that there are no omissions in the table, several plants about which definite information is not at hand having been included to insure its completeness. An effort has been made to exclude all developments still in the proposition stage, such as the Victoria Falls scheme in South Africa, the one from the river Rhône to Paris, France, at about 150,000 volts, one from Trollhättan, Sweden, to Copenhagen, Denmark, at about 100,000 volts, and several in the southern part of the United States.

The selection of 70,000 as the lowest value of volts may require some explanation. At the outset of the work it became evident that even by setting the limit at 60,000 effectiveness would be sacrificed to bulk. Moreover, roughly speaking, 70,000 volts marks the change from the thoroughly standardized older practice used for pressures up to 66,000 volts to the newer long-span construction.

The voltage reported is the one at which the system is designed to operate; thus, 150,000 volts is given for the Pacific Light & Power Company (No. 1), although it is operating at about 135,000 volts, and 140,000 volts for the Southern Sierras Power Company (No. 3), which after a considerable period of running in parallel with its parent company, the Nevada-California Power Company, at 55,000 volts (its transformers are designed for 55,000, 87,000 and 140,000 volts) is about to change to 87,000 volts. The present station equipment rating is intended to represent that value of power which can be delivered to the transmission lines under normal conditions. Furthermore, auxiliary plants, whether used for increasing the generating equipment of the system or for stand-by service, have been omitted when they are situated at or near the end of the main transmission lines. This is the case, for example, of the Southern California Edison Company, which has a large steam plant at Los Angeles, and the Ebro Irrigation & Power Company, Ltd., which has at Barcelona a steam station that is one of the largest in the world under one roof. The total station equipment is not always concentrated in one plant; in all cases the figure stated in the table is based on generator ratings.

In the hydraulic details it has been impossible to avoid some indefiniteness, due to the difference between English and metric horse-power, the failure of those supplying information to distinguish between the maximum rating of the waterwheel, which is the figure usually stated by the turbine manufacturer, and a normal rating with sufficient reserve to carry as much temporary overload as the generator, and also to the confusion between static head and actual head at the turbine under load conditions. There is also a persistence of the habit of overlooking the difference between kva and kw ratings of generators, and an endeavor has been made to give the manufacturer's rating in all cases. Allowance must be made for differences in standards for rating machines. Foreign-built generators are likely to be rated on a maximum continuous basis, such as was proposed at the mid-winter convention of the A. I. E. E. last February and is already in use in the United States in the case of turbo-generators. The same practice has occasionally been adopted here, the 12,500-kva machines of the Great Western Power Company and some others being rated on this basis. All the generators listed in the table are three-phase machines with the exception of the 80,000-volt installation of the Swedish State Railways, which is single-phase. The name of the manufacturer of the generators is that of the parent company, even though a branch or affiliated factory may have actually built the machines. The same rule has been followed in connection with other apparatus.

The discrepancies between the total and individual ratings of step-up transformers, and also between transformer and generator ratings, are due to the inclusion of reserve units, differences in rating and the rounding off of the totals. For example, the total rating of the Central Colorado Power Company transformers corresponds to 50 per cent overload, while the rating of the generators of the Ebro Irrigation & Power Company, Ltd., being on a maximum continuous basis, is 25 per cent greater than the normal rating of the transformers. No attempt has been made to list the sizes of step-down transformers as the local conditions of each installation preclude the possibility of standardization in this respect.

The distance of transmission stated under "transmission lines" is the distance between the points mentioned and represents the farthest point to which energy is transmitted at this voltage, no attempt being made to include either all the lines or the total mileage. All but one—the Swedish State Railways—are three-phase lines. By height of towers is meant the length from ground level to the extreme top, this dimension having been chosen because it is most accessible in published descriptions. The number of circuits per tower (usually three conductors each) is the standard arrangement, but in some special cases entirely different methods of support are used. The same remark applies to the arrangement of conductors on the towers and the distance between conductors.

Under "lightning protection," which, of course, is intended to guard against damage from excess voltages of all kinds, only the most prominent devices are mentioned; for example, arc suppressors and oil switches with damping resistances are also in use on some lines. Switch plant means not only switchboards but also all high-tension controlling and overload protective devices.

No conclusions can be drawn from the hydraulic data, because the basis of selection of plants is entirely electrical. Neither the highest and lowest head nor the most powerful waterwheel is included in the table. The generator of highest rating is 18,000 kva steam-driven or 17,500 kva water-driven, the most powerful is 14,875 kw, the smallest 750 kw. Specified power-factors range generally from 0.80 to 0.90, although one plant is designed for a power-factor of 0.60 on account of an electrometallurgical load. The number of units in one station varies from one to fifteen.

The list of transformer ratings seems to indicate a trend away from the polyphase unit, most of the newest systems having single-phase transformers. One polyphase transformer or group of single-phase units for each generator is the general rule. With the exception of three plants, all of which were equipped by one manufacturer, delta connection is used in at least one of the transformer groupings. The column of high-tension voltage of the step-down transformers shows different opinions as to the most suitable value of line drop and different methods of allowing for it. Where the rated high-tension voltage of both groups of transformers is the same, taps on the windings are provided.

The longest transmission is about 240 miles. The normal span ranges from 450 ft. to 850 ft., the average being about 625 ft. Most of the lines are strung on double-circuit towers, and few have a total of more than two circuits. The strong predominance of copper as a conductor may be due to commercial causes, but in all of the foreign systems (outside of America) use is made of copper conductors. The hemp center seems to have disappeared. A very popular arrangement of conductors is the vertical, but, as the result of some unfortunate experiences, the middle conductor is now moved out of the plane of the other two. Since atmospheric conditions exert a considerable influence on the dielectric strength of air, any figure for the average spacing would be of little value. A like condition exists with respect to the insulators. Numerous ingenious arrangements are used for connecting strings of suspension insulators in multiple to carry heavy stresses. The overhead ground wire is apparently firmly established as a protective measure, one system (No. 13) using it also to stiffen the line.

The arresters are largely of the electrolytic type because American firms have equipped most of the plants. Of the two plants for more than 100,000 volts which use the horn-gap and series resistance protection, one has not yet been placed in service.

A noteworthy development in methods and apparatus for the control and switching of circuits has been the introduction of outdoor devices. At least three plants have complete installations of busbars, switches and circuit-breakers (some oil-break, others air-break), while others have less elaborate ones.

The author wishes to express his thanks to the numerous engineers, representatives of manufacturing companies and others who have responded willingly to his requests for data for presentation in the table.

LIST OF ABBREVIATIONS USED IN TABLE OF HIGH-TENSION TRANSMISSION PLANTS

A.G.—stock company.
Al.—aluminum.
Ca.—approximately.
Conn.—connection.
Cu.—copper.
D.—directly.
Dist.—distance.
H.—hydraulic, or horizontal.
H.T.—high tension.
Hydr.—hydraulic.
Liq.—liquid.
L.T.—low tension.
Mfg.—manufacturing
Pr.—power.
R.—resistance.
Ry.—railway.
S.—steam.
S.P.—steel poles
St.—steel.
S.T.—steel towers.
Susp.—suspension.
Transf.—transformer.
Transm.—transmission.
V.—vertical.
W.P.—wood poles.
A.E.G.—Allgemeine Elektricitats Gesellschaft.
Al.Ch.—Allis-Chalmers.
Br.Bov—Brown, Boveri.
Al.Sv.El.Akt.—Allmanna Svenska Elektriska Aktiebolaget.
C.W.—Crocker-Wheeler.
Day.—Dayton Iron Works.
Esch.W.—Escher-Wyss.
G.E.—General Electric Company.
M.A.N.—Maschinenfabrik Augsburg-Nürnberg
Nippon Toki GK—Nippon Toki Gomei Kaisha
Oh-Br.—Ohio Brass Company.
Penna. China.—Pennsylvania China Company
Sm.—S. Morgan Smith.
S. M. Smith—S. Morgan Smith.
S.S.—Siemens-Schuckert Werke.
W—Westinghouse Electric & Manufacturing Company
W.S.M.—Wellman, Seaver, Morgan Company.

"Electrical World" Articles

News items and descriptive articles relating to the installations operating at and above 100,000 volts have appeared from time to time in the *Electrical World*, as follows:

Pacific Light & Power Company, June 1, 1912, p. 1192; June 22, 1912, p. 1342; Nov. 29, 1913, p. 1108; Jan. 3, 1914, p. 33, and Jan. 10, 1914, p. 85. Au Sable Electric Power Company, April 13, 1912, p. 795; April 20, 1912, p. 843; June 1, 1912, p. 1195. Southern Sierras Power Company, Aug. 10, 1912, p. 298; Aug. 2, 1913, p. 234. Utah Power & Light Company, July 12, 1913, p. 106. Pacific Gas & Electric Company, Nov. 22, 1913, p. 1055. West Penn Traction & Water Power Company, June 8, 1912, p. 1280. Tennessee Power Company, April 13, 1912, p. 820; March 22, 1913, p. 644; March 29, 1913, p. 696; May 24, 1913, p. 1111; Oct. 25, 1913, p. 868. Connecticut River Transmission Company, Oct. 4, 1913, p. 685; Oct. 11, 1913, p. 737. Inawashiro Hydroelectric Power Company, March 9, 1912, p. 524; May 17, 1913, p. 1058. Grand Rapids-Muskegon Power Company, Nov. 3, 1906, p. 841; Nov. 2, 1907, p. 850; Feb. 4, 1909, p. 354; Sept. 16, 1909, p. 664; June 1, 1912, p. 1195. Ontario Hydro-Electric Commission, Jan. 6, 1912, p. 33; Jan. 13, 1912, p. 96; Jan. 20, 1912, p. 137; June 1, 1912, p. 1195. Lauchhammer Actien-Gesellschaft, Oct. 28, 1911, p. 1057; June 1, 1912, p. 1195. Georgia Railway & Power Company, May 4, 1911, p. 1127; June 1, 1912, p. 1195; Dec. 20, 1913, p. 1257; Dec. 27, 1913, p. 1309. Alabama Interstate Power Company, Jan. 4, 1913, p. 68; June 7, 1913, p. 1278; Sept. 13, 1913, p. 527. Mississippi River Power Company, April 5, 1913, p. 715; May 31, 1913, pp. 1157 and 1169. Lehigh Coal & Navigation Company, April 26, 1913, p. 903. Cedar Rapids Manufacturing & Power Company, April 26, 1913, p. 902; July 12, 1913, p. 105; Aug. 16, 1913, p. 319. Mexican Northern Power Company, May 31, 1913, p. 1190; July 19, 1913, p. 155. Chile Exploration Company, May 31, 1913, p. 1191. Sierra Electric Power Company, Sept. 20, 1913, p. 576. Sierra-San Francisco Power Company, Sept. 26, 1908, p. 667; Oct. 24, 1908, p. 985; Oct. 14, 1909, p. 946; June 1, 1912, pp. 1193 and 1195. Yadkin River Power Company, March 23, 1911, p. 748; April 20, 1911, p. 999; May 4, 1911, p. 1128; Aug. 5, 1911, p. 361; April 6, 1912, p. 774. Great Falls Water Power & Townsite Company, June 1, 1912, p. 1195. Central Colorado Power Company, Jan. 27, 1910, p. 217; June 23, 1910, p. 1649; June 1, 1912, pp. 1195 and 1205. Great Western Power Company, Aug. 26, 1909, p. 471; Sept. 16, 1909, p. 657; Sept. 23, 1909, p. 712; June 1, 1912, pp. 1193 and 1195; June 7, 1913, p. 1277. Southern Power Company, Dec. 28, 1907, p. 1241; March 24, 1910, p. 741; July 1, 1911, p. 17; June 1, 1912, p. 1195. Shawinigan Water & Power Company, May 4, 1912, p. 953; May 11, 1912, p. 1015; June 1, 1912, p. 1195. Los Angeles Aqueduct Company, Feb. 10, 1912, p. 301; May 3, 1913, p. 955. Tata Hydroelectric Company, June 14, 1913, p. 1332; Nov. 8, 1913, p. 950.

Use of Electricity in Mining Operations

Abstracts of the papers read at the Pittsburgh meeting of the American Institute of Electrical Engineers and of the discussions thereon

LAST week's issue of the *Electrical World* reported the meeting of the American Institute of Electrical Engineers held at Pittsburgh, Pa., on April 9 and 10, under the auspices of the committee on the use of electricity in mines and the Pittsburgh Section of the Institute, and noted briefly the discussion upon foreign and American regulations for electrical installations in mines. Following will be found abstracts of the papers presented at the meeting and of the discussions thereon.

Mine-Duty Controllers

Owing to the absence of the author of the first paper presented, it was read by Mr. Walter C. Kennedy, Pittsburgh.

This paper, by Mr. Harrison P. Reed, pointed out the peculiar conditions under which electrical apparatus has to operate in mines and suggested the types of control equipment which should be employed to give safe and reliable operation in that service. In selecting the control equipment for mine apparatus careful consideration should be given to the following points: Presence of explosive dust and gases, continuity of operation, voltage fluctuations, and dampness.

The speed of direct-current motors can be easily changed by varying the shunt-field current, but the method of varying the resistances in the secondary circuit of an induction motor to change the speed is open to serious objections because of rheostatic losses and decreased efficiency. Commutating-pole, slip-ring and squirrel-cage motors are not desirable, because of complexity of construction in the first case and poor starting characteristics in the second.

A system of speed control employing a motor-generator to supply an adjustable frequency below that of the main circuit was recommended as being exceptionally efficient. It is advisable from a safety and economic standpoint to employ self-starting motors on these sets. By installing auxiliary feeders to the motors which will prevent voltage fluctuations, many of the control complications can be avoided.

Mine pumps are generally installed within the mine to reduce the suction head, hence the control equipment should be designed to withstand moisture but need not necessarily be explosion-proof as it is generally at a distance from the mine workings. An inclosed switch for use where explosions are possible was described. With this device the motor acceleration is governed by limiting the current peaks with series-wound switches.

In discussing mine locomotives, it was pointed out that there is a tendency to eliminate overhead trolleys where there are low ceilings and to use storage battery energy or a trailing cable kept taut by a tension reel. If batteries could be automatically charged without delay by operating the locomotives periodically on trolley sections, the present objections to this type of locomotive would probably be eliminated. The nickel-iron battery, which seems most popular in mine service, shows its maximum efficiency when thus periodically boosted.

As acceleration is the important consideration in vertical mine hoisting, variable-voltage-control systems are preferable. Hoisting apparatus was described consisting of a shunt-wound motor receiving energy from a flywheel motor-generator. In conclusion the paper pointed out that there is a tendency to design motors for drilling and coal-cutting apparatus which may be connected directly to the supply lines without starting devices. Mine terminal boxes should preferably be designed so that contact between the plug and socket is made in oil. When an overload occurs the plug should be thrown out automatically. Types of series-parallel locomotive controllers, inclined tramway motor controllers and travel-limit devices were briefly discussed.

Discussion

Among those discussing the paper were Messrs. C. E. Waxborn, Columbus, Ohio; F. L. Stone, Schenectady; Sidney G. Vigo, Chicago; A. S. Biesecker, Scranton, Pa.; Graham Bright, H. H. Clark, H. D. James and W. M. Hoen, Pittsburgh. The effect of gas in switch oil, the carbonization of contacts and the frequency with which a mine switch operates as compared with one in an installation above ground were discussed.

Mr. Stone called attention to a case in which an oil switch was operated 388,000 times without any bad results. He added, however, that there is a difficulty in securing a perfectly air-tight switch.

Mr. Bright pointed out that since mine owners must of necessity pay more for experienced labor than railway and industrial concerns self-starting direct-current motors are especially desirable in mine service as a means of reducing the labor expense. The speaker said it would be more desirable to use a railway-type controller if one could be designed to fit into the limited space available on a mine locomotive. As a rule a mine motorman will not use the series connection for starting unless he is compelled to do so, a fact which should be borne in mind when designing mine controllers. The speaker said that in most cases a change from steam to electric drive has increased the economy of operation.

Mr. Clark, in answer to an inquiry, stated that some tests made by the Bureau of Mines on 250-volt, 100-amp oil switches showed that ignition would not take place with the switch surrounded by an explosive mixture of Pittsburgh gas and air. During the experiment each switch was operated 75,000 time under these conditions. He expressed the opinion that an oil switch can be made explosion-proof if the parts are properly proportioned, but it is questionable whether explosions can be prevented when the oil deteriorates.

Mr. James pointed out that, when necessary, the motor equipment can be modified to suit the control system adopted.

Mr. Waxborn did not appear to favor the use of oil switches for controlling coal cutters because there is a tendency for miners to pour any kind of oil into the switch cases when they need refilling. He mentioned a scheme that has been tried successfully in starting and stopping a motor-driven machine employing a form of friction drive which permits running the motor continuously.

Mr. Hoeu recommended wound-secondary motors for driving fans, especially where the starting current must be limited. When a large speed reduction is necessary considerable energy loss occurs in the resistors, but it is not so great as if the motor were driving a constant-torque load. A two-speed squirrel-cage motor is satisfactory where only one speed reduction is required, since the control is simple and the starting characteristics satisfactory. For driving pumps simplicity is secured by using self-starting direct-current motors which may be thrown directly on the line. Motors of this type are now available up to 20 hp.

Self-Contained Portable Electric Mine Lamps

It is only since the carbon-filament lamp has been superseded by the tungsten lamp with its lower unit energy consumption that storage batteries have become light enough for practical use with portable electric mine lamps. Mr. H. O. Swoboda pointed out in his paper that an electric mine lamp must meet the following requirements: Absolute protection against ignition of mine gases; uninterrupted supply of light for at least one shift; simple, durable and foolproof construction; light weight, and facilities for charging and inspecting the battery. Experiments have shown that an exposed glowing filament will ignite mine gases, but sparks caused at a switch contact will not do so as long as the maximum short-circuit current of the battery does not exceed 100 amp at 2.5 volts or 45 amp at 6 volts.

A portable lamp should be protected against tampering and should be capable of burning in any position as well as when immersed in water and even after being dropped on hard objects. Several types of lamps meeting most or all of these requirements were described. One of those mentioned is equipped with an inclosed fuse which blows the moment the bulb breaks, thus preventing the ignition of mine gases. The battery can be removed only in the charging room by means of a strong electromagnet which acts on a magnetic lock. Special means is provided for allowing the battery gases to escape without permitting the acid to leak out. Attention was called to a special alloy which is being used in flexible-cord conductors connecting portable batteries with a cap lamp. If a short-circuit occurs, the conductor will fuse and interrupt the circuit without causing an explosion when surrounded by inflammable gases. Special racks for charging a large number of portable mine batteries at one time were described. In these racks the batteries are charged in multiple groups of forty batteries in series.

Investigation made in a large English colliery using more than 10,000 electric lamps showed that with careful supervision only about 1.5 per cent of the lamps used in each shift developed defects. Of this amount, 0.6 per cent burned at reduced intensity, 0.2 per cent had broken filaments, 0.2 had broken bulbs, 0.1 per cent had leaky batteries, and 0.3 per cent of the batteries discharge too quickly.

Experience in Europe indicates that the first cost of electric lamps is greater than that of benzine lamps, but the cost of operation, including maintenance, is 10 to 15 per cent lower for the electric lamps. Lead-battery electrodes last about 100 to 400 shifts, depending on the treatment received. Claims have been made that alkaline cells will last 2000 shifts, but according to the author this statement requires verification. The average life of mine lamps is about 1000 hours; about 0.1 per cent are lost by rough handling.

To attract attention to the rugged construction of some portable mine lamps the author threw a number of samples on the floor without damaging them in the least.

Discussion

Discussion of the paper was participated in by Messrs. H. H. Clark, H. H. Smith, Orange, N. J., and R. R. Burrows, Cleveland, Ohio.

Mr. Clark said that for mine service a lamp is needed which does not require an excessive amount of repairs or replacements and which is equipped with an exceptionally good battery. He pointed out that manufacturers have so far given little attention to increasing the life of a lamp bulb, which is just as important as the life of a filament. Lamps made by foreign manufacturers have shown a life of from 500 to 1000 hours. As the electric cap lamp is now more in demand than the hand lamp, special attention should be paid to designing the flexible cord connecting the lamp with the battery, so as to minimize its weight and prevent abrasion. The light from mine lamps should be distributed evenly and should be free from dark spots and sharply contrasting areas of bright and faint illumination.

Mr. Smith called attention to the fact that 20 per cent of the operating expense of mine lamps is for the battery repairs and renewals and 15 per cent is for attendance. He expressed belief that the use of alkaline batteries would tend to reduce these expenses.

Mr. Burrows spoke of a new primary cell which he tested and found to compare favorably with the lead cell in weight and discharge rate. The cost of charging was low and the maintenance not very great. He also mentioned a paste-electrolyte cell which is not subject to so large a voltage decrease during discharge as the liquid-electrolyte cell. Mention was made of a cell containing sawdust saturated with sulphuric acid which is inexpensive and should meet the requirements of a service where batteries are subjected to rough usage. Small batteries have an efficiency of only about 50 per cent and the fixed charges are high owing to rapid depreciation of the cell. When the ratio of the total fixed charges to initial cost is eight to one the most economical life is 300 hours instead of 1000 hours. Increasing the life to 1000 hours requires a 40 per cent increase in ampere-hour output of the battery and from 30 to 40 per cent increase in battery weight and cost.

Mr. Swoboda stated, in closing, that the candle-power referred to in his paper as being required in mines was measured without a reflector and the life records were reported by special investigators appointed by the Prussian government.

The Development of the Electric Mine Locomotive

Mr. G. M. Eaton's paper traced, largely by means of pictures, the development in locomotives for coal-mine service. The two main factors which have influenced their present design are the demand for increased entry capacity and the exploitation of thin seams. Since 1896, when the first electric locomotive was placed in this service, the block displacement has been reduced from 3.88 cu. ft. to 1.54 cu. ft. per hp. It was pointed out that mine locomotives should be designed to withstand severe collisions, sustain slight damages from falling roofs, and so that repair work can be done in a blacksmith shop. For welding broken parts quickly and effectively the author recommends the electric or Thermit process.

To meet the demand for a high drawbar pull with a minimum-weight locomotive, the wheels may be coupled with side rods, chains or gears and driven by one or more axle-drive motors. When a single motor is employed, however, the advantage of series-parallel operation is sacrificed. Tractive adhesion and the life of the wheels have been increased by the introduction of steel-tired wheels. Some four-axle-drive mine locomotives are now being equipped with two controllers, one controlling all four motors and the other only two. This arrangement permits of operating the motors at their best efficiency, depending on the load, and allows flexibility of operation in case of injury to any one of the units.

The author urged against the employment of track-return and overhead-trolley circuits for operating gathering locomotives in mine rooms, suggesting the use of storage batteries or insulated cables wound on motor-operated or spring-retrieving reels as better practice. Since mine locomotives have little opportunity to coast and polish their commutators, sparking at the brushes should be prevented as far as possible by employing commutating poles.

Discussion

The paper was discussed by Messrs. F. L. Stone, W W. Miller, Schenectady, N. Y.; Charles W. Beers, Wilkesbarre, Pa.; W. A. Thomas and N. W. Storer, Pittsburgh. Ventilation and safety were discussed quite fully, but there was considerable difference of opinion as to how to obtain the best results. It was brought out that ball bearings are not satisfactory on mine locomotives because they become unsymmetrical by wear.

Mr. George Shapter, Schenectady, N. Y., declared that if satisfactory and economical results are to be obtained from storage-battery locomotives considerable attention will have to be paid to laying the rails evenly. He quoted 4 cents per ton-mile as the operation cost of a certain installation with which he was acquainted. The speaker declared that the storage-battery locomotive is not so efficient as the trolley locomotive, but it has a reason for existence.

Mr. Storer pointed out that while ball bearings permit the use of a smaller air-gap, they are not always desired, since the efficiency is reduced thereby. The air gap should always be such as to give good commutation and should not be determined by other conditions.

Mr. Eaton recommended solid gears in preference to the split type and expressed belief that case-hardened gears will be used more extensively in the future. The storage-battery locomotive, he believed, is doomed to failure unless the conditions under which it has to operate can be very materially bettered.

The two papers on mine substations were presented and discussed together.

Mine Substations

The installation, operation and maintenance of coal-mine substations were discussed in Mr. H. Booker's paper. A substation can generally be placed at a more advantageous position relative to the mine than can a private steam plant, as the former does not require coal or water for its operation. As the mine is enlarged and the output increased additional operating energy can be furnished quickly and cheaply by installing larger transformers and rectifying apparatus, or both. When energy is not required, there is practically no upkeep charge such as exists with a station requiring a boiler plant. When the station is operating the attendant is required to perform only such simple functions as closing switches, etc.

In general, a substation should be installed above ground and preferably near the pit mouth, so that it can be attended by a man who has other duties to perform. The fan attendant, tipple foreman or hoist engineer can generally look after the substation. In large mines the substation should be situated near the center of distribution to minimize the first cost of copper feeders. When the feeders cannot be run into the mine through one of its openings bore-holes can be employed.

Among the objections to installing a substation below the surface are danger of fire, presence of moisture, and poor ventilation of apparatus. When it is necessary to employ an underground installation, provision should be made for ventilating with intake air, and the high-tension cable should, when possible and practicable, be run through the intake airways. To guard against roof failure arched or reinforced-concrete ceilings should be employed and the entire structure made fireproof. For a 200-kw substation the dimensions should not be less than 24 ft. by 24 ft. by 12 ft. Cables leading from the surface to the underground equipment may be inclosed in lead-covered cables attached to a messenger wire about every 30 ft. by wiped joints or clamps. All machine frames should be grounded. Many accidents are caused by incompetent employees, hence good salaries should be paid to secure good attendants. To prevent accidents danger warnings should be posted liberally and conspicuously about the mines, indicating the presence of electrical equipment.

Mine Substation Motor-Generator Sets Versus Synchronous Converters

The paper by Mr. Will M. Hoen pointed out the relative characteristics of synchronous converters and motor-generator sets driven by induction and synchronous motors. Considered from their starting characteristics, these machines were ranked in the following order of desirability: Induction motor-generator, synchronous motor-generator, and synchronous converter. An induction motor has a small air-gap and hence operates with a lagging current which is detrimental to voltage regulation. A synchronous motor, on the other hand, has a large air-gap, and the power-factor can be easily controlled, thereby benefiting voltage regulation and avoiding penalization by the electric-service company for taking lagging currents. It is not generally economical, however, for a consumer to maintain higher than 90 per cent power-factor. A synchronous converter has a large air-gap, consists of only one unit, is much lighter per kilowatt output than the other two types of rotary machines, and requires less energy for starting. On the other hand, it is not adapted to simple power-factor correction through a wide range.

Discussion

Mr. Thomas said that while a rotary converter is more efficient than a motor-generator set, the use of the former will not greatly increase the total plant efficiency. The motor-generator is generally more popular in extensive coal fields where energy has to be distributed a considerable distance, since the generator can be over-compounded to make up for line drop.

Mr. P. M. Lincoln pointed out that the rotary converter is desirable when conversion from alternating to direct current is the only question, but this machine does not permit of much over-compounding; hence a motor-generator must be used when this feature is desired.

Mr. O. S. Newton, Columbus, Ohio, described a circuit-breaker which cannot be closed while a short-circuit exists on the line. The device also protects against fire, limits the current and regulates the control of a motor in its circuit.

Mr. N. Stahl, Pittsburgh, spoke briefly on over-compounding rotary converters and discussed the advisability of correcting power-factor by changing the field excitation of the converter.

Mr. Stone brought out the fact that with a rotary converter operating from a high voltage line it is often necessary to employ two banks of transformers on account of the large ratio of transformation necessary in obtaining the proper rotary voltage.

Mr. Hoen, in closing the discussion, said that underground substations should be avoided where possible.

Meeting of the American Electrochemical Society

Summaries of a number of the papers that were read at the session of the society held at New York City last week and of the discussions that followed their presentation

THE American Electrochemical Society met in annual session in New York April 16 to 18 inclusive. The sessions were held at the Chemists' Club and Columbia University. Routine business occupied part of the time of the first session, after which there was a symposium on power problems in electrochemistry.

Mr. P. W. Sothman spoke on power transmission and transmission economics, particularly with reference to electrochemical industries. He discussed the methods of generating electrical energy, dwelt on the transmission problems which must be considered in providing for the economical utilization of the energy, referred to some important structural design features, and gave general power-generation costs at different voltages. A more detailed report of this paper will be published in a subsequent issue of the *Electrical World.*

Dr. C. P. Steinmetz's topic was "Characteristics of Electrical Energy as Affecting Chemical Industries." He pointed out that where practicable it is advisable to locate chemical industries near nature's stores of energy in order that the power may be utilized to the best advantage. Near coal mines it is possible to generate energy for as small a sum as 0.01 cent per kw-hr., while hydroelectric energy cannot be developed for less than about 0.1 cent per kw-hr. Where central-station energy has to be employed Dr. Steinmetz suggested that the operations of a chemical industry be arranged to use off-peak energy, thereby obtaining lower rates than might otherwise be secured.

In commenting on the advantages of employing electricity for producing chemical changes instead of the heat of combustion, the speaker said that a higher temperature can be obtained by electricity than by burning coal or oil, consequently making it possible to reduce many ores that could not be worked by any other method. The ease of controlling the temperature of a furnace more accurately when using electricity was pointed out as another advantage. Moreover, electricity can be transmitted, distributed and converted into other forms of energy very economically.

As electrical energy cannot be stored except in small quantities, the cost of power is dependent on the rate of consumption. The power cost in an electrochemical industry operating on a twelve-hour schedule with electricity produced by burning coal is about 50 per cent greater than if the plant were operated twenty-four hours a day. Operating only one hour of the day costs about thirteen times as much as twenty-four-hour operation as regards energy used. When employing energy developed by water-power the ratio is different, because the fixed charge is practically the only expense in a hydroelectric plant.

When it is not possible to arrange operation to take advantage of the off-peak energy Dr. Steinmetz recommended operating an electrochemical plant at a constant electrical load without peak demands to secure the lowest energy rates. He also recommended using reactors in series with electric furnaces to prevent fluctuations in load and correcting the power-factor by floating synchronous motors on the circuit. This method, the speaker declared, is preferable to employing apparatus which has been designed to operate at high power-factor, as it is usually less expensive and answers the purpose more effectively. Electricity supplied for lighting factories is more expensive than that furnished for power purposes because of the poor load-factor.

The possibility of storing water in hydroelectric developments for twelve-hour instead of all-day operation was brought out, but it was declared that it would be less expensive to operate twenty-four hours a day, because the first cost of the generating plant would be less. In closing, Dr. Steinmetz emphasized the fact that electrical energy can be obtained at the least expense when the period of supply is chosen by the producer of the energy.

Mr. F. A. J. FitzGerald discussed some of the methods of obtaining economy in electric-furnace operation. He recommended examining power contracts very carefully before signing them. When the load is constant the rate offered is generally reasonable, but when energy must be supplied for peak demands the rate is generally raised with the primary charge based on the average of the intermittent peaks. He also called attention to the common practice of penalizing consumers if the load is not equalized on each phase of a three-phase system. It is not always advisable to employ the most electrically efficient apparatus, as it runs into money. The speaker pointed out that continuous operation has in many cases stunted the efforts to utilize off-peak power. Mr. FitzGerald advocated the use of apparatus for regulating the power delivered to electric furnaces, saying that it will often pay for itself by eliminating peak demands on which there is usually a very high rate. In addition, the use of regulating apparatus has often increased the output of furnaces as much as 10 per cent. In closing, he pointed out steps for obtaining economy and warned against exaggerating the importance of using highly efficient apparatus.

Mr. Robert Turnbull spoke on electric-furnace regulation and called attention to the advantages which may be obtained by employing automatic regulators instead of hand regulation. The labor expense may be decreased about 25 per cent to 30 per cent by employing automatic regulation, peak demands will be eliminated, and the product obtained from the furnaces will be more uniform. The speaker gave a detailed description of the Thury regulator, which is being used extensively in Europe and which has been employed in this country about five years.

Discussion

In the discussion Mr. M. Pettinot, Niagara Falls, N. Y., said that by using Thury regulators the cost of energy can be considerably reduced, as the power required is more constant and consequently there is no penalizing for peak demands.

Mr. C. A. Hansen, Schenectady, N. Y., called attention to the wave distortion caused by electric furnaces operating at light loads, saying that the power-factor is considerably reduced thereby. He also criticised the policy of some electrical concerns taking advantage of the lack of electrical knowledge of some electrochemical operators to sell them apparatus which is not required by the industry and which does not perform the work ascribed to it.

Mr. F. A. Lidbury, Niagara Falls, N. Y., spoke on the complexity of electrical problems which are encountered even in the simplest electrochemical operations and called attention to the need of expert and reliable advice on these subjects. As from 20 hp to 100 hp is required in electrochemical industries per employee hired, the energy cost is very important, and there is danger in the smaller plants adopting the practice of larger concerns rather than considering the particular conditions applying to the specific case.

Dr. Steinmetz, Schenectady, N. Y., said that reactors in series with furnaces are inherently inductive but that they reduce the wave distortion caused by the electric arc and thereby increase the power-factor. Besides having this advantage, reactors prevent power fluctuations and balance the loads on a three-phase system. He added that it is bad practice to connect the neutral of a furnace to the neutral of a transformer installation when three-phase furnaces are employed.

Mr. P. M. Lincoln, Pittsburgh, Pa., pointed out that a power-factor meter does not measure the true power-factor when the waves are distorted.

Mr. Sothman, New York, described a power contract used in Canada which permits reducing the energy expense from 22 per cent to 24 per cent if a constant load is maintained during the year except at peak-demand periods of the supply system.

Mr. Robert Turnbull, Welland, Ontario, Canada, declared that it is not practicable to run furnaces off peak, since in the interest of economy they should operate continuously. If the power is shut off from a furnace for a certain period, the furnace will cool and must be brought up to the original temperature again, requiring a reheating period about equal in length to the cooling period.

Dr. Carl Hering, Philadelphia, Pa., suggested increasing the rate of production in electrochemical industries during off-peak periods to tide over the peak-demand periods, in that way taking advantage of the lower rates for energy.

Three papers read at the Jan. 9 meeting of the society and abstracted in the Jan. 17 issue of the *Electrical World* were presented at this meeting for the second time to invite discussion. The papers are as follows: "Sources of Direct Current for Electrochemical Processes," by Mr. F. D. Newbury, and two papers having the same title, "The Power Problem in the Electrolytic Deposition of Metals," by Messrs. Lawrence Addicks and H. E. Longwell respectively.

Owing to the absence of Mr. W. S. Horry his paper on "Power for Electric Furnace Works" was read by title.

On Thursday afternoon there was an experimental lecture on electrolytic flames, by Mr. W. D. Bancroft. This was followed by the reading and discussion of papers by Messrs. C. A. Hansen and E. B. Clark.

Electric Steel Castings

Operating data and characteristics of a 2-ton electric furnace employed by a steel-casting company at Easton, Pa., were presented in the paper by Mr. C. A. Hansen. The furnace is operated on 85-volt, sixty-cycle energy stepped down from 2200 volts. Direct-current motors regulate the position of the electrodes. The cost of melting metal in this furnace has been about one-half of what it was in the old crucible furnace which was displaced and was heated by oil costing 2.5 cents per gal. Since the advance in the price of oil, it costs $6 to $7 more per ton of molten crucible steel than formerly.

Electric-steel castings can be made with a lower percentage of carbon than crucible steel, but the cost of production increases rapidly with a decrease in the carbon content. Steel containing as low as 0.10 per cent carbon cannot be produced economically. It is not usually advisable to preheat the metal for charging an electric furnace, as the energy consumption per ton of output is greater than when a cold charge is used. The original cost of metal preheated in a cupola was about $18 per ton, as compared with $12 per ton for cold charging. Preheating an electric furnace with oil costing 2.5 cents per gal. until the charge is at red heat increases the cost of production about $1 per ton over the price of steel made by an all-electric process. Considering cost of production alone, continuous operation of an electric furnace means from 10 to 15 per cent saving over intermittent operation, but the decreased efficiency of night labor in other departments of a foundry may offset this saving.

Mr. Clark's paper compared various types of electric furnaces with other apparatus for producing or refining steel as to quality of output and cost of operation. The paper also brought out the best types and sizes of furnaces to employ for different installations.

In the discussion the following took part: Messrs. H. D. Hibbard, Plainfield, N. J.; E. P. Humbert, Niagara Falls, N. Y.; K. G. Frank, New York; Henry Hess, Philadelphia, Pa.; C. A. Hansen, Schenectady, N. Y.; J. W. Richards, South Bethlehem, Pa.; C. G. Schluederberg, Pittsburgh, Pa.; E. L. Crosby, Detroit, Mich.; W. D. Mainwaring, Cleveland, Ohio, and E. F. Cone, New York.

Mr. Hibbard suggested operating furnaces in pairs alternately, so that energy is on each only half the time, and employing oil burners to preheat the charge. By this arrangement the advantage of oil heating can be obtained without changing the electrical load on the entire system.

Mr. Hansen said that power fluctuations occurring when a furnace is being started can often be prevented by putting lime and fluorspar in the furnace. He does not believe that it is necessary to install flywheel generators to compensate for fluctuating loads.

Mr. Richards said that at Easton, Pa., the energy charge for operating electric furnaces is 1 cent per kw-hr. and the power is available all except one hour each day.

Mr. Crosby said that the Detroit Edison Company is doing all in its power to attract electrochemical industries by offering a maximum rate of 0.75 cent per kw-hr. The company's greatest difficulty is in obtaining suitable furnaces. The central-station company is willing to correct the power-factor itself by installing synchronous converters. A new rate is now being considered for off-peak business which will apply to the entire territory served by this company. The new rate will make it possible to save from 15 per cent to 30 per cent of what is now being paid for energy. A flat rate of $51.30 per kw-yr. for constant-load demand is now in effect.

Mr. Cone declared that the use of electric furnaces makes refining a simpler operation and permits of regulating the physical properties of the steel more accurately than by any other method.

Advantages of Southeastern Alaska for Hydroelectrochemical Industries

The paper by Mr. W. P. Lass called attention to the opportunities for hydroelectrochemical developments in southeastern Alaska by pointing out the natural power resources and crude manufacturing products available there. Vast coal deposits in the western part may be utilized in firing boilers, and the rainfall, which is exceedingly heavy, makes it possible to develop hydroelectric power economically. Water rights may be obtained for periods of fifty years, subject to renewal, upon payment of a fee not exceeding $1 per hp-yr. Lakes situated in rock gorges with narrow outlets at altitudes of 1000 ft. afford natural means of conserving the precipitation and equalizing the flow during the year. The rugged character of the country makes long transmission difficult and expensive, however, so that it is advisable to utilize the energy at the place where it is developed. The entire country is open to navigation at all times of the year, making it a simple matter to receive and ship materials. Crude California oil with an asphaltum base may be obtained for $1 per barrel in Alaska.

Other papers presented at the afternoon meeting were "Improvements in the Metallurgy of Zinc," by Mr. G. C. Stone, and "Electric Zinc Smelting," by Mr. W. R. Ingalls.

On Thursday evening Dr. E. F. Roeber delivered his presidential address on "Some Economic and Esthetic Aspects of Electrochemistry." His discussion dealt with the time, place and form value of electrochemical products and the effect that modern engineering has had on the esthetic senses. Electrochemical products always have high form value; by transportation to some place where their energy content may be extracted they acquire place value, and by deriving their energy content when it is needed they get time value. Through electrochemical processes what was formerly waste material has become valuable. Modern engineering has extended the natural senses of the human being by furnishing artificial senses in the form of instruments and apparatus.

Friday was devoted to inspecting electrochemical industries in the vicinity of New York, trips being made to the works of the American Smelting & Refining Company, the United Lead Company and the Waclark Wire Company.

The presentation of papers and discussions was resumed on Saturday, the sessions being held at Columbia University.

Electrochemical Extraction of Copper Ore on Large Scale

Mr. E. A. Cappelen-Smith gave an interesting talk on the "Progress in Leaching and Electrolytic Treatment of Copper Ores in South America." He described a copper refinery located at Chiquicamata, Chili, which is capable of handling 10,000 tons of ore per day. The impurities in the ore used do not interfere with electrolysis, but chlorine, which is the major impurity, is removed by treating the ore with cold sulphuric acid and passing the solution through shot copper, which becomes coated with cuprous chloride. About 9 lb. of sulphuric acid per ton of ore must be used in leaching, but the composition of the ore is such that the sulphuric acid is automatically replenished by chemical change.

Five hundred and ten electrolytic tanks are installed at the plant, thirty being used for making cathode plates and the rest employed in extracting the copper from the electrolyte. The tanks are made of reinforced concrete lined with 1.5 in. of mastic Trinidad asphalt in which there has been mixed crushed quartz and granite. It is said that the lining is unaffected by the chemical action in the cell. Magnetic oxide of iron anodes, which are about 4 ft. long and 4 in. wide, are used in these cells. The anodes are hollow and copper-plated within to increase their conductivity. Five units are placed in each tank. It is declared that these anodes do not depreciate because they are not subjected to electrochemical action; hence their life depends on the care with which they are handled. Copper obtained by melting the cathodes produced in this plant has 100.26 conductivity compared with the Matthiessen standard.

Electricity for operating this plant is generated in a station about 85 miles away and is transmitted to the electrochemical works over a 100,000-volt transmission line. Installed in the generating station are oil-fired boilers and four 10,000-kw turbo-generators. At the delivery end of the line the energy is converted to direct current by five 2500-kw motor-generators.

In the discussion which followed Mr. Cappelen-Smith said that the uniform thickness of the copper cathodes obtained depends on the manner in which the interior of the anodes is copper-plated. The cathodes contain about 0.001 to 0.01 per cent of chlorine. The speaker declared that the anodes contain about 3 to 5 per cent of silica, which serves as a binder for the Fe_3O_4.

A paper on the "Hydroelectric Treatment of Copper Ores" was next presented by Mr. Robert Rhea Goodrich. It contained a brief summary of several practised and suggested processes of extracting copper from its ores by electrical methods.

Among other papers which were delivered at this session were the following: "Leaching of Copper Tailings," by Mr. R. Gahl; "Metal Inventory in an Electrolytic Refinery," by Mr. R. W. Deacon; "Electrolytic Zinc," by Mr. J. W. Richards; "Addition Agents in the Deposition of Zinc from a Solution of Zinc Sulphate," by Messrs. O. P. Watts and A. C. Shape; "Electrodeposition of Cadmium," by Messrs. F. C. Mathers and H. M. Marble; "Electrodeposition of Nickel," by Messrs. C. W. Bennett, H. C. Kenny and R. P. Dugliss; "Electrolytic Deposition of Brass on a Rotating Cathode," by Messrs. C. W. Bennett and A. W. Davison, and "A New Method for the Determination of Free Cyanide in Electroplating Solutions," by Mr. G. E. F. Lundell.

The afternoon session was opened by an experimental lecture on "Electric Conduction at High Temperatures and Methods of Measurement," by Dr. E. F. Northrup, of Princeton University. He pointed out that the sharp distinction which is generally drawn between conductors and insulators exists only at normal temperatures and not at the higher temperatures. Curves were shown indicating the variation in resistivity of several pure metals, some oxides and brass at temperatures as high as 1500 deg. C. Of the metals tested all except bismuth and antimony showed a sudden increase in resistance in passing from the solid to the liquid state. In general, the ratio of the resistances just before and after fusion is roughly two. With the exception of zinc, cadmium and antimony the increase in resistance is practically a linear function of the temperature, while with gold and copper it is exactly linear. Methods of producing and measuring high temperatures were discussed and models of the new Northrup high-temperature furnace in which platinum may be melted were exhibited and described. A "cascade" attachment was also described which can be placed in a furnace to melt tungsten or even carbon. Data were given showing that the ratio of the coefficient of resistance to that of cubical expansion is approximately constant for the metals tested when they are in the molten state. It was suggested that the cubical expansion of molten metals could be determined by measuring the resistivity of the metal at the particular temperature under consideration.

The meeting of the American Electrochemical Society was concluded by the presentation of the following papers: "Laboratory Notes on Some Electrical Properties of Silver Sulphide," by Mr. F. A. J. FitzGerald; "Polarization Single Potentials," by Mr. C. N. Hitchcock; "New Cell Arrangements for Direct Determination of the Free Energy," by Mr. R. Beutner; "A New Railway Track Cell," by Mr. E. L. Marshall; "Experiments on White Lead," by Mr. R. S. Owens; "A Microscopic Study of Electrolytic Iron," by Mr. O. W. Storey, and "The Effect of Addition Agents in the Electrodeposition of Iron," by Messrs. O. P. Watts and M. H. Li.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

The Sun Never Sets on the Electric Vehicle

"At the present time the electric truck is used in more than 125 different lines of trade and in forty-one of the forty-eight states," commented Mr. F. W. Smith, vice-president of the United Electric Light & Power Company, New York, and president of the Electric Vehicle Association of America, in the course of a recent address at Washington.

"The electric vehicle has followed the sun around the world and is doing yeoman service in Canada, Cuba, England, China, South America, Turkey, Siam and Australia. Everywhere it is setting the pace in simplicity of design and operation. Electric trucks are cutting costs where hills are unknown, as well as in such hilly centers as Pittsburgh, Cincinnati, Kansas City and San Francisco. It is for these reasons of economy and efficiency that the 'electric' is favored by public opinion as the ideal vehicle for city and suburban haulage."

Window Displays of the New York Edison Company

The New York Edison Company makes its show windows serve two purposes—first, the displaying of electrical appliances and fixtures, and second, the instruction of the public as to how windows should be equipped electrically to attract the most attention. In one of its windows the company recently exhibited a motor-driven advertising mechanism which produced such fascinating ocular illusions and went through such peculiar movements that considerable attention was attracted to the movable central-station advertisements attached thereto. The device, which was called a "symmetroscope," consisted of a mirror-lined, pyramidal-shaped vessel which was rotated about its axis of symmetry by a small motor through gears and belting.

Attached to the rotating part nearest the observer were ten circular cards bearing snappy advertisements, and weighted so as always to remain in a vertical, or readable, position, even when the pyramidal-shaped vessel revolved. In the latter was some imitation fruit which was apparently tripled in quantity by reflections in the mirrored walls of the container. After every third revolution of the fruit container, a rack and pinion operated by a cam on the motor shaft caused the vessel to swing back through a vertical angle away from the window, at the same time allowing a small advertising curtain to unroll. Ten different curtains dropped automatically in the course of thirty revolu-

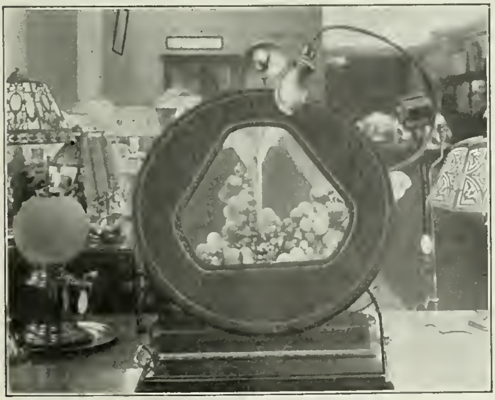


FIG. 1—MOTOR-DRIVEN SYMMETROSCOPE, SHOWING FRONT CONTAINER

The Public's Picture Gallery is The City's Streets

Your *show window* should be a masterpiece. People pause before a good picture well lighted. If your window can't make them stop consult our Bureau of Illuminating Engineering.

The New York Edison Company

FIG. 2—BULLETIN DISPLAYED IN CENTRAL-STATION WINDOW

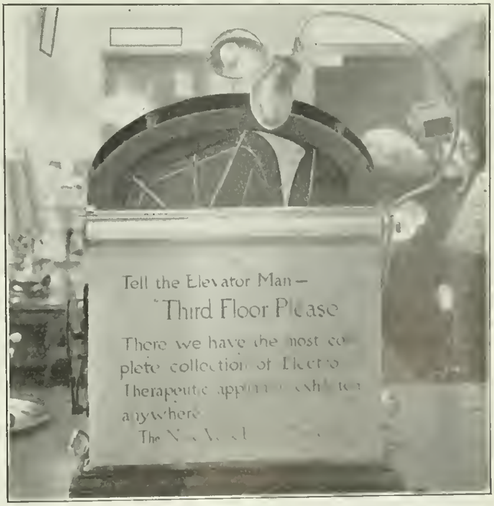


FIG. 3—SYMMETROSCOPE TILTED BACK, DISPLAYING ADVERTISEMENT

tions of the container, each time rewinding again ready for the next advertising display to appear. This device is manufactured by the Publicity Experts' Association, 18 West Thirty-fourth Street, New York.

In another one of the electric company's windows, displaying several ornamental table lamps and electrical appliances, were placards, similar to the one reproduced herewith, presenting the advantages of electrically lighted show windows and advising customers to consult the Edison company's bureau of illuminating engineering for suggestions.

Village Closes Municipal Electric-Light Plant

Westerville, a town of 1600 inhabitants about 15 miles from Columbus, Ohio, has recently discontinued the operation of its 100-kw municipal electric-lighting plant and is now receiving service from the mains of the Columbus Railway & Light Company. Energy is delivered to the town at 13,200 volts and is sold to the town itself at a wholesale rate and retailed by the town to the former customers of the municipal company over the existing distribution system. For a portion of the distance the transmission line is carried on the poles of an electric-railway company but for the remainder of the distance a line of 50-ft. and 60-ft. poles has been erected.

An extension in the opposite direction from Columbus also has been completed recently so that Grove City, with a population of about 1000, is now receiving electric service.

Metered Versus Unlimited Service to Office-Building Tenants

Customers sometimes question whether the average public-service company furnishing electricity or gas is always sincere in its professed attitude toward waste. Interesting in this connection is the case of the modern office building, the consumption in which is usually sufficiently large to make it an important factor with the local electric company. There is a growing tendency toward giving the tenant the option between having his electricity metered to him or paying for it with other service in the flat rental charge.

By the latter plan, which in some sections is still the most generally used, the tenant is practically on a flat rate for his electricity. That is, a charge is included in his rental to cover the energy he uses, and this is in turn paid for by the owner of the building on a meter basis. Thus the tenant is free to use all the service he wishes, without the restraint imposed by the knowledge that he must pay for each hour his lamp burns or his fan is kept running. The result, therefore, is usually considerable waste.

In an office building where a majority of the tenants elect to have their service metered to them it is certain that less energy will be consumed than where a flat rate, inviting waste, is charged by the building management. The rate to all such buildings, it may be assumed, is the same, and hence the revenue from them is proportioned exactly to the relative consumption of energy. This would make it appear that the company gains nothing from the metering plan, but rather loses the sale of just so much service, without any corresponding advantage, unless it be in the form of increased good-will.

It has been found, however, that there is a decided advantage of the last-named character. One of the officers of a central-station company which has a number of buildings taking service and remetering to tenants declared recently that the owners of buildings purchasing energy on the old plan of unlimited service to tenants are nearly always among the most vigorous "knockers" of the central-station company because of their large bills, and this in spite of the fact that the tenants are to blame, and not the company.

Another decided advantage, which is pretty sure to operate as an affirmative business-getter for the company, is the fact that an office tenant taking service through his own meter and finding the monthly charge to be a trifling amount is not only pleased at the saving but will be impressed by the economy of electricity for various purposes.

This, again, means that in cases where the tenant having electricity in his office has never used it in his home the low bills received at the office are almost certain to result sooner or later in the installation of electricity in the home, thus adding another consumer to the central-station lines, which is the ultimate aim of the company and the justification of the modern policy of waste prevention.

"Do It Electrically" Slogan Bears Fruit in Iowa City

The slogan "Do It Electrically" is bearing fruit in Fort Madison, Ia. (population about 11,000), as shown by the number of electric signs which have been installed on the main street during a central-station sign campaign begun only a few months ago. Electric service has been furnished in this city since April, 1913, by the Fort Madison Electric Company, a Stone & Webster property. Before that time the power plant was operated in conjunction with a sawmill. Now energy is purchased from the Mississippi River Power Company and is transmitted to the city from Keokuk over a 11,000-volt line. The central-station company has equipped a modern office and an attractive electric shop in which to receive its customers.

NIGHT AT FORT MADISON, IA.

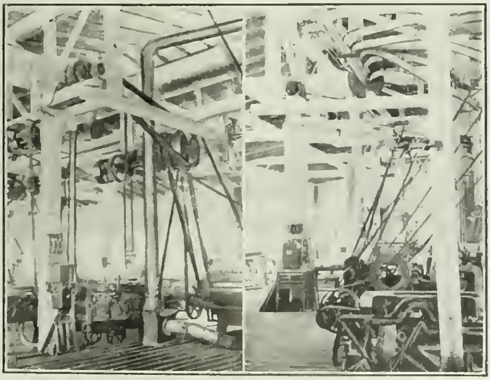
Ice-Making Returns in a Central West City

The ice factory owned by a combination ice-electric company in a city of 4000 population in one of the Central States consists of a 9-5-in. bore by 15-in. stroke ammonia compressor driven by a 10-in. by 30-in. Corliss engine. The condenser comprises two sections of 2-in. pipe, 20 ft. long and 24 pipes high, giving a total of 960 lineal ft. of 2-in. pipe. The freezing tank is 32 ft. long, 16 ft. wide and 4 ft. deep, with 3073 ft. of $1\frac{1}{4}$-in. expansion pipes. This freezing tank contains 160 300-lb. ice cans made of No. 16 galvanized iron and each measuring 11.5 in. by 22.5 in. by 45 in. Distilled water is supplied by a "dog-house" condenser. The engine driving the ice machine supplies all the distilled water necessary. This water does not have to be reboiled, as it produces very clear water without other preparation. The ammonia compressor is normally rated at 10 tons output per twenty-four hours. A storage room capable of holding a reserve of 50 tons of ice is also cooled through the direct expansion of ammonia in 500 ft. of 2-in. pipe. Under the terms of the manufacturer's guarantee, 30 hp at the shaft, with condensing water at a temperature of from 60 to 70 deg. Fahr., will produce 10 tons of ice for twenty-four hours. The building was constructed about ten years ago for $1,500. The total investment in machinery, building, freezing tank, etc., amounted to about $10,000. During 1911, a good ice year, the total plant income from ice manufacture was $4,480, while for 1912, which will be remembered as a cool season, the return was reduced to $3,855.

Multiple Switching of Blowers in Motor-Driven Woodworking Plant

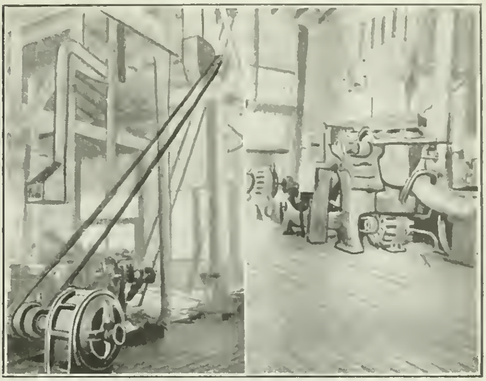
High first cost of the blower installation is often the factor which decides whether or not a woodworking plant can be equipped economically with motor drive. Sometimes a large blower capable of serving several machines is provided with a separate motor and arranged to operate continuously, although this plan increases the energy cost out of all proportion to the service rendered. A scheme recently tried out in the mill of the J. T. Weybrecht & Sons Company, Alliance, Ohio, in which the motor-driven blowers are connected on multiple-switching circuits, has proved quite satisfactory and also very economical.

As will be seen from data in the accompanying table, each blower is arranged so that it serves a group of milling machines. On the circuits feeding the blowers for each group are multiple switches placed near the control apparatus of each milling machine, which enable the operators to start the blower just before beginning work on any individual machine. Should the blower be in operation when a man closes his multiple switch, operation of the blower is unimpaired, and as long as any one operator is using a machine the corresponding blower continues in operation, being taken off the circuit when the last multiple switch is opened. It is a rule of the shop that each man must close the blower switch adjacent to the machine on which he wishes to work before beginning operation and must open it when the operation has been concluded.



FIGS. 1 AND 2—MULTIPLE-BLOWER SWITCHES ON POSTS NEAR MACHINES

Service for these machines is supplied from the distribution system of the Alliance Gas & Power Company through three 20-kw, 2300/220/110-volt transformers, energy being metered on the primary side of the circuit. Practically all of the motors in the shops operate at 1720 r.p.m., so that units of the same horsepower rating are interchangeable. Shavings and sawdust from the woodworking machines are delivered through the blower pipe system to an overhead bin and are used in the furnace of a 100-hp boiler supplying live steam for a dry kiln.



FIGS. 3 AND 4—TYPICAL MOTOR INSTALLATIONS; MOTOR BENEATH MACHINE

In expressing his satisfaction with the new motor-driven installation, Mr. W. F. Heiff, foreman of the shop, declares that the present cost of operation is approximately one-third of that for the former steam-driven plant. Besides this, speeds are more steady and there is less noise. The Weybrecht company is engaged in general milling and employs sixteen men who work nine hours a day. The total connected load of the woodworking plant is 148 hp.

GROUP MACHINES IN WOODWORKING PLANT

	Motor Hp
Group No. 1:	
Smith & Phillips pulley mortiser; 8-in. jointer, T-slotted head	3
14-in. jig saw, 36-in. band saw	3
Double-spindle shaper	3
Horizontal-head panel raiser	3
Blower (25-in.)	5
Group No. 2:	
4-in. molder; 6-in. molder	10
24-in. pony planer	5
Blower (25-in)	5
Group No. 3:	
20-in. rip saw; combination No. 2 tenoner; American chain mortiser	5
16-in. jointer; 20-in. rip saw, Beech; sash and door mortiser, light	5
Blower (25-in.)	5
Group No. 4:	
48-in. drum sander and blower (20-in.)	20
Group No. 5:	
16-in. jointer; Beech rip saw	5
27-in. double surfacer	15
Blower (25-in.)	5
Group No. 6:	
8-in. molder; Berlin self-feed rip saw	10
Blower (25-in.)	5
Group No. 7:	
12-in. molder	20
Blower (30-in.)	5
Other Machines:	
Two turning lathes	3
20-in. swinging cut-off saw	2
Emery grinder	2
Tool-room utility motor-emery	3
Band-saw sharpener	1
Total	148

Illumination and Wiring

Sanitary District to Supply 1000 More Street Lamps for Chicago

The majority trustees of the Sanitary District of Chicago are reported to have assented to the wishes of the minority, and also to those of the majority of the City Hall officials interested in the subject, in promising to erect and maintain 1000 additional street arc lamps at the present rate for the city of Chicago. This number is to supplement the 23,000 now under contract. The rate is equivalent to 0.5 cent per kw-hr. The majority trustees desired to increase this to 0.59 cent, on the advice of Mr. Roy Palmer, the city electrician and Mr. E. B. Ellicott, electrical engineer of the Sanitary District. A long dispute waged around the question of the actual cost of producing and distributing the hydroelectric energy of the Sanitary District. Finally, it was agreed that the rate should not be increased, the additional lamps not to exceed 1000 in number.

1600 Inverted Magnetite-Arc Units at Providence

The city of Providence, R. I., is just completing the installation of 1600 inverted-type magnetite arc lamps in its business section and on the principal thoroughfares radiating therefrom, making one of the largest systems of the kind ever installed in an American city. Eight hundred of the lamps are carried on posts in the underground district, and the remaining 800 are supported on brackets on wooden poles in the outlying sections where overhead distribution is the rule. Posts, lamps and energy to operate the system 4000 hours yearly are furnished by the Narragansett Electric Lighting Company on the basis of $85 per lamp-year for units in the underground district and $75 per lamp-year for those carried on overhead brackets. These General Electric 5.5-amp arc lamps operate with a potential of 72 volts across the lamp terminals, and each burns about 120 hours per trim, making it necessary to replace electrodes only once every ten days or longer. As the mechanism is placed below the arc chamber, it is impossible for heat from the flame to warp the parts or bake the coils. The lamp-posts are staggered on opposite sides of the streets and in the business section are placed at intervals of 60 ft. to 90 ft. The two sides of a given street are fed from separate circuits so that in case of failure of one circuit the lighting of the section affected will not be entirely extinguished.

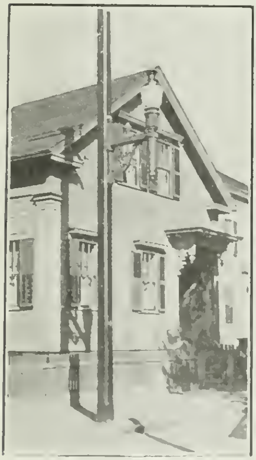


FIG. 1—BRACKET LAMP ON OVERHEAD SECTION

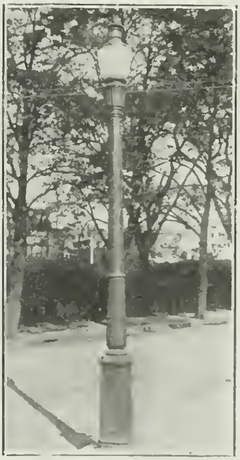


FIG. 2—UPRIGHT POST IN UNDERGROUND DISTRICT

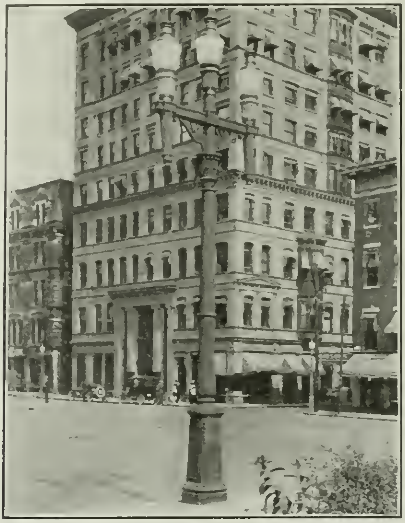


FIG. 3—THREE-LAMP POST IN PUBLIC SQUARE

In general the new Providence lighting system employs magnetite lamps on posts in the down-town section and along the principal streets leading out through the suburbs, bracket-type arc lamps on less important and more remote principal streets, and 60-cp tungsten incandescent lamps on the intervening and residential streets. Some 8000 of these overhead tungsten units are now being installed, for the operation of which the city pays $17 per lamp year. In addition, there are about 700 tungsten standards in the underground district for which an annual charge of $22 each is made.

These 8700 tungsten units will ultimately replace all the former gaslight posts in the city, as it is found that the electric lamps are less expensive to maintain and require less trouble for their proper attention. Formerly the cost of lighting Providence's streets was $285,000 yearly. The new electric-lighting installation will cost but $260,000 yearly to operate, or $1.07 per capita, and compared with the former system of open-arc and gas lighting has twice the number of units, a better distribution and more diffuse illumination. Mr. R. L. Brunet is engineer of the Providence public servive board.

Top Versus Bottom Connections for Meters

Following careful consideration of the subject of meter connections, the lighting department of the British Columbia Electric Railway Company, of Vancouver, B. C., has decided to alter its former policy regarding the use of the top-connected type of meters heretofore employed and will hereafter use "bottom connection" meters exclusively. Among the reasons for the change brought forward at recent departmental discussions on the subject were the following:

(1) Meters are very often installed in damp locations, and in such cases the top connection does not

afford as much protection for the equipment as the bottom connection.

(2) Requirements of the municipal electrical bureaus demand that meters shall ordinarily be installed at a considerable height. Under these circumstances it is difficult to inspect closely the contact points with the top connection. With the "bottom connection" the condition of the contacts can be seen from the floor at a glance.

(3) Should there be loose contacts and consequent overheating with the top connection, the melting of the terminal would result in the flow of the metal into the meter.

(4) With the use of the bottom connection it is comparatively easy to notice any attempt to tamper with the meter, since the connection is several feet lower down, is not concealed in any way and permits the inspection seal to be seen without trouble.

(5) Testing of the meter may be carried on with much less difficulty where the bottom connection is used.

The new policy of the Vancouver company will go into force very shortly and its contracts for meters will be based on specifications framed accordingly. All new meters placed will be of the new type and the top-connection meters now installed will be replaced as soon as their useful lives are ended.

Line-Construction and Cost-Keeping Methods at Milwaukee

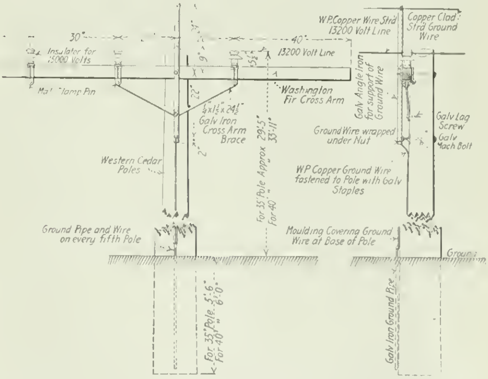
Exemplifying the high grade of line construction employed by the Milwaukee Electric Railway & Light Company, the 13,200-volt Watertown-Fort Atkinson transmission line, completed a short time ago, extends 28 miles from Watertown, a city about 47 miles west of Milwaukee, south to Fort Atkinson, serving the intermediate towns of Johnson's Creek, Jefferson and Lake Mills. The methods of preventing telephone disturbances, provisions for adding another circuit, means of insuring continuous service, methods of highway and foreign cross-over construction, and system of keeping construction costs, are among the interesting facts connected with this installation.

Watertown, which is the northern terminal and energizing source of the new 13,200-volt line, is also situated on a 40,000-volt, twenty-five-cycle steel-tower transmission line connecting the steam generating stations of the Milwaukee electric-service company with a hydroelectric plant at Kilbourn, Wis. Although energy is normally fed to Watertown from the hydroelectric plant, it will be possible in case of emergency to energize the new line from the Milwaukee extremity of the 40,000-volt line. A substation containing two 300-kw, 25/60-cycle frequency changers and one 300-kw waterwheel generator was installed at Watertown before the present 13,200-volt line was planned to supply energy for the local city service. To furnish electricity for the new line a 500-kw frequency changer has been added. This machine is fed from the higher voltage line through three 200-kw step-down, single-phase, oil-cooled General Electric transformers connected in delta on the high-tension side.

The line extending to Fort Atkinson consists of three No. 4 seven-strand hard-drawn copper wires supported on wooden poles, as shown in the accompanying drawing. Although only one circuit is installed at present, the insulators are arranged so that another set of equally spaced conductors may be erected in the future without reconstructing the line. This may be done by fastening the second cross-arm below the first one with the insulators arranged in the reverse order to that employed on the upper arm, thus providing positions for two sets of equally spaced conductors on each side of the pole.

Independent and Bell telephone circuits parallel the transmission line throughout practically its entire length, one system being on the same side of the road as the transmission line. To avoid disturbing communication over the telephone circuits the transmission line conductors were strung about 8 ft. above those of the telephone system, and a 0.25-in. copper ground wire is supported about 24 in. above the center line of the upper cross-arm on a vertical angle-iron and grounded at every fifth pole. At the main highway crossovers the poles are equipped with double cross-arms, guys and grounding connections. Where permission has been obtained the trees on each side of the right-of-way have been cleared away, leaving a minimum clearance of 5 ft.

Johnson's Creek, which is the first town south of Watertown supplied with electricity from this system, is equipped with a distributing substation from which the street-lighting circuits and residence service are supplied. Step-down transformers are installed outside the station on the 13,200-volt poles. Twenty-five 75-watt tungsten lamps are employed for street lighting. From this town two lines branch out, feeding Lake Mills and Fort Atkinson. On the pole where these lines originate are installed two sets of open-air Delta-Star pole-top sectionalizing switches, so that either of the aforesaid lines may be disconnected from the line leading north to Watertown. A man at Johnson's Creek has charge of the supervision and maintenance of the branch lines.


30"
40"
Insulator for 15000 Volts
Mal. Clamp Pin
9"
5½"
13200 Volt Line
W.P. Copper Wire Strd 13200 Volt Line
Copper Clad Strd Ground Wire
Washington Fir Cross Arm
22"
¼"x1½"x24½" Galv Iron Cross Arm Brace
2"
For 35' Pole Approx 29'-5"
For 40' " 33'-11"
Galv Angle Iron for support of Ground Wire
Galv Lag Screw
Ground Wire wrapped under Nut
Galv Mach Bolt
Western Cedar Poles
WP Copper Ground Wire fastened to Pole with Galv Staples
Ground Pipe and Wire on every fifth Pole
Moulding Covering Ground Wire at Base of Pole
Ground
For 35' Pole 5'-6"
For 40' " 6'-0"
Galv Iron Ground Pipe

STANDARD POLE EQUIPPED FOR 13,200-VOLT TRANSMISSION LINE

Two municipal lighting plants are supplied with energy from this system, one being situated at Lake Mills and the other at Jefferson. Lake Mills, which is a town of about 1700 population, is furnished with two-phase, 1100-volt energy by two T-connected transformers. Induction-type, single-phase voltage regulators are employed. About 100 kw is delivered to the municipal plant at Jefferson.

At Fort Atkinson three 75-kw transformers and four aluminum-cell electrolytic lightning arresters are installed supplying energy to an ungrounded 2300-volt, three-phase distributing system. There are large creamery package industries at both of the last-mentioned places.

While the line was in the process of construction the work was hastened by subdividing the job and employing several squads of men at different points along the right-of-way (instead of in a single group) to set poles, erect cross-arms, string conductors, etc. As the line was not conveniently situated for receiving supplies by railroad, considerable long-distance hauling by wagon had to be done, which both raised the unit cost of line construction considerably and delayed progress.

Special itemized construction-cost records were kept on the job. Meals and lodging provided the workmen were recorded on one set, line-construction time reports on another, statements of total work done by the line-construction gangs on a third, and the entire data were segregated under different items on a fourth sheet. In the form covering work by the line-construction gang the work done by each man is itemized under the following heads:

Number post holes dug.
Number poles unloaded.
Number poles shaved and framed.
Number poles painted and trimmed.
Number poles distributed.
Number poles erected.
Number poles back-filled and tamped.
Number poles concreted.
Number cross-arms unloaded.
Number cross-arms delivered.
Number cross-arms placed.
Number insulators distributed
Number insulators placed.
Pounds of No. 4 cable unloaded.
Pounds of No. 4 cable distributed.
Feet of ¼-in. ground cable unloaded.
Feet of ¼-in. ground cable distributed.
Pounds of No. 4 cable strung.
Feet ¼-in. ground cable strung.
Pounds of No. 4 cable tied.
Feet of ¼-in. ground cable tied.
Number splices made.
Ground-wire supports distributed.
Ground-wire supports erected
Ground rods distributed.
Ground rods installed.
Feet of ground wire distributed.
Feet of ground wire installed.
Number deadmen installed.
Number guys installed.
Number trees trimmed.

In addition a record of the following items was kept: Time lost due to lack of material, waiting for orders and weather conditions; traveling time; maintenance of equipment; care of teams and wagons, and camp work. These records, together with tabulated petty expenses, rolling stock investments, rail charges, electric shop expenses and general utility charges, constitute data which will be extremely valuable to the engineering department of this company when making preliminary estimates on other work of a similar nature at any subsequent period.

Arc Lighting for Main Streets of Hammond, Ind.

Eighty-six ornamental luminous-arc lamps have recently been placed in service at Hammond, Ind., fifty-two of the units being installed on Homan Avenue and thirty-four on West State Street. The lamps, which are of the General Electric 4-amp luminous-arc type, are supported on ornamental iron posts made by the Morris Iron Works, Baltimore, Md. Posts are spaced 50 ft. apart on both sides of the street, being set opposite one another. Steel-taped cable incloses the conductor in the underground construction. In order to provide for future festivities in the city, lugs for holding flags have been cast on the ornamental posts at a point about 6 ft. above the sidewalk. One of these lugs may be seen on the post in the foreground of the accompanying illustration.

LIGHTING UNITS, HOMAN AVENUE, HAMMOND, IND.

Electrical energy for the lamps is supplied from two fifty-lamp rectifier sets in a station of the Northern Indiana Gas & Electric Company, operating in Hammond and adjacent cities. The expense of the installation was borne by property owners, the amount, $102 per unit, being collected by special assessment. At present the lamps are operated from dusk until 11 p. m. The city pays $47 per lamp for energy and maintenance.

Recent Telephone Patents

The automatic-exchange impulse transmitter has been used for both wall and desk-stand telephone sets for a long time, but it has never been adopted to any great extent to the hand-microphone set with the transmitter at one end of a handle piece and the receiver at the other end. Mr. A. E. Keith, of Hinsdale, Ill., has now arranged such a set with an impulse sender attached, and he has obtained a patent for this apparatus, which is assigned to the Automatic Electric Company. The impulse-sending device is reduced to a size commensurate with the watch-case receiver, and it is mounted upon the opposite side of the handle from the receiver. The case is cylindrical and its base is secured to the handle concentrically with the receiver, the hand wheel being on the outer end of the casing.

Mr. Keith has also obtained a patent for an automatic exchange system for which he has devised a master switch for trunking. This patent is also assigned to the Automatic Electric Company. The contacts of the trunking apparatus are connected to trunk springs, which are so arranged that the contact wipers may be oscillated step by step before the springs. The oscillating wipers are driven by a shaft under control of a ratchet, the motion of which is unidirectional. The switch stops with its wipers before an idle trunk, one set of wipers being arranged in a vertical row for each incoming line. If a call arrives, the corresponding wiper is freed from the motor mechanism and thrust into the trunk terminals, whereupon all the other wipers are advanced until each confronts the next idle trunk. With this apparatus every step of the motor causes an effective motion of the wipers, and no quick-return step is necessary, as would be the case if the contact wipers stepped in one direction only.

Mr. E. E. Clement is the patentee of an automatic switch for automatic-telephone systems, his patent being assigned to the Clement International Engineering Corporation. According to this system the contacts are arranged on edge in vertical rows on a cylindrical surface. Thus the wipers take their horizontal rotary motion first and the vertical linear motion last. The elevating rack or ratchet is a bar attached to a sleeve which does not rotate with the shaft. Another novelty lies in the fact that all armatures are arranged to swing on knife edges rather than on pins or pivots.

An automatic system has already been invented for party lines in which each party line appears on the connector switch, one switch being used for each station. In a system patented by Mr. F. Aldendorff, of Antwerp, Belgium, and assigned to the Western Electric Company, the party line appears upon the connector once only, the station selection being effected by an auxiliary ringing selector. The number of the called station must, of course, be related to the character of the selector current required. When a selection has proceeded to the required point, a finder associates an idle ringing selector with the connector switch and the impulses next arriving serve to select the proper current supply for the desired station and to connect this station with the connector, so that when the next set of impulses drives the latter to the terminals of the desired line the proper station will be rung. As soon as the ringing is completed the ringing selector and its finder are free. Thus a few sets of these selectors and finders may serve many connectors.

Prepayment System

Mr. W. Aitken, of Liverpool, England, is the inventor of a prepayment system in which a call-registering device is mounted at the substation. This device has a removable part, which may be obtained from the telephone company already set for a certain amount of service according to the price paid. The patron inserts this unit in his register, and service is rendered until the last call previously agreed upon is used, when the line circuit is opened.

Railway-Dispatch Apparatus

A rather elaborate selective-call apparatus forms the subject of a patent granted to Messrs. M. F. Geer and R. C. Leake, of Rochester, N. Y. Buttons are depressed to correspond with the desired stations and a rotating handle is driven forward to effect the selection. The speed of the handle is controlled by a centrifugal brake. Current for selection and ringing is supplied from generators which are driven by a motor which is started when the first selection is made. When the selection is completed all the parts are restored to their normal position and are then ready for re-use. This patent is assigned to the General Railway Signal Company.

Letter to the Editors

The Attitude of Conciliation

To the Editors of the Electrical World:

Sirs:—What is the greatest need of the public utility company of to-day? If this question were sent broadcast throughout the land it is highly probable the returning answer would be: "The confidence of its patrons in particular and the public in general." There are many phases of a utility company's business which require more than ordinary attention and there are many problems to solve, but the ever-present problem is how to eliminate the prevailing prejudice against corporations. The responsible heads of companies have little difficulty in obtaining the services of competent engineers to construct and operate a property. There is not much trouble in obtaining the financial aid necessary to develop a property if it is well located in a thriving center of population, but there is always difficulty for the best-intentioned corporation when it comes to the subject of winning and holding the confidence and good will of a community. Time and again the question is asked: "Why does this condition continue to exist?" The answer to the query points in two directions, external reasons on the one hand and internal causes on the other.

Looking at the external reasons, we find that there is more than one page of earlier corporation history written over with true stories of greed, aggression and a disregard of public rights. Turning from the past, we find that there is more than one latter-day example of corporation short-sightedness, breach of faith and mismanagement. Added to this is the ever-present yellow journal with its love of startling headlines inveighing against the so-called trusts. Then there are the mouthings of the professional agitator and the theories and vagaries of the self-appointed reform politician. Who can deny that the yellow journal, the agitator and the politician have not had some reason for their utterances because of the mistakes, indifference and incivility of the utility companies under their observation?

Turning to the internal causes of public distrust, it is necessary for each company, through its officials, to make a self-examination. Much regrettable history of corporations which has left its mark of prejudice on the public mind is not chargeable to any present-day company, but existing companies are responsible for what goes on within their own organizations. If a public does not exhibit much confidence in all a corporation says and does, perhaps it is not the public that is most to blame.

The regulation of public utilities by state commissions has advanced step by step during recent years, and it is more than likely that in the near future each public utility company in the United States will be subject to the immediate control of some commission responsible to the people. In the main, patrons, consumers, managers, owners and security holders of public utilities have been satisfied with the results thus far achieved. Uniform rates have been established and uniform systems of accounting have been put into effect. Some commissions have very broad powers, and while the distinction between regulation and management is recognized, there is always a possibility that regulation may be extended. If a state commission has power to dictate what rates shall be charged and what shall be the quality of service and the conditions under which it shall be supplied, then why should it not control the personal treatment which shall be given customers by a public utility company, through its employees? Are not civility, courtesy and attention as much a part of good service as the rate charged or the voltage delivered? These questions are asked, but such supervision is not advocated. However, the trend of the times may bring some surprises in this direction. It may not be an improbable development that representatives of a commission will drop into some of the public offices of utility companies just to learn how the company treats its patrons across the counters and over the telephones, and through this agency a few company managers might be enlightened about the way their assistants are handling the public.

Many officials of companies will say: "Oh, things are altogether different now from what they once were—the public is being well treated." For the present it may be acknowledged that there has been a great improvement in matters of this kind. Managers have sent out correctly worded circular letters with carefully prepared instructions to employees as to how the public must be treated. If the instructions given were carried out, conditions would be ideal; but they are not always. Time and again a man may be told to be civil and polite, but he will not be so unless he desires. In other words, real civility and courtesy must come from within a man and not from without.

It too frequently happens among corporation employees that the words "serve" and "service" are not rightly understood. The utility company serves the people, consequently the company and its officers and employees are servants. Dignified service is honorable and in no way degrading unless the servant himself degrades it. Life is made up of service; all are servants in some respects, although perhaps masters in others. The motto of the heir to the throne of England is "I serve." The policeman on his beat, the judge on the bench and the governor in the Capitol all serve, and the President of the United States is the greatest servant of all because he serves all the people.

Now, if a servant in a house should become uncivil, inattentive, indifferent or discourteous to his master, would the master be pleased? Would he love that servant and say that he would help him all he could? No, not likely! The master would say to himself: "I will let that fellow go as soon as I can find someone decent to take his place." The relation between the utility company and the public is very similar. The public is the master and the company is the servant. The company does business by virtue of a franchise granted by the public. The public patronizes the company and from the public the company derives its income. The company is the servant and the public is the master. In the very nature of things the servant must frequently ask the master for favors. Are they granted cheerfully or reluctantly? That depends upon how the servant has pleased the master.

The public is the people, but whom does the public know as the company? Not the bondholders, stockholders or directors, not the president, secretary or manager—just the employees who transact the company's business with the public. In all truth, a company is known and judged by the men it keeps; at any rate, the public knows of no other way to determine whether a company is good, bad or indifferent—no other way to tell whether a company is worthy of confidence or entitled to distrust. If the confidence of the public is the greatest need of the public utility company to-day, then the way to obtain that confidence is to conciliate.

It has now become the habit to dwell upon the word courtesy in referring to the relations between a public utility company and the public, and it is a good habit. But there are degrees of courtesy, or, rather, there is the imitation and the real article. There is the formal courtesy of the lip and manner and there is the courtesy which flows from the heart. The former freezes and the latter warms, and the one is seldom mistaken for the other. Stripped of all verbiage, genuine courtesy is the "doing unto others as you would that others should do unto you." But courtesy is not all that is required to obtain confidence; there must be conciliation. This word expresses a combination of the attributes which compel confidence, namely, consideration, alertness, sympathy, attention and courtesy.

The paramount question is how to spread the gospel of conciliation among company employees so that they may be permeated with the knowledge of what the word stands for and its importance to them and the organizations of which they are a part.

Connected with every modern electric company there is a new-business department, and it is a notable fact that the experienced salesmen attached thereto do not require to have the word "conciliation" explained to them. They have learned that there can be no success in their work without courteous cheerfulness. They know that conciliation makes friends and friends make business for the salesman. Now, if the salesman has learned how to spell "conciliation," what has kept the cashier, order clerk, collector and troubleman so backward in their lessons? Because the cashier or order clerk is behind a counter in an office and the customers go to him to do business, is he any better than the salesman, who must go out and seek the customer? Is there any reason why the office man should adopt an air of superiority and talk to the customer abruptly, impatiently or uncivilly? There is no reason why, but even now in the office of almost every electric company of any size there are some clerks who are putting their company in a bad light by indifference and discourtesy to the company's patrons. It is acknowledged that there are offices where exceptional conditions prevail, but only where this matter has had special attention.

The principal points of contact between a company and the public should be guarded by men who have been carefully selected for the positions they are to fill. The manager will find that for the good of his company and its standing with the public he cannot give too much thought to this important matter. The question of salary should not be allowed to interfere with getting good men for such work, and keeping good men at it. Men of the wrong stamp are dear at any price. Men who are forgetful, moody, grouchy or dyspeptic should be kept in the background, and only such men as are cheerful, alert and considerate should be in the forefront in whatever place or through whatever medium the company does business with the public.

Some men are born with the natural desire to win friends by conciliation, some men may have this quality developed in them by education, and others could never acquire it by any possible way. Most electric companies have regular or occasional meetings of their employees, and it is suggested that at these meetings those responsible for proper public relations should give a series of "little lessons on conciliation." Employees might be called upon to demonstrate how consumers should be handled under different conditions. At each meeting one department should show by actual representation the ideal way of pleasing the public from its standpoint. In their turn those in charge of office work, collection department, selling department, trouble department, service department and telephone exchange should show to others in the company how the work can be done in a manner which will please and make friends. The manager should be on hand to criticise, suggest and point out the value of the right way and the injury resulting from following the wrong way. Such a program will impress employees with the absolute necessity for conciliation and will produce good results where circular letters of instruction would not avail.

There is an attitude of conciliation which almost every man can assume if he is personally desirous of impressing another to gain a wished-for end. It expresses a desire to please which may be clearly seen in the eyes, in the features, in the gestures and in the tone of voice, which cannot be misunderstood. This attitude of conciliation is visible not only in personal contact, but may be traced in the wording of letters and felt in conversations over the telephone. If a man can effectually assume this attitude in personal matters, why can't he assume it when transacting business for the company which pays for his services?

Some men think they have done their full duty toward the policy of conciliation if they "meet the customer half way." Some go a little further and say, "Give the customer the benefit of the doubt," believing that should satisfy and please. But no! Both classes of men have stopped too soon, for in a complaint or controversy the real attitude of conciliation assumes that "the customer is always right." Before such an attitude complaints are forgotten, troubles vanish and opposition fades away. The attitude of conciliation does not imply continuous kowtowing, bowing and scraping. It does not mean a loss of self-respect, or the relinquishing of any rights. On the contrary, the implied consideration for the feelings and rights of others adds dignity to a position, costs nothing, and yet will yield the most marvelous returns.

A corporation, in its defense, will sometimes state that it is only an aggregation of individuals. What is the public but a greater aggregation of individuals? The corporation which consistently and persistently adopts the attitude of conciliation with its patrons will realize some day that, having pleased the individuals, it has won the much-desired confidence of the public.

Los Angeles, Cal. S. M. KENNEDY.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Condenser Lifts Water from the Sump

By drilling a hole in the side of a Leblanc condenser which is operated in connection with a 3000-kw turbine in the station of the Massillon (Ohio) Electric & Gas Company, attaching a 0.75-in. pipe to the opening and extending the pipe to the nearby sump, the condenser has been made to do the work of a sump pump. A valve in the 0.75-in. pipe line adjusted at intervals keeps the water in the sump at about the same level at all times, care being taken not to let the water get below the intake of the suction line so that air will enter the condenser. For emergency service and to aid the suction line in case water enters the sump faster than it can be removed through the 0.75-in. pipe a steam siphon has been installed, which is capable of lifting the water into the canal at the side of the station.

Preventing Waste of Excess Exhaust Steam

By A. E. Anderson

The sight of steam escaping through the atmospheric valve and going to waste is not pleasing to the manager of a combined electric and heating plant. Visions of dollars and cents floating into the air greet his eyes and the waste assumes large proportions. This loss may occur only during the period of the daily electric peak, but it is none the less displeasing and indicates an unnecessary waste.

Such a condition existed during the past heating season in the plant of which the writer had charge. Live steam had to be supplied to the heating system from twenty to twenty-two hours per day, but as this loss nevertheless continued during the daily peaks, a way was sought to correct this condition in order that "no guilty steam might escape."

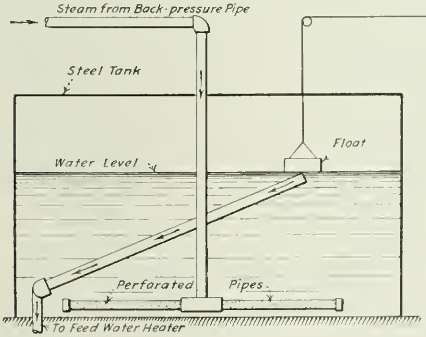


FIG. 1—TANK FOR CONSERVING EXHAUST STEAM

At first it was planned to set an old fire-tube boiler on end and to utilize the excess exhaust by passing it through the tubes to heat the water in the boiler. This was, however, quite out of the question as it would have been necessary to tear out a brick wall to get the boiler in place. There was, moreover, not enough floor room for the installation. Even then the problem would have been only partly solved as some steam would have passed through the tubes and into the air and the heat radiation from the boiler shell would have been large. Covering the boiler would have been quite expensive.

It was therefore decided to utilize the exhaust steam by heating water in a steel tank over the coal bin, this water then passing to the feed-water heater and thence to the boilers. Just below the back-pressure valve a tee was installed and a pipe run to the top of the tank and then down to the bottom where a home-made heater is placed. This heater consists of two capped pipes perforated with small holes and screwed into a tee at the end of the pipe from the back-pressure pipe. In this way not only is all the excess exhaust steam condensed, but the softening effect of this steam is obtained and its effect has been noticed in cleaner boilers.

In the original lay-out the hot water was drawn from the bottom of the tank and then taken to the heater. It was soon found that the cold water in the bottom of the tank was being drawn off, allowing the hot water to dissipate its heat to the tank room. This was afterward changed, a pipe being arranged with a float and counterweight so that the outlet pipe was always at the surface and "skimmed" off the hot water. This arrangement has since worked out very nicely.

During the months of September, October and November the temperature of the water in this tank frequently rose to 140 deg. and 150 deg. During December, January and February, however, the heating load had grown so heavy and the weather was so severe that we did not have enough steam to take more than "the chill off the water."

The maximum pressure carried on the heating main is 3.5 lb., and the back-pressure valve has been set at 5 lb. A bell alarm has been devised so that when the back-pressure valve opens, showing an excess of exhaust steam, this bell rings. The attendant then opens the valve to the tank heater. When the valve has been open and the bell again rings showing that the exhaust supply is just equal to the heating demand, the valve is closed.

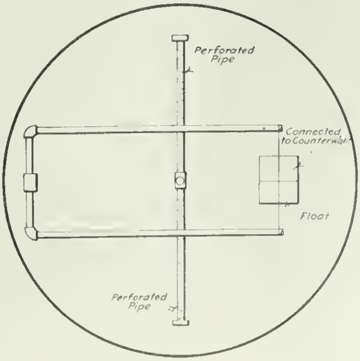


FIG. 2—PLAN OF CONDENSATION TANK

To prevent the tank water from siphoning over into the exhaust main, an automatic air valve was placed in the steam pipe to the tank heater, thus allowing air to enter the pipe and prevent the forming of a siphon.

No boiler troubles due to oil have been experienced. A year ago oil enough to lubricate the feed-pump cylinders was taken from the pit into which the water and oil and grease from the separator in the heating main empties. Since this time the oil consumption has been cut down very materially and no pitting or corrosion is seen in the boilers. The force-feed lubricator on the low-pressure side of the compound engine has been taken off, as the steam from the high-pressure side carries over enough oil for the lubrication of the low-pressure cylinder.

With this simple arrangement the plant has made an appreciable saving in coal—in fact, a number of new heating customers were added before the coal consumption showed any increase over that of the previous season. There has been only one evening in about five months that steam escaped into the air from the plant, and the old familiar sight and sound of puffing steam is now entirely absent.

Control of Large Motor-Driven Machine Tools

Nowhere is the ease and convenience of electric drive better illustrated than in the control and manipulation of very large machine tools like those illustrated herewith. Indeed, it may almost be said that the operation of such machine tools would be impossible without the completeness and delicacy of speed control made feasible through the use of individual motors. Fig. 1, for example, shows a large 10-ft. by 10-ft. by 20-ft. reversing-motor planer, used in the shops of the Busch-Sulzer Brothers Diesel Engine Company, St. Louis, Mo. The largest of the five motors with which the machine is equipped is a 50-hp reversing motor which runs at speeds of from 250 r.p.m. to 1000 r.p.m. and drives the planer bed. An 8-hp, 1200-r.p.m. motor raises and lowers the rail, two 2-hp, 1500-r.p.m. motors drive rapid-travel mechanism for rail heads and side heads, and a fractional horse-power motor operates an oil pump, providing forced lubrication. In Fig. 1 the planer is shown working on a Diesel-engine frame, the operator in charge having his hand upon a pendent control switch.

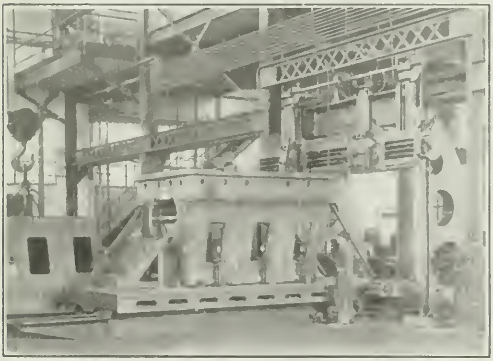


FIG. 1—LARGE REVERSING MOTOR PLANER WITH PENDENT CONTROL

Another group of large heavy machine tools in the same shop consists of three large lathes which are capable of turning up stock from 30 in. to 54 in. in diameter and from 8 ft. to 25 ft. in length. The largest machine is driven by a 20-hp motor having a speed variation of from 400 r.p.m. to 800 r.p.m. Rapid travel of the tool carriage is effected through a separate 2.5-hp, 1075-r.p.m. motor. A 12-hp, 775-r.p.m. to 1350-r.p.m. motor operates the medium-sized lathe, and the smaller lathe in the rear is equipped with a 9-hp motor running at speeds varying from 500 r.p.m. to 1500 r.p.m. All of these machines are equipped with gear changes providing further speed reductions.

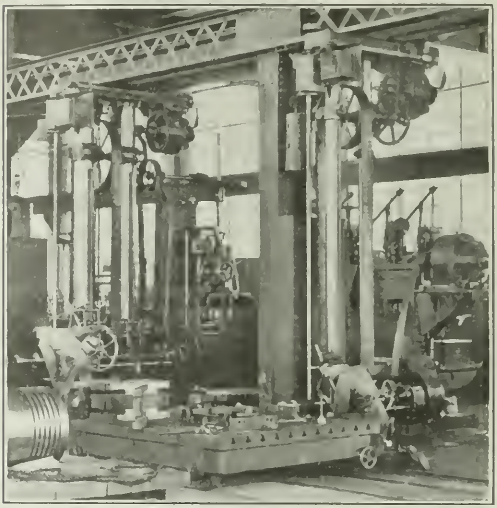
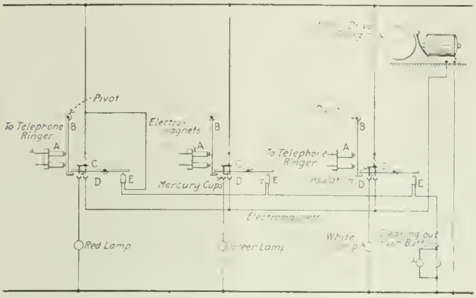


FIG. 2—DRILLS, SHOWING CONTROLLING APPARATUS ON MACHINE COLUMN

Interesting applications embodying unusual features have been made in connection with two drills shown in Fig. 2. These drills, with a vertical range of 96 in. and spindle travel of 44 in. and 36 in. respectively, are driven by 8.5-hp and 6-hp motors. Starting boxes and rheostats are mounted at the top of the machine columns, control being effected through an extended shaft terminating in a handle always within easy reach of the operator. Work handled by these drills is held on cars with 6-ft. by 8-ft. decks. The rails supporting these cars are accurately leveled and either or both cars may be used with either drill. A revolving table is provided for use with either car.

Telephone Call System with Signal Lamps

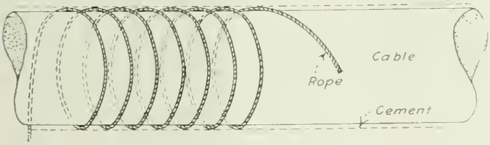
Mr. A. L. Platt, engineer of the main generating station of the Canton (Ohio) Electric Company, has recently done away with all separate bell-ringing outfits for the three telephones in the station and has installed an original system, the circuit diagram of which is shown in the accompanying illustration. From the ringers of the three telephones in the plant, the Bell, the Stark and the private lines, conductors are led respectively to the three sets of electromagnets marked *A*. When the ringing current from an incoming call energizes one of these sets of magnets, the lever *B* swings toward the pole-pieces, allowing the pivoted horizontal lever *C* to fall by its own weight and immersing the small contact points *D* in the mercury contained in the cups beneath. This completes the circuit through the colored lamp corresponding to the ringing telephone and also energizes the motor-driven gong. Both the lamps and the gongs continue in operation until one of the push-buttons shown at the right of the illustration is operated by the person answering the telephone. Sets of these push-buttons, connected in multiple, are situated both in the booth containing the three telephones and in the office of the chief engineer. Actuation of the push-buttons, as will be seen by tracing the circuit, energizes the electromagnets *E*, returning the pivoted lever *C* to its original position. These magnets are wired in series, no provision having been made for selective operation.



CONNECTIONS FOR HOOD-RINGING TELEPHONE

Method of Fireproofing Cables

Various cements, some of them patented compounds with superior heat-resisting qualities, are used to cover cables in manholes and in basements of buildings. In emergencies cables in these places are sometimes called upon to render service when a fire is raging about them, and the covering should be applied so that it will not be easily cracked or chipped and broken off. A common method of preparing the cable for the coat of cement is to wrap the length of cable to be protected with an ordinary 0.25-in. rope, leaving about 0.75-in. open space between each turn. With the rope fastened at each end the wrapped exterior of the cable presents a surface to which the cement will adhere just as plaster clings to lath in a building.



METHOD OF HOLDING FIREPROOF CEMENT ON CABLE

Methods and Cost of Electric Heating

We have a 400-kw hydroelectric plant available for supplying energy for electric heating. Please advise us concerning the cost of electric heating, watts required per cubic foot of space heated, methods of heating recommended, etc. W. J. E.

Among the methods of electric heating which have been employed satisfactorily are direct radiation from resistance elements, hot-water heating from a single central plant, individual hot-water units, and forced-draft hot-air systems. A system employing hot-water heated in a single electric boiler is advantageous from the maintenance viewpoint because the heating elements do not deteriorate rapidly, being maintained at a low temperature by the surrounding water. Another advantage obtained with this system is that heat can be stored in the water during off-peak periods, consequently lower energy rates can be obtained. As the efficiency of electric heaters is a definite unchanging quantity, the effectiveness of this form of heating can be improved only by preventing radiation from the building to the outer air and by excluding cold air which may seep in through cracks. A forced-draft hot-air system has the advantage of counteracting cold-air seepage, but has the disadvantage of increased maintenance charge due to resistance deterioration. The Ontario Power Company's office building at Niagara Falls is heated exclusively by the latter system. The motor-driven blower and set of heating elements utilized cost $388 and consumes 85 kw. Seventy-two thousand cubic feet of office space exposed on three sides is heated. A central-plant hot-water system, costing about $1,200 installed, has been employed with considerable satisfaction in the Biltmore House, Atlantic City. The water heater consists of a cylindrical tank 5 ft. long and 3 ft. in diameter containing twenty 5-kw heating elements inclosed in concentrically arranged, parallel copper tubes. Water is heated from faucet temperature to 180 deg. Fahr. with an average efficiency of 85 per cent. The heating elements being surrounded with water have shown a normal life considerably in excess of that usually obtained with air-cooled resistance wire. The heater operates on 230 volts with either alternating-current or direct-current energy. An electric steam generator used in the laundry of this house gives from 95 to 100 per cent efficiency. Feed water is taken from the hot-water mains and is delivered at practically zero pressure. The generator consists of a drum containing five 3-in. vertical pipes each surrounded by a 7-kw heating element. Carefully conducted experiments have shown that from 85 watts to 110 watts is equivalent in heating ability to low-pressure steam condensing on 1 sq. ft. of radiating surface with a temperature difference of 126 deg. Fahr. Some engineers estimate that 1.5 watts to 2 watts is sufficient to heat 1 cu. ft. of space under average conditions. When direct radiation from resistance is employed, it is recommended that thin, bare, flat resistance wires be utilized. Fireproof or asbestos-covered wire should be used in preference to rubber-covered wire on all heating circuits. Inclosed fuses on these circuits have been found to deteriorate more rapidly than other forms. Solder should never be used on any part of an electric heater, as it is liable to melt. Switches should preferably be placed directly on the heating unit, otherwise the connections between the unit and the switch should be inclosed in conduit. When a hot-water or steam-heating system is employed particular attention should be paid to the type of switch used as they must not be affected by moisture or steam. Assuming that a certain hot-water-heating system using coal containing 14,000 lb. Fahr. units has an efficiency of 50 per cent, an electric boiler producing an equivalent amount of heat would require 2 kw-hr. of electricity per pound of coal fired in the first case at 100 per cent efficiency. Therefore, to compete with coal at from $10 to $11 per long-ton, electricity must sell at about 0.25 cent per kw-hr., omitting the stand-by losses in a heating system using coal. When heat is supplied during only a small portion of the time, these losses are considerable, so that an economy may still be effected when the energy rate is as high as 2 cents or 3 cents per kw-hr. If a 400-hp boiler is used, electricity at from 3 mills to 5 mills per kw-hr. would be equivalent to coal at $10 per ton in producing heat. Successful competition with coal may become possible if heat can be stored in water during off-peak periods.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Commutation.—K. PICHELMAYER.—A brief illustrated paper on the role which the armature field plays in commutation phenomena.—*Elek. u. Masch.* (Vienna), March 8, 1914.

Variable-Speed Dynamos.—A note on a recent British patent (No. 30,107, 1912) of the British Thomson-Houston Company and the General Electric Company of this country. To maintain constant pressure across a variable-speed dynamo a differential exciting winding is provided, and a resistor of carbon, tungsten or tantalum, containing a material such as boron, having a marked negative temperature-resistance coefficient, is used in series with one winding. There are several modifications.—London *Elec. Eng'ing*, April 2, 1914.

Lamps and Lighting

Mercury-Vapor Lamps.—F. P. KERSCHBAUM.—An illustrated article on the absorption of light in mercury-vapor lamps and an arrangement to avoid it. The author describes a method of reducing the absorption of the ultra-violet rays passing through the vapor in a mercury-vapor lamp. For this purpose water cooling is used to reduce the density of the vapor, and a magnetic field is applied to deflect the arc so that it is near the quartz. The effectiveness of the method is demonstrated by the results obtainable with a mercury resonance lamp when excited by the lamp here described. Such a combination provides a source of monochromatic ultra-violet light such as is not easily obtained by other means.—London *Electrician*, April 3, 1914.

Stage Lighting.—H. H. REEVES.—An illustrated article on the best practice in the construction and installation of the equipment which controls the electricity supply for stage lighting. The usual layout of the stage equipment is pictured, and particular attention is directed to those locations for the electrical equipment which produce the most effectiveness in presenting a performance. Wiring diagrams of the main circuits and of convenient arrangements for wiring the switchboard are given. The suggestion is made that the motion-picture machine shall be connected to the secondary service lines. In the event of the blowing of the main fuses a possible panic may thus be easily averted, for the audience can be entertained with pictures until normal conditions can be restored.—*Gen. Elec. Review*, April, 1914.

Incandescent Lamps.—A note on a recent British patent (No. 17,416, 1913) of Siemens & Halske A. G. Where a chemical compound is used in the bulb for the purpose of giving off gas, this is arranged to be heated by a special wire in series or parallel with the filament; for example, it may be wound round a tube containing the compound. The wire is of such material that its cross-section decreases with time and therefore runs hotter, thus tending to maintain the quantity of gas evolved constant as the amount of the chemical left decreases.—London *Elec. Eng'ing*, March 26, 1914.

Signal Lamps.—G. R. NYLO.—An illustrated description of the arrangement of signal lamps on some Berlin bridges for the regulation of the boat traffic.—*Elek. Zeit.*, April 2, 1914.

Generation, Transmission and Distribution

Current-Limiting Reactors on Large Power Systems. K. M. FAYE-HANSEN AND J. S. PECK.—A paper in abstract read before the (British) Institution of Electrical Engineers. The operation of current-limiting reactors is discussed with a view to indicating where they may be placed and the sizes which should be used in the different positions in order most satisfactorily to accomplish the desired results under various conditions. The advantages of placing reactance in generator leads are: The busbar voltage may be kept constant, giving the same voltage on all feeders; no damage to the generators in the case of a short-circuit on a feeder or a busbar; no damage to the generator circuit-breakers in any case; synchronous apparatus will not fall out of step in the case of a short-circuit on the generator. The disadvantages are: Enormous current rush into a short-circuit on a feeder; excessive load on the feeder circuit-breaker in the case of a fault on a feeder; synchronous apparatus may fall out of step; a complete shut-down may follow a short-circuit on a feeder or "busbar." The advantages of reactance in the feeders are: A short-circuit on a feeder causes no serious disturbance on the system and there is no excessive overload on circuit-breakers or generators; the feeder circuit-breakers may be of smaller breaking capacity than those where feeder reactances are not used; the tendency of synchronous apparatus to feed back in the case of a busbar fault is slightly reduced by the feeder reactors. The disadvantages are: The voltage drop on the feeders will vary with the load and cannot be compensated for by varying the busbar voltage; a short-circuit on the busbar or generators is a short-circuit directly on the terminals of all generators; the generator windings and circuit-breakers may be damaged and the complete plant shut down; a short-circuit on any generator or between any generator and its circuit-breaker may throw an excessive load on this circuit-breaker, and if it fails to clear the fault the whole system will be shut down. The size of the feeder reactors will depend on the capacity of the feeder, as compared with that of the generators, and upon the breaking capacity of the feeder circuit-breaker. The advantages of busbar reactors are: Trouble is confined to the particular section on which the fault occurs; the amount of current that can be fed into a fault is reduced; the danger in the case of bad synchronizing is considerably reduced. The disadvantages are that no protection to a generator is given when a short-circuit occurs on or near its busbar section, and that the generators coupled to the different busbar sections must be operated with a certain angular displacement in their voltages. Reactors between busbar sections may be exceedingly useful for confining any disturbance on the system to that particular section on which the trouble occurs, and thus it is possible to operate a large number of generators or two or more stations in parallel with almost the same factor of safety against a complete shut-down as though they were operated separately. It is seldom, however, that busbar reactors are used except in conjunction with reactors in generators or feeders.—London *Electrician*, March 27, 1914.

Generator Short-Circuit Current Waves.—F. D. Newbury.—The author discusses some of the more important characteristics of the theoretical short-circuit current wave, describes two methods of approximating the maximum possible short-circuit current from an oscillograph record, and defines reactance and short-circuit current as applied to short-circuit conditions, as follows: The short-circuit current of a generator is the peak value of the first cycle of current in one phase after a short-circuit is established, when the short-circuit occurs at that point in the voltage wave of the phase in which the current is measured, resulting in maximum short-circuit current. Short-circuit of the complete winding shall be assumed unless other conditions are specified. The transient reactance of a synchronous generator is defined by the relation, reactance $= E/I$, in which E is the maximum value of the voltage at the instant before short-circuit and I the corresponding maximum value of the sine component of the short-circuit current. It follows from these definitions that the ratio of the short-circuit current to the peak value of rated current is approximately equal to 180 divided by the reactance in per cent.—*Elec. Journal*, April, 1914.

Regenerative Motor-Control.—A note on a recent British patent (No. 6806, 1913) of Crompton & Company and H. Burge. A motor is connected in series with a motor-generator across the line. There is a field winding on the motor through which the current is automatically decreased or increased as the motor speed rises or falls. This winding is connected between one side of the line and a choking coil across the armature, or through a slip-ring to the armature.—London *Elec. Eng'ing*, April 2, 1914.

Electric Drive in Workshops.—O. Pollok.—Machine tools gain considerably in efficiency if driven directly by motors with variable speed. For the present it is hardly to be expected that three-phase commutator motors with variable speed will come near the direct-current commutator motors with respect to low price and possibility of speed regulation. Without the use of direct current with a normal voltage of 220 or 2 × 220 volts the great advantages of electric driving cannot be utilized in general for machine shops.—*Elek. Zeit.*, April 2, 1914.

Electric Drive for Ship Propeller.—H. Peters.—After a brief review of the present status of electric driving of ship propellers, the equipment of the *Tynemount* is described. By the use of currents of different frequency the screw, which is driven by a three-phase motor with short-circuited armature, can be operated at different speeds.—*Elek. Zeit.*, April 2, 1914.

Steam-Turbine Condensers.—A. R. Smith.—The author discusses the three common types of condensers, the surface condenser, the low jet condenser and the barometric condenser. To afford a ready comparison of the different types, he has arranged a table which shows at a glance the advantages and disadvantages of each. The question of the best form of drive for the auxiliaries is discussed, and a recommendation is given for motor drive from an auxiliary non-condensing turbo-generator set. The several types of air pumps, circulating pumps and hot-well pumps are described and the merits of each are pointed out. Numerical data and curves are added.—*Gen. Elec. Review*, April, 1914.

Power in Foundries.—A. E. Richards.—An article giving data on the production problem in the foundry and machine-shop industry. The article shows the economic situation now confronting the foundry and machine-shop industry and how purchased energy affords a means of solving many of their problems.—*Elec. Journal*, April, 1914.

Traction

Railway Signaling.—H. G. Brown.—An illustrated paper read before the (British) Institution of Electrical Engineers on the signaling of a rapid-transit railway. The author considers in some detail the various methods of signal lay-out where an automatic system is used to control the traffic of a rapid-transit railway. The effects of delays, and especially of the length of the station stop, are also dealt with. Some figures derived from practical experience are given.—London *Electrician*, April 3, 1914.

Installations, Systems and Appliances

German Electrical Industries.—Continuations of the series of reviews of the status of the different branches of electrical engineering in Germany in 1913. Usbeck writes on electric railways, V. Engelhardt on electrometallurgy, K. Arndt on electrochemistry. The series is to be continued.—*Elek. Zeit.*, April 2, 1914.

Wires, Wiring and Conduits

Relays.—F. E. Ricketts.—An article illustrated by diagrams on the protection of transmission circuits by relays.—*Elec. Journal*, April, 1914.

Electrophysics and Magnetism

Electrification Produced During the Raising of a Cloud of Dust.—A note on a recent (British) Royal Society paper by W. A. D. Rudge in which the author stated that during the raising of a cloud of dust a considerable amount of electrification occurs. Insulated conductors held in a stream of dust become charged to a potential of some hundreds of volts. The dust particles seem to be charged by friction among themselves, some with positive, others with negative electricity. If a cloud is raised by blowing air through a wash bottle containing finely divided material, the air accompanying the cloud becomes strongly charged, and this charge persists in the air for some time. The sign of the charge carried by the air depends on the nature of the material. Mercury sulphide, sand, molybdic acid and "acidic" bodies in general give negative electricity, while coal, flour, red lead, alkaloids and "basic" bodies give positive electricity. A very small amount of dust —10^{-10} grams per cubic centimeter—would give rise to quite strong charges. The finer the material the stronger and more persistent is the charge.—London *Electrician*, March 27, 1914.

Secondary Electronic Radiation.—A. J. Philpot.—A note on a (British) Physical Society paper on the asymmetric distribution of the secondary electronic radiation produced by X-radiation. Homogeneous X-radiations, characteristic of various elements, have been employed to eject electrons from gold. By an ionization method the relative energies of the electrons emitted in the direction of propagation of the exciting X-radiation and in the reverse direction have been measured for each of the homogeneous X-radiations employed. It has been found that the ratio of the energy of the former to that of the latter increases with the penetrating power of the exciting radiation, its value rising from 1.11 when the mass absorption coefficient of the X-radiation was 5 to 1.24 when the mass absorption coefficient was 0.5.—London *Electrician*, April 3, 1914.

Photochemical Rays.—H. L. Heusner.—A continuation of his article on photochemical rays and their measurement.—*Zeit. f. Feinmechanik*, March 20, 1914.

Electrochemistry and Batteries

Silit Resistors.—G. Egly.—An illustrated article on the manufacture and uses of resistors of silicon carbide called silit. Silicon carbide, silicon and carbon are mixed together, pressed into forms, and heated at 1500 deg. C. in an atmosphere of carbon monoxide, whereby the silicon is changed to silicon oxycarbide. By further heating to 1600 deg. or 1700 deg. the carbon reduces the oxycarbide to silicon carbide so that the whole mass consists now of silicon carbide baked together in a very firm manner. Resistors made in this way can be used as electric resistors, as heating resistors and as refractory material.—*Mitteil. Siemens & Halske*, February, 1914.

Units, Measurements and Instruments

Hot-Wire Ammeter.—W. H. Eccles.—For making measurements of the effective current in a certain high-frequency circuit where it was difficult to hold values steady for more than a second or two, the author has devised the following simple quick-reading hot-wire ammeter (Fig. 1). Two fine wires *AB*, *CD*, of the same gage and material and about 10 cm long, are stretched between electrically independent supports so that they are not in the same plane. Near the place of shortest distances a cross-wire *CW* is soldered parallel to *CD*. The wire *CD*, which does not carry any current, is provided with a torsion head at *C*, and by twisting this the cross-wire can be made to press on the wire *AB*. Thus, when a current is passed through *AB*, the expansion of the wire due to the heating by the current is taken up by the rotation of the cross-wire. A light mirror, indicated by the dotted lines in the figure, is attached to the cross-wire and to the torsion wire, and it is advisable to crank the cross-wire a little so that the mirror does not touch the active wire *AB*. The period of the mirror is determined by its mass, by the torsion modulus of the wire *CD*, and by the elastic resistance of *AB* to lateral displacement. This period can easily be made of the order of a twentieth of a second. With copper wires of No. 40 S. W. G. an instrument can be built to measure currents ranging from 0.02 amp to 0.2 amp. The low resistance and quick action of such an instrument made it very valuable in the carrying out of some researches on resonance curves belonging to certain rather unstable quenched-spark plants.—London *Electrician*, March 27, 1914.

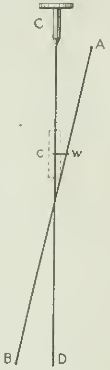


FIG. 1—HOT-WIRE AMMETER

Electrometer.—W. H. Eccles.—In an article on some instruments for high-frequency currents and voltages the author describes an exceedingly simple electrometer, which can be made sensitive enough for the detection of the voltages arising between the condenser plates in the secondary circuits used in wireless telegraphy and can be rigged up in any laboratory as follows: Clamp at its lower end a very fine wire or a silvered glass fiber in a vertical position, and cut away its upper end gradually until it can stand erect. It is convenient to have the clamp which supports the wire supported itself on leveling screws so that the operation of balancing can be carried out with perfect control, and it is necessary that the wire should be protected from air currents by inclosure in a chamber. In the writer's instrument the chamber is about 10 cm high with two brass sides 3 cm apart and with glass back and front 2 cm apart. The chamber has a brass top, and its base is a brass disk provided with leveling screws and carrying the fiber clamp. One of the brass sides is slotted, and an ebonite cover slides over the slot and can be clamped at any height. Through the ebonite an electrode projects horizontally nearly up to the vertical fiber. The ebonite is clamped so that the electrode is level with the top of the fiber. For the particular experiments which the author had in hand at the time, the electrode and the fiber were connected to the same side of the condenser. The movement of the fiber away from the electrode was observed by aid of a horizontal microscope provided with an eyepiece scale. In one such instrument the vertical fiber was a fine phosphor-bronze strip 9 cm long, and potential differences of a hundredth of a volt could be detected when the connections were as indicated above. Other possible modes of connection are obvious.—London *Electrician*, March 27, 1914.

Telegraphy, Telephony and Signals

Tuning of Wireless Telegraphy Receivers.—W. H. Eccles.—In the conclusion of his article on recent patents in wireless telegraphy and telephony a patent of the Compagnie Générale Radiotélégraphique is mentioned for a system of connections facilitating the tuning of a receiving set. The arrangement is shown in Fig. 2. Suppose, first, that the antenna and secondary are right out of tune with the signals to be received, and let the switch *N* be over against the point *O*. The telephone *T* and the detector *L* are in a non-oscillating circuit closely coupled to the antenna at *RD*, and, therefore, by varying either the antenna inductance at *D* or the antenna condenser at *F*, or both, the signals can be picked up. Then, while keeping the switch on *O*, vary the condenser *C* or the inductance *S*, or both, in the secondary circuit *SQCBE*, which is loosely coupled to the antenna at *BE*. As this circuit comes more nearly into tune with the signals, the loudness of the sounds in the telephone will diminish, till when the circuit is perfectly in tune there will be no trace of the signals. One way of explaining this is to observe that the energy picked by the antenna from a train of damped waves is passed in much greater proportion to a circuit in resonance than to one not so adjusted. Thus when the signals have vanished from the circuit including the point *O* the switch may be moved over to *P* and the signals be found in strength in the loosely covered secondary.—London *Electrician*, March 27, 1914.

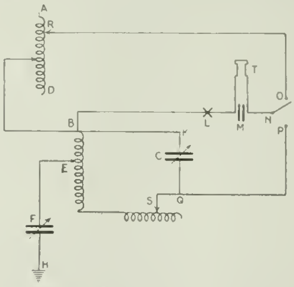
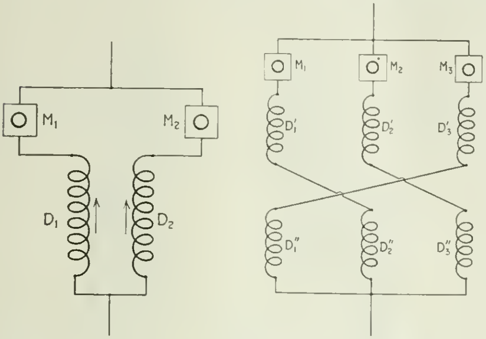


FIG. 2—CONNECTIONS TO FACILITATE TUNING OF RECEIVERS

Working Microphones in Parallel.—W. H. Eccles.—In the concluding portion of his illustrated serial on recent patents in wireless telegraphy and telephony a method of R. Goldschmidt is described which enables microphones to be worked in parallel satisfactorily. As it is impossible to make two microphones which will remain perfectly alike electrically, it has hitherto been necessary to use microphones in series. The present invention overcomes the difficulty for a pair of microphones by putting in series with each microphone a coil so wound that the surging of the compensating currents which always arises through unequal operation of the instruments is prevented by the mutual inductive action of the coils. Fig. 3 shows the arrangement: M_1, M_2 are the microphones, and D_1, D_2 are coils wound oppositely on a common core. Equal currents down the coils cancel each other's magnetic field, but a circulating current would build up a field and therefore experiences a great choking effect. When more than two microphones are to be connected in parallel they may be caused to work uniformly by pairing them and applying the above method. But a more advantageous arrangement is that shown in Fig. 4, where coils D_1' and D_1'' act on each other, and the remaining coils are paired similarly. Still another method is given in the specification. A coil in series with each microphone acts on one and the same secondary current. If the microphones operate unequally, the presence of the secondary tends to choke the circulating current; if they operate equably, the secondary current tends to neutralize the self-inductance of the coils. The method promises to be of importance in radiotelephony. It suggests, by the way, the possibility of making oscillatory arcs work in parallel.—London *Electrician*, March 27, 1914.



FIGS. 3 AND 4—ARRANGEMENT TO PREVENT SURGING OF COMPENSATING CURRENTS

Telephony in Rural Districts.—An illustrated article on the Steidle telephone system in use in Germany. There are a manual main exchange and automatic sub-exchanges.—London *Electrician*, March 27, 1914.

Book Reviews

Elements of Electrical Engineering. Edited by J. L. LaCour. Vol. I. Theory and Calculation of Electric Currents. By J. L. LaCour and O. S. Bragstad. Translated by Stanley P. Smith. New York: Longmans, Green & Company. 482 pages, 404 illus. Price, $5.

This well-considered book will be of great use to the electrical engineer. Any scholarly treatise is of much value, when compared with the enormous quantity of slipshod and careless contributions to what is termed "technical literature." The book contains much to interest the student of alternating-current phenomena. The chapters on inversion are not only extremely interesting but also fraught with practical results. Other chapters of interest are those on impedances in series and in parallel circuits. The chapter on capacity in circuits is remarkably simply and clearly treated; it is doubly valuable on account of a discussion of distributed capacity. Load diagrams of electric circuits, leading to the circle diagram, are discussed with skill and interest. A chapter on harmonic analysis and one on resonance, with remarks on the wave-shape, are of interest. Load diagrams of polyphase circuits are lucidly presented. The subject of eddy-current losses in conductors, as first presented by Messrs. A. B. and M. B. Field, is given in considerable detail. The book may be heartily recommended.

Practical Uses of the Wave-Meter in Wireless Telegraphy. By J. O. Mauborgne. New York: McGraw-Hill Book Company, Inc. 74 pages, 42 illus. Price, $1.

This book is an outgrowth of a pamphlet printed for use at the Army Signal School, Fort Leavenworth, Kan. The author begins with a series of fundamental definitions and relations, and proceeds to describe the basic operation of all wave-meters of the resonance type. The Pierce meter and three types of Telefunken instrument (all of which are used by the United States Signal Corps) are discussed in detail. The later chapters contain specific instructions for and examples of wave-meter measurements of open and closed circuit wavelength, coupling inductance, capacity, decrement, etc. Attention is given to the adjustments necessary to make transmitters comply with the various federal regulations as to wave-length and radiation purity. The measurement of received wave-lengths is described, and a full-page chart which simplifies computation of frequencies and wave-lengths from inductance and capacity, or vice versa, is presented. In future editions a discussion of simpler methods of measuring antenna constants and of the adjustment of "quenching" transmitters would be welcomed. As the book now stands it should be extremely useful to all who have occasion to make resonance measurements at radio frequencies.

Problems in Alternating-Current Machinery. By Waldo V. Lyon. New York: McGraw-Hill Book Company, Inc. 136 pages. Price, $1.50.

Collections of problems for the use of engineering students are always of somewhat doubtful value to any but the compiler, unless they appear as numerical examples in school textbooks. It is easy to originate problems, but all problems involving the theory of electrical machines are not of equal value in familiarizing the student with the fundamentals of electrical engineering. The problems here presented by Mr. Lyon have the merit of being carefully developed by an instructor whose experience enables him to judge accurately of their educational value. The problems refer to transformers, synchronous generators and motors, induction motors, converters, polyphase circuits, and non-sinusoidal waves. The answers are not given, but will appear as a second volume in the fall of this year. It is admittedly difficult to preface the various groups of problems by introductory material and explanations which shall be of value without occupying too much space, and the author has decided to omit entirely any such introductory paragraphs. He may be justified in his decision; but, on the other hand, there are many problems which must of necessity present difficulties not only to students but also to instructors not thoroughly familiar with the courses of instruction on which these problems presumably are based. The exact predetermination of alternator regulation under various load conditions is generally admitted to be impossible on the usual sine-wave assumptions, which alone justify the use of vectors; but some methods of calculation are easily recognized as being worse than others. Problems in alternator regulation are based on the "synchronous impedance," the "magnetomotive force," and the "general" methods. The reader who does not understand these terms is, of course, unable to solve these particular problems, and it is doubtful whether the publication of the answers will help him to any appreciable extent. The difficulties in the way of producing a book of problems without explanatory matter must not, however, be underestimated, and this collection will in any case prove suggestive to teachers of electrical engineering, even if they cannot use all the problems without first adapting them to their needs.

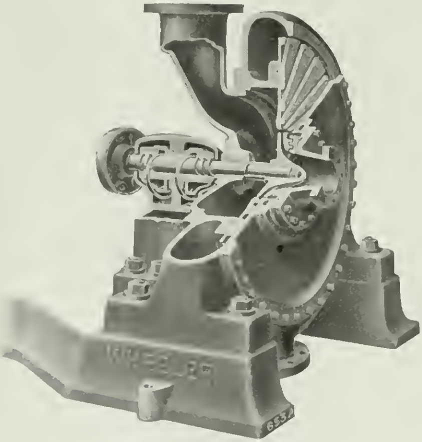
New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Turbo-Air Pump

The turbo-air pump illustrated herewith consists of a high-speed impeller, a ring of diffusion channels and a casing. The impeller discharges water in separate streams into the fixed compression or diffusion ring, and the blades of this ring cut the jets of water into a large number of layers which close the channels and force the entrapped air out against atmospheric pressure. Air is admitted to the center of the casing by a large nozzle on the bearing side of the pump and is drawn into the diffuser around the impeller. Use is made of a small-diameter impeller which rotates at very high speeds, being thus suitable for directly connected turbine drive.

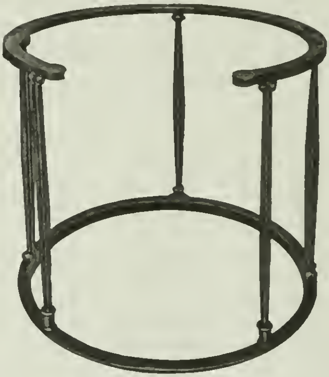
In a test on this pump with the temperature of the water at 70 deg. and the air-suction passage cut out a vacuum 100 per cent of the theoretical was maintained. With 10 cu. ft. of free air per minute the pump maintained a 29.1-in. vacuum, corresponding to a vacuum of 99.7 per cent of the theoretical. With 18 cu. ft. of free air per minute there was a vacuum of 29 in. This corresponds to a 99 per cent vacuum, which is greater than that of a large surface condenser with normal leakage.


AIR PUMP FOR TURBINE DRIVE

This pump is manufactured by the Wheeler Condenser & Engineering Company, Carteret, N. J., and is similar in design to the rotary pump made by the Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.

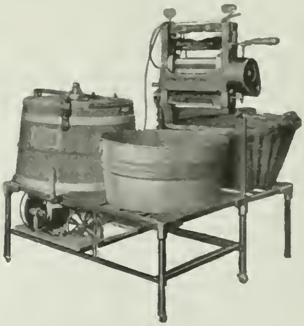
Manhole Guard

A manhole guard with two horizontal steel rings which are supported by five hinged metal uprights is shown herewith. The top ring is provided with an opening for access to the manhole about which it is placed. By means of the hinged arrangement the guard is made collapsible. When in position two loose sleeves on the lower ends of the two front uprights forming the entrance to the guard engage with stubs on the front half of the bottom ring and hold the uprights in place so that the guard will not collapse. Steel and malleable-iron fittings are used in the construction of this guard, which is manufactured by the Universal Cable Grip Company, Syracuse, N. Y.

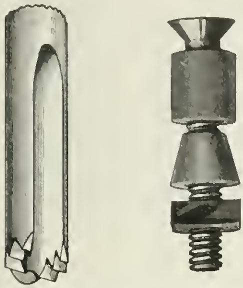

MANHOLE GUARD WITH HINGED UPRIGHTS

Electric Bench Washing Machine

The electric bench washer shown in the accompanying illustration is equipped with a platform made of angle iron, gas pipe and malleable-iron corners. The side table can be easily removed. The total floor area occupied is 24 in. by 39 in. The tub is attached firmly to the platform and has a bottom outlet. The wringer can be swung to any desired position and a safety release insures against injury to the clothes or the operator's fingers. The lightest and the heaviest articles are handled without changing the tension. This machine is manufactured by the Automatic Electric Washer Company, Newton, Ia.


ELECTRIC BENCH WASHER

Tools for Drilling



FIGS. 1 AND 2—CUTTING EDGES OF BIT, AND EXPANSION BOLT

A set of tools for drilling holes in stone, concrete and brick which will prove valuable to wiremen has been placed on the market by the Chicago Expansion Bolt Company, 1808 North Forty-second Avenue, Chicago, Ill. An expansion bolt and bridle ring are also being made by this company. The manufacturers claim that with the rapid-cutting bit and the improved accessories labor cost can be materially reduced without impairing the installation. The cutting teeth of the bit are arranged so that each stroke applies a cutting surface at a new point, thus eliminating the centering tendency. Dust is removed from the drill hole through a slot in the shank of the bit. With the expansion bolt force is applied by means of a screwdriver to wedge the steel cone into the lead and spread the lead so as to fill the hole. With the ring a hollow-shanked drill is used.

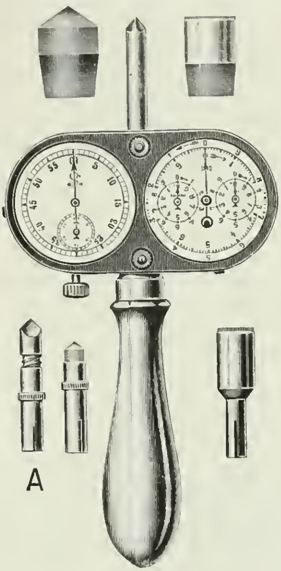
Electric Letter Sign

LETTER SIGN

Each unit of the electric letter sign shown herewith is made up of four parts, a porcelain base, a 10-watt lamp, a lantern and a glass letter. The base is equipped with a small brass projection at one end which fits snugly into the adjoining base. The lantern fits securely over the neck of the porcelain base and its finish is a telephone-black on the outside and a blue-white on the inside. This lantern is open from the front and the back and therefore permits one to insert the glass letter in the front, leaving the back open, or to use the letters in both the front and the back. In the former case it is well adapted for display-window lighting, the white interior of the lantern reflecting the light into the window without affecting the brilliancy of the sign; in the latter case a sign that can be hung in a store and read both ways is the result. The letter is made of black flash opal glass with a high finish. Porcelain spacers are provided for separating the words of the sign. The porcelain bases fit into a metal trough which is furnished in sections. These sections may be joined together to accommodate any length of sign. The width of all letters and space blocks is 2.75 in. This Midas sign, as it is called, is being placed on the market by the Mercantile Advertising Company, Broadway and Herald Square, New York.

Combined Speed Counter and Stop-Watch

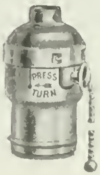
The instrument shown in the accompanying illustration consists of a speed counter and a non-magnetic stop-watch. The counter dial is graduated to read speeds up to 10,000 r.p.m., and the instrument may be used, it is claimed, on shafts rotating at speeds as high as 20,000 r.p.m. without injury. Revolutions in either direction are registered, and the direction of rotation is indicated by the appearance of a red or black disk on the dial, the color of which agrees with that of the corresponding dial figures.



SPEED COUNTER AND STOP-WATCH

To use the "tachoscope," as it is called, it is merely necessary to press the spindle upon the end of the shaft under test. This operation starts the watch and the counter simultaneously, and they run as long as the instrument is held in position. When the instrument is removed the pointers show the time elapsed and the number of revolutions made until returned to the zero position by small levers provided for the purpose. The instrument is inclosed in a morocco leather carrying case, and the total weight, including that of the case, four tips of different sizes, an extension piece and a bottle of oil, which are assembled in the case with the instrument, is 1.375 lb. Mr. James G. Biddle, 1211 Arch Street, Philadelphia, Pa., is the importer of this device.

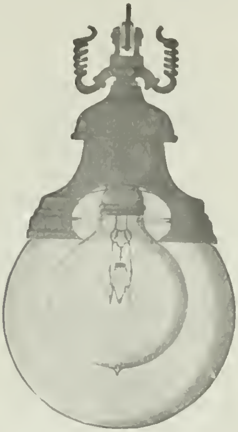
Pull-Chain Socket



The pull-chain socket shown in the accompanying illustration is being placed on the market by D. R. Ostrander & Company, 22 Dey Street, New York. The chain is completely insulated from the live parts of the socket. The socket is equipped with a double-make and double-break mechanism which is designed to carry a considerable overload without affecting the contacts. The cap and shell are connected firmly together, as shown in the cut.

Tungsten Lamp with Large Outer Globe

A tungsten lighting fixture with large outer globe for either outdoor or indoor use is being placed on the market by the Post-Glover Electric Company, Cincinnati, Ohio. Solid bronze is used throughout. The fixture is equipped with a reflector of baked-porcelain enamel and either a standard screw-base socket or a mogul socket. Either the ordinary tungsten lamp or the nitrogen-filled 750-watt or 1000-watt unit can be used. This fixture, which is known as the "Flam-bo," is made weatherproof. No set screws or other parts which are liable to rust are used.



TUNGSTEN LAMP WITH OUTER GLOBE

Electric Glue Heaters

In the heating of glue, when steam is used, only about one-fifth the amount of heat generated is said to be used in the actual heating of the glue. Four-fifths of the heat energy, therefore, radiates through the pipes and creates a heat that in summer tends to reduce the efficiency of the workmen. With gas the same results are obtained, with the added risk of fire. With electricity, using a heat-retaining jacket to conserve the heat, waste energy is reduced to a minimum, and a safe, convenient and cheap heating agent is the result.

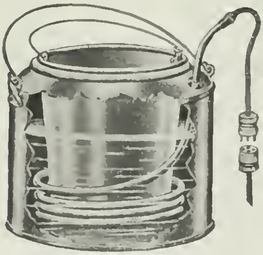


FIG. 1—ELECTRIC GLUE HEATER WITH HEATING COIL

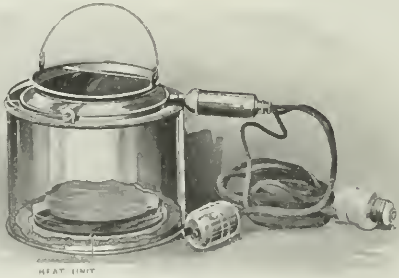


FIG. 2—ELECTRIC GLUE HEATER WITH DISK HEATING ELEMENT

In the illustrations herewith are shown electric glue heaters made entirely of copper and brass. In Fig. 1 is shown a portable glue heater with a single pot and a single water-jacket and a heat-retaining jacket surrounding the water which is made of a material that is a non-conductor of heat. It is heated by a coil as shown and can be connected to any ordinary lighting socket. The heater shown in Fig. 2 has a disk heating element. It is also provided with a water jacket and a heat-retaining jacket surrounding the water. The heater shown in Fig. 3 is similar in construction to the two heaters described above, but it is not portable. It is made in sizes with capacities varying from 2 gal. to 50 gal. When complete this heater is supplied with a thermometer, a stand and a water gage.

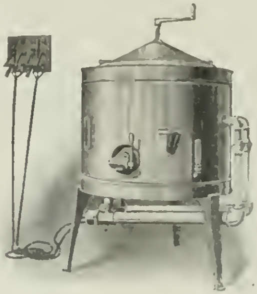
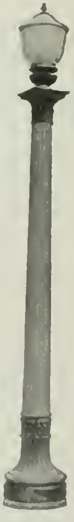


FIG. 3—NON-PORTABLE ELECTRIC GLUE HEATER

These electric glue heaters are manufactured by the Advance Machinery Company, Toledo, Ohio.

Single-Lamp Standard for High-Efficiency Lighting

A single-lamp standard having a globe of ornamental design is being manufactured by the Holophane Works of the General Electric Company, Cleveland, Ohio. The globe consists of two pieces. The upper part is made of a dense opal glass known as "Pyro," and the lower part of an opal glass of light density. The upper portion serves the purpose of a reflector. The unit is designed for use with high-efficiency tungsten lamps of either the multiple or series type. With a 750-watt multiple tungsten lamp the maximum candle-power is said to be 950 at an angle of about 65 deg.



SINGLE-LAMP STANDARD

Jobber, Dealer and Contractor

Noteworthy Features of New England's Largest Jobbing House

Two notable features deserve special emphasis in the electrical jobbing house of the Pettingell-Andrews Company, of Boston, Mass.: the specialization of the concern in illuminating engineering and fixture merchandising and the comprehensive display accorded electrical household conveniences in connection with a broad policy of co-operation with contractors and dealers. The establishment is situated in the wholesale district of the city, and the company does not strive to capture a large volume of retail trade in competition with local dealers, its policy being rather to supplement the activities of the latter in the sale of supplies by making itself as useful as possible to the trade as a whole. To accomplish this, an extensive stock of electrical conveniences is carried in the company's storehouse adjoining the main offices and a liberal space is set aside on the ground floor of the latter for the accommodation of visitors, whether these are sent to the house by New England central stations, by contractors and local dealers, or whether they call upon their own initiative.

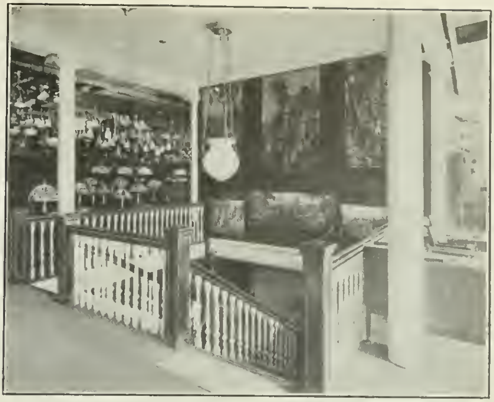


FIG. 2—ENTRANCE TO FIXTURE STUDIOS

Fig. 1 illustrates the display facilities of the house as one enters the offices. Visitors are cordially greeted at the information desk shown in Fig. 3 and, in case waiting is necessary, are invited to make themselves at home at a large reading table provided with the latest issues of the principal electrical periodicals. The trade-mark monogram of the house, 6 ft. square and illuminated by five 15-watt tungsten lamps, is shown in Fig. 3, and the general lighting of the appliance exhibition room is by 250-watt tungsten lamps installed in indirect reflectors. Liberal space has been allowed for passage between tables, counters and large apparatus units shown upon the floor. In the foreground are

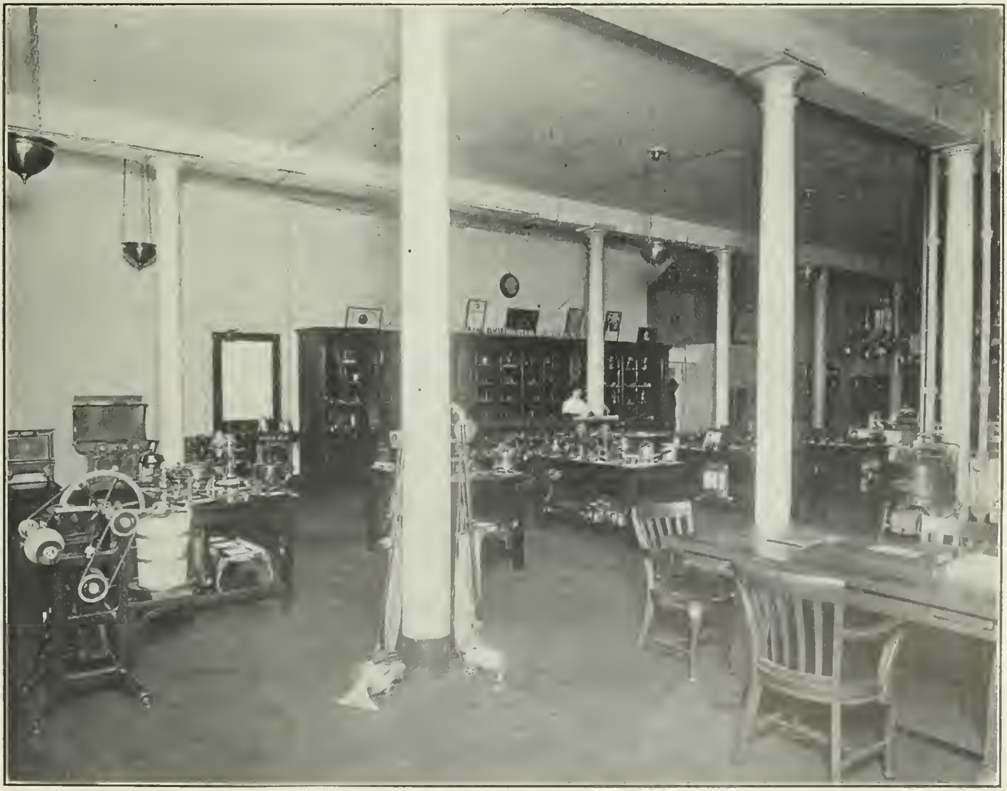


FIG. 1—APPLIANCE DEPARTMENT, PETTINGELL-ANDREWS COMPANY

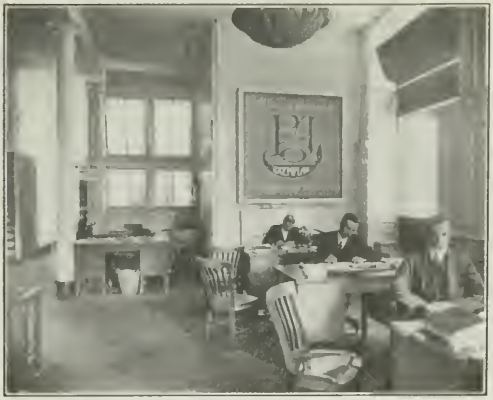


FIG. 3—ILLUMINATED TRADE-MARK MONOGRAM

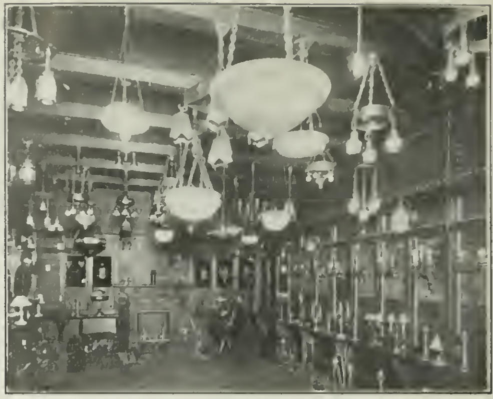


FIG. 4—ENGLISH ROOM

shown utility machinery, heating and cooking appliances, washers and other products of interest to the householder, while against the rear wall a striking display is provided in the form of a mahogany cabinet 25 ft. long, 8 ft. high and 30 in. deep, equipped with four plate-glass shelves and surmounted by a sign "Electrical Household Conveniences," formed on Stanley block letters of 15 watts rating each. The house is strongly opposed to merchandising electrical equipment as "energy-consuming devices," preferring to emphasize the convenience of apparatus in the home and elsewhere instead of its expenditure aspects. The main showcase is illuminated by fifteen 40-watt tungsten lamps mounted in a reflector trough at the top of the cabinet. Miscellaneous heating appliances are shown in the cabinet, and in front of it is a plate-glass showcase for smaller devices, such as flash-lamps, battery instruments, medical coils, clock lamps, etc. A counter at

FIGS. 5 TO 8—OAK, FRENCH, COLONIAL AND SILVER ROOMS

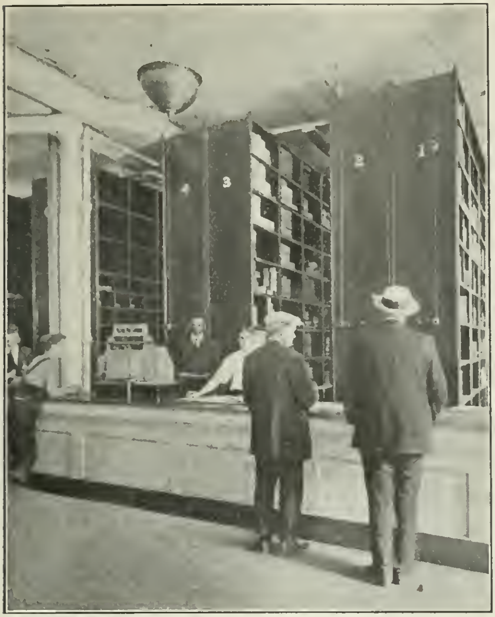


FIG. 9—SUPPLY DEPARTMENT SALES COUNTER

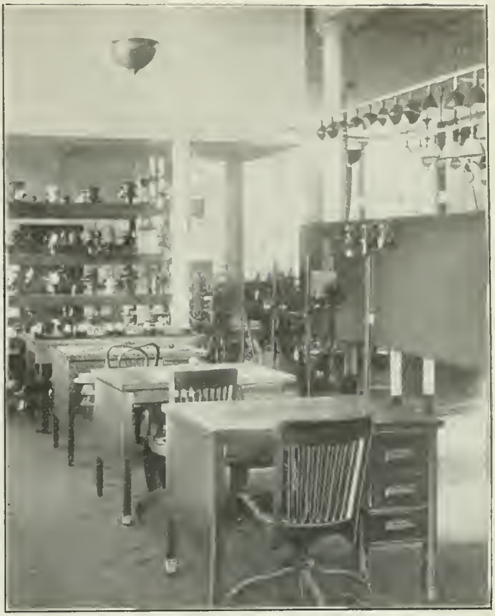


FIG. 10—LAMP-SHADE EXHIBIT

the right is equipped with four outlets for testing, each outlet having a red pilot lamp indicating when the circuit is alive.

At the rear of the appliance department space is set apart for the display of switches, motors and heavier equipment. Fig. 10 shows the method of exhibiting industrial lamp shades by attaching them to conduit carried about 10 ft. above the floor in a horizontal rectangle, and a convenient method of exhibiting cross-arms and insulators for transmission lines. A saving in first cost of mounting this equipment was made by attaching the arms to pairs of posts supporting a stairway to the second floor. The usual 5-ft. 6-in. arms are shown spaced 16 in. apart on centers, and forty-seven insulators are shown in a space about 6 ft. square and 5 ft. high. Suspension and pin-type insulators are shown, the former being hung from an iron rod at the side of the inclosure. The sale of supplies is handled at a counter illustrated in Fig. 9, behind which are unit steel stock shelves with sliding ladders providing for easy access to the upper tiers.

The fixture studios, on the second floor, consist of five principal display rooms, offices for the head of the department and an area set apart for the exhibition of mercantile and industrial fixtures, provision for the designing staff being made in adjoining quarters. Fig. 2 is a view of the main stairway leading to the studios, several tapestries and an alabaster fixture inclosing four 25-watt tungsten lamps adding much to the attractiveness of the furnishings. The display rooms are en suite, and are decorated artistically according to a carefully prepared plan. There are a colonial room, 25 ft. long; a silver or blue room, 16 ft. long; an English room, 30 ft. long, all three being 19½ ft. wide; an oak room, 30 ft. long, and a French room, 20 ft. long, both being 16 ft. wide. All the rooms are 11½ ft. high. They are wired for a total of about 900 outlets in walls, ceilings and baseboards, the various circuits being controlled by gang push switches mounted in wall-plates about 4 ft. above the floor.

In general, each room is wired with rows of ceiling outlets containing seven outlets per row, as shown in Fig. 6, the French room, and Fig. 7, the colonial room. Every fixture displayed is controlled either from a push switch in the wall or by a flexible cord and plug. Each wall panel is provided with an individual fixture, and the tables, shelves and other furniture are arranged for the most effective display of portable lamps and standards in great variety. All the rooms are inside chambers, no daylight being admitted, and each may be cut off from its neighbors by heavy portières harmonizing with the color scheme. Portable plush-covered 18-in. by 30-in. panels are also provided with individual fixtures in each for various displays. The French room contains twenty-four wall switches, the English room thirty-five, the oak room thirty-eight, the silver room thirty-five, and the colonial room thirty-three. Effects can be obtained singly and in any desired combination, and the treatment of each lighting installation as an independent problem has been an important factor in the growth of the business. The company does not engage in electrical contracting, but hangs fixtures with its own force when necessary. Its advice has proved its value to both contractors and customers.

House-Wiring Campaign at Cambridge, Mass.

An energetic house-wiring campaign was started by the Cambridge (Mass.) Electric Light Company on March 9, to run until July 1. By arrangement with local contractors the company offers to provide the householder occupying six rooms and a basement with ten lamps, fixtures and shades, wired complete, with tungsten lamps, at a price of $47.50. In a return post card sent to householders the company illustrates the types of fixtures included in its offer and provides space for a notification that a call from a lighting expert is desired at no expense to the signer.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Cleveland Utility Using Terry Turbines for Operating Boiler-Feed Pumps.—The Terry Turbine Company, of Hartford, Conn., has recently received an order for two turbines for driving boiler-feed pumps in the Lake Shore station of the Cleveland Electric Illuminating Company, and when these are installed there will be fourteen of this manufacturer's turbines in service in the station mentioned.

Illinois Manufacturers' South American Excursion a Success.—Edwin N. Hurley, leader of the excursion to South American states conducted by the Illinois Manufacturers' Association and president of the Hurley Machine Company, has returned to Chicago. He reports that his delegation received a hospitable welcome and that the tour was a successful one. Mr. Hurley thinks that the interchange of visits between public men and business men in the United States and the South American countries is mutually beneficial.

Extent of the Illuminated Signboard Industry.—According to the daily newspapers, the Chicago manager for the Thomas Cusack Company testified in a recent lawsuit that his company maintained 1500 billboards in Chicago. Of this number it is said that between 400 and 500 are illuminated at night. This statement gives an idea of the extent to which illuminated billboards are used in general and local advertising. The testimony was introduced in a case brought by the Cusack company against the city in an effort to have the city enjoined from enforcing an ordinance requiring billboard companies to procure frontage permits before erecting signs.

Electric Ranges Given Same Freight Classification as Gas Ranges.—By the action of the Western Classification Committee electric ranges for cooking are now given the freight classification of third-class in less than carload lots and fifth-class in carload lots where the minimum carload is 20,000 lb. Where the minimum carload is 24,000 lb. a better rate is obtained. This action places the electric range and the gas range in the same classification. The Canadian roads have made the same rate. George A. Hughes, of Chicago, president of the Hughes Electric Heating Company, has been active in the effort which resulted in the railroads taking this action. He appeared before the Western Classification Committee and showed that the electric range is now in competition with the gas range and should have the same freight rate.

Molded Insulation Applied to Commutator Construction.—The General Bakelite Company, maker of the insulating material of that name, has given out particulars concerning a new application of its product. About two years ago experimental work began with the object in view of improving on the old mica V-ring style of commutator assembling, which was expensive, complicated and liable to disarrangement during operation. After much work on the subject a new method for securing the commutator bars was evolved by which they are molded into the insulating material, which is reinforced by metal rings also embedded in it. This method has reached its most extended use within the last two months, a number of prominent manufacturing companies applying it to the construction of small and medium-sized commutators with gratifying results.

Generating Stations Installing New Apparatus.—Among the electrical-energy-supply projects in this country which are at present engaged in making extensions is the Sierras Construction Company, Riverside, Cal., which is planning the installation at its Imperial Valley (Cal.) plant of a 2000-kva synchronous condenser, three 1250-kva and nine 300-kva transformers, with switchboard and accessories. The Montana Power Company, Butte, Mont., will shortly install a 3750-kva alternating-current generator in one of its stations. The Pittsford Power Company, Rutland, Vt., has purchased recently a 1250-kva alternating-current generator, three 400-kva water-cooled transformers, and a switchboard. An order has been placed by the Florida Power Company, of Ocala, Fla., for two 200-kva transformers, and the Towaliga Falls Power Company, of Griffin, Ga., will add to its equipment a 1600-kva alternator and switchboard. All of this apparatus has been, or is being, supplied by the General Electric Company.

Large Boiler Order from Philadelphia.—The Babcock & Wilcox Company has recently secured an order from the Philadelphia Electric Company for 20,180 hp of boilers, with superheaters, and this, together with other large orders recently received, makes an aggregate of 46,300 hp of boiler equipment to be supplied by the above manufacturer. This company is finding present conditions in its line very good. There is a good volume of small orders, which in its case is welcomed in place of the same volume of larger orders. Also, as indicated above, there have been some orders of good size received, and the outlook for future business is excellent.

Wire Company Sees Poor Business Conditions Ahead in the Northeast.—The American Electrical Works have pending orders for thousands of dollars' worth of their various wire products, but because of the present dullness these orders cannot be satisfactorily closed. A representative of that company, recently returned from a trip through Eastern and New England territory, stated that the business sentiment in New York State, New England and Canada is very pessimistic. He said that everywhere he found signs of retrenchment and that improvements and extensions that have been planned and are needed have been held up for a more favorable time. Questioned as to his company's operations during the active portion of last year, he said that, while it had experienced a large volume of business at that time, the margin of profit was small, so that the actual prosperity was less than the surface conditions might have indicated. The recent immense foreign shipments of copper were stated by him to represent the efforts of the producers to keep prices in this country from complete demoralization and he said that to his own knowledge copper has recently been used to some extent as ballast for ships, constituting thus a hidden stock.

Steel Mills Buying Electrical Equipment.—A partial index to activity in the steel business at the present time is afforded by the following record of electrical equipment orders recently placed by several of the large steel companies with the General Electric Company. The Pennsylvania Steel Company, Philadelphia, Pa., will shortly add to the equipment of its mills at Steelton, Pa., a 450-kva regulating set, a 600-hp induction motor and a switchboard. The Detroit (Mich.) Seamless Steel Tube Company is planning to install two new 300-hp induction motors, with control equipment and switchboard. Orders have recently been placed by the Indiana Steel Company, Chicago, Ill., for twenty-seven 15-hp motors. From the Worcester (Mass.) Pressed Steel Company orders have been received for three 300-kva transformers and a 500-hp induction motor, with auxiliary equipment. Work is now progressing on a 4000-kva, two-unit, three-bearing motor-generator set with combined exciter and blower set for the American Iron & Steel Manufacturing Company, Lebanon, Pa. The John Wood Manufacturing Company, Conshohocken, Pa., has placed orders for two 200-kw rotary converters, four 110-kva transformers and a switchboard. The above manufacturer has also received an order from the Jeanesville Iron Works Company, Hazelton, Pa., for three 200-hp induction motors with compensator.

New Line of Small Induction Motors Coming Out.—The Richmond Electric Works, of Richmond, Va., are planning the introduction within a short time of a new line of small induction motors of from ¼ hp to 7½ hp rating, for which they think there is a demand in the market they serve. This company is also arranging at present for the opening of its own office in Philadelphia.

Large Electric Garage Opened in New York City.—Announcement is made of the opening of the Exide Battery Depots, Inc., on Twenty-third Street near Tenth Avenue, New York City. This garage, exclusively for electric vehicles, is modern and complete in every respect. With room for 100 commercial electric cars, it is claimed that it is one of the largest public garages in the country. The United Electric Light & Power Company, which supplies the electricity used in this service station, has been instrumental in introducing a great number of cars and is waging an energetic campaign in bringing the attention of New York's merchants to the economies effected by the modern electric vehicle.

New Electric Heater Developed.—The Electrical Steam Radiator Company, of 130-132 Commercial Street, Portland, Maine, has developed a new form of heating unit, consisting of a steam radiator the steam for which is generated electrically. The apparatus is portable and is made in three sizes, the smallest being about 1 ft. high by about 2 ft. long and the largest being the same length and about twice as high. The small unit will draw 350 watts and the two larger ones will take 500 watts. The apparatus weighs from 18 lb. to 25 lb. and can be operated from an ordinary lighting socket. The control is automatic, being regulated to open and close the circuit between desired limits, and the only care needed is to fill the water tank about once in three months. The officers of the above company are J. D. Ross, president; C. T. Swett, treasurer and general manager, and A. M. Robbins, assistant general manager. Mr. Ross is the inventor of the device, and Mr. Robbins, who will have charge of the sales arrangements, has been connected with various electrical enterprises in and around Boston, Mass., for the past ten years. The main office and factory of the company is at the above address, and a branch office has been established at 437 Oliver Building, Boston, Mass. Arrangements are under way for establishing branches in New York City, Buffalo, Chicago, St. Louis, St. Paul and Minneapolis.

Winter Rains and the Cost of Energy.—The year 1913 was not in all respects an easy one for the hydroelectric companies in the Pacific States, but it may be remembered that statements which were given out by officials of some of those companies during the latter part of last year forecast a better condition for 1914. It is gratifying to note that the truth of these predictions is being confirmed by experience. There are various reasons for the decreased operating expenses which one or two of the hydroelectric companies are now having to meet, and while there is no doubt that one of the most substantial of these is attributable to a cause quite beyond the control of the offices of those companies, its effect on efficient operation is none the less plainly marked. The California rains of last winter—the first of any consequence for three years—have put the pondage at the headworks upon a thoroughly adequate basis, and for many months to come no fears for insufficient water need be entertained. This natural factor has an appreciable effect on the fuel consumption of the auxiliary steam stations, and, in conjunction with other considerations, will continue to exert a favorable influence on the 1914 expense sheet. For the first two months of the present year the Pacific Gas & Electric Company of California reports an increase in gross of $240,574, a decrease in operating expenses of $67,137, and an increase in net of $307,711 (24.8 per cent gain over the corresponding period of 1913).

General Electric Company Developing New Type of Railway Motor for Use in Pittsburgh.—In connection with the equipment of a number of low-floor cars by the Pittsburgh Railways Company orders have been placed with the General Electric Company for the design and construction of 100 sets (of four motors each) of a new type of railway motor. This motor, to be known as the GE-274, is to be of the box-frame, commutating-pole type, with a nominal rating of 30 hp on 500 volts. The two most striking features of the new cars will be their small weight and the small diameter of their wheels, which items are 18 tons and 24 in. respectively. The cars will carry the same number of passengers as those now in operation and will operate on schedule speeds of from 9½ to 10 miles per hour, with about nine stops per mile estimated. The motor design is characterized also by a marked reduction in weight and an improved system of ventilation. The field coils of these motors are to be asbestos-insulated and impregnated, giving them a solid structure, practically indestructible and moisture-proof. They are to be supported on spring metal seats and to be securely held from movement in any direction by spring flanges, resulting in evenly distributed pressure, and preventing abrasion of the insulation. The armature shaft is removable without disturbing the commutator connections or windings. The armature itself is banded while hot. The control system to be used is the Sprague General Electric type M, arranged to operate on the Jones system, designed by P. N. Jones, general manager of the Pittsburgh Railways Company. By this system a permanent series connection is used between the four motors in a unit equipment, and by a combination of series and multiple steps acceleration is completed with practically all of the resistance cut out, thus saving rheostat losses.

How Some Electrical Manufacturing Companies View the Parcel Post.—The parcel post service, now in operation about fifteen months, was early seized upon by electrical manufacturers and supply dealers as a cheap and quick method for shipping small lots or single pieces of apparatus within the weight limit. In connection with this service there has been some criticism recently to the effect that the liability to breakage of goods when sent by parcel post is greater than when handled by express. Several concerns recently visited by an *Electrical World* representative have expressed opinions on this phase of the matter, and these opinions vary somewhat. W. H. Bliven, of Harvey Hubbell, Inc., maker of lighting specialties and wiring devices, stated that his company has shipped a good deal by parcel post and found it cheaper than the equivalent express service, but part of the difference, he thought, was made up by a larger amount of breakage when the former method is used. R. V. Sutliffe, New York representative of the Hoyt Electrical Instrument Works, said that that concern has adopted the parcel post for all shipments, unless otherwise specified, and that with careful packing little or no difficulty has been experienced from breakage in transit. The Electric Controller & Manufacturing Company has found the parcel-post service advantageous in the shipping of replacement parts. According to R. G. Widdows, the New York sales manager of that company, no trouble has been found from breakage in this connection, which is explained in part perhaps by the substantial character of the parts shipped.

Exhibiting the Electric Truck.—The value of a well-selected exhibition of electric trucks as an aid to the sale of such equipment appears to have been overlooked at the recent commercial motor-vehicle show in Boston, where only two manufacturers of battery-operated business cars displayed their wares. A contrast was afforded by the gasoline-truck exhibits, these machines being shown by the score to thousands of interested visitors, not a few of whom noticed the absence of a proper display of electric trucks and perhaps drew the wholly false conclusion that in some way the latter are falling behind the times. The two electric-truck dealers who exhibited were more than repaid for doing so, and an increased volume of sales is directly attributable to the interest aroused at this show, which was perhaps the only comprehensive display of commercial motor vehicles that has been made in the country this year. It is understood that a good many electric-truck dealers and manufacturers were not in favor of a show at Boston or anywhere else this year, and that this was the reason why such a nominal exhibition was made. There is no question that frequent shows are burdensome and tedious and that they cost a good deal of money both directly and indirectly; but, on the other hand, the interest of the business world in motor vehicles is growing to a degree which is steadily driving the horse off city streets, and it is certainly a step backward not to take advantage of every reasonable opportunity to convince the public of the efficiency of this modern method of transportation. It is not the province of the central station to bear the cost of such exhibits, although there is a field for broad co-operation in the supply of energy and garaging facilities at moderate prices. Certainly, the electric truck has come to stay, and there should be a general recognition of the fact among manufacturers that whenever competitive equipments run by gasoline are displayed on a large scale the electric vehicle should have its rightful place under the same roof, where its good points can be dwelt upon and its limitations cheerfully admitted as the stream of inquiring visitors flows by. It may be good policy to forego giving a show for a year or so—this depends upon local conditions—but once a show is decided on, let the electric truck have its opportunity to claim popular attention. It is all well enough to contend that the best exhibit is a working truck on the highway; but the fact remains that there is no place like a well-organized show in which to develop popular interest in one's product through direct, personal methods and close contact with the actual equipment under conditions favorable for searching examination of its design and construction.

What Some Electrical Manufacturers Think About the Proposition of Increased Freight Rates.—In answer to an inquiry concerning the advisability of allowing the railroads of the country an increase in freight rates, the following opinions have recently been received from several large manufacturers of electrical apparatus and material. The Bristol Company, of Waterbury, Conn., maker of electrical instruments, has found its rail shipments to be handled promptly and in other ways satisfactorily, but does not know whether or not an increase in rates is desirable. J. C. Belden, president of the Belden Manufacturing Company ,of Chicago, Ill., maker of insulated wire and other electrical materials, states that the transportation conditions have been found satisfactory by that concern, except that the railroads will evade all just claims until forced to settle. He says that when the railroads generally buy their goods on a basis of free and open competition he will have more sympathy for their demands for higher freight rates. G. A. True, president of the Northern Engineering Works, of Detroit, Mich., makers of electric traveling cranes, states that his company has found transportation conditions good, that its railroad shipments have been satisfactorily handled, and that in his opinion the roads are entitled to the increased rates. Edmund J. Burke, president of the Blake Signal & Manufacturing Company, of Boston, Mass., says that the railroads' ruling that their minimum charge is their first-class rate per 100 lb. is excessive and unreasonably discriminatory against small shipments. He thinks that the present freight rates are ample for the service rendered. A Southern manufacturer of motors states that the transportation conditions in his vicinity are very satisfactory, with the exception of the express service. His rail shipments are usually handled in a satisfactory manner.

NEW YORK METAL MARKET PRICES

	—Apl. 14—		—Apl. 21—	
Copper	Bid	Asked	Bid	Asked
Standard spot*	13.50	14.20	13.40	14.00
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	64 5 0		64 6 3	
Prime Lake	14.62½	to 14.87½	14.50	to 14.75
Electrolytic	14.30	to 14.40	14.20	to 14.30
Casting	14.10	to 14.20	14.05	to 14.15
Copper wire base	15.75	to 15.87½	15.50	to 15.75
Lead	3.80		3.80	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.25½	.....	5.15	to 5.25
Tin, spot	36.45	to 36.75	35.45	to 35.65
Aluminum:				
Prompt delivery	18.00	to 18.25	18.00	to 18.25
Future	18.00	to 18.25	17.87½	to 18.12½

*OLD METALS

Heavy copper and wire	13.62½	13.25
Brass, heavy	8.62½	8.62½
Brass, light	7.62½	7.62½
Lead, heavy	3.80	3.80
Zinc, scrap	4.25	4.15

*COPPER EXPORTS

Total tons to Apl. 21	22,173

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*From daily transactions on the New York Metal Exchange.

Corporate and Financial

February Returns of Central Stations.—Central-station returns for February, 1914, have been received by the *Electrical World* from companies generating altogether about one-half of the entire output of the country. For these properties the gross earnings increased from $13,403,175 in February, 1913, to $14,713,000 in February, 1914—a gain of 9.7 per cent for the year. Returns from cities of different size in the State of Massachusetts show a marked uniformity and indicate that the rate of annual increase established by the census reports of 1907 and 1912 is being well maintained. In that five-year period gross income grew from $10,750,000 in 1907 to a little over $16,000,000 in 1912—an increase of just about 10 per cent per annum. February, 1914, reports from the ten largest companies in Massachusetts show an increase in gross from $1,040,834 in February, 1913, to $1,144,903 in February, 1914—a gain of just over 10 per cent for the year. This figure may be regarded as typical for the whole of the Bay State, as the returns relate to at least 80 per cent of all the energy generated in Massachusetts. The energy output of all these companies was a little less than 28,000,000 kw-hr. for the month—an increase of 11.8 per cent over 1913, which shows that, considering strictly energy output of stations (making no allowance for distribution losses, etc.), the gross yield per kilowatt-hour works out at 4.125 cents—practically identical with the value derived from the 1912 census figures. Taking the Massachusetts figures as an index for the whole of the New England States, the central-station companies in that area seemingly acquire new business steadily at about 10 per cent per year. This figure is probably appreciably lower than the rate for the Middle Atlantic States and the East North Central States. These two groups include New York, New Jersey, Pennsylvania, Ohio, Illinois, Indiana, Michigan and Wisconsin and in this manufacturing belt the percentage rate of increase for the year is at least 14 per cent. In New York State alone the companies supplying energy to the large cities (constituting probably 60 per cent of all the energy generated in the State) show an increase of from $2,986,091 in February, 1913, to $3,465,725 in February, 1914—or 17 per cent. A scrutiny of the returns from two of the Southern States, Texas and Florida, shows an expansion coefficient of 12 per cent for the former and 16.5 for the latter. In the State of Texas only 24 per cent of the entire population is urban, and of the urban dwellers over one-half live in the cities of Dallas, Fort Worth, Houston, Galveston, San Antonio, Waco, El Paso and Beaumont. The companies supplying energy to those eight cities generate nearly 80 per cent of all the energy produced in the State. From the returns received from every one of these companies, it is found that the gross income increased from $690,091 in February, 1913, to $773,877 in February, 1914, an increase of 12 per cent. For Florida returns from the four largest cities show that the gross earnings grew from $146,168 in February, 1913, to $170,532 in February, 1914, an increase of 16.5 per cent. This result is typical for the State, since the companies reporting generate at least 80 per cent of all the energy produced in Florida. Another group of states from which returns have been sufficiently numerous to admit of safe generalization are those on the Pacific seaboard. Of all the energy produced in California, Oregon and Washington, over three-fourths is generated by the large Pacific companies having their headquarters in the metropolitan area of Los Angeles, San Francisco, Portland, Seattle, Spokane and Tacoma. Returns from these companies show an increase from $3,167,358 in February, 1913, to $3,370,404 in February, 1914, or 6.5 per cent. It may be somewhat surprising to find the Western cities reporting a smaller rate of increase than those in New England, but the above figures are founded upon official data and are offered without reservations of any kind. They are probably a true reflection of the somewhat unsatisfactory condition of general business which has been recently experienced by the cities on the coast. From the above results it is shown that the gross earnings of all the energy supply companies in the country increased from $30,500,000 in February, 1913, to $33,500,000 in February, 1914. To finance this expansion $1,000,000 is required each month.

Capital of Cities Service Company Increased.—At a stockholders' meeting of the Cities Service Company in Dover, Del., on April 7, an increase in the capital stock of that company from $50,000,000 to $65,000,000 was authorized. The board of directors was re-elected without change, except that Paul R. Jones was elected to fill the vacancy caused by the death of William T. Hoffman.

Bangor Railway & Electric Initial Dividend Declared.—The Bangor Railway & Electric Company directors have declared an initial dividend of one-half of 1 per cent on the $2,000,900 common stock of the company, payable May 1. The Bar Harbor & Union River Power Company, one of the subsidiaries of the above company, is planning the extension of its high-tension distribution line from Ellsworth to Blue Hill, Maine, which line will be completed in the fall of this year.

Operations of Subsidiary of Indiana Traction Company.—In the report of the Union Traction Company of Indiana, Arthur W. Brady, the president, says that during the year the subsidiary Traction Light & Power Company continued to extend its operations. It took from the Union Traction Company of Indiana the contract which that company had for furnishing current at Pendleton, Middletown and Summitville, so that now all light and power business is handled by the one company. At the close of 1913 the Traction Light & Power Company was doing business at twenty places. At all except three of these points the Traction Light & Power Company furnishes light and power directly. At the three places excepted current is sold to the municipality or local company, which makes distribution. The company's operations are profitable and should be extended. During the year the Traction Light & Power Company authorized an issue of $100,000 of 6 per cent fifteen-year first mortgage bonds. The $68,000 outstanding bonds and $49,500 of the capital stock were issued to the Union Traction Company for advances and are held in the treasury of that company.

Montana Power Securities.—Securities of the Montana Power Company, as follows, have been listed on the New York Stock Exchange: The $10,000,000 outstanding of the authorized issue of $75,000,000 first and refunding mortgage bonds; the $9,700,000 outstanding of the authorized issue of $25,000,000 of 7 per cent cumulative preferred stock, and the outstanding $27,057,600 of the authorized issue of $75,000,000 common stock. The mortgage securing the bonds now covers either directly or through collateral trust twelve hydroelectric power plants and four reserve steam plants having about 102,080 developed electrical hp, of which 8080 is steam, 1403 miles of transmission lines, complete distribution systems serving the greater part of Montana, and, in addition, undeveloped water-powers capable of generating about 280,000 hp, of which it is expected that 167,000 hp will have been developed by 1918 through construction of three new plants now under way or definitely projected, so that by 1918 the mortgage will cover plants having about 269,000 developed electrical hp. The mortgage will, immediately after July 1, 1914, be a first lien on about 33 per cent in capacity of the present developed power plants, 20 per cent of the present transmission lines and 31 per cent of the undeveloped water-powers of the system, and upon completion of the new power plants now under construction will be a first lien on a much larger percentage of the total power plants and transmission lines of the system. Although $27,057,600 of the outstanding common stock is entitled to share in dividends, $22,500,000 of the remaining authorized amount is deposited under a voting trust but is not entitled to share in dividends except as follows: $17,500,000 is not to begin bearing dividends until after the complete installation of a new dam and hydroelectric plant near Great Falls, with a capacity of at least 30,000 hp, and is then only to share in dividends as follows: When the Chicago, Milwaukee & St. Paul Railway Company has taken power for six months under the contract with the Great Falls Power Company or whenever the gross earnings of the Great Falls Power Company shall for any fiscal year have amounted to $1,750,000, then $2,500,000 of this stock is to become entitled to share thereafter in dividends and the balance is to become entitled to share in dividends in instalments of $3,000,000 at intervals of one, two, three, four and five years thereafter. The balance of $5,000,000 of the $22,500,000 common stock is not to begin bearing dividends until after the complete installation of the new dam and hydroelectric plant at Thompson Falls, which it is estimated will have a capacity of 30,000 hp, and is then only to share in dividends as follows: When the Chicago, Milwaukee & St. Paul Railway has taken power for six months under the contract with the Thompson Falls Power Company, $2,500,000 shall become entitled to share thereafter in dividends and the remaining $2,500,000 shall become so entitled after another year. Of the common stock on which the dividends are deferred 175,000 shares are deposited with John D. Ryan, Charles H. Sabin and Gates W. McGarrah as voting trustees under a voting trust agreement dated May 5, 1913, and 50,000 shares are deposited with John D. Ryan, F. W. Allen and C. R. McCabe as voting trustees under a trust agreement of the same date.

Columbia Gas & Electric Company Earnings and Business.—The consolidated income account of the Union Gas & Electric Company, of Cincinnati, Ohio, and the Columbia Gas & Electric Company of Huntington, W. Va., shows gross earnings in the calendar year 1913 of $5,497,960. This is an increase of $342,514, or 6.6 per cent, over the previous year. Operating expenses and taxes amounted to $2,574,644, an increase of $50,169 over 1912. Net earnings aggregated $2,923,316 in 1913, as compared with $2,630,970 in 1912. Other income was $471,583 last year, as against $513,953 in the preceding year. Total gross income in 1913 was $3,394,899, as compared with $3,144,923 in 1912. Deductions from income in 1913 aggregated $2,585,955, as compared with $2,631,314. The net income was $808,944 last year and $513,609 in the preceding year. Fixed charges of the Columbia Gas & Electric Company amounted to $589,823 in 1913, as compared with $515,435 in 1912. The surplus in 1913 was $219,121. This compared with a deficit of $1,826 in 1912. Sinking-fund payments of the Columbia Gas & Electric Company in 1913 amounted to $95,005, as compared with $81,096 in 1912. A. B. Leach, the president, says in the report that the general operating condition of the subsidiary Union Gas & Electric Company has been satisfactory. The cost of the betterments and extensions made during the year has been charged to the Cincinnati Gas & Electric Company, and in July, 1913, 5113 shares of stock were received from that company in payment on account of betterments and extensions. The Union company now owns 11,913 shares of the Cincinnati Gas & Electric Company stock. The installation of the new street-lighting system, together with the necessary substation work incident thereto, was completed during the year, and Mr. Leach remarked that it has given general satisfaction. Three miles of underground lines and 135 miles of overhead lines were built to provide for extension of business; 1381 services and 1262 meters were installed. On Dec. 31, 1913, there were 20,326 electric customers, an increase over 1912 of 1286, or 6.75 per cent. The electric new-business department has been reorganized and provided with an adequate force of solicitors. The distributing system has been maintained at a high point of efficiency and good service and has been operated without interruption. The Plum Street generating station has been thoroughly overhauled, and to a large extent the machinery has been reconstructed. This has resulted in a general improvement in efficiency and reduced cost of operation and has provided approximately 9000 hp of increased capacity. It is estimated that during 1914 it will be necessary to spend approximately $103,000 in the electric department for line extensions, services, meters, transformers, etc., required for new business and for other miscellaneous construction work. A new station will be built on the Ohio River at a cost of $7,500,000. The Kentucky properties added 520 new electric customers, an increase of 9.4 per cent. These properties added 42 miles of electric lines to provide for new business. Mr. Leach says that, in view of the two severe floods that occurred and the depressed industrial conditions that existed during the greater part of the year in the territory served, resulting in both increased operating expenses and decreased gross revenue, the directors feel that the results are most encouraging. In conclusion he says that with the resumption of normal business conditions throughout the country a continued and permanent improvement in the earnings of the company is assured.

Business Notes

Norton & Bird, consulting engineers, of Chicago, have moved their office to 111 West Monroe Street, that city.

The R. Thomas & Sons Company has moved its New York office to the new Adams Express Building, at 61 Broadway.

The Southern California Edison Company is planning to move its Monrovia office, in charge of Mr. Fred Schwartz, into larger quarters on or about May 14.

The Asbestos Protected Metal Company, of Beaver Falls, Pa., announces the removal of its Pittsburgh office to 1611 Bennedum-Trees Building, with H. E. Marks continuing as district manager. This company now manufactures a complete line of prepared roofing and shingles.

The Federal Sign System (Electric) has remodeled the four-story building at the corner of Pine and Twelfth Streets, St. Louis, and has made it a headquarters for its electric specialty business in that city. The New York office of the company has been moved to the United States Rubber Building, 1790 Broadway.

The Titan Storage Battery Company is the name under which the business formerly carried on by the Baltimore Storage Battery Company will henceforth be conducted. The new company has secured quarters at Chapel Street and Lister Avenue, Newark, N. J., and manufacturing operations are now in progress at that location.

Hickey & Schneider, New York, manufacturers of electrical specialties, have recently submitted their new designs of open-air-break 44,000-volt and 110,000-volt switches to a series of tests at Atlanta, Ga. These tests, which extended over a period of three months, were conducted by Messrs. John Schneider and M. P. Maxwell, of the company, who are now engaged in preparing a full report relating thereto. The office of the concern has been removed to the Adams Express Building, New York City.

New Industrial Companies

The Moran Electric Company, of Detroit, Mich., has been organized with a capital stock of $2,500 by Samuel J. Moran, J. Moran and Charles E. Long.

The American Wireless Equipment Company, of Boston, Mass., has been incorporated with a capital stock of $50,000 by F. L. Hall, of Stoneham, and L. W. Bishop, of Boston, Mass.

The Bradley Electric Garage Company, of Dayton, Ohio, has been organized with a capital stock of $10,000 by Francis Bradley, Frank Blessing, Albert Miller and T. M. Hiester.

The Gardiner Storage Battery Company, of Chicago, Ill., has been incorporated with a capital stock of $12,000 to manufacture electrical goods. The incorporators are Monroe Mitchell, Joseph L. Toohey and Martin O'Shaughnessy.

The Niagara Searchlight Company, of Niagara Falls, N. Y., has been incorporated with a capital stock of $100,000 by J. F. Murphy, J. Tugby and F. G. Anderson, of Niagara Falls. The company proposes to manufacture lamps, electrical apparatus and supplies.

The National Piano Company has been granted a charter under the laws of the State of Delaware with a capital stock of $50,600. The company proposes to deal in pianos, piano players, electric pianos, etc. The incorporators are W. M. Pyle, G. C. Steigler and L. W. E. McCarthy.

The Provident Motor Supply Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $75,000. The company proposes to manufacture motor vehicles and supplies for same. The incorporators are H. E. Latter, W. J. Maloney and N. P. Coffin.

The Maryland Electric Vehicle & Manufacturing Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000 to manufacture vehicles of all kinds and to deal in electrical goods. The incorporators are J. M. Satterfield, W. P. Carrow and M. M. Hirons, of Dover, Del.

Trade Publications

Valves.—In a folder published by the Nelson Valve Company, Chestnut Hill, Philadelphia, Pa., is described and illustrated the process of manufacture of Nelson steel valves. The care in making and the rigid testing are referred to.

Recording Synchroscope.—Schweitzer & Conrad, 1770 Wilson Avenue, Chicago, Ill., in Bulletin No. 3 describe their recording synchroscope. An illustration is shown of a typical wiring diagram for this device and of a perfect synchronizing record.

Automobile Supplies.—The latest catalog of A. J. Picard & Company, 1720 Broadway, New York, contains ninety-two pages of illustrations and brief descriptions of automobile supplies. It will be found useful by automobile owners and manufacturers.

Household Devices.—"A Few Suggestions for the Home" is the title of an attractive booklet issued by the General Electric Company. It refers to electrically heated devices, such as radiators, toasters, percolators and other labor-saving appliances. The booklet contains some excellent illustrations.

Lamps.—An illustrated booklet of twenty-eight pages issued by the Eastern Electric Lamp Company, Hartford, Conn., gives price schedules for various types of lamps, effective April 1, 1914. Three pages of definitions of terms used in the incandescent lamp industry form a useful addition to the catalog.

Cutouts.—An eight-page leaflet issued by the Trumbull Electric Manufacturing Company, Plainville, Conn., contains brief descriptions and prices of its combination switches, panel cutouts, snap-switch panel cutouts, plug cutouts, combination switches in iron boxes and other Trumbull specialties.

Safety Set Screws.—Bulletin 801 of the Bristol Company, Waterbury, Conn., refers to "Bristo" safety set screws. This type of screw protects itself from all danger of the metal spreading and the screw becoming cracked or split. The dovetailed design of screw and wrench contracts the metal under pressure.

Automatic Rectifier.—The Electric Products Company, Cleveland, Ohio, has issued a pamphlet with the title "My Electric Car Simplified," which tells of the simple method of charging an electric car at home with a Wotton automatic rectifier. Its simplicity and ease of operation and its economy are briefly set forth.

Heating Appliances.—The national advertising campaign of the Hotpoint Electric Heating Company, Ontario, Cal., is described in some literature that has been prepared for circulation among dealers. The latest publication announces "Hotpoint Week" (May 11-16) and outlines special inducements to dealers to further the sales of Hotpoint appliances.

Wires and Cables.—Bulletin No. 400-I, of the Standard Underground Cable Company, Pittsburgh, Pa., refers to weatherproof insulated wires and cables. Illustrations are shown of the solid and stranded and double and triple braid varieties, and tables of wire and shipping data are included. Bulletin No. 200-I gives specifications for Standard colonial copper-clad wire.

Isolated Power Plants.—The Main Electric Manufacturing Company, 219 South Beatty Street, Pittsburgh, Pa., has issued an eight-page pamphlet describing the Main electric lighting and power plants. An excellent illustration is shown of a complete plant that occupies a space of 2½ ft. by 8 ft. The generators, switchboards and engines used in these plants are fully described. A price list is given of complete isolated plants of various types.

Insulating Compound Specification.—The Simplex Wire & Cable Company, 201 Devonshire Street, Boston, Mass., has published a reprint of the report made upon a 30 per cent compound by the joint rubber insulation committee of the American Institute of Electrical Engineers under the title "Specification and Analytical Procedure for 30 per Cent Hevea Rubber Insulating Compound." It is divided into two parts: (1) a procedure for chemical analysis and the interpretation of the results obtained, and (2) a specification and chemical limits for a 30 per cent compound.

Personal Mention

Mr. Fred Spears has resigned as city electrician of Springfield, Ill., to go into business for himself.

Mr. A. P. Singer, formerly engineer at the Spy Run power station of the Fort Wayne & Northern Indiana Traction Company, has resigned to accept a position with the Tennessee Power Company.

Mr. E. I. Sifton has been appointed general manager of the Hamilton (Ont.) Hydro-Electric System. He was formerly engineer in charge of the construction of the system. He is to have 5 per cent of his time to devote to private work.

Mr. Bernard E. Sunny, president of the Chicago Telephone Company and other telephone companies and a director of the General Electric Company and other companies, has been elected president of the Commercial Club of Chicago.

Mr. Thomas A. Edison and his family have returned to their home in Llewellyn Park, West Orange, N. J., after having spent six months at the inventor's winter home at Fort Meyer, Fla. Mr. Edison is reported well and several pounds heavier than when he started on his vacation.

Capt. William H. Rose, Corps of Engineers, U. S. A., has been appointed electrical engineer of the electrical division of the department of operation and maintenance of the Panama Canal. Mr. Edward Schildhauer continues as electrical and mechanical engineer of the division of erection.

Mr. W. J. Maxwell, formerly one of the chief operating engineers of the Merchants' Heat & Light Company, Indianapolis, has accepted a position as engineer of the Spy Run power station of the Fort Wayne & Northern Indiana Traction Company, beginning his duties at that plant April 20.

Mr. John J. Treacy, who was recently appointed by Governor Fielder as a member of the Board of Public Utility Commissioners of New Jersey, was sworn in by Secretary of State Carter on April 14. Mr. Treacy succeeds Mr. Winthrop M. Daniels, who was recently appointed by President Wilson as a member of the Interstate Commerce Commission.

Mr. Elbert Hubbard, sometimes known as "Fra Elbertus," was entertained at supper in Dayton, Ohio, on April 11, by the Dayton Jovian League. Mr. Hubbard had given a public lecture earlier in the evening, and Mayor George Shroyer, who accompanied him, was a fellow-guest of the Jovians. Mr. Hubbard is himself a Jovian. About sixty men were present, and speeches were made by Messrs. Thomas F. Kelly and F. M. Tait as well as by the guest of honor.

Mr. C. C. Chappelle has resigned as vice-president and general manager of the Federal Light & Traction Company, New York, effective May 1, to devote his entire time to private business matters. Mr. Chappelle came to the Federal company early in 1911 from the Westinghouse Machine Company, with which organization he held the position of Western sales manager, with headquarters at Chicago. He remains as one of the three members of the executive committee of the Kansas City, Clay County & St. Joseph Railway Company, which is not affiliated with the Federal interests.

Mr. R. H. Sperling, general manager of the British Columbia Electric Railway Company, Vancouver, B. C., has received the offer of a seat on the London board of his company, an offer which carries with it the appointment of Mr. Sperling to an important position as assistant to the chairman of the board, Mr. R. M. Horne Payne. It is understood that Mr. Sperling will accept the new post and that on his return from England, where he has gone to confer with the directors, the name of the company's new general manager will be announced. Mr. Sperling joined the service of the British Columbia Electric Railway Company in 1896 and in the following year was appointed the electrical expert in charge. He later became general superintendent of the company, and on the appointment in 1905 of the then general manager, Mr. J. Buntzen, to a seat on the London board, Mr. Sperling was chosen as his successor.

D. A. HEGARTY

Mr. D. A. Hegarty, formerly manager of the railway and lighting departments of the New Orleans (La.) Railway & Light Company, has been transferred to the position of assistant to the president and general manager of the Houston Lighting & Power Company, Houston, Tex. Mr. Hegarty was until 1911 vice-president and general manager of the Little Rock (Ark.) Railway & Electric Company, a position which he held three years. He was born in Philadelphia and was educated at the University of Pennsylvania. After early experience in the engineering department of the Pennsylvania Railroad, Mr. Hegarty was appointed engineer in charge of the Richmond (Va.) Electric Railway, which was the first commercially successful electric road in America. Afterward he became general manager of the company, and was later appointed chief engineer of the Norfolk (Va.) Railway. This position he shortly relinquished in order to become superintendent of the Railways Company General, a holding and operating concern. In 1908 Mr. Hegarty joined the staff of Ford, Bacon & Davis, in general charge of the Little Rock property. At last year's convention of the American Electric Railway Transportation and Traffic Association, held at Atlantic City in October, Mr. Hegarty was elected president for 1914.

Mr. Milan V. Ayres, recently appointed senior electrical engineer for the Eastern District, Division of Valuation, Interstate Commerce Commission, with office in Washington, D. C., was born at Hamlin, Kan., on Feb. 14, 1875. Mr. Ayres was graduated from the electric department of the Massachusetts Institute of Technology in 1898. After graduation he entered the service of the General Electric Company at Schenectady, N. Y., being employed in the testing department and later in the design of alternating-current machinery. In 1903 he became electrical and mechanical engineer for the Boston & Worcester Street Railway, South Framingham, Mass., continuing in this position until July, 1911. From July, 1911, to November, 1911, he was assistant to the general manager of the Rockland Light & Power Company, Nyack, N. Y. In November, 1911, he became chief engineer of the Mobile (Ala.) Light & Railroad Company, but resigned from that company in 1912 to accept a position with Ford, Bacon & Davis, consulting engineers, New York City, in which position he continued until his recent appointment with the Interstate Commerce Commission. While employed with the Boston & Worcester Street Railway Mr. Ayres was admitted to the Massachusetts bar. Mr. Ayres is a member of the American Institute of Electrical Engineers, the American Electrical Railway Association and the American Statistical Association. He was for several years a member of the publication committee of the New England Street Railway Club, and in 1911 he became a member of the executive committee of the New England Railroad Club. In 1910-1911 he was chairman of the equipment committee of the American Electrical Railway Engineering Association and a member of the executive committee of the Boston Section of the American Institute of Electrical Engineers.

Obituary

Mr. Alfred Noble, a widely known civil engineer and prominent from his connection with the St. Mary's River improvements, the construction of the Pennsylvania Railroad tunnels in New York City, and the Panama Canal advisory board, died at New York, April 19, following an operation for organic trouble. Mr. Noble had received the John Fritz medal for his work on the Pennsylvania tunnels, and he was a past-president of the American Society of Civil Engineers.

Construction

New England

ROCKLAND, MAINE.—The property of the Rockland, Thomaston & Camden St. Ry. Co., which furnishes electrical service and operates the street-railway system in the Camden district, has been purchased by a syndicate headed by Hugh J. Chisholm, of Portland. N. J. Neal, of Boston, Mass., has been appointed managing engineer of the system.

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 2 for furnishing and installing a three-motor, 20-hp electric traveling crane at the navy yard, Boston, Mass., to cost approximately $5,000. Plans and specifications can be obtained upon application to the above bureau or to the commandant of the navy yard named. H. R. Stanford is chief of bureau.

FARLEY, MASS.—The real estate of the Farley Paper Co., with other real estate in the neighborhood, has been transferred to the Franklin Pwr. Co., a voluntary trust, the trustees consisting of Chauncey D. Parker, Bowen Tufts, Paul D. Webber, M. Bernard Webber and Edward Mason. The papers filed indicate that the company contemplates developing power from Millers River at Farley.

SOUTH HADLEY FALLS, MASS.—The town of South Hadley Falls has assumed control of the electric plant of the South Hadley Falls El. Lt. Co.

PROVIDENCE, R. I.—The city is contemplating the installation of an electrically driven pump at the Pettaconsett pumping station. Electricity for operating the pump will be purchased from the Narragansett Ltg. Co.

THOMPSONVILLE, CONN.—The Northern Connecticut Lt. & Pwr. Co., of Thompsonville, expects to erect within the next six months a new substation. Walter P. Schwabe is general manager.

Middle Atlantic

BINGHAMTON, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until April 27 for reconstruction of electric-lighting system, steam and exhaust piping at the Binghamton State Hospital, Binghamton. Drawings and specifications may be consulted and blank forms of proposal obtained at the hospital and at the office of Lewis F. Pilcher, state architect, Capitol, Albany, where complete sets of plans and specifications may be obtained. J. H. B. Hanify is secretary of state hospital commission.

DEPOSIT, N. Y.—The Deposit El. Co. expects to rebuild its plant (recently destroyed by fire) at Stilesville and will have complete service restored by May 1. The power station was completely destroyed on April 2 and power service was resumed the same day through temporary installation from a small local plant. The step-up transformer, which supplied Hancock, 11 miles distant, was destroyed. Complete service was renewed April 7 by means of a generator shipped and installed in a local manufacturing concern. John D. Mickle is treasurer and general manager.

KINGS PARK, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until April 27 for new elevators and wiring thereto, at the Kings Park State Hospital, Kings Park. Drawings and specifications may be consulted and blank forms of proposal obtained at the Kings Park State Hospital, Kings Park, the office of the State Hospital Commission, 1 Madison Avenue, New York, and at the office of Lewis F. Pilcher, state architect, Capitol, Albany.

MINEOLA, N. Y.—Bids will be received by George M. Goodale, clerk of Board of Supervisors, Mineola, until May 5 for the erection of additions to the Nassau County Court House, in accordance with plans and specifications prepared by W. B. Tubby, architect, 81 Fulton Street, New York, as follows: (1) For general contract work, excluding plumbing, heating and electric wiring; (2) plumbing work complete; (3) heating and ventilating; (4) electric wiring.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school building, Department of Education, Park Avenue and Fifty-ninth Street, New York, until April 27 for installing electric equipment in new Public School 51 on Trinity and Jackson Avenues and East 158th Street, borough of the Bronx.

OLEAN, N. Y.—The Olean El. Lt. & Pwr. Co., of Olean, and the Cattaraugus County Ltg. Co., of Franklinville, have filed a petition with the Public Service Commission asking for permission to consolidate under the name of the latter. The petition also asks for authority to issue $250,000 in capital stock and to execute a mortgage for $2,000,000, also to issue $117,000 in bonds. The company contemplates the erection of a transmission line from Olean to Franklinville.

POUGHKEEPSIE, N. Y.—The Central Hudson Gas & El. Co., of Poughkeepsie, has closed a contract with the J. G. White Co. Engineering Corpn., 43 Exchange Place, New York, N. Y., for the erection of a duplicate transmission line between Poughkeepsie and Newburgh, to cost about $60,000. It is understood that new generators will be installed in the steam generating plant.

ROCHESTER, N. Y.—The Common Council has adopted an ordinance which provides for the installation of inverted magnetite-arc lamps erected on ornament posts the entire length of Lake Avenue, to cost about $5,292. Ordinances were also passed for the installation of incandescent lamps and concrete poles on Second Street.

ROCHESTER, N. Y.—A syndicate of New York capitalists, represented by Richard B. Hayden, is contemplating utilizing the water from the barge canal and the construction of a power canal from the proposed harbor at Western Wide Waters to the point where it is proposed to erect the power plant. It is estimated that about 20,000 hp can be developed a a cost of about $2,000,000.

SPENCERPORT, N. Y.—Bids will be received by the town of Spencerport until May 5 for $16,000 electric light bonds. For details see proposal columns.

UTICA, N. Y.—The contract for construction of city electric subways on Broadway and other streets has been awarded to William F. Cogley, at $21,770.

WEST POINT, N. Y.—Bids will be received until May 15, addressed to the Quartermaster, West Point, N. Y., for supplying the United States Military Academy with electrical goods, building materials, gas and steam fittings, hardware and other miscellaneous stores specified in schedules to be had upon application to the above office.

BENTON, PA. — Extensive improvements will be made to the plant of the Benton El. Co. and the Benton Wtr. Co., which are controlled by John S. Stone, of Coudersport. Orders have been placed for three alternating-current generators, and an auxiliary plant will be installed in the pumping station at West Creek, which will be driven by a 40-hp oil engine. A turbine wheel will be installed at the water plant and the retaining walls and dam at reservoir will be remodeled.

ELLWOOD CITY, PA.—The Public Service Commission has ruled that the Harmony Co. will not be permitted to carry out its contract to light Ellwood City. This ruling was made because the Pennsylvania Pwr. Co. has already invested $350,000 in a plant and equipment and should be able to furnish the city with adequate service.

KUTZTOWN, PA.—The electric light committee has submitted a report to the Town Council which estimates that it would require an expenditure of $26,000 to make the contemplated additions and improvements to the municipal electric-light plant.

PHILADELPHIA, PA.—The contract for installing the underground distributing system for the Philadelphia Navy Yard has been awarded to the Newport Contracting and Engineering Co., of Newport News, Va., at $12,288.

BAYONNE, N. J.—The New York & New Jersey Construction Co., which has the contract for the Passaic Valley sewer, has acquired property on the Boulevard and Sixty-first Street, on which it will erect a power and air compressor plant, to be used in connection with this work.

HADDON HEIGHTS, N. J.—Bids will be received by the Borough Council for furnishing electricity for street-lighting in Haddon Heights for a period of one year. William J. Dallas is Mayor.

JERSEY CITY, N. J.—Steps have been taken by the City Centre Merchants & Property Owners' Association for the installation of a new electric-lighting system along the business section of Upper Newark Avenue. Michael Sexton is president.

PATERSON, N. J.—Bids will be received by the Board of Public Works until May 5 for furnishing and maintaining electric-arc lamps for lighting the public streets of the city of Paterson. Specifications may be obtained at the office of the Board of Public Works, City Hall. T. Simpson Standeven is clerk.

POMPTON LAKES, N. J.—Bids will be received by the Mayor and Council of Pompton Lakes until May 5 for the construction of an electric-light plant and water-works system, in accordance with plans and specifications which are on file in the office of J. Frank Cornelius, clerk, and at the office of Joseph B. Rider, consulting engineer, 29 Broadway, N. Y. Plans may be obtained from the engineer upon payment of $5.

VINELAND, N. J.—Appropriations amounting to $297,800 have been granted by the State Legislature for the State Home for Feeble-Minded Women at Vineland. The sum of $154,800 was appropriated for new buildings, which include a new building for patients, a new dining hall and dietetic department, including cold storage, to cost $50,000, a new boiler house to replace the temporary one, enlarging the present power plant, at a cost of $33,000, and a new dairy barn, at $13,000. Dr. M. A. Hallowell is superintendent.

BALTIMORE, MD.—Plans are being prepared for the erection of a concrete pumping station (one story) on the north side of the Patapsco River for the Consol. Gas, El. Lt. & Pwr. Co., of Baltimore.

MOUNT AIRY, MD.—The bill authorizing the town of Mount Airy to establish a municipal electric-light plant has been passed by the State Legislature.

WILLIAMSPORT, MD.—The bill authorizing the town of Williamsport to install a municipal electric-light plant has been passed by the State Legislature.

GRAFTON, W. VA.—Arrangements have been completed to consolidate the Grafton Gas & El. Lt. Co. and the Grafton Trac. Co., under the name of the Grafton Lt. & Pwr. Co. John T. McGraw is president of the Grafton Trac. Co.

WHEELING, W. VA.—Bids will be received at the United States Engineer Office, Wheeling, until May 13 for building a fireproof power house and furnishing and installing machinery at each of the dams Nos. 15 and 20, Ohio River. For further information address Major J. P. Jervey.

ALEXANDRIA, VA.—Plans have been prepared by the Alexandria County Ltg. Co. for rebuilding its power house at the foot of Wolfe Street, which will practically double the output of the plant. New machinery, including a 1000-kw turbine, will be installed.

HARRISONBURG, VA.—J. M. Snell, chairman of electric light committee, is getting estimates of cost of the installation of an auxiliary plant at the municipal hydroelectric plant on the Shenandoah River, 12 miles east of Harrisonburg.

WASHINGTON, D. C.—Bids will be received at the office of the purchasing agent, District government, Washington, D. C., until April 30 for furnishing electrical supplies for the Business High School. Bids will also be received until April 28 for furnishing five ammeters, model 45, and six galvanometers. For further information address the purchasing agent.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 28, for supplies to be delivered at the various navy yards and naval stations as follows: Fort Lafayette, N. Y. Harbor, Schedule 6656—one duplex fire pump (500 gal. per minute), Underwriter type; Schedule 6655—1400 ft. four-conductor, 2400-volt submarine cable. Brooklyn, N. Y., Schedule 6652—600 tubes, 4-in. outside diameter, 18 ft. long, 1¾ in. thick; Schedule 6664—1500 ft. rubber insulated wire, lead-covered, single and duplex, 26,300 circ. mil; Schedule 6657-5000 ft. single-conductor wire, 9000 circ. mil, leaded, and armored and soft steel. Newport, R. I., Schedule 6654—30,000 unannealed brass tubes; Schedule 6655—10,000 ft. iridium-platinum wire, 2 mils diameter; Schedule 6665—6200 ft. insulated and lead-covered, 500,000 and 212,000-circ. mil cable, 3000 ft. lead-covered, insulated paper telephone cable (50 pair and 25 pair). Norfolk, Va., Schedule 6663—three 1-ton and three 0.5-ton self-contained electric hoists; Schedule 6664—8000 ft. triplex-covered, weatherproof, solid 52,600-circ. mil copper wire Philadelphia, Pa., Schedule 6658—telephone switchboard, front connection type of ship's service, miscellaneous telephones and spare parts. Bids will also be received until May 12 as follows: Brooklyn, N. Y., Schedule 6675—four ammeters and three voltmeters, portable and 100 wave-meters; Schedule 6673—miscellaneous material for Curtis turbines; Schedule 6682—miscellaneous steel tubing. Philadelphia, Pa., Schedule 6669—six rigid frogs and six split switches (miscellaneous). Norfolk, Va., Schedule 6674—58,300 lb. seamless-drawn condenser tubes, composition "A," ⅝-in. outside diameter, 13 ft. 2¼ in. long. Bids will also be received until May 26 for one Universal motor-driven woodworker, to be delivered f.o.b. Rixey, Col., as per Schedule 6686.

Bids will be received until June 2 for 5000 electric primers (3-ft. wires), to be delivered at Pearl Harbor, Hawaii, as per Schedule 6660. Application for proposals should designate the schedule desired by number. T. J. Cowie is paymaster-general, U. S. N.

North Central

ALMA, MICH.—The Alma Illg. Engineering Co. has obtained franchises through the townships of Sumner and Seville in Gratiot County. The company will furnish electricity for lamps and motors in Elwell, Riverdale, Sumner, Elm Hall and Vestaburg.

DETROIT, MICH.—The contract for the electrical work in the new Statler Hotel, which will be 18 stories high, has been awarded to L. K. Comstock, of Chicago, Ill.

DETROIT, MICH.—The Edison Illg. Co., of Detroit, has awarded the general contract for the construction of its new power plant, to be erected at the junction of Connor's Creek and the river, to the A. A. Albrecht Co., of Detroit. This plant is intended to duplicate the one in Delray.

MACKINAC ISLAND, MICH.—The Municipal Wtr., Lt. & Pwr. Co., of Mackinac Island, expects to install one 200-kw Allis-Chalmers generator and engine and two General Electric switchboards in April; it also expects to install one 200-kw General Electric generator next December.

MARQUETTE, MICH.—A transmission line will be erected between Marquette and Palmer to furnish electricity in the latter town. The new line will also furnish electricity for lamps and motors for several mining locations south of Negaunee.

CLEVELAND, OHIO.—Bids will be received by A. R. Callow, commissioner of purchases and supplies, 513 City Hall, Cleveland, until April 29, for lead-covered cable for the municipal lighting plant. Specifications are on file in the office of commissioner of light and heat division, 1443 East Third Street.

CLEVELAND, OHIO.—F. W. Ballard, commissioner of the lighting division, has announced that light and power service from the new municipal electric-light plant will be extended to the vicinity of Euclid Avenue and East 105th Street. With the $800,000 derived from the recent sale of bonds the lighting division is prepared to install a large portion of its distributing system. Distributing equipment is to be installed in the Fairmont heating station and the district supplied with municipal heating service is to have city light and power service. An extension will be made first to the lake front factory section near the East Fifty-third Street plant.

DAYTON, OHIO. — Preliminary steps have been taken by the Doty Mfg. Co., now located in the Callahan Power Building, for the erection of a new building, 80 ft. by 120 ft., to cost $100,000. The company manufactures vacuum sweepers. Walter G. Doty is president and manager.

HAMDEN, OHIO.—The village of Hamden is negotiating with the town of Wellston to secure electricity from the municipal electric plant in Wellston. The franchise of the Hocking Valley Ry. Co., which now furnishes electrical service here, will soon expire.

HOWENSTINE, OHIO.—Homer V. Briggle, general manager of the O. C. Barber Mining & Fertilizer Co., of Howenstine, has announced plans for the construction of an electric power plant here, to cost about $1,000,000, to furnish electricity to towns in this vicinity. The company also contemplates the construction of a new hydrate plant, at a cost of $100,000.

LANCASTER, OHIO.—The Board of County Commissioners has granted the Ohio Ry. & Lt. Co. a franchise to erect a transmission line connecting the Lancaster with the Newark plant. The entire right-of-way, it is understood, has been secured.

LOGAN, OHIO.—The Ohio Lt. & Pwr. Co. has secured the right-of-way from Logan to New Straitsville, a distance of 18 miles, for a high-tension transmission line.

LONDON, OHIO.—Bids will be received by J. W. Byers, village clerk, until May 12, for equipment for cluster lamps to be erected on North Main Street.

LORAIN, OHIO.—The Lorain, Ashland & Southern Ry. Co., it is reported, expects to have its railway between Custaloga and Lorain completed within two months. Approximately 22 miles of track are yet to be laid. Plans have not yet been completed for the construction of the power house. A temporary arrangement has been made with the Cleveland, Southwestern & Columbus Ry. Co., of Cleveland, to furnish energy. J. Palmer Ramsey is chief engineer of Lorain, Ashland & Southern Ry. Co.

MASSILLON, OHIO.—Within the next two months the Massillon El. & Gas Co. expects to purchase two 650-hp boilers, one 2000-kw and one 1500-kw turbine, condensers for above units and switchboard equipment for same; also within the next 10 months to erect a 200-ft. smokestack and rebuild boiler room. R. A. Brooks is general manager.

MILAN, OHIO.—The Lake Shore El. Ry. Co., of Cleveland, has submitted a proposition to the Village Council to furnish electricity in this village at a low rate. The service is now supplied by a municipal plant.

NEW BREMEN, OHIO.—Bids will be received at the office of the clerk of board of trustees of public affairs until May 20 for the purchase of the following equipment: One De Laval steam turbine, driving two 37½-kw, three-phase, 60-cycle Western Electric generators, directly connected, with condenser and centrifugal pump complete, and exciter for same; one 50-kw Westinghouse three-phase, 60-cycle generator; one belt tightener, one 60-in. by 12-in. wood pulley. For details see proposal columns. Ferd W. Rabe is president of board of trustees.

PORTSMOUTH, OHIO.—The Ohio Public Utilities Commission has authorized the Portsmouth St. R. R. & Lt. Co. to issue $250,000 in capital stock and $500,000 in bonds, the proceeds to be used to extend its system to Ironton and for new construction in Portsmouth.

SYCAMORE, OHIO. — The municipal electric-light plant has been closed by the orders of the state boiler inspector, owing to defective boilers. This action has left the entire town without electrical service. It is understood that it will be necessary to call a special election to authorize bonds to make the necessary improvements.

TOLEDO, OHIO.—The Willys-Overland Co. is constructing a building, 401 ft. by 430 ft., adding 28 acres floor space to its factory. A large power plant will be erected in connection with this addition.

TOLEDO, OHIO.—A resolution has been presented to the City Council recommending municipal ownership of the street railway, power plants, heating and lighting systems and all machinery and equipment necessary to operate these utilities. The resolution provides for submitting the question of municipal ownership to the voters.

TRUMAN, OHIO.—The installation of a municipal electric-light plant in Truman, to cost about $4,000, is reported to be under consideration.

BURGIN, KY.—The installation of an electric-light plant and ice factory in Burgin is under consideration. P. H. DeBaun, of Perryville, is interested in the project.

FULTON, KY.—The Fulton El. Lt. & Pwr. Co. is contemplating making some improvements to its plant during the coming year.

SEBREE, KY.—The Warren Milling Co., it is reported, contemplates remodeling its electric-light plant and mill. H. G. Warren is president.

EAST GARY, IND.—A petition has been filed with the Public Service Commission by the city of East Gary, asking permission to issue $9,000 in bonds to build a municipal electric-light plant.

CHICAGO, ILL.—Bids will be received by Ray Palmer, commissioner of gas and electricity, Room 614, City Hall, Chicago, until April 25, for furnishing the Department of Gas and Electricity, city of Chicago, with 30,000 ft. No. 6 B. & S. G. rubber-covered, lead-incased electric-light cable and 50 to 115 keyless-door fire-alarm signal boxes. Proposals to be made out on blanks furnished by the commissioner.

CHICAGO, ILL.—Bids will be received by the Armory Commission, Room 648, 29 South LaSalle Street, Chicago, until May 8, for the construction of an armory for the Eighth Infantry, Illinois National Guard, at Forest Avenue, near East Thirty-fifth Street. Bids will be received separately on the general work and plumbing and heating. Plans and specifications may be obtained at the office of James B. Dibelka, supervising architect of the State of Illinois, upon deposit of $25. On a return of plans $20 will be refunded.

DU QUOIN, ILL.—The Du Quoin Utility Co. is now erecting new transmission lines and changing its system from single to three-phase for power purposes. The company has purchased a turbine and generator and material for distribution system. J. Naumer is superintendent.

FARMER CITY, ILL.—Within the next two months the electric light commission expects to purchase 40 single-lamp boulevard posts. Fred H. Reed is city clerk.

FISHER, ILL.—Within the next few months the town of Fisher expects to purchase a small amount of wire and some meters. A. L. Baker is engineer and manager.

GENOA, ILL.—A contract has been awarded to the Illinois Northern Utilities Co., for the installation of an ornamental street-lighting system in the business district, consisting of 60 ornamental lamps to be placed on cement posts. The cost of the system is estimated at about $1,800, the cost to be paid by the merchants and the maintenance by the city.

PEORIA, ILL.—The officials of the Illinois Trac. System have awarded contract for the construction of the new depot transfer station and public office in Peoria, to cost about $300,000.

PEORIA, ILL.—Within the next two months the Central Illinois Lt. Co., of Peoria, expects to erect 8 miles of three-phase transmission lines from Farmington to Elmwood, material for which has been purchased. R. S. Wallace is vice-president.

GOOD THUNDER, MINN.—The Good Thunder El. Co., recently incorporated with a capital stock of $10,000, has been granted a 30-year franchise to furnish electricity here. Plans and estimates for the proposed plant are being prepared by B. H. Grover, consulting engineer. All machinery and equipment to be purchased. F. H. Griffin is secretary.

HENNING, MINN.—The installation of a municipal electric-light plant in Henning is under consideration. A committee of three has been appointed to make investigations of plants in other towns.

HILLS, MINN.—Within the next three months the village of Hills expects to erect a power house and to purchase one 50-hp oil engine and a 37½-kva, three-phase, 2300-volt generator and switchboard, pole-line material, transformers and street-lighting fixtures; also within the next two weeks a complete line of wiring supplies, heating devices and meters. V. A. Hoar is superintendent and purchasing agent.

LAKE PARK, MINN.—We are informed that a municipal electric-light plant has already been installed in Lake Park. Reported in the issue of April 4 to be considering the installation of a municipal plant.

LAMBERTON, MINN.—The Village Council has granted a 10-year franchise for the installation of an electric-light plant in Lamberton. Ornamental lamps will be installed in the business district. Fred Griffin is interested in the project.

NEW ULM, MINN.—Representatives of the Luce El. Co., it is reported, have submitted a proposition to the Commercial Club, offering to extend its transmission lines to New Ulm.

ROUND LAKE, MINN.—Estimates have been submitted by Earl Jackson, consulting engineer, of St. Paul, placing the cost of a municipal electric-light plant at $9,000. Energy may be transmitted from Worthington via Bigelow.

VERGAS, MINN.—The installation of an electric-light plant is reported to be under consideration. J. E. King, of Frazee, is interested.

BUCK GROVE, IA.—Messrs. Quarthamer & Schoening, who have a franchise to furnish electricity in Buck Grove, it is reported, have begun work on construction of plant

CEDAR RAPIDS, IA.—The Cedar Rapids & Marion Tel. Co. will soon begin work on the installation of a tile-conduit system in Cedar Rapids, to cost about $85,000.

DES MOINES, IA.—Plans are being considered by the Des Moines El. Co. for the installation of a central heating plant. The proposed initial plant would serve the West Des Moines business district.

EARLHAM, IA.—Bids, it is understood, will soon be asked for equipment for the municipal electric-light plant.

EMMETSBURG, IA.—The installation of a municipal electric-light plant in Emmetsburg is under consideration.

HAMPTON, IA.—The Hampton El. Lt. & Pwr. Co. has applied for a new franchise in Hampton. The company, it is reported, contemplates enlarging and improving its plant here with a view of furnishing electricity in all adjoining towns.

KEOKUK, IA.—The Mississippi River Pwr. Co., of Keokuk, has applied to the Public Utilities Commission of Illinois for authority to issue debenture bonds to the amount of $4,000,000 and also $200,000 in first mortgage bonds.

PATON, IA.—At a special election held April 9 the proposal to issue bonds for the installation of an electric-lighting system was carried.

PIERSON, IA.—At an election held recently the proposal to install an electric-light system in Pierson was carried.

RADCLIFFE, IA.—The Ellsworth Milling Co., of Ellsworth, has submitted a proposal to the town of Radcliffe offering to furnish electricity for lighting the town.

GILMAN CITY, MO.—The City Council has engaged E. B. Murray and L. C. Hamilton, associate engineers, Missouri Savings Bank Building, Kansas City, to prepare plans for the installation of a municipal electric-light plant in Gilman City, to cost about $8,000. Contracts, it is understood, will be awarded about May 1.

HAYTI, MO.—The Hayti Lt. Co. will install another generating unit in its power plant within the next 60 days. The company has not yet decided upon the machinery to be installed. A. B. Cortright is general manager.

HUNNEWELL, MO.—Bonds to the amount of $5,000 have been voted for the installation of a municipal electric-lighting system.

MACON, MO.—The city of Macon is negotiating with the Bevier El. Co., of Bevier, and the town of Callao to furnish electricity. The plan provides for the erection of transmission line and equipment, including transformers, wire, poles, etc., for 9 miles of transmission line, by the parties to be supplied. The Bevier El. Co. has a small gas-engine equipment and the town of Callao is establishing a new system. C. F. Thudium, superintendent of the municipal electric-light plant, will have charge of the engineering work.

AVON, S. D.—The Council has granted John Burbeck a franchise to install an electric light plant in Avon.

BRUNING, NEB.—Bids will be received by G. G. Bruckert, village clerk, until May 12 for the construction of an electric-light system, to cost $7,308, and water-works system at $11,778. Grant & Fulton, of Lincoln, are engineers.

CREIGHTON, NEB.—I. J. Jamison & Sons, of Malmo, and Robert Fulton, of Lincoln, who recently purchased the property of the Creighton Gas & El. Lt. & Pwr. Co., it is reported, contemplate improvements to the plant, to cost about $5,000.

HOLSTEIN, NEB.—Daniel Essinger, of Holstein, has applied to the Village Council for a franchise to install and operate an electric-light plant. We are informed that the village does not contemplate the installation of a municipal plant, as reported in the issue of April 11. C. L. Stanley is village clerk.

HOOPER, NEB.—The local electric-light plant is reported to have been purchased by M. E. Shipley, of Hooper.

MARYSVILLE, KAN.—Plans are being considered by Charles O. Beardslee and E. G. Ward, who have established offices in Marysville, for developing the water-power of Big Blue River. The plan provides for the construction of four dams and to develop about 6000 hp to be transmitted to cities and towns within a radius of 100 miles for lamps and motors.

PRATT, KAN.—At an election held recently the proposal to install a municipal electric-light plant in Platt was carried.

SUMMERFIELD, KAN.—Plans are being prepared by E. B. Murray and L. C. Hamilton, associate engineers, Missouri Savings Bank Building, Kansas City, Mo., for the installation of a municipal electric-lighting system, to cost about $12,000.

WELLSVILLE, KAN.—The Wellsville Lt. & Pwr. Co. is planning to build an electric power plant, contracts for which will be awarded in about 30 days. The equipment will include one 75-kw, three-phase, 60-cycle, 2300-volt generator (belted), one generator switchboard panel, one series switchboard panel, three ammeters, one voltmeter, one service ammeter, one 2300-volt automatic oil switch, one totalizing wattmeter, 5-kw, 2300-volt, service regulator and transformer, about 125 5-amp ammeters, 6.6-amp series tungsten lamps and about 4½ miles of distribution lines. The company will carry a complete line of electrical supplies. The street-lighting system will consist of sixty 100-watt series street lamps. A 6-ton ice plant will be operated in connection with the electric plant. C. A. Smith is proprietor of the plant.

WESKAN, KAN.—A power plant will be erected near Weskan by the Kansas State Irrigation Board to furnish power for irrigating purposes. R. P. Hines, of Topeka, is chairman of board.

Southern States

CHARLOTTE, N. C.—The Southern Pwr. Co., of Charlotte, it is reported, has organized a company to construct an electro-chemical fertilizer plant, utilizing 10,000 electrical hp.

ELKIN, N. C.—Plans are being considered to construct a hydroelectric power plant at Carters Falls, 3 miles west of Elkin, to cost about $20,000. The work will include a diverting dam, power house, etc., to develop 200 hp for transmission to Elkin and Jonesville. A company will probably be organized under the name of the Carters Falls Power Co. to operate the plant. The J. B. McCrary Co., of Atlanta, Ga., is engineer.

ALLENDALE, S. C.—At an election held recently the proposal to issue $65,000 in bonds for the installation of an electric-lighting, water and sewer system was carried.

COLUMBIA, S. C.—The Columbia Ry., Gas & El. Co., it is reported, is planning to build an addition to substation at Washington and Assembly Streets, at a cost of about $2,000; will install switchboard and transformers.

EHRHARDT, S. C.—The town of Ehrhardt, it is reported, has awarded contract for the installation of an electric-light plant.

SPARTANBURG, S. C.—The City Council is considering the question of installing an ornamental street-lighting system in the business district. The present plans provide for the installation of 88 arc lamps to take the place of 25 arc lamps under the present system.

WILLISTON, S. C.—Bids will be received by the Commissioners of Public Works until May 1 for the installation of an electric-light plant. L. S. Mellichamp is secretary.

ACWORTH, GA.—The managers of the municipal electric-light plant expect to purchase some lightning arresters soon.

ALBANY, GA.—The Albany Pwr. & Mfg. Co. expects to erect within the next three months 10 miles of 6600-volt, single-phase No. 4 copper wire transmission lines and to purchase one 50-kw, 2300/6600-volt transformer, one 20-kw and one 5-kw, 6600 115-volt transformer; also to purchase within the next six months one 750-kw, three-phase, 60-cycle, 2300-volt turbo-generator complete with condensing equipment. E. S. Killebrew is superintendent.

COLUMBUS, GA.—Within the next six months the Columbus Pwr. Co. expects to purchase one 500-kw generator and waterwheel (three-phase, 60-cycle, 11,000 volts); this will be a horizontal unit working under a head of 70 ft.; also to purchase one 100-kw, 60-hp, two-phase, 2200-volt motor-driven exciter and two 800-kw, 60-cycle, 11,000/2200-volt transformers. John S. Bleecker is manager.

MACON, GA.—A resolution authorizing the city of Macon to issue bonds for the installation of a municipal electric-light plant has been introduced into the City Council.

METTER, GA.—The Metter Co-operative Lt. & Pwr. Co., recently incorporated, has installed a small plant to light the business district of Metter. G. L. Williams is secretary and treasurer.

PELHAM, GA.—At an election held April 15 the proposal to issue $4,000 in bonds for extension to the lighting and water systems was carried.

BARTOW, FLA.—Within the next three months the city of Bartow expects to build a new brick power house and to purchase within the next 30 days a 250-hp boiler, one 175-kw, three-phase, 2300-volt alternator, a 225-hp single automatic engine, a feed-water heater, boiler-feed pump, etc. D. E. Bivins is manager.

BUNNELL, FLA.—Within the next six months Lambert & Moody, owners of the local electric-light plant, except to erect a new power house and substation and to purchase generators, engines, waterwheels, switches, protective devices, waterwheel governors, pumps, condensers, lightning arresters, transformers, insulators, arc lamps, incandescent lamps, posts, etc.; also electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, switches, etc.

JOHNSON CITY, TENN.—John W. Hunter, of Johnson City, who is making arrangements to furnish electrical service here and also to furnish electricity to operate the street railway system in Johnson City, will either purchase the local plant or build a new one.

BENTONVILLE, ARK.—Within the next six months the electric light and water works commissioners expect to erect 5 miles of transmission line and to purchase pumps and switching equipment for plant and also motors and complete pumping outfit George A. Johnson is superintendent

HARRISON, ARK.—The electric-light plant of the Harrison El. Lt. & Ice Co. has been purchased by a syndicate of Eastern capitalists headed by George D. Locke, of Rogers. The company has been reorganized under the name of the Harrison Gas & El. Co. and the capital stock increased to $100,000. Work will begin at once on the construction of a new electric plant on a new site. The present plant will be abandoned when the new plant is completed. The ice plant has been retained by R. M. Fellows, former owner of the light and ice plant, who will expend $25,000 for new equipment. Mr. Locke has been elected president of the gas and electric company.

HUNTINGTON, ARK.—The Coal & Gas Belt El. Co., of Huntington, expects to purchase within the next 10 months one 350-kw turbine, one 350-hp water-tube boiler and one 10-ton ice tank. G. W. Skow is general manager.

MELVILLE, LA.—A special election has been called for May 2 to submit the proposal to issue $15,000 in bonds for the installation of a municipal electric-light plant. Anderson Offutt, of New Orleans, has been engaged as electrical engineer.

ARANSAS PASS, TEX.—Bids will be received by the town of Aransas Pass until May 5 for equipment for electric-light plant and water-works system as follows: One 45-hp oil engine, one 25-hp oil engine, one 35-kva, three-phase, 60-cycle generator, one 18-kva generator, one two-stage centrifugal pump (500 gal. per minute capacity), one triplex pump (300 gal. per minute capacity), one switchboard, pole-line material, cast-iron pipe and fittings (class B), standard fire hydrants, water-gate valves, one tank and tower, 60,000 gal. capacity (120 ft. to bottom of tank); also cement, brick, sand and gravel. Specifications may be obtained from M. Griffin O'Nell & Sons, Dallas, Tex. Jesse J. Todd is Mayor.

CARLSBAD, TEX.—Plans are being prepared for the installation of an electric-light plant at the Texas Tuberculosis Sanitarium, at a cost of $9,000.

CUERO, TEX.—The Cuero Lt. & Pwr. Co has been granted permission by the State of Texas to build dams on the Guadalupe River for the development of electrical power. The contract is for a period of 50 years. The company already has one dam and hydroelectric plant, representing an investment of $240,000, and it proposes to construct two additional dams and plant, at a cost of $160,000.

NAPLES, TEX.—The Seven Cities Co., of St. Louis, Mo., is installing an electric-light plant and ice factory in Naples, and extending its transmission lines to Omaha and New Boston, Tex. The company is planning to build a large hydroelectric plant in Russellville, Ark.

SHERMAN, TEX.—The Texas Lt. & Pwr Co. contemplates improvements to its local plant, at a cost of about $18,000.

Pacific States

REPUBLIC, WASH.—The Republic Lt & Pwr. Co., it is reported, is contemplating repairs to its flumes, power plant, etc., at once.

SEATTLE, WASH.—Application has been made to the Commissioners of King County by Stephen J. Lynden, president of the Vashon El. Co., for a franchise to construct and operate telephone, electric transmission lines and electric railway on Vashon and Maury Islands.

SOUTH BEND, WASH.—The Willaps Pwr. Co., recently incorporated with a capital stock of $1,000,000, it is reported, contemplates developing several water-power sites in Pacific County. Franchises to operate in several nearby cities have been granted. William Summers, Lane Summers, H. R. Harriman and Frank MacKean, all of Seattle, and Frank Balcom, of Grand View, are incorporators. The headquarters of the company are located in the White Building, Seattle.

SPOKANE, WASH.—The Spokane Valley Pwr. Co., it is reported, is contemplating the reconstruction of entire power system here, at a cost of about $800,000. The company proposes to utilize a power site below Spokane. it is estimated that 20,000 hp can be developed. J D. Sherwood is president

TACOMA, WASH.—The Tacoma Ry. & Pwr. Co. expects to purchase within the next three months steel trolley poles for 27 blocks in the business section of the city. Orders have been placed by the company with the General Electric Co. for a complete new relay protective system for high-tension switches, with 60-amp-hr., 110-volt storage battery, from the Electric Storage Battery Co., of Philadelphia, Pa., and has also purchased one 50,000-volt and one 25,000-volt aluminum lightning arrester.

COVINA, CAL.—We are informed that bids will not be received until some time in May (date not yet determined) for material for the proposed ornamental street-lighting system. Reported in the issue of March 14 that bids would be received about April 15. Floyd G. Dessery, Central Building, Los Angeles, is engineer.

NEWPORT BEACH, CAL.—Contracts have been awarded for the installation of an ornamental street-lighting system. The plans provide for the erection of 150 fluted pressed-steel posts, equipped with one 100-cp lamp, and the installation of metal underground conduits, to cost about $23,000. The work will be done under the supervision of W. T. Weber, city engineer.

REDLANDS, CAL.—The Coachella Valley Ice & El. Co., of Redlands, has applied to the State Railroad Commission for a certificate of public convenience and necessity authorizing it to do business in Riverside and Imperial Counties.

SAN DIEGO, CAL.—The construction of a dam, reservoir and power plant on Boulder Creek as an adjunct to the Cuyamaca Wtr. Co.'s system has been announced by Col. E. Fletcher and James A. Murray. The dam will be 40 ft. high, 455 ft. long at the top and 90 ft. wide at the bottom and will have a capacity of 2,200,000 gal.; a conduit 4 miles long will lead from the reservoir. The power plant will cost approximately $247,000. It is proposed to furnish water for irrigating about 4000 acres and for other purposes in El Cajon Valley, La Mesa and East San Diego.

SANTA MARIA, CAL.—The Midland Counties Gas & El. Co., of Santa Maria, it is reported, is negotiating for the purchase of the Lompoc Lt. & Pwr. Co., of Lompoc. The plan contemplates not only the purchase of the Lompoc plant but also the erection of a high-tension transmission line from Santa Maria to Lompoc, via Harris station and over the Purissima grade; from Lompoc the line will be extended up the Santa Ynez River valley to Santa Ynez and thence to Los Olivos. The installation of a 2500-kw generator in the Santa Maria plant is also contemplated.

VISALIA, CAL.—The Mount Whitney Pwr. & El. Co., of Visalia, is planing to erect a substation 1 mile east of Terra Bella. The new station is one of five to be built this spring; the others will be erected at Earlimart, Goshen, Strathmore and Woodville.

NEZ PERCE, IDAHO.—The Grangeville El. Lt. & Pwr. Co., of Grangeville, it is reported, will install new transformers at Nez Perce.

MANTI, UTAH.—Orders have recently been placed by the city of Manti with the General Electric Co. for a series street-lighting system. Poles for the new lighting system have already been erected. George Brox is superintendent.

GLOBE, ARIZ.—We are informed that it will probably be three months before the proposal to establish a municipal electric plant will be submitted to the taxpayers. As yet an engineer has not been engaged. Harry C. Houser is city clerk.

PRESCOTT, ARIZ.—Surveys are being made by the Pacific Wtr. Pwr. Co., of Prescott, for the construction of three power plants on the Verde River. Two power plants are to be built on the river below a point where Fossil Creek empties into the Verde, and the other plant is to be located about 12 miles below Camp Verde. Electricity generated at the plants will be transmitted to Miami and Globe, in Gila County, a distance of about 70 miles. E. H. Meek is president.

PRESCOTT, ARIZ.—Bids will be received by the board of school trustees, District No. 1, Yavapai County (Prescott City Schools), until May 4 for construction of brick high school building and a manual arts building. Separate bids will be received for the work as follows: (A) For general contract work for the high school building and for the manual arts building, including wiring for electric-lighting and power purposes and for telephones; also to include the wrecking of present structures on premises; (B) plumbing; (C) heating and ventilating; (D) program clock system; (E) for athletic field complete. Copies of plans may be secured at the office of the board of trustees, Prescott; at the office of W. B. Barr, National Bank of Arizona Building, Phoenix, and at the office of William J. Bliesner, architect, 1616 Highland Avenue, Los Angeles, Cal., for which a deposit of $20 will be required, to be refunded upon return of plans.

LEWISTOWN, MONT.—Bids, it is reported, will be received by the City Council until May 11 for installation of lighting system in the business district.

SIDNEY, MONT.—The Water Users' El. Co. has been granted a franchise to furnish electricity in Sidney. The company will erect a transmission line from Enia to Sidney, a distance of 40 miles.

AGUILAR, COL.—The Aguilar Lt. & Pwr. Co. expects to erect within the next three months a pole transmission line to Lynn, a distance of about 1 mile. A. J. Arnold is manager.

AKRON, COL.—The Washington County Gas & El. Co., of Denver, has purchased equipment for a generating station at Wray and also for a 60-mile transmission line to be erected within the next three months to furnish 24-hour service in the towns of Laird, Wray, Eckley, Yuma, Otis and Akron, Col. The central unit to be installed at Wray consists of a 350-hp compound condensing steam engine and a 250-kva, three-phase, alternating-current generator and a smaller unit, consisting of a 150-hp steam engine and a 125-kva generator. The present plant furnishing electrical service in Akron will be closed and held as a reserve unit. It will require about 30 miles of line to serve the towns; for this and the transmission line about 3000 poles will be required, with necessary transformers, distribution cable, etc. George H. Sethman, of Denver, is president of the company, and W. B. Glasser is manager.

MONTROSE, COL.—Within the next three months the Montrose El. Lt. & Pwr. Co., of Montrose, expects to erect a transmission line to Delta, a distance of 23 miles. C. L. Flower is manager.

PUEBLO, COL.—The Arkansas Valley Ry., Lt. & Pwr. Co., of Pueblo, expects to erect 6 miles of 13,000-volt transmission lines on existing poles and approximately 3 miles on new poles. W. F. Raber is vice-president and manager.

Canada

CALGARY, ALTA.—The city commissioners are considering the question of requiring all wires to be placed underground in the business section of the city.

CALGARY, ALTA.—A by-law authorizing an expenditure of $300,000 for equipping and extending the street and residence lighting systems will be submitted to the voters on May 7.

VICTORIA, B. C.—The City Council has instructed the city electrician to begin work on the construction of conduit for underground cables on Herald Street from the electric-light station to the present terminus of the conduits on Store Street.

CANSO, N. S.—The Town Council is contemplating the installation of an electric-lighting system, to cost about $15,000.

RENFREW, ONT.—The Town Council has requested the Hydro-Electric Power Commission to submit an estimate of the cost of installing a street-lighting system in Renfrew.

MONTREAL, QUE.—Preliminary plans are being prepared for an extensive hydro-electric development for the Lachine Rapids Pwr. Co. It is proposed to develop power on the north and south sides of Heron Island in the center of the Lachine Rapids.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until May 8 for motors and centrifugal pumps, float switches, electric cables, sheet copper, sheet brass, bronze bars, brass tubing, steel wire, etc. Blanks and general information pertaining to this circular (No. 845) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

New Incorporations

LOS ANGELES, CAL.—The Midland Counties Pub. Ser. Corpn., recently incorporated with a capital stock of $2,000,000 by William Kerckhoff, A. C. Balch, Kaspar E. Cohen, A. Haas, A. G. Wishon and A. E. Wishon, proposes to furnish electricity for lamps and motors in the Santa Ynez valley, the northern end of the county and all of San Luis Obispo County. The company has acquired the power plants at Santa Maria, San Luis Abispo, Lompoc and other points, and plans for immediate extensions are being made. The company is a subsidiary of the San Joaquin Lt. & Pwr. Co.

COLUMBUS, MISS.—The Mississippi El. Co. has been incorporated with a capital stock of $1,000,000 by Charles F. Herrod, F. W. Crosby, Battle Bell and others. The company proposes to build electric power plants.

BARTLESVILLE, OKLA.—The Hominy Ice, Lt. & Pwr. Co. has been incorporated with a capital stock of $15,000 by Harry A. Cushing, D. B. Mason and F. M. Overless, of Bartlesville.

DALLAS, TEX.—The Northern Texas Utilities Co., of Dallas, has been incorporated with a capital stock of $500,000 to generate and distribute electricity and gas; supply water for domestic and power purposes and also to manufacture ice. The company is authorized to do business in the counties of Dallas, Parker, Comanche, Rockwell, Montague, Wise, Panola, Bosque, Hunt, Clay and Collins. The incorporators are Hiram Grosman, W. C. Woodlief and W. T. Heninger, all of Dallas.

ST. JEAN CHRYSOSTOME, LEVIS, QUE.—The Canada Lt. & Pwr. Co. has been incorporated with a capital stock of $140,000 by A. Jodoin, L. Gagne and J. E. Vincent.

ST. PIE, QUE., CAN.—The Bagot El. Co. has been incorporated with a capital stock of $99,000 by J. A. Bourbeau, J. T. Gazelle and A. M. Morin.

UPTON, QUE., CAN.—The Upton El. Co. has been incorporated with a capital stock of $99,000 by J. A. Bourbeau, G. W. Piche and R. Loiselle.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 14, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,092,849. Rotor Construction for Induction Motors; J. D. Nies, St. Charles, Ill. App. filed Feb. 15, 1912. Conductor bars thrown out by centrifugal force into engagement with short-circuiting rings.

1,092,878. Therapeutic Electric Apparatus; R. H. Wappler, New York, N. Y. App. filed Aug. 12, 1913. For effecting a rhythmic swelling of the current.

1,092,880. Rheostat; H. J. Wiegand, Milwaukee, Wis. App. filed Aug. 2, 1912. Disk type theater dimmer

1,092,891. Trolley Switch; A. Bevan, Providence, R. I. App. filed March 4, 1910. Actuated by trolley wheel to control signal circuits.

1,092,918. Signal Device; D. G. Knittel, Pittsburgh, Pa. App. filed Jan. 28, 1913. For sending signals from police or fire-alarm boxes to a central station.

1,092,919. Signal Transmitter; D. G. Knittel and W. J. Davis, Pittsburgh, Pa. App. filed March 19, 1913. For transmitting variable codes from police reporting boxes to a central station.

1,092,952. Compression Rheostat; P. J. Ray, Lakewood, Ohio. App. filed June 21, 1913. Formation of air-gaps prevented when elements are not under compression

1,092,956. Means for Reducing Reflection Losses in Duplex Circuits; T Shaw, Hackensack, N. J. App. filed Feb 28, 1913. Applicable as a phantom circuit.

1,092,957. Means for Reducing Reflection Losses in Phantom Circuits; T. Shaw, Hackensack, N. J. App. filed Feb. 28, 1913. Reflection-reducing transformer.

1,092,964. Combined Jack and Drop; R. M. DeVignier, Hollis Terrace, N. Y. App. filed Dec. 27, 1911. Readily assembled self restoring jack and drop construction

1,092,969. Automatic Electromagnetic Switch; C. Benton, San Francisco, Cal App. filed June 12, 1912. For keeping one or more signal lights burning at all times.

1,092,977. Printing Controlled Electric Sign; M. Compos, Mobile, Ala. App. filed Aug. 16, 1911. Perforated stencil cards give letters or designs desired.

1,092,985. Appliance for Cleaning Tarnished Metals H M. Fetters, Laporte, Ind. App. filed Dec. 18, 1912. Electropositive plates with electropositive filling therebetween.

1,093,003. Cooker, P. A. McCaskey, Lakewood, Ohio. App. filed July 6, 1911. After desired heat is attained, cooker operates on "fireless" principle.

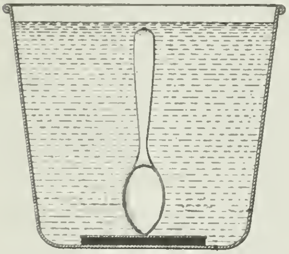
1,093,010. Method of and Means for Manufacturing Metal Pipe and Tubing, E. E. Ries, New York, N. Y. App. filed Nov. 30, 1908. Electrically welded seamless metal tubing.

1,093,034. Party-Line Telephone System; A. G. Cerda, Morelia, Mexico. App. filed June 26, 1908. For obtaining talking connection between branch and central station, to exclusion of other branches.

1,093,041. Party-Line Telephone System; C. J. Erickson, Chicago, Ill. App. filed Nov. 15, 1906. Prevents interference between subscribers on the same line in an automatic system.

1,093,045. Dynamo-Electric Machine; V. A. Fynn, London, England. App. filed June 26, 1911. Continuous current, operating under varying speed in conjunction with storage battery.

1,093,051. Oil Switch; E. M. Hewlett and C. E. Eveleth, Schenectady, N. Y. App. filed Nov. 12, 1904. Special oil-pot construction.



1,093,236—Electrolytic Cleaning Electrode

1,093,072. High-Frequency Discharge Apparatus; H. W. Perkin, Glendale, Cal. App. filed Dec. 30, 1912. For ignition systems; retains high-frequency, high-tension character throughout duration of discharge.

1,093,074. Electric Motor; E. S. Pillsbury, St. Louis, Mo. App. filed April 11, 1911. Centrifugal switch mechanism for fan motors.

1,093,076. Removable Tip for the Contacting Ends of Armature Springs; C M. Proctor, Detroit, Mich. App. filed Oct. 19, 1912. Clip carrying a tip removably engaged on armature spring of electric bell.

1,093,083. Distribution System for Vapor-Electric Devices; R. G. Standerwick, Lynn, Mass. App. filed May 24, 1913. Alternating-current high-pressure or "quartz" lamp.

1,093,100. Multiple Key; C. E. Beach, Binghamton, N. Y. App. filed Sept. 12, 1910. Controls plurality of signal circuits and applies one battery to each of such circuits, one after another.

1,093,113. Spark Plug; C. M. Conklin, Cincinnati, Ohio. App. filed Nov. 6, 1909. Heat-insulating diaphragm interposed between the parts of the insulating core which are subjected to internal and external temperature.

1,093,126. Temperature Regulator; W. S. Hadaway, Jr., New York, N. Y. App. filed Aug. 16, 1911. For electrical heating systems.

1,093,132. Call System; J. Hergesheimer, Glenside, Pa. App. filed March 5, 1913. For indicating at various points in a factory that a certain party is wanted.

1,093,137. Electromagnetic Controlling Device; H. J. Keating, Chicago, Ill. App. filed Aug. 6, 1912. For imparting slow reciprocating movements to advertising and other devices.

1,093,144. Portable Electric Lamp; W. J. Monaghan, Waterbury, Conn. App. filed Oct. 27, 1913. Battery held in casing so as to prevent accidental closing of circuit.

1,093,147. Electrical Controlling Mechanism; F N. Reeves, Newark, N. J. App. filed Aug. 20, 1912. High-speed selective switching apparatus for telephone exchanges.

1,093,149. Driving Mechanism for Electrically Propelled Vehicles; E. W. Schneider, New York, N. Y. App. filed May 31, 1910. Driving motor is made a part of the wheel which it drives.

1,093,164. Refillable Fuse Cartridge, G W. Appler, Lyons, N. Y. App. filed May 6, 1913 Multiple fuse.

1,093,174. Gate-Locking Means; G. E. Ericsson, Dubois, Pa. App. filed June 15, 1912. For elevator shafts, etc.

1,093,182. Arc Electrode and Process for Making It; J. L. R. Hayden, Schenectady, N. Y. App. filed Aug. 17, 1908. Solidified fusion of magnetite, rutite chromite and fluoride of potassium.

1,093,191. Igniter Trip Device for Explosion Engines; R. Kelley, Minden City, Mich. App. filed Aug. 13, 1913. May be adjusted to advance or retard spark during the running of the engine.

1,093,195. Electrical Water Heater; R. R. Lockhart, Winnipeg, Manitoba, Canada. App. filed May 28, 1913. Applicable to presend-day water-heating systems.

1,093,197. Method of Welding Lamp Filaments; G. F. Morrison, Newark, N. J. App. filed March 16, 1907. Magnetic means deflects the welding arc away from the filament.

1,093,207. Method of Making Welded Chain; M. B. Ryan, Bridgeport, Conn. App. filed Oct. 23, 1912. Beveled ends overset and subjected to electric welding heat with pressure.

1,093,221. Case for Incandescent Electric-Lamp Sockets; W. Weber, Sr., and J. Weber, Schenectady, N. Y. App. filed April 7, 1908. Multiple-lock socket shell.

1,093,235. Trolley Wire Feed Tap Insulator; E. L. Alvord, Hartford, Conn. App. filed Aug. 27, 1913. Constructed so that insulator and the tap wire will not drop out of the hanger.

1,093,236. Electrolytic Cleaning Electrode; T. Appleby, Philadelphia, Pa. App. filed June 24, 1913. Unitary insulating means and electropositive element.

1,093,237. Electric Heater; G. A. Arnold, Middletown, Conn. App filed March 19, 1913. Heating coil of a size to permit its introduction through one of the holes in the induction pipe in which the insulator supports are engaged.

1,093,240. Wireless Telegraph Receiver; J. G. Balsillie, Melbourne, Victoria, Australia. App. filed Feb. 10, 1914. Associated with an air wire or absorbing circuit of the looped type.

1,093,281. Electric-Welding Machine; N. Macneale, Cincinnati, Ohio. App. filed Dec. 31, 1913. Die-carrying horns for spot-welding machines.

1,093,287. Electric Cap Light; A. R. Neff, Los Angeles, Cal. App. filed Nov. 20, 1913. For use with commercial dry battery and combining functions of bulb holder, reflector, contact maker and light.

1,093,297. Machine for Welding Reinforcements for Concrete; W. S. Southwick, Clinton, Mass. App. filed Oct. 26, 1911. For welding tension rods and stay wires together.

1,093,301. Vibrator; G. Vande, Los Angeles, Cal. App. filed June 16, 1913. Alternating-current magnet with core of double U-shaped form.

1,093,318. Electrical Sparking Device; W J. Cunningham, Toledo, Ohio. App. filed Aug. 5, 1912. Magnet breaks contact between two electrodes.

1,093,328. Electric Induction Heater of Furnace; A. Helfenstein, Vienna, Austria-Hungary. App. filed June 5, 1912. Embodies a metal bath, a transformer and water-cooled poles.

1,093,368. Vapor-Electric Device; E. Weintraub and A. E. Hibschman, Lynn, Mass. App. filed Jan. 3, 1914. Mercury cathode and co-operating solid anodes located in separate arms of the envelope.

1,093,378. Motor-Control System; L. E. Bogen, Milwaukee, Wis. App. filed July 28, 1911. For mechanically connected motors coupled to a common load.

1,093,382. Electric Furnace; J. W. Brown, Lakewood, Ohio. App. filed Jan. 8, 1912. Continuous type for calcination of granular carbon.

1,093,384. Rotary Electroplating Apparatus; C. J. Charlton, South Benfleet, England. App. filed Nov. 7, 1913. Outer rotating drum and inner perforated article-containing drum.

1,093,395. Automatic Fire Alarm; E. A. Gehrke, Lincoln, Neb. App. filed March 22,1913. Alarm turned in thermostatically or by hand.

1,093,423. Spark Plug; E. Holzworth, Alliance, Ohio. App. filed April 9, 1912. Parts held together in a two-part clamping member.

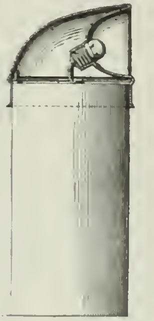
1,093,424. Adding Machine J. P. Hunter and H. Küntzler, Wilkes-Barre, Pa. App. filed Dec. 30, 1908. Automatically locked against accidental actuation when motor is not energized.

1,093,468. Separable Attachment Plug, J G. Peterson, Jersey City, N. J. App. filed March 31, 1913. Has screw shell with flange clamped between members of insulating base.

1,093,477. Means for Protecting Electric Circuits from Excessively High Differences of Potential and Similar Disturbances; R. Rüdenberg, Charlottenburg, Germany. App. filed March 14, 1913. Employs concentrated inductance and concentrated capacity.

1,093,479. Insulator; J. A. Sanford, Jr., East Liverpool, Ohio. App. filed Dec. 16, 1911. High-voltage, pin-type, built-up, nested units.

1,093,480. Insulator; J. A. Sanford, Jr., East Liverpool, Ohio. App. filed June 13, 1912. Built-up nested units spaced by plug disks.



1,093,287—Electric Cap Light

1,093,491 Static Electric Eradicator, F. A. Smith, Syracuse, N. Y. App. filed March 28, 1913. For printing presses.

1,093,494. Electric Furnace for Medium Temperatures, Particularly for Melting Copper and Its Alloys; E. Stassano, Turin, Italy, and N. Petinot, Niagara Falls, N. Y. App. filed July 18, 1913. Special electrode holders and air-lock hopper.

1,093,507. Trolley-Wheel Guard; E. W. Warnick, Cuyahoga Falls, Ohio. App. filed Oct. 1, 1913. Opens automatically when passing a hanger or support.

1,093,508. Street Indicator for Cars, F. H. Webster, Marvell, Ark. App. filed June 17, 1913. Indications carried on endless band.

1,093,510. Electric Stove or Iron; G. Wenzelmann, Galesburg, Ill. App. filed Nov. 11, 1913. Has asbestos heat-resisting ring running around inner face of heater cavity.

1,093,512. Sheathed-Wire Terminal; W. R. Whitney, Schenectady, N. Y. App. filed Oct. 17, 1912. Formed integral with conductor.

1,093,525. Automatic Telephone Exchange System; W. R. Binkley, New Bedford, Mass. App. filed July 22, 1905. Percentage trunking scheme.

1,093,539. Machine for Covering Electric Conductors; E. H. Cook, Wilkes-Barre, Pa. App. filed June 5, 1908. For applying asbestos or like covering to wire.

1,093,545. Starting Means for Vapor-Electric Apparatus; J. T. H. Dempster, Schenectady, N. Y. App. filed Dec. 19, 1903. Bodily movable filament of carbon with one end tipped with titanium carbide.

1,093,583. Electric Elevator System; E. M. Fraser, Yonkers, N. Y. App. filed July 29, 1912. Shunt-wound motors with coupled armature shafts and rotary field structures.

1,093,592. Incinerator; M. H. Rice, New Rochelle, N. Y. App. filed Sept. 19, 1913. For burning garbage and wet material.

Electrical World

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Monopoly in Utility Service

The Public Service Commission of Pennsylvania has rendered decisions upholding as desirable the principle of monopoly in public utility service. In so doing it takes the same position that most of the other commissions hold on this question. That is to say, it decides that it is unwise to permit two companies to do in competition what one existing company serving a territory is able to do. The grounds on which such a policy is defensible are reasonable and economic. The history of public utility companies in various parts of the country proves the case. Generally a competing plant is absorbed by the existing company whose rates it demoralized and whose business it tried to get. The public has been so short-sighted in the past as to see only the lower rates which the competitor promised and to fail to see that a consolidation was inevitable after an uneconomic rate war had demoralized the business. After such a consolidation there are two plants and two capital accounts upon which the public is expected to pay a return. The theory of regulation by the public is that the monopoly furnishing the service shall be protected from destructive competition. The companies, on their part, are not without obligations when they accept this theory. They owe it to the public to give as good service while enjoying protection as a monopoly as they would give if they were under the spur of competition.

Activity in Manufacturing

The annual report of the General Electric Company may be taken as fairly representative of conditions in the manufacturing part of the industry. It is, therefore, encouraging to note that comparison of the figures for 1913, given in last week's issue, with the reports of previous years shows a much greater volume of business. The increase in the amount of sales billed in 1913 as compared with 1912 is 19.4 per cent. Favorable as this record is, it is not so good as that of 1912, which showed an increase of 26.7 per cent over 1911. That the business now is less sensitive to the changes in general business conditions than it was in earlier years is a fair conclusion from a consideration of these figures as compared with the record of 1911, which showed a slight decrease, amounting to 1.5 per cent from 1910. The amount of sales billed in 1913 was 51.3 per cent greater than in 1911. At the same time it is evident that signs of a let-up were manifest at some time in 1913 because the increase in the value of orders received was 8.6 per cent, or, roughly, less than one-half of the proportionate percentage increase in amount of sales billed. There was thus a time during the year when the new orders did not gain so rapidly as the filled orders over the preceding year. This is less significant than it would have been a few years ago. With the increasing diversity of uses for electrical energy and with the central stations working steadily toward a more universal application, it is reasonable to predict a measure of stability in the electrical manufacturing industry that is not common in most other manufacturing lines.

Improving a Small Plant

The changes and rehabilitations effected in some of the great central stations of the country are most impressive in their magnitude, yet oftentimes they do not represent a finer ingenuity or a greater degree of resourcefulness than the changes which have to be carried out in bringing a small plant up to date. It is the small plant which is typical of the ordinary requirements of the electrical business; it represents average conditions of load and requires more than average skill to bring into a state of maximum productiveness. The account published in this issue of the work done in rehabilitating the plant at Alliance, Ohio, should interest many practical engineers and managers. Like most plants in places of moderate size, the Alliance station gradually grew from nothing in particular to a plant carrying a considerable and rapidly increasing load, until finally complete reconstruction without interruption of service was the problem which presented itself. The plant was originally without water for condensation, and no good water supply was available without so considerable a change in location as would involve serious difficulties. Therefore the cooling tower was resorted to for the betterment of steam economy. In passing from the old engine plant to a modern outfit of turbo-generators it was necessary to provide a new boiler plant, to move and turn around the stack, and make a suitable arrangement for the turbines as well as shift and entirely reorganize the switchboard without interfering with the service. To carry out these changes while building a new station on the same site as the old one was no easy matter, and the first step was to build a temporary sheltering house around the old station and inside the location of the new one. Thereafter apparatus could safely be moved around the old station while the new walls were going up on the outside of the intermediate one. Gradually the new equipment went into place, and the old equipment was shifted to the new location with an interruption of service of only two hours at a convenient time one Sunday.

The station now contains a 1750-kw equipment in two modern steam turbines, with a first-class equipment of water-tube boilers and a completely reorganized switchboard of the latest type. An unusual feature of the boiler-room outfit is that two of four boilers are equipped with natural-gas burners, the other two burning coal with mechanical stokers. It is interesting to note that at present prices of fuel the coal-fired boilers are depended upon for the bulk of the work, the gas-burning boilers being kept warmed up and used when necessary. At a pinch they can be pushed to the working pressure of 150 lb. in about twenty minutes. The study of this work of rehabilitation may be of considerable service to the many engineers who in the course of the next few years will have to undertake similar work.

Alternating-Current Electromagnets

The fundamental law of electromagnetic attraction between opposing polar surfaces, as stated originally by Maxwell, is very simple; namely, that per unit of area it is directly and simply proportional to the square of the flux density, and that it is directed along the stream lines of flux density. If, therefore, a direct-current electromagnet is provided with such a magnetic circuit that the flux density in the air-gap is uniform and directly across the gap, the total pull between the polar surfaces becomes definitely determined when the flux density is known. Actually, however, when the iron becomes so nearly saturated that the magnetizing force H becomes appreciable with respect to the flux density B the realizable pull falls below the electromagnetic tension existing along the flux paths. If, for example, a lifting solenoid contained a movable iron-core plunger which became completely saturated, magnetically, before the end of its stroke was reached, the lifting force on the plunger would cease and it would behave from that point like a core of lead; since, by hypothesis, no increase in flux could occur in the air-gap by any further advance of the core. As, however, complete saturation is never attained throughout the length of a plunger core, such a state of complete magnetic stagnation and standstill cannot be produced in this manner, although it may be brought about in other ways. Again, the magnetic leakage in an electromagnet may cause the flux density in the air-gap to disperse and weaken, so that the direct-current electromagnet may behave in a seemingly very erratic fashion in respect to its tractive force, owing to the combined effects of magnetic leakage, saturation and contour of the polar surface.

The laws of action of a direct-current traction magnet are, however, simple and few by comparison with those governing any simple alternating-current electromagnet. Here the magnetic pull is never steady over more than an infinitesimal interval, so that, under a steady tractive load, there is a tendency for the magnet to release its load altogether at zero-flux moments, and then to think better of its laxity and take up its load again—twice in each cycle. This makes the pull chattering and unstable. The reactance and impedance of the magnet also change when the air-gap changes, so that under constant impressed emf the exciting current changes of itself, in a somewhat irregular manner. Eddy currents set up in the magnetic circuit, or in adjacent metallic parts, develop demagnetizing forces in a very complicated manner, associated with what is ordinarily termed a "skin effect." One may thus understand the attitude of mind of the magnetician who expressed the desire that his enemy should be compelled to compute the complete electromagnetic behavior of an alternating-current electromagnet to the uttermost detail. In an article in this issue Mr. Charles R. Underhill outlines some of the characteristics of a comparatively simple form of alternating-current electromagnet employing different lengths of stop-gap, an attempt being made to co-ordinate observation with predetermination.

A Milliampere Series Transformer

The ordinary form of oscillograph is a very valuable implement in exploring the behavior of electric circuits, but it has its limitations in regard to the strength of current which it can measure satisfactorily. When the current is less than, say, 20 milliamperes, the wave recorded on the oscillograms is of too small an amplitude to give satisfactory indications.

In one of the papers at the Washington meeting of the A. I. E. E. last week Mr. Edward Bennett described the design, construction and application of a special small series transformer for use with an oscillograph in such a manner that a primary current of about 200 microamperes can be conveniently recorded, or about the hundredth part of the current ordinarily required. By this means the charging current of a single aerial-line insulator under moderately high-tension voltage, becomes readily recordable, and various other relatively feeble alternating-current phenomena become capable of oscillographic analysis.

Some of the difficulties which presented themselves in the design of the apparatus possess considerable practical interest. The new series transformer requires manifestly a large number of turns in the primary winding, which is stated to contain more than 3 km of fine enameled copper wire. Such a winding tends to bring successive layers of the copper wire into close proximity, their separation being merely two thicknesses of enamel; so that if the successive layers develop a considerable difference of potential they virtually form a condenser of very appreciable capacity. By successive transition from layer to layer it is evident that high-frequency harmonics might find a condensive shunt through the aggregate capacity of the winding, and thus fail to develop a proper proportion of secondary current through the oscillographed vibrator. This difficulty was finally remedied by sectionalizing the fine-wire winding.

A marked advantage and merit of the paper is that the dimensions and data for this transformer are given entirely in the metric system, a procedure which greatly aids the reader in this as well as in other countries. It is greatly to be desired that this procedure shall be generally followed in all papers presented to engineers.

The oscillograms appended to the paper illustrate effectively some of the feeble-current oscillographic investigations attained by the use of the apparatus. In particular, they seem to show that when the voltage on a suspension insulator is raised to such a point that streamers occur over the insulator surface these streamers set up groups of oscillations with some 3000 cycles per second, commencing shortly after the maximum or crest voltage in each alternation.

The new apparatus extends appreciably the range of voltage and current over which oscillographic records can be secured. High-voltage oscillograms are already well known. High-current oscillograms are no novelty in so far as they merely introduce a non-inductive shunt in the apparatus, but low-current oscillograms offer a new field of usefulness.

Bulk Electric Supply for London

It is very encouraging to note all over the world the increasing appreciation of the economies incident to the supply of electricity in bulk. The time has gone by when isolated small stations can make a good economic showing in face of the steady public pressure for lower prices. The great stations of this country have for years past been working at the economics of wholesale supply, and the excellent results obtained have served as an admirable example elsewhere. Now London seems to be awaking to the situation, and the present London electric supply bill may fairly be said to be chargeable in no small degree to the good example set on this side of the water. Incidentally, it may be remarked that one of the consulting engineers is an American long distinguished for his knowledge of large enterprises, and particularly familiar through long residence with the London situation. Speaking broadly, London needs consolidated electric supply more than any other city. It is full of small and large, private and public plants. They represent every phase of electrical development from the beginnings of the direct-current system to the last forms of alternating-current distribution. They run at all varieties of voltages and from all sorts and conditions of prime movers. Individually it is not too much to say that they are remarkably well handled within their limitations and succeed in turning out reliable supply at what seems in this country a very modest price, yet there is no doubt at all that the present movement looking toward stations able to furnish bulk supply can effect great economy.

It is little too early yet to predict what the final scope of the operations will be in case the bill runs the gantlet of the various legislative and other trials that will doubtless besiege it. Work may have to begin on a somewhat modest scale by virtually merging a number of private supply companies and arranging for the better and more economically equipped ones to furnish bulk supply for those less fortunate. It is not unlikely that the scheme once in operation will result in a general system of supply in which all the present sources of electrical energy will be united in a comprehensive scheme. There are good engineering reasons back of the plan which have particular application to a place like London. As things now stand, a perfectly possible station accident might easily leave a large district of the world's largest city absolutely without electrical supply until repairs could be executed. Some of the stations are now so situated with respect to the nature of their distribution that they could not easily get emergency service from neighbors who might be ever so willing and able to supply it so far as station equipment is concerned. Such an unfortunate situation could not arise in any large section of a city with distribution from several generating stations. The feeder system in America is so thoroughly organized and the arrangements for alternative sources of supply have been so completely worked out that more than a temporary break-down over a comparatively small area is almost unthinkable. The mere possibility of complete failure with no ready means short of actual repairs for keeping up the service is not pleasant to contemplate.

Even if the unified plan of supply now gradually being formed should not be able materially to reduce the cost of the product, the general security given by a completely worked-out system of distribution would be well worth taking a very considerable commercial chance to obtain. In point of fact, the experience shows plainly that when a unified system is secured the actual cost of energy drops in a very notable degree because a small station has limitations due to its size and to the nature of its load-factor which good management cannot overcome. It is well known to those who are familiar with London conditions that the union of a large group of plants in that metropolis would mean a considerably improved load-factor and that the diversity-factor conditions would be extremely advantageous.

For instance, in one prosperous and well-managed plant the load is largely residence lighting and the peak falls certainly two or three hours later than that in another station of not dissimilar size a few miles away. Indeed, we think it is safe to say that the diversity to be found in the London stations with respect to demand for output is exceptionally great, for London itself is the most diversified of the world's great cities. This means exceptional advantages in united supply. Eventually the situation might advance to complete unification with several very large stations situated at advantageous points and thoroughly linked together so that no failure of one could interrupt the integrity of the general supply. The scheme is a most interesting one, and if carried out by conservative managers and skillful engineers, as is likely to be the case, should result in a very great public benefit as well as in a not inconsiderable financial success.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

New Rates in Los Angeles

An election on a proposition to issue city power bonds will be held in Los Angeles on May 8. The Board of Public Utilities has ordered a reduction in rates in Los Angeles. The lighting rate has been from 6 cents to 2.3 cents per kw-hr. The motor rate has been from 5 cents to 1.2 cents per kw-hr. The reduced rates are about 20 per cent lower.

Convention of Arkansas Association of Public Utility Operators

The seventh annual convention of the Arkansas Association of Public Utility Operators was held in Little Rock, April 21-23. At the closing session the following officers were elected: Mr. C. J. Griffith, general manager of the Little Rock Railway & Electric Company, president; Mr. W. L. Wood, Jr., of the Southwestern Gas & Electric Company of Texarkana, first vice-president; Mr. H. C. Hoagland, general manager of the Fort Smith Light & Traction Company, second vice-president; Mr. W. J. Tharp, auditor of the Little Rock Railway & Electric Company, secretary-treasurer.

Program of Pittsfield A. I. E. E. Meeting

The general subject for discussion at a meeting of the American Institute of Electrical Engineers to be held in Pittsfield, Mass., on May 28 and 29 is "Relative Advantages of Star and Delta Connections." The following papers will be presented: "Experiences with Line Transformers," by Mr. D. W. Roper; "Experience of the Pacific Gas & Electric Company with the Grounded Neutral," by Messrs. J. P. Jollyman, P. M. Downing and F. G. Baum; "Influence of Transformer Connections on Operation," by Mr. Louis F. Blume, and "A Study of Some Three-Phase Systems," by Mr. Charles Fortescue. The headquarters for the meeting will be at the Maplewood Hotel.

International Electrotechnical Commission

At the Berlin meeting of the International Electrotechnical Commission, held in September, 1913, an account of which appeared in our issue of Sept. 20, 1913, it was agreed that meetings of the (international) special committees should be held in Madrid toward the close of the present month. These special committees deal with symbols, standardization rules for electrical machinery, nomenclature and prime movers for electrical plant. It has been found impracticable to hold these meetings at the present time, and they have therefore been postponed until the autumn. It is probable that they may take place in London. This extension of time will enable the national committees to consider in detail the various proposals which will be discussed by the special committees, and it should have the additional advantage of simplifying the work of the delegates.

Activities of Society for Electrical Development

The Society for Electrical Development, Inc., in selecting its staff has chosen, among others, Mr. John P. Mallett, whose duties will be to investigate the application of electricity to the various industries and to suggest further applications. The information thus gathered will be filed and indexed for the benefit of the members of the society, and in addition to other available information on the subject of the uses of electricity will be taken care of by the Commercial Exchange Bureau, which will be in charge of Mr. Theodore Dwight. Mr. James Smieton, Jr., has been engaged as office manager and acting secretary-treasurer of the society. Other members of the staff are being secured, and the society expects to commence its active work this week. Among the important companies which have recently joined the society is the Edison Electric Illuminating Company, of Boston, Mass.

Burdensome Taxation in Colorado

Valuations of all corporations in Colorado for taxation are now determined by the State Tax Commission of that State. This commission was created by the last Legislature. Heretofore taxes have been levied on a one-third valuation, whereas at the present time they are levied on the full valuation. Valuations have been fixed by the new commission at an amount which the commission undoubtedly thinks is fair. However, the actual result has been a very large increase in the taxes to be paid by the public utility corporations of Colorado for 1913, as compared with those for former years. It is asserted that these taxes will amount to about 10 per cent of the gross income of the utility companies. It is declared further that the 1913 taxes on some of the utility companies will run as high as 14.5 per cent of the gross income for the year.

Convention of Mississippi Electrical Association

With a registration of more than sixty, the annual convention of the Mississippi Electrical Association, which is a state section of the National Electric Light Association, was held at Meridian, Miss., April 27 to 29.

Mr. W. E. Baskin opened the sessions with an address of welcome on behalf of the Meridian Light & Railway Company, the host of the convention. President W. F. Gorenflo, of Gulfport, then called on Mr. N. P. Bissett, of Hattiesburg, who spoke on "Liability Insurance." On Tuesday Mr. R. M. Ellis, of Selma, Ala., president of the Alabama Electrical Association, read a paper on "Lubrication," which was discussed by Messrs. A. P. Patterson, of Meridian, and W. A. McWhorter, of Atlanta. Mr. Charles M. Rogers, of Meridian, also spoke on boiler operation and efficiency. Messrs. W. F. Gorenflo, R. M. Ellis and A. H. Jones, of McComb, joined in the discussion. On Tuesday afternoon Mr. L. W. Wade, of Vicksburg, presented a paper on "Short Cuts in the Office of a Small Electric Plant." On Wednesday Mr.

R. E. Perry, of St. Louis, Mo., gave an illustrated talk on nitrogen-filled tungsten lamps.

Officers were elected as follows: President, Mr. A. H. Jones, of McComb; vice-president, Mr. Charles Hay, of Columbia, S. C.; secretary-treasurer, Mr. H. F. Wheeler, of Hattiesburg. The executive committee comprises Messrs. R. B. Claggett, of Greenville; A. B. Patterson, of Meridian; W. F. Gorenflo, of Gulfport; E. P. Booth, of Vicksburg, and R. H. Smith, of Jackson. The next convention of the association will be held at Hattiesburg on April 12 to 14, 1915.

Progress of the Panama-Pacific International Exposition

The accompanying illustration shows a part of the main exhibit section of the Panama-Pacific International Exposition, taken from the dome of the Palace of Education. The buildings shown comprise a central group of eight main exhibit palaces, four of which face San Francisco Harbor on the north and four face the South Gardens, on the right of the illustration. The Palace of Education is the southwest building of the group. Dividing the group north and south are three great courts and their approaches. The court seen in the photograph is the Court of the Four Seasons. Further to the east is the great central court, the Court of the Universe, and still further is the Court of Abundance. The walls of the exhibit palaces, forming the sides of the courts, are screened by colonnades, some of which may be seen in the photograph. Following the line of the colonnades one comes to a great esplanade upon the shores of San Francisco Harbor.

PANORAMIC VIEW OF THE PANAMA-PACIFIC INTERNATIONAL EXPOSITION BUILDINGS, SAN FRANCISCO

Labor Exchange Proposed by National Commission on Industrial Relations

Plans for legislation by Congress to do away with the evils of non-employment have been announced by the members of the United States Commission on Industrial Relations.

The proposed legislation would establish a National Bureau of Labor exchange in connection with the Department of Labor, with a central office in Washington and branch offices in other cities, and with a clearing house for each of several districts into which the country would be divided. The bureau would have power to establish and conduct free public employment offices.

The bureau's most important service would be to gather and distribute accurate information regarding the labor market in various localities. This information would be published in the form of bulletins at frequent intervals, circulated in such a way as to be available to every person in search of work and every employer seeking workmen.

Pacific Coast Convention A. I. E. E.

The 1914 Pacific Coast Convention of the American Institute of Electrical Engineers will be held in Spokane, Wash., in September, the exact date not having been set as yet. President C. O. Mailloux has appointed the following convention committee: Mr. D. L. Huntington, chairman; Mr. John B. Fisken, vice-chairman, and Mr. H. B. Peirce, secretary, all of Spokane, and Messrs. C. S. MacCalla, H. A. Shearer, J. W. Hungate and S. E. Gates, of Spokane; E. R. Northmore and C. G. Pyle, of Los Angeles, Cal.; G. R. Murphy and A. H. Halloran, of San Francisco, Cal.; G. P. Nock and R. F. Monges, of Portland, Ore.; S. C. Lindsay and A. A. Miller, of Seattle, Wash.; E. M. Breed and F. D. Nims, of Vancouver, B. C., and Max Hebgen, of Butte, Mont.

This committee is already actively at work through various sub-committees, including the committee on papers, of which Mr. John B. Fisken, chairman of the Spokane Section, is chairman.

The Northwest Electric Light and Power Association will hold its convention in Spokane at the same time, and the respective committees will co-operate and will probably arrange for one or more joint sessions. Committees on finance, transportation, and entertainment, composed of members of the Spokane Section, have been appointed and will co-operate with similar committees from the Northwest Electric Light and Power Association.

Empire State Association Discusses Workmen's Compensation Law

The spring meeting of the Empire State Gas & Electric Association was held at Medina, N. Y., on April 22 and was devoted mainly to discussion of the workmen's compensation law which goes into effect in New York State on July 1. About a hundred people representing fifty companies were present. The business session was held in the morning at the Alerts Club, and Mr. James T. Hutchings, Rochester, N. Y., president of the association, presided.

The first speaker was Mr. Cyrus W. Phillips, of Rochester, member of the New York State Assembly, who explained the law and answered questions of members in regard to the different features. Mr. Phillips outlined the history of compensation laws in other states and the developments leading up to the enactment of the new law in New York. He also explained at length the former compensation law, which was declared to be unconstitutional by the Court of Appeals, but was substantially the same as that which is to become effective on July 1 next. He called attention to the amendment of the constitution designed to permit the enactment of the law, but said that the constitutionality of the new measure has not been passed upon by the federal court. Mr. Phillips added that the rates proposed by the New York law are much higher than in any other state and that its provisions are far more drastic.

Mr. Hutchings stated that Mr. J. Mayhew Wainwright, a member of the Compensation Commission, had been expected to address the meeting but that it was impossible for him to be present.

Mr. L. H. Belden, of Buffalo, discussed the subject from the standpoint of the liability insurance company. Mr. Edgerton Parsons, of New York, explained a plan for the formation of a mutual insurance company for the gas and electric companies of New York State. This plan is mentioned elsewhere in this issue.

Lunch was served to the delegates at the Alerts Club at the close of the morning session. Afterward the members were taken to the power house of the A. L. Swett Electric Light & Power Company and to other points of interest.

At the afternoon session Mr. J. Boardman Scovell, treasurer of the Lewiston & Lake Ontario Shore Power Company, discussed the legislation pending at Washington in regard to power at Niagara Falls. A brief report was submitted by the safety committee.

The next meeting will be held at Lake George, N. Y., on or about June 19.

Mutual Insurance Company Proposed in New York State

A number of electric and gas companies in New York State have joined in a plan for the formation of a mutual insurance company to carry their obligations under the workmen's compensation law of New York State, which is to take effect on July 1, 1914. A circular letter addressed to the officers and directors of the electric light, heat and gas corporations of New York State has been issued by the following companies:

Binghamton Light, Heat & Power Company, Canandaigua Gas Light Company, Despatch Heat, Light & Power Company, Eastern Monroe Electric Light & Gas Company, Homer & Cortland Gas Light Company, Ithaca Electric Light & Power Company, Ithaca Gas Light Company, Norwich Gas & Electric Company, Northern New York Utilities, Inc., Ontario Light & Traction Company, Oxford Electric Light Company, Rochester Railway & Light Company, Sayre Electric Company, Syracuse Lighting Company, Upper Hudson Electric & Railroad Company and Watertown Light & Power Company.

The circular says in part:

"The workmen's compensation law, which applies to the industry in which we are mutually engaged, will take effect July 1, 1914. Under it insurance for injuries to employees is compulsory. It is possible to effect this insurance in one of four ways—self-insurance, mutual insurance, stock-company insurance, and the State fund. It is conceded by those who have had experience in this matter that the State fund is the least desirable method to adopt, as the State is deprived of any right of selection among the companies which apply to it for insurance and it is obliged to accept every application made to it, regardless of how undesirable the hazard, and besides this the State assumes no responsibility beyond the fund actually created by the State.

"Self-insurance is impossible for any of us except the very largest companies, and is not practicable for them unless they have enough insurance to effect to establish an average on their own business. The stock companies are intimating rates at the present time which are and will be prohibitive.

"The only solution of the difficulty appears to us and to those who have advised us in these matters to be the formation of a mutual company to inter-protect ourselves. This company will be managed by the best insurance talent obtainable, at a reasonable expense ratio, and will confine its operation to the risks of the light, heat, power and gas corporations in this State. It is the purpose of this mutual insurance company to provide its members with insurance at cost by doing away with brokerages and middlemen's charges, making the surplus premiums returnable to employer members."

Mr. Frederic Culver, 25 Broad Street, New York City, has been appointed temporary secretary for the organizers.

I. E. S. Nominees

The board of nominations for the Illuminating Engineering Society has selected the following as nominees for officers for the 1914-15 term:

President, Dr. A. S. McAllister, New York; vice-president from the Chicago Section, Mr. F. A. Vaughn, Milwaukee, Wis.; vice-president from the New England Section, Mr. C. A. B. Halvorson, Jr., West Lynn, Mass.; vice-president from the Philadelphia Section, Prof. George A. Hoadley, Swarthmore, Pa.; general secretary, Mr. Joseph D. Israel, Philadelphia; treasurer, Mr. L. B. Marks, New York. Directors, Messrs. Ellice M. Alger, of New York; Harold W. Calvert, of Philadelphia, and V. R. Lansingh, of Cleveland.

The nominating committee for the New York Section of the society has selected the following nominees: Chairman, Mr. Norman Macbeth; secretary, Mr. Clarence L. Law; managers, Messrs. George W. Cassidy, Norman D. MacDonald, H. B. McLean, Frank E. Wallis and Percy S. Young.

The Philadelphia Section has issued the following ballot: Chairman, Mr. H. A. Hornor; secretary, Mr. L. B. Eichengreen; managers, Messrs. James Barnes, Douglass Burnett, George S. Crampton, R. B. Ely and F. H. Gilpin.

The nominating committee for the New England Section has made the following selection of nominees: Chairman, Dr. Louis Bell; secretary, Mr. S. C. Rogers; managers, Messrs. C. M. Cole, J. W. Cowles, Walter B. Lancaster, H. F. Wallace and R. C. Ware.

In Pittsburgh the nominating committee of the local section has made the following selection: Chairman, Mr. G. W. Roosa; secretary, Mr. S. G. Hibben; managers, Messrs. W. A. Donkin, H. S. Hower, Harold Kirschberg, E. B. Rowe and R. H. Skinner.

The Chicago Section's nominating committee has issued the following slate: Chairman, Mr. W. A. Durgin; secretary, Mr. H. B. Wheeler; managers, Dr. Harry S. Gradle, Dr. M. G. Lloyd, Messrs. F. A. Pinckney, Edward G. Pratt and Herman V. Willman.

Meeting of Georgia Electrical Contractors

At the first session of the Georgia Electrical Contractors' Association held in Atlanta on April 15 officers were elected, and Macon was selected as the meeting place for the association on May 26. At that meeting delegates will be named to represent Georgia at the national convention to be held in Detroit, July 15. The officers elected were as follows: Mr. R. M. Walker, of the Walker Electric & Plumbing Company, Rome, president; Mr. H. E. Lowe, of the H. E. Lowe Electric Company, Macon, vice-president; Mr. J. M. Clayton, of Atlanta, secretary; Mr. W. L. Baily, of Atlanta, treasurer.

Merz and McLellan on London Electricity Supply

On April 15 Messrs. C. H. Merz and W. McLellan submitted to a special committee on electricity supply of the London (England) County Council a report with recommendations on the electrical-energy-supply situation in London. They stated that the fundamental cause of the present unsatisfactory conditions is to be traced to the action of Parliament, which has encouraged the formation of small rather than large and more efficient undertakings, on the mistaken theory that competition is the best safeguard for the public. The solution of the difficulty is to be found in treating the metropolitan area as a whole and in anticipating the needs of the future. The authors stated that the best, and in fact the only complete and satisfactory, solution is the establishment of a new undertaking with such powers as will enable it to concentrate production, standardize and unify distribution and bring about the amalgamation of the various undertakings. They recommended that the London County Council promote a bill in the next session of Parliament, empowering some central body to set up an undertaking with powers of bulk supply and the means of gradually acquiring and amalgamating the different undertakings on commercial terms.

The conclusions arrived at as a result of their investigations may be summarized as follows: (1) The concentration of generating plants on sites down the river is the correct policy to begin with, both on technical and commercial grounds, deferring the question of generating part of the energy at the coal fields or elsewhere until both the load and the load-factor have grown. (2) In order to carry out this policy with the minimum waste of capital, a high-voltage three-phase primary distribution system at fifty cycles per second should be standardized for London as soon as possible. In this connection a standard primary voltage should be adopted at once for all new high-pressure mains. (3) If electricity is to be supplied for motor service and general domestic use at the lowest possible prices, it is also necessary, both for economical and other reasons, that the existing low-pressure distribution networks should, as a rule, not be extended but be supplemented by a new three-phase network. (4) The most satisfactory and economical method of achieving these results is the establishment of a new undertaking with such powers as will enable it gradually to concentrate production, standardize distribution, and bring about the amalgamation of all the various undertakings.

Hydroelectric Development with Massive Water-Wheels Near Spokane, Wash.

The accompanying illustration shows a view of the Long Lake development of the Washington Water Power Company on the Spokane River. The plant will consist of an ultimate installation of four 13,900-kva generators having a continuous overload capacity of 25 per cent. Each generator will be connected to an I. P. Morris waterwheel rated at 22,500 hp, the largest waterwheel thus far built. The station when completed will be the largest of the company. It is situated less than 30 miles west of Spokane. At that point the Spokane River passes through a box canyon the walls of which rise about 400 ft. above the river. A dam approximately 200 ft. in height is being erected across the river at that point, giving a fall of 170 ft. at the power house and backing up the water for 23 miles. Considering only 15 ft. of storage, the water thus held for reserve will be 2,695,000,000 cu. ft., all of which will be available not only for the Long Lake plant but also for the Little Falls station of the company, 4 miles below the Long Lake development on the same river. The dam being constructed at Long Lake is unique in that it will not only be higher than any other spillway dam now in existence but will at times of flood carry about 19 ft. of water over its crest. Three roller dams mounted upon the crest of the spillway will be used to hold the low-water level of the lake at the same level as at high water.

LONG LAKE DEVELOPMENT OF THE WASHINGTON WATER POWER COMPANY ON THE SPOKANE RIVER

The illustration shows a very recent view of the site. To one side is the spillway dam, the extreme left portion of which is completed. Temporary sluices in the center pass the flow of the river during construction, and behind the portion of the dam at the right are the headgates. Steel penstocks will lead directly over the barrier to the power house below. The walls of the latter are shown completed. The tunnel which was blasted out of the rocks to divert the river from its old bed around the bend while the dam was being constructed has been closed, and it is expected that the station will be in operation by the end of the year. The company will then have four hydroelectric stations on the Spokane River: Post Falls, Idaho; Lower Falls, city of Spokane; Long Lake, and Little Falls, in addition to a steam-turbine relay station at Ross Park within the city limits of Spokane on the Spokane River.

Mr. D. L. Huntington is president of the Washington Water Power Company, and Mr. C. S. MacCalla is general manager.

Joint Meeting of American Physical Society and A. I. E. E.

Under the auspices of its electrophysics committee, the American Institute of Electrical Engineers held a two-day meeting at Washington, D. C., April 24 and 25, in conjunction with the American Physical Society. The sessions were held in the new electrical laboratory of the Bureau of Standards, which was thrown open so that visitors might inspect its splendid equipment of instruments and apparatus. In addition a number of manufacturers, federal departments, universities, laboratories and individuals made special exhibits of scientific appliances and instruments.

The program of the American Physical Society comprised fifty papers, most of which were briefly abstracted by their authors. The session of Friday evening was devoted to the reading and discussion of three of the five papers presented by A. I. E. E. members, the remaining two being read by title. Abstracts of these papers will appear in a later issue. The feature of Thursday afternoon's session was an address by Sir Ernest Rutherford, F. R. S., on "X-ray and Gamma-ray Spectra." The speaker described some of his own experiments in spectrum analysis, using these extremely short wave lengths, and he showed a series of elements (with gaps for missing elements not yet discovered) based on the determinations of the X-ray method.

Many of the papers presented by members of the American Physical Society related to electrical subjects and of these a number were of interest to electrical engineers. Messrs. A. G. Worthing and W. E. Forsythe reported their experience in measuring the brightness of tungsten-lamp filaments with an optical pyrometer, noting the errors introduced by diffraction. Messrs. Jacob Kunz, J. Stebbins and W. F. Schulz described the use of photoelectric cells in astronomical measurements. Mr. C. W. Hewlett discussed the relatively greater conductivity of the air over oceans than that over land. Messrs. F. Wenner, E. Weibel and F. B. Silsbee described a method of measuring the time constants of low resistances, using pure mutual inductances. The same authors, with Mr. F. C. Weaver, also described a sensitive moving-coil galvanometer.

Mr. C. W. Waggoner recounted his experiments with using the muscle of a frog as a wireless detector. Mr. E. H. Hall outlined mathematically a theory of electric conduction to account for the increased conductivity of a metal when heated without being permitted to expand. Mr. F. A. Harvey showed how a recording ammeter in series with an electrode circuit may be made to indicate the uniform character of an electrolyte mixture. Dr. G. W. Middlekauff showed characteristic curves of tungsten lamps. Mr. H. L. Curtis reported his test of the leakage that occurs over hard rubber and other insulating materials. Mr. S. P. Farwell described the corona effects obtained by connecting a number of direct-current generators in series, obtaining in this way continuous pressures up to 10,000 volts. Prof. F. J. Rogers presented as "an electromagnetic puzzle" the fact that emf is developed in a wire carried through a tubular conductor carrying a current, although no flux be present within the tube. He also reported on tests made on a number of subjects to determine the toleration of a flow of direct current. In these tests he found that the subject invariably reported the greatest pain in the part of the body nearest the cathode. Dr. H. E. Ives described an absorbing fluid for eliminating color differences between lamps, and also exhibited a new form of flicker photometer. Messrs. Frank Wenner and Ernest Weibel discussed a method of testing potentiometers.

How Public Utility Investments Are Held

Before the Finance Forum of the Young Men's Christian Association in New York on the evening of April 27 Mr. W. H. Gardiner, of Henry L. Doherty & Company, New York, gave a talk on the subject "Investments in Public Utilities and How Held." Mr. Gardiner is statistician for the Doherty company.

The speaker gave $20,000,000,000 as a fairly close approximation of the face value of the railroad securities at present outstanding in this country, while the outstanding securities of those concerns which he classed under the head of public utilities—namely, gas, electric light and power, traction, telephone and telegraph companies—come to about $14,000,000,000. An idea of the comparative rate of growth of the two may be gained from Mr. Gardiner's statement that the former total has increased 20 per cent in the last decade, while the latter has about doubled.

The status of the holding company in connection with public utility financing was then taken up by Mr. Gardiner. Of a total of about $8,300,000,000 of stock of the various public utility companies now outstanding in this country, he said that approximately 75 per cent is controlled by holding companies. This concentration of control, he said, has been a natural result of the inability of small local interests to finance properly the necessary extensions of their closely held utility properties.

In the latter part of his talk Mr. Gardiner reviewed the gradual change in sentiment concerning security issues and described the real security back of these issues and the bearing of these tendencies on problems of new financing.

A point on which Mr. Gardiner laid special stress was that when there is new financing to be done there is no time to discuss the academic questions of whether or not securities should be sold below par and what is a fair rate of interest to allow. When the money is required, the thing to do is to get it as cheaply as possible, but to get it.

Terminal Freight Congestion and Its Solution

A paper entitled "The Problem of Terminal Freight Congestion and Its Solution" was read before the New York Section of the Electric Vehicle Association April 24 by Mr. Fred A. Hortter, car accountant Boston & Maine Railroad. Mr. Hortter not only rehearsed the various causes of congestion at freight terminals and the defects of the systems now in vogue for handling the freight but also suggested a remedy for bettering the conditions.

The railroads have given much attention, Mr. Hortter asserted, to improving the so-called "long hauls" of freight from city to city, but it is only recently that the necessity for giving an equal amount of study to the so-called "short hauls," or teaming of freight from terminals, has been impressed upon the transportation interests. Investigation has resulted simply in emphasizing the defects of the systems employed, but whatever remedies have been suggested have mostly emanated from, and been put into practice by, the railroads themselves. These improvements have generally been to little purpose through the lack of co-operation between the carrier and the public and the inability of the railroads to control the operations of the teamsters and the truckmen.

For years, Mr. Hortter concluded, men of the motor-vehicle industry have been endeavoring to produce a better quality of street transportation. They have not gone far enough, however, and they have not endeavored to change the methods. The remedy is apparent. It lies in the co-ordination of the railroad and highway movement of merchandise and in a collaboration of the railroads and the teaming interests.

In the discussion following the presentation of Mr. Hortter's paper Mr. W. P. Kennedy recited four factors that entered into the problem of handling freight at terminals, these being the railroad, the teamster, the merchant with his own teaming facilities, and the electric-vehicle man. The railroads, the speaker declared, are the exemplification of practically everything that is efficient and the result of scientific management, with the exception of the handling of freight at terminals, where their methods are archaic.

Mr. C. A. Shirley maintained that in his experience the railroad was always willing to co-operate. He suggested that much of the congestion could be avoided by shipping goods at night.

Mr. H. Cowen declared that railroad men were necessarily cautious and careful, and above all the efficacy of a new device had to be proved before its adoption.

Mr. R. M. Lloyd suggested that the railroads buy their own trucks and deliver the goods themselves, thereby eliminating the congestion in a way best suited to their own interests. Mr. Hortter in reply, however, called attention to the increasingly high cost of labor and materials and the difficulty of obtaining the money which would be necessary to invest in a large number of new trucks.

Cleveland Company Appeals to State Commission in 3-Cent Rate Case

An appeal has been made to the Public Utilities Commission of Ohio by the Cleveland Electric Illuminating Company in regard to an ordinance passed by the City Council of Cleveland on March 16, 1914, fixing a maximum rate for illuminating electricity of 3 cents per kw-hr. In a statement issued in Cleveland in regard to the matter, Mr. Samuel Scovil, president of the company, says:

"The fact that the city is a competitor, actively engaged in soliciting business from the public which this company serves, in equity disbars it from fixing the terms upon which its competitor may do business.

"Under the laws of Ohio the State Public Utilities Commission has practically unlimited power to appraise the property and investigate the business of any public service corporation for the purpose of establishing just and equitable rates. These laws have been in force three years. At any time during that period the rates of the illuminating company have been subject to regulation and adjustment, if, upon investigation by this expert public body, they were found to be unreasonable. Instead, however, of appealing to the commission for an expert and impartial adjustment of rates, the city elected to engage in competition and has authorized the issue of bonds for that purpose to the amount of $2,500,000. These bonds are issued on the faith and credit of the people and are payable both as to principal and interest by taxes levied on the property of non-users as well as users of electricity.

"The ordinance fixing 3 cents as the maximum price for electric light was passed by the Council without any investigation, expert or otherwise, as to whether it is a reasonable and proper rate. The new $2,500,000 municipal plant is not yet completed and therefore no data to justify the 3-cent rate could have been obtained from that source, while the city's experience with its lighting plants in Brooklyn and Collinwood does not furnish a reasonable basis for a rate of 3 cents for residence lighting.

"The illuminating company pays annually large sums for the privilege of doing business under the laws of Ohio and the ordinances of Cleveland, and for such protection to its property and business as those laws and ordinances afford. Last year these payments amounted to $303,743 and for the current year they will exceed $350,000. It will cheerfully abide by any just and equitable rate or service regulation which may be fixed after due consideration by the legally constituted authorities as provided by these laws."

Bush Terminal Meeting of New York Electrical Society

A meeting of the New York Electrical Society was held on April 22 at the Bush Terminal, Brooklyn. After the meeting was called to order by President H. H. Barnes, Jr., Mr. R. E. Ireton, educational director of the Bush Terminal Company, gave a brief description of the notable features of the terminal. Mr. T. I. Jones also addressed the meeting and described some interesting points in regard to the electric energy supply. The electrical energy for the operation of the plant is obtained exclusively from the mains of the Edison Electric Illuminating Company of Brooklyn. There are two substations on the premises, each with 2000 kw in direct-current machinery for the supply of energy at 125 volts and 250 volts and 1500 kw in rotary converters, which supply 500-volt service to operate a freight railroad on the premises. The energy is received at 6600 volts, three-phase, twenty-five cycles.

The energy supplied is used for lighting and nearly every conceivable motor service. Practically all the occupants of the model factories with their diversified manufacturing products use electricity. It is interesting to note that one of these factories is operated by a German concern making wire-drawn tungsten lamps in this country. The Bush company operates all its elevators, hoists, cranes and many ingenious labor-saving devices by electricity. A freight line connects all parts of its enterprise, the motive medium consisting of three 100-ton electric locomotives. A trolley line is operated on the premises for carrying passengers from one part of the plant to another. An elaborate and extensive fire-alarm system is also operated.

One of the interesting features of the equipment is the storage-battery crane trucks and baggage carriers. The batteries are charged at night. They are readily portable, so as to avoid the necessity for long cord connections and numerous outlets on piers. The lighting of the piers is accomplished almost exclusively by flaming-arc lamps, but the new pier will be illuminated by 500 250-watt incandescent lamps.

This remarkable pier, recently constructed to prepare for the increase in trade expected to follow the Panama Canal's operation, was the object of particular interest to the delegation. It is 1450 ft. in length, 270 ft. in width and more than 50 ft. in height. Its two floors comprise an area of 15 acres. Six large ocean-going vessels may be accommodated at one time at this pier, and they may load and unload simultaneously. The American-Hawaiian Line, which has leased this pier, expects to handle 1,500,000 tons of freight annually thereat. The enormous range of warehouses along the bulkhead and the completely equipped railroad yard of the plant were other features inspected by the visitors.

The total electrical equipment rating in the Bush company's plant exceeds 15,000 hp, and the consumption of electrical energy during 1913 was more than 4,000,000 kw-hr.

Matters Affecting Niagara Power Stockholders

Mr. Edward A. Wickes, president of the Niagara Falls Power Company, refers in the annual report to stockholders for the year 1913 to several matters which materially affect the interests of that company. In that year there was an increase of 9.8 per cent over the previous year in the combined gross earnings of the Niagara Falls Power Company and the Canadian Niagara Power Company. Mr. Wickes says that the substantial increase in the operating revenues was made possible mainly by the completion of generating unit No. 7 in the Canadian plant, the release by expiration of the Burton law in March, 1913, of restrictions expressly imposed by Congress on transmission into the United States of electrical energy generated in Canada, and the substitution for the peak measurement of water diversion under the Burton law of the more practicable method indicated in the international waterways treaty of determining the rate of the daily diversion.

Mr. Wickes called attention to the fact that an appeal is now pending from the order of the New York Public Service Commission, Second District, made in April, 1913, reducing by 28 per cent the energy rates of the Cataract Power & Conduit Company in Buffalo, except rates for energy for railway purposes. A decrease in non-operating revenues of the generating companies is due to the fact that dividends of the subsidiary Cataract Power & Conduit Company and the Tonawanda Power Company have been stopped since this order was made.

As in previous years, various bills dealing with Niagara diversion and, Mr. Wickes adds, more or less drastically with the rights of the operating power companies at Niagara Falls have been introduced in Congress and the New York Legislature. The Legislature adjourned without enacting any bill upon the subject, and the bill of Mr. Cline, of Indiana, is still before the foreign affairs committee of the House of Representatives.

The board of directors is of the opinion that present conditions as well as public sentiment in Buffalo call for the consolidation of the two companies now distributing in that city Niagara power furnished by the generating companies. So far as may be, the Niagara Falls Power Company should refrain from engaging in the retail lighting and public distribution branch of the electric business by means of corporations which it does not wholly own and control. Its normal function generally should be the production of energy for industrial uses and its transmission in large amounts for distribution by others. In view of this and of the opinion of the Public Service Commission, an agreement has been made with the Buffalo General Electric Company to sell to it all of the 10,050 shares, constituting a majority, of the stock of the Cataract Power & Conduit Company owned by the Niagara Falls Power Company for 145, or $1,457,250, with interest on the purchase price from Dec. 1, 1913, at 6 per cent per annum. In payment the company is to take the first refunding 5 per cent bonds of the purchasing company for $1,005,000 at par with adjustment of interest in money, and the remainder of the purchase price, $452,250, is to be paid in money upon delivery of the shares. The Cataract Power & Conduit Company is to agree to set aside an annual sinking fund to pay its outstanding mortgage bonds at maturity. The Buffalo General Electric Company is to offer to purchase the minority shares of stock of the Cataract Power & Conduit Company at the same price and terms. The agreement is conditioned upon the consent of the Public Service Commission and the city of Buffalo.

Convention of Iowa Section, N. E. L. A.

The Iowa State Section of the National Electric Light Association and the new Iowa Electrical Contractors' Association met in joint session at Cedar Rapids on April 22 to 24. The program was as follows: Presidential address by Mr. A. L. Dodd, of Charles City; "The Society for Electrical Development," by Mr. J. M. Wakeman, of New York; "Co-operation of Contractors and Central Stations," by Mr. J. T. Marron, of Rock Island, Ill.; "Workmen's Compensation Law," by Mr. G. A. Wrightman, of Des Moines; "Features of the Operation of the New Keokuk Development," by Mr. A. D. Ayres, of Keokuk; "The Conduct of Public Utilities Under Commission Supervision," by Mr. F. W. Stearns, of Chicago; "High-Tension Lightning Protection," by Prof. A. H. Ford, of Iowa State College; "Facts and Factors," by Mr. A. Burt, of Waterloo; "Objects and Results of Affiliation with the N. E. L. A.," by Mr. E. W. Lloyd, of Chicago; "Rubber-Covered Wires," by Mr. J. E. Latta, of Chicago; "Is There a Saturation Point of the Sale of Electricity?" by Mr. J. S. Forbes, of Cedar Rapids.

An account of the meeting of the Iowa Electrical Contractors' Association is given elsewhere in this issue, and abstracts of the papers presented before the Iowa State Section and the discussion thereon will appear in a subsequent issue.

PRESIDENT RUFUS E. LEE

At the closing session it was decided to hold the next meeting of the association at Keokuk. Officers were also elected as follows: Mr. Rufus E. Lee, of Clarinda, president; Mr. W. H. Thomson, of Des Moines, secretary; Mr. W. A. Mall, of Belle Plaine, treasurer.

Mr. Rufus E. Lee, Clarinda, the newly elected president, is a comparatively young man. He started in the electrical business at Wahoo, Neb., upon leaving high school in 1892. In the fall of that year he went to Chicago, working as a wireman, and later helped to install power-station apparatus in Michigan. Returning to the State of Nebraska, he later installed lighting and telephone systems at Superior, and in 1902 went to Clarinda, Ia., obtained a franchise and started a 100-kw lighting station, known as the Lee Electric Light Company. In 1905 the Lee Electric Light Company was incorporated, a steam-heating system and a 150-kw generating unit being added to the station. By steps this property, of which Mr. Lee is manager, has grown till it now includes ice and cold-storage plants, a modern turbine station and 70 miles of transmission line, of which 32 miles is erected on steel poles.

Public Service Commission News

Pennsylvania Commission

In two decisions the Public Service Commission of Pennsylvania has declined to grant authority to companies to enter territory already served by existing public utilities. The petitions for authority to compete which were denied by the commission were those of the Schuylkill Light, Heat & Power Company, which desired to enter the borough of Ashland, already served by the Eastern Pennsylvania Light, Heat & Power Company, and of the Harmony Electric Company, which wanted to compete in Ellwood City with the Pennsylvania Power Company.

In its decisions the commission said: "Long experience has shown that while the temporary effect of competition between public utilities occupying the same territory is to secure lower rates, the final result is likely to be the absorption of one utility by the other and then an increase of rates to pay the expenses of the warfare.

"Vested rights and interests must be duly conserved and protected. The commission has no warrant to invite or permit limited competition anywhere unless the area and population served, the needs of the community or the prospects of the municipality, as based on its growth and development, can reasonably show that the public welfare demands it. This principle of protection must be extended to the public utility to the end that the individual citizens who have invested in its plant equipment in good faith may be duly protected in their interests."

New Jersey Commission

The Board of Public Utility Commissioners of New Jersey has issued an order recommending to the Public Service Gas Company the modification of its rule under which service is discontinued to a customer who has failed to pay his gas bill within the time limit but who has a deposit with the company in excess of the unpaid bill. The ruling was made in connection with the complaint of Mr. Charles Reincke, a consumer, who held that it was not reasonable for the company to give one day's notice of service discontinuance. In its decision the board says:

"The deposit is held to answer the default of the consumer, and whenever the consumer defaults in payment the fund may be resorted to. Its exaction cannot be justified on any other ground. Persons with credit and financial standing are not required to make a deposit. It is a sum of money in the company's hand, which is answerable for the payment of the consumer's account, whenever there is a default in the payment thereof. In this view the company should have applied so much of that fund as was required to cancel complainant's charge for the gas consumed."

Wisconsin Commission

The annual report of the Wisconsin Railroad Commission for the year ended June 30, 1913, has been submitted to the Governor. A total of 473 formal cases were heard, of which 156 were utility cases. A total of 1305 complaints were received, an increase of 210 over the previous year. Authority was granted for the issue of $40,655,832 in securities, as follows: Stocks, $8,288,332; bonds, $18,617,500; equipment trust certificates, $10,220,000; notes, $3,530,000.

A considerable portion of the report is devoted to a review of the scope of the commission as outlined by the statutes and also to an analysis of the vast amount of informal work performed by the commission while serving in the capacity of intermediary on matters of dispute over which the commission has no jurisdiction.

The Equitable Electric Light Company, of Lake Geneva, has been ordered to reduce its rates for electric lighting in Lake Geneva from a rate of 15 cents per kw-hr. to the following: Primary rate, 14 cents per kw-hr. for the first thirty hours' use per month of the active connected load; secondary rate, 12 cents per kw-hr. for the next sixty hours' use per month; excess rate, 8 cents per kw-hr. Consumers outside of the city will continue to pay at the old rate. The minimum bill is to range from a charge of 60 cents per month for loads under 1 kw to a charge of $2.25 for a connected load of over 5 kw. No change was made in the rates for energy or street lighting.

Oregon Commission

H. M. Byllesby & Company have been retained by the Eastern Oregon Light & Power Company to make a valuation of the property of the company in Oregon in connection with the filing of rate schedules with the Railroad Commission of Oregon.

District of Columbia Commission

The Public Utilities Commission of Washington, D. C., expects to make a valuation of the various public service corporations operating in the District of Columbia. According to the plans under consideration the work of valuation will be under the direction of Prof. Edward W. Bemis, of Chicago. Congress appropriated $100,000 for the expenses of the valuation. Although the date of July 1, 1915, is set for completion of the work, it is not believed that so much time will be required. Professor Bemis is to make reports to the commission of his progress each month. His staff will consist of a chief engineer, a chief accountant and other employees. The properties to be valued are the Washington Railway & Electric Company and subsidiaries, including the Potomac Electric Power Company, the Capital Traction Company, the Washington Gas Light Company, the Georgetown Gas Light Company and the Chesapeake & Potomac Telephone Company.

Indiana Commission

The Northern Indiana Gas & Electric Company, of Michigan City, Ind., has asked the Public Service Commission of Indiana for authority to publish a lower rate schedule for electric power used by electric railways operating in and about Laporte County, Ind. The petition was presented on the ground that the company could afford to furnish such power to nearby companies at lower rates than to companies farther from the generating plant, because of the lower cost of wires and poles used in transmission.

There is still much discussion in Indiana, particularly in labor circles, of the possibility that the next Legislature will create a board for the arbitration of industrial disputes.

The commission has not had to act on the situation brought up at Lafayette, where the lighting companies were engaged in a controversy with citizens regarding franchise provisions concerning rates. The controversy was settled without the action of the commission. Rates for large amounts for power were reduced. Other rates were not changed. The commission dismissed a petition which had been filed with the announcement that it had no power to go into the rate-making situation as it concerned the small consumers unless a petition should be filed taking up that side of the case.

The first annual report of the commission is being prepared. Statistics showing the different results of companies using meters entirely and companies using flat rates will be included. It will be shown that the total indebtedness of the utilities of Indiana, as a whole, exceeds the total stock capitalization of the companies. A comparison of electrical rates in all cities of the State will be a feature of the report.

Current News Notes

CENTRAL STATION OFFERS $25,000 TOWARD DEVELOPMENT OF WILMINGTON, N. C.—At the meeting of the City Council at Wilmington, N. C., on April 17, Mr. Hugh MacRae, president of the Tidewater Power Company, offered to give $25,000 to a fund of $75,000 to be expended by a commission of three for the development of the city of Wilmington.

* * *

STANDBY STORAGE BATTERIES.—In an item entitled "Storage Batteries in Central-Station Service," on page 711 of the issue of March 28, by reason of a typographical error Mr. T. Milton, district engineer in Chicago for the Electric Storage Battery Company, was reported as saying that certain large standby storage batteries would carry over 400 amp, when the figure should have been 40,000.

* * *

CHICAGO ELECTRICAL SHOW.—Notwithstanding the fact that Chicago's seventh annual Electrical Show is still more than six months in the distance, there is a gratifying preliminary demand for space. The directors decided to make an early campaign owing to the intervening summer months, with the idea of getting contracts rounded up before the outing season gets here. The show is set for Oct. 31-Nov. 14, and Manager Homer E. Niesz has already secured most of the large electrical manufacturing companies as exhibitors, in many cases with larger space than they formerly used.

* * *

SOCIETY MEETINGS

ELECTRIC CLUB OF CHICAGO.—At the weekly luncheon of April 23 the Electric Club of Chicago listened to an illustrated address by Major M. L. C. Funkhouser, second deputy superintendent of police, on the work of the Police Department in combating vice in various forms. An audience of about 300 was present, and much interest was manifested.

* * *

NATIONAL FIRE PROTECTION ASSOCIATION.—The eighteenth annual meeting of the National Fire Protection Association will be held in Chicago from May 5 to May 7, with headquarters in the Insurance Exchange, Jackson Boulevard and LaSalle Street. The committee on signaling systems and the electrical committee will make their report at the morning session of May 7. Mr. Ralph Sweetland, Boston, is chairman of the former, and Mr. F. E. Cabot, Boston, is chairman of the latter committee.

* * *

JOVIAN ACTIVITIES IN MEMPHIS.—Mr. J. A. Fowler, of Memphis, Tenn., was a visitor at the luncheon of the Chicago Jovian League on April 27. Mr. Fowler was called on for a speech, and he told of the activities of the Jovian League of Memphis. In that city it has been found that the proper way to instil enthusiasm into the local organization is to give the Jovians something to do. During the holiday season the League erected a large Christmas tree in a prominent location. It has also provided various forms of public entertainments, particularly for children, both white and colored. It entertained the Tennessee Electrical Contractors' Association at the recent Memphis meeting of that organization and is now planning an electrical show to be held in Memphis in June.

* * *

GENERAL MEETING OF ENGINEERS AT PHILADELPHIA.—The scientific and engineering men of Philadelphia are preparing for a meeting to be held the evening of May 15 on the Continental Hotel roof garden, at which many prominent engineers will give short addresses. The speakers who thus far have promised to be present are Dr. C. P. Steinmetz; Mr. Walton Clark, of the United Gas Improvement Company; Dr. A. C. Humphreys, president of Stevens Institute of Technology, and Mr. James Mapes Dodge, of Philadelphia. Prof. George A. Hoadley, of Swarthmore College, is chairman of the general committee; Mr. L. B. Eichengreen, secretary, and Mr. C. C. Tutwiler, treasurer. Other members of the committee are Dr. R. B. Owens, secretary of Franklin Institute; Mr. J. A. Vogleson, chief of the Bureau of Health; Mr. Joseph D. Israel and Mr. H. A. Hornor. Members of the national engineering and scientific societies of other cities are invited to join the gathering.

* * *

SAFETY ENGINEERING AS A NEW PROFESSION.—On April 23 Dr. W. H. Tolman, director of the American Museum of Safety, delivered an illustrated lecture on safety engineering as a new profession before the association of employees of the United Electric Light & Power Company, New York. He called attention to the statements of some noted efficiency engineers regarding the importance of providing safe working conditions for employees as a means of increasing the efficiency of an organization. In quoting one of these men the speaker declared that human efficiency is increased by preventing the possibility of accidents, by insuring healthful working conditions and by promoting good will. Dr. Tolman said that it will not be long before safety engineering will be regarded as a profession just as necessary to the conduct of a business as efficiency engineering has come to be. The exhibits of the safety museum conducted by the Allgemeine Electricitäts Gesellschaft, Germany, and those of the American Museum of Safety were described quite in detail. Following Dr. Tolman, short talks were also given by Messrs. F. W. Smith, vice-president United Electric Light & Power Company, and Mr. Arthur Williams, president of the American Museum of Safety.

* * *

NEW YORK JOVIANS.—"The Fire Alarm System of New York City" was the general subject discussed at a meeting of the Jovian Order in New York on April 29. Fire Commissioner Robert Adamson, his associate Mr. Putnam A. Bates, electrical engineer; Mr. J. J. Carty and Mr. T. C. Martin were the chief speakers. Mr. Bates stated that during 1913 19,318 calls were received over the fire-alarm circuits, which have a total length of about 3500 miles. In the built-up sections of Manhattan the circuits are underground, but in Brooklyn, the Bronx, Richmond and Queens Boroughs most of the circuits are overhead. Overhead circuits are unreliable even with the very best of construction and should be superseded by modern underground circuits. Commissioner Adamson said that there is urgent need for reconstruction of the fire-alarm system, which should be placed wholly underground. He claimed that the city should own and control the underground conduits along the streets. The Board of Estimate will be asked to provide money for reconstructing the fire-alarm system practically in accordance with the plans made nearly twenty years ago by Messrs. Kempster B. Miller and J. J. Carty. Mr. Carty discussed the problems that have confronted the Fire Department for many years and expressed the hope that a proper solution is now at hand. He claimed that it is essential for the circuits to be underground, but stated that it is of no importance whether the conduits are owned by the public or by private companies. The attendance at the meeting exceeded 200.

Rehabilitating Electric-Service Station at Alliance, Ohio

Complete reconstruction and rearrangement of 1750-kw generating plant in a city of 16,000, involving service interruption of but two hours' duration

As the result of the thorough-going reconstruction recently completed at the power plant of the Alliance Gas & Power Company, the city of Alliance, Ohio, now receives electrical energy from a rebuilt generating station which is to all appearances a brand-new plant. In addition to the erection of a new building measuring 95 ft. by 110 ft. in over-all dimensions, the old generating switchboard and boiler-room equipment was all moved and a 1250-kva turbine unit was added. While the work of rebuilding was in progress the single actual service interruption was of but two hours' duration, and this early one Sunday morning when the load was very small. Among the properties of the Doherty Operating Company 1914 is known as "clean-up year," and the completeness with which the spirit of this slogan has been carried out at Alliance is typical of work elsewhere under the same management.

The beginning of co-operative effort in the city of Alliance, it is of some interest to note, dates back to the day when the city assumed its present name. Formerly there were three towns here—Mount Union, Lexington and Freedom—each under separate government, although geographically they were a single community. When the three towns joined under one city government the newly formed city was called "Alliance."

Story of the Reconstruction

The Alliance Gas & Power Company is the outgrowth of a pioneer public-service corporation, the Alliance Gas Light Company, organized in 1864. The original company has since undergone a number of reorganizations and changes in management, but the production of energy has been carried on in the same location ever since the installation of the first dynamo in the city, in 1886. In its infancy the electric plant was stowed away in a corner of a manufacturing establishment, but as the demand for the electric service increased, the generating station grew in magnitude and eventually crowded out the parent manufacturer, who was forced to seek a new site for his operations.

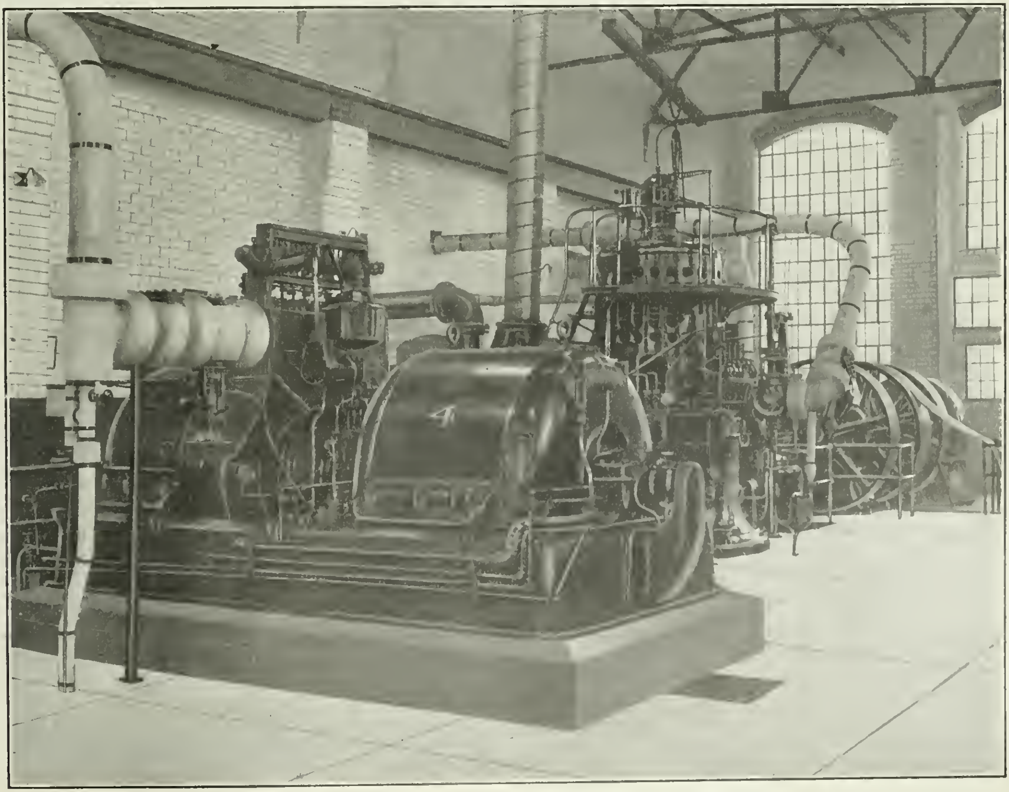


FIG. 1—AN ENGINE ROOM TYPIFYING PROGRESS IN PRIME MOVERS

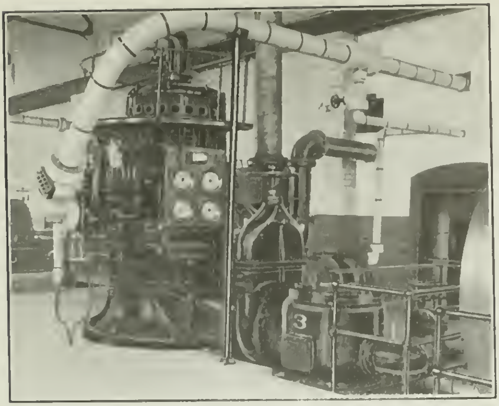


FIG. 2—VERTICAL TURBINE AND CONDENSER

Those in the electric-service business readily appreciate the problems that have had to be met in handling a growing load and in warding off possibility of embarrassment caused by outages due to overtaxing generating equipment. It was after completing one of those seasons of uncomfortable overload in the winter of 1911 that the owners decided to install equipment of greater rating. To house this new apparatus it was thought best that the old building, which had been patched up and added to as necessity demanded, should be replaced by a new one. The question of a new site was considered as the present location has no direct water supply, but it was decided that the advantages of the present site outweighed its disadvantages, and plans were prepared for an up-to-date building in the same place.

During the month of July, 1911, contracts were awarded for two 350-hp boilers, two Green chain-grate stokers and a Stocker cooling tower. The condenser was purchased to serve a 500-kw, 2300-volt Curtis turbine which prior to this time had operated non-condensing, and the cooling tower was designed to relieve the water situation.

During the month of August the work of rebuilding was begun. In the boiler room a number of old return-tubular boilers were removed to make room for the new boiler equipment, and as the new power house plans contained provisions for a coal bunker, a railroad track hopper and equipment for handling coal and ashes, work was at once commenced on the construction of this end of the building. While this work was going on in the boiler room, work on the cooling tower was pushed rapidly, an Ideal engine and a 150-kw, 2300-volt alternator were moved to new foundations, and the old foundation was removed to make room for the condenser. A condenser foundation was built, and while the condenser was being installed, a reservoir or cold well was dug in the engine-room basement on the same level with the cooling-tower reservoir, to provide a supply of cold water.

Change of Plant Ownership

The condenser and cooling tower were placed in operation in October, but fires were not built under the boilers until January, 1912. Preparations at this time were under way for the completion of the station during 1912. It happened, however, that the property was sold about this time to the Doherty Operating Company of New York, and construction work was temporarily discontinued.

The succeeding management took on so much new business during the year that the peak load of the holidays again brought uneasiness to those in charge, and the beginning of 1913 found the manager ready to contract for new generating equipment. The plans of 1911 were taken from the files and with a few changes and additions were adopted a second time. Work was resumed in the early spring.

The problems which faced the reconstructing engineers at this time were numerous. Service must not be interrupted. A new building had to be erected where the old one stood, although at all times it was necessary to protect the switchboard and other apparatus from the weather. This work was accomplished by erecting temporary walls outside the old structure, but inside the line of the walls of the new building, tearing away the old walls and building the new brick structure about the temporary building. When the roof beams of the new building had been laid in position holes were cut in the old roof to effect clearance and patched with tar paper till the new roof was completed. Switchboard panels were moved in pairs from the south end of station to a position along the last wall. The scheme used consisted in carrying all connections from two panels on one panel at the old switchboard site while one panel of a pair was being moved. These connections to a single panel in the new position, and then moving the second panel and again dividing the connections, completed the change. As soon as this removal was completed the new 1250-kva turbine was set in place in close proximity to the former switchboard site.

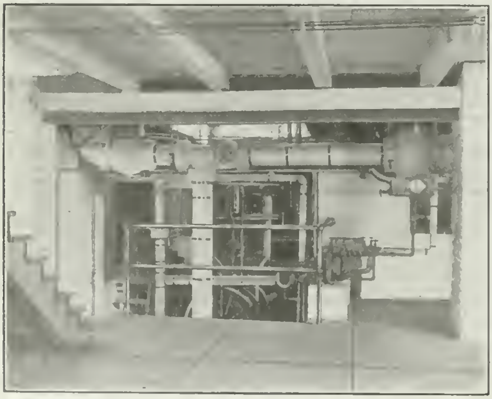


FIG. 3—CONDENSER PIT FOR 1250-KW TURBINE

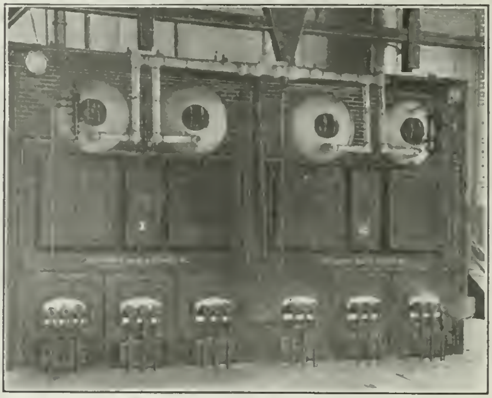


FIG. 4—TWO 350-HP GAS-FIRED BOILERS

At the same time a 6-ft. by 125-ft. steel stack was moved 28 ft. and received a quarter turn without mishap, and a basement was dug under the operating floor of the engine room. Shifting the mass of wiring before permanent leads were in place involved much labor, but each difficulty was met in turn, and the company is now the possessor of a neat and modern generating station.

Rearranged Generating Equipment and Switchboard

As it now stands the total rating of the generating equipment is 1750 kva. The largest unit recently purchased is a horizontal General Electric 1250-kva, 2300-volt, sixty-cycle, three-phase alternator operating at 3600 r.p.m. Exhaust from this machine is conducted through a Westinghouse LeBlanc condenser, the circulating pump and wet and dry-vacuum pumps for which are driven by a 75-hp direct-connected, non-condensing Westinghouse turbine. Arrangements were made in piping the exhaust steam from this auxiliary turbine to utilize the exhaust either in the feed-water heater or in the atmospheric stage of the main turbine. However, the latter method has been used entirely since starting the machine in October. An emergency trip ordinarily attached to the main steam line has been connected so that a valve in the exhaust steam line is automatically operated by the same trip. This precaution has been taken to prevent operation of the turbine on exhaust steam from the condenser auxiliaries after the automatic emergency trip has operated to close the live steam main.

The 500-kw vertical machine operates at 1300 r.p.m. and exhausts into a Westinghouse LeBlanc condenser the auxiliaries of which are driven by a 75-hp, 440-volt induction motor. Ordinarily these two turbine units carry the station load, but on Sundays or holidays when the load is very light it is sometimes transferred to one of the two 150-kw Ideal engine units. One of these machines is directly connected while the other is driven through a belt. They are maintained chiefly for breakdown service. Two 25-kw exciters, one motor-driven and one operated by a General Electric steam turbine, furnish energy for excitation.

The eighteen-panel Vermont blue-marble switchboard controls the four station units, six lighting and power circuits, two exclusive motor-service circuits, a sign circuit, a station auxiliary circuit and seven arc-lamp circuits, and supports a Tirrill regulator. Circuit-breakers and a system of double busbars are installed in the basement beneath the switchboard, the switching apparatus being of the manually operated, remotely controlled type. Each feeder circuit-breaker is equipped with an overload relay. Ground detectors mounted on an iron frame above the board are connected to the station buses.

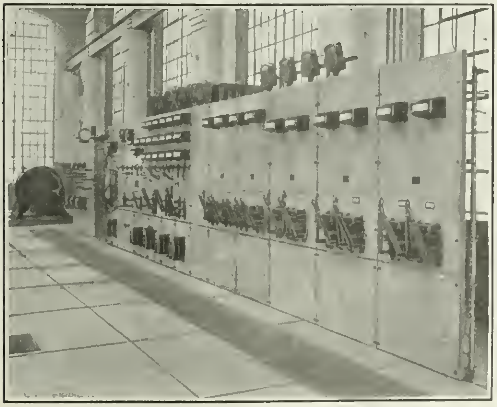


FIG. 5—EIGHTEEN-PANEL SWITCHBOARD

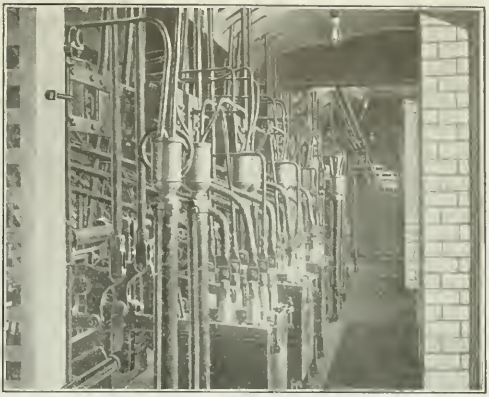


FIG. 6—HIGH-TENSION APPARATUS INCLOSED

Coal and Gas-Fired Boilers

Four 350-hp Babcock & Wilcox boilers carrying 150-lb. gage pressure are at present furnishing steam for the plant. Two of these boilers are equipped with natural-gas burners and the other two are arranged for coal burning with Green chain-grate stokers, each having an effective grate surface of 82.5 sq. ft. Slack coal from eastern Ohio mines is burned. Each battery is served by a separate, guyed steel stack, the one on the gas-fired boilers being 6 ft. in diameter and 125 ft. in height, while that for the coal-burning boilers is 6 ft. in diameter and 135 ft. in height.

Feed water is heated in a Cochrane open feed-water heater to a temperature of over 200 deg. Fahr. and is supplied to the boilers by two Platt Iron Works pumps of the duplex type. Either pump is of ample rating to supply the station at full load. High-pressure steam and water piping is all extra heavy with extra-heavy semi-steel flanged fittings. Long-radius bends have been used wherever possible, and all steam piping is covered with 1.5 in. of 85 per cent magnesia covering. Low-pressure material is employed in exhaust piping, and where practicable spiral-riveted pipe is used. Gate valves are in-

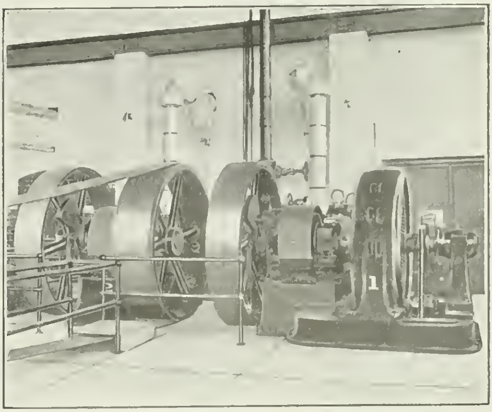


FIG. 7—BELTED AND DIRECT-DRIVEN ALTERNATORS

stalled in the steam header and its feeders so that it is possible to take any boiler from the line at any time or to sectionalize the header for repairs.

It has been found most economical to operate the coal-fired boilers as much of the time as possible, keeping the gas-burning units "floating" at all times by operating one burner beneath each unit. In times of emergency these gas-fired boilers can be brought up to 150-lb gage pressure, all ready for operation, in approximately twenty minutes.

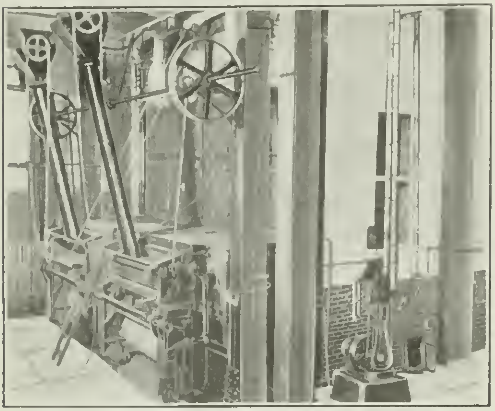


FIG. 8—COAL-BURNING BOILERS WITH CHAIN-GRATE STOKERS

Industrial Railway for Coal Handling

Coal is placed on the company's private siding by the Pennsylvania Railroad and is dumped from the cars into a track hopper at the end of the boiler room. Industrial cars of 27 cu. ft. capacity are loaded at the bottom of this hopper and lifted by means of a freight elevator to coal bunkers from which coal is fed by gravity to the furnaces. The same cars are used to convey the ashes from the ash pits to a tramway leading to the ash pile. The elevator is belt-driven from a 15-hp induction motor and is reversed by shifting belts.

As the plant is without a natural water supply, the condensing water has to be used over and over again. The cooling tower is of the combination chimney and forced-draft type, the water being forced by the discharge pumps of the condensers to the top of the tower against a head of 39 ft., where it is distributed evenly in troughs over the cypress-wood filling. When the natural draft becomes insufficient to cool the water, two fans, each 11 ft. in diameter, are placed in operation. A 50-hp, 2300-volt induction motor drives these fans.

The Building and Its Interior Finish

A brick, steel and reinforced-concrete structure houses the generating equipment. Foundations and footings of the walls are of concrete, the foundation walls up to the height of the water table being built of Bedford stone. From this point up paving blocks laid in cement mortar are used. Red coloring was added to the mortar of the outside course, and all joints were neatly struck with a 0.75-in. round tool. The window sashes are of steel, and the roof and floors are of reinforced concrete, making the building fireproof throughout.

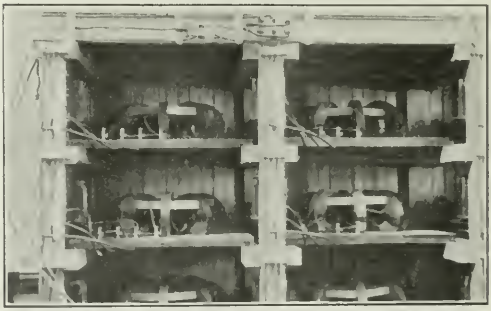
A material known as ferroinclave, manufactured by the Brown Hoisting Machinery Company, of Cleveland, was used on both roof and floors. On the roof the sheets of ferroinclave are laid flat on the steel purlins and coated with concrete top and bottom, while on the floors the sheets are arched between I-beams on 6-ft. centers. The coal bunkers, which form a part of the building on the boiler-room side, are supported by structural steel columns and trusses and are built of ferroinclave and concrete.

The interior of the building has been neatly and tastefully painted. A white cold-water paint was used on the upper part of the walls in both engine room and boiler room. In the engine room the white extends down to within 5 ft. of the floor, below which a border of brown oil paint has been applied. In the boiler room the white extends down to within 7 ft. of the floor, below which is a border of black. The concrete floors are all covered with a gray cement paint. All engines and generators have been coated with brown oil paint, giving a surface easily cleansed and presenting at all times a trim and neat appearance.

The manager of the Alliance Gas & Power Company is Mr. W. J. Rose, who is assisted by Mr. Edward Quillen, new-business manager. Mr. E. A. Wilder was in charge of the reconstruction of the generating station, and at present Mr. G. E. Morris is chief engineer.

Design for Artificial Transmission Line

An artificial transmission line of unusual compactness and flexibility has recently been completed at the Massachusetts Institute of Technology, Boston, by Mr. R. D. Huxley, a post-graduate investigator in the electrical engineering department. This artificial line is electrically equivalent to 800 miles of single-phase 500,000-circ.-mil copper line having a 10-ft. conductor spacing, or it may be used as a three-phase line 700 miles in length, with conductors spaced in an equilateral triangle. Shorter lengths may also be used by appropriate changes in the connections. The line is composed of thirty sections housed in a cabinet 12 ft. long, 5 ft. 6 in. high and 2 ft. deep, each section being contained in a compartment 20 in. long and 1 ft. high. Several typical sections are illustrated in the accompanying photograph. The line inductance is provided by eight coils per section centered on a circular axis, each coil being of No. 12 wire and wound to a diameter of 7 in. and a width of 1 in. The distributed capacity is provided by a condenser mounted on the side of each compartment. The method of securing mutual inductance effects by arranging the coils on circular axes is a novel feature of the design. With this equipment many phenomena of line operation may be studied and a great variety of resistance, inductance and capacity combinations secured, notably in connection with the production of resonance.



SECTIONS OF ARTIFICIAL TRANSMISSION LINE

Characteristics of Alternating-Current Electromagnets

Behavior of uniformly wound plunger-type electromagnets with various lengths of stops throughout the entire coil when subjected to alternating currents. By Charles R. Underhill

THOSE who have experimented with alternating-current electromagnets having a fairly long stroke are well acquainted with the erratic behavior of the pull characteristics. When a short stop is used the pull falls off as the air-gap closes until, at a certain point it rises very rapidly. Again, if a long stop is employed, the pull increases enormously with a decrease in the length of air-gap. Sometimes the turns in the winding are distributed in such a manner as to maintain the pull with a short stop.

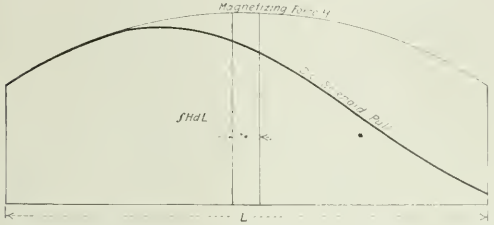


FIG. 1—DIRECT-CURRENT SOLENOID PULL COMPARED WITH MAGNETIZING FORCE

In this article will be discussed the general characteristics for various lengths of stops throughout the entire coil, which is assumed to be uniformly wound. The dimensions of the test electromagnets are the same as those given in the *Electrical World* for Jan. 31, 1914. In Fig. 1 is shown the magnetizing-force curve for a solenoid of length L which is excited with continuous current. Only the value of the magnetizing force within the physical limits of the coil will be considered. Furthermore, in referring to this figure in connection with plunger electromagnets, the ends of the coil will be considered as fitting closely against the inside of the frame. The "D.C. solenoid pull" curve is merely the magnetization curve $(B - H)$ of the plunger, with air return circuit, multiplied by the magnetizing force; since the solenoid pull is directly proportional to $H\,(B - H)$. The solenoid pull, attributable entirely to magnetic leakage in a simple coil and plunger, will be shown to be a very important factor in the behavior of alternating-current electromagnets. By reason of this pull it is impossible to predetermine accurately the pulls at all points by assuming that all of the flux passes through the air-gaps, since all, or nearly all, of the leakage flux cuts the coil.

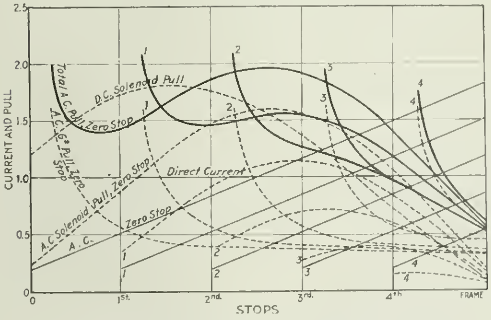


FIG. 2—GENERAL PRINCIPLE OF ALTERNATING-CURRENT ELECTROMAGNET CHARACTERISTICS

The general principles of alternating-current electromagnets of the plunger type are illustrated in Fig. 2, wherein there is assumed to be reluctance in the ferric parts and the current is supposed to increase directly with the reluctance of the air-gap plus that referred to above. For the purpose of this article the varying permeability of the ferric parts is not considered but the "D.C. solenoid pull," transferred from Fig. 1 to this figure, is assumed to be of constant form and to vary in magnitude with the strength of the alternating current. Only the curves representing the characteristics with zero stop are marked in the figure. The numbers on the other curves indicate that these are the characteristics with stops of corresponding numbers. The coil is assumed to be surrounded with a frame of magnetic material, and the term "zero stop" means that the attraction through the air-gap is between the end of the plunger and the frame, although the cross-section of the air-gap flux path is assumed to be constant throughout the coil.

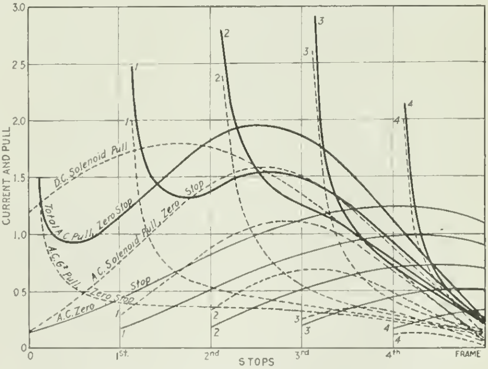


FIG. 3—CORRECTED CHARACTERISTICS OF ALTERNATING-CURRENT ELECTROMAGNET

In all cases, the value of the "D.C. solenoid pull" is multiplied by the effective strength of the alternating current in order to obtain the "A.C. solenoid pull." Then the "A.C. G^2 pull" (proportional to $\frac{I^2}{l^2}$, wherein I is the effective strength of the alternating current and l is the length of the air-gap plus the equivalent additional length of air-gap due to additional reluctance), is the pull in the air-gap proportional to $(B - H)^2$. The total pull is the sum of these two pulls.

Now, when the air-gap is entirely closed, the impedance of the electromagnet will be constant regardless of the position of the joint between the plunger and the stop; but when there is an appreciable reluctance in the air-gap the impedance will be decreased since a portion of the total mmf, proportional to $\int HdL$ (see Fig. 1) is employed in overcoming the reluctance of the air-gap. Consequently the strength of the alternating current will be greater when the air-gap is at or near the middle of the coil than when it is near either end of the coil.

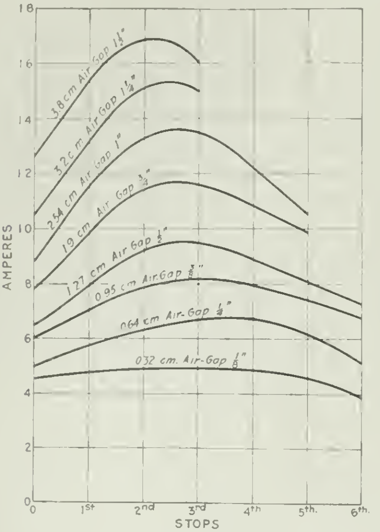


FIG. 4—CURRENT CHARACTERISTICS OF THE TEST ELECTROMAGNET

In Fig. 3 the strength of the alternating current is made to vary with the magnetizing force throughout the entire length of the coil. That is, the current strengths in Fig. 3 are determined by multiplying the current strengths in Fig. 2 by the value of the magnetizing force for corresponding points. The other characteristics in Fig. 3 are developed in the same manner as was employed in producing Fig. 2.

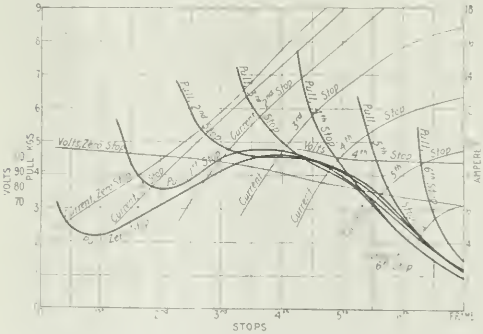


FIG. 5—PULL AND CURRENT CHARACTERISTICS OF THE TEST ELECTROMAGNET

Fig. 4 gives the results of a test of the electromagnet referred to at the beginning of this article. In order to obtain test characteristics at various points throughout the inner limits of the coil and frame, two plungers, 1 sq. in. in cross-section, were employed. One of these was the same plunger used in the test published in the issue of the *Electrical World* dated Jan. 31, 1914.

Fig. 6 shows the general characteristics excepting the pulls and I^2r losses. The watts were read from a wattmeter connected in the usual manner. The numbers on the curves represent the stops, which varied in lengths of ½ in. The resistance of the coil varied from 0.74 ohm to 0.85 ohm during the tests, and, since the tests extended over a considerable period, the results are approximate, although the percentage of variation must be small since the average coil resistance, used in calculating the losses, was taken as 0.80 ohm.

The heating of the electromagnet caused a considerable variation in the pull, so the pull characteristics were taken on a separate test with sufficient intervals between tests to keep the resistance near the average, the idea being to obtain the true pull characteristics for comparison with those in Fig. 3. There was a considerable voltage drop in the line, and this should always be allowed for in designs. It will be found that the current strengths in Figs. 4 and 5 compare favorably excepting for the zero and first stops. There was a great change in impressed emf in both cases, so it is apparent that if the impressed emf had been of constant value the general characteristics for the total pulls in Fig. 5 would closely resemble those in Fig. 3.

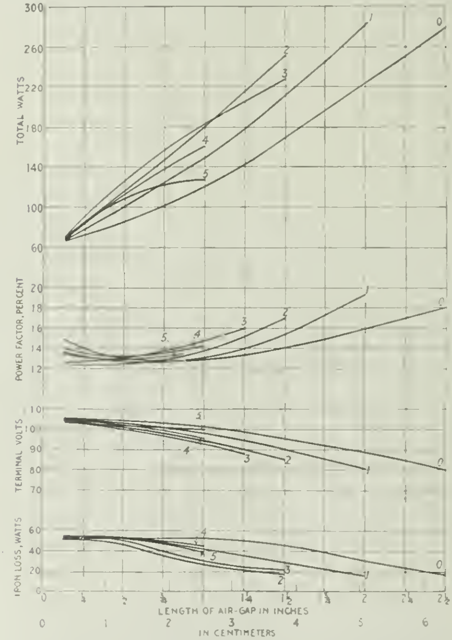


FIG. 6—GENERAL CHARACTERISTICS OF THE TEST ELECTROMAGNET

Referring to Fig. 6 it is seen that for 0.5-in. air-gaps the average power-factor is 13 per cent, the average emf 102 volts, the average total watts about 110, and the average iron loss can be taken as 50 watts. The average current strength for 0.5-in. air-gap (see Fig. 4) is about 8 amp. Then the I^2r loss is $8^2 \times 0.8 = 51.2$ watts, and the total loss is $50 + 51.2 = 101.2$ watts. For a total loss of 110 watts, on the above basis, the current would be 8.6 amp, which probably represents a closer average.

World's Largest Electric Generating Set

Two turbo-alternators, one of which is the greatest ever built, to be installed by the Philadelphia Electric Company —Unique surface-type condensers also unsurpassed in size

IN the new generating station which the Philadelphia Electric Company has under construction adjoining its present Christian Street station there will be installed not only the largest prime-mover electric generating set ever built, but also the largest surface-type condensers ever constructed. These condensers, moreover, embody a unique center-flow principle of design which makes them of particular interest in addition to their great area of tube surface—50,000 sq. ft.

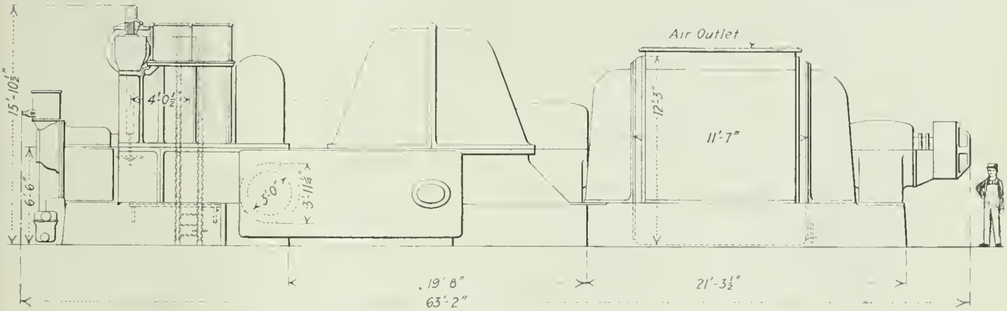


FIG. 1—35,000-KW HORIZONTAL TURBO SET FOR PHILADELPHIA ELECTRIC COMPANY'S NEW STATION

Two turbo-alternators will make up the entire equipment of the new plant—one a 35,000-kw, 13,200-volt, sixty-cycle, three-phase unit, and the other a 30,000-kw, 13,200-volt, twenty-five-cycle, three-phase set. The first-mentioned huge machine, now under construction, is at the present time the largest electric generating unit ever built. It is of the General Electric horizontal type and will measure over all 63 ft. 2 in. in length, 21 ft. 7 in. in width and 15 ft. 10 in. in height. Complete with generator and exciter, it will weigh 600 tons.

Steam will be furnished its thirteen-stage Curtis turbine element at 215 lb. pressure and 150 deg. Fahr. superheat, and it will exhaust into a 50,000-sq. ft. surface condenser of the center-flow type illustrated in the accompanying diagram. The exhaust enters the condenser shell at the top and passes roughly radially through the banks of tubes to the center, from which point the air is removed. This radial path of the steam, it will be noted, involves the shortest travel through the tubes. The condenser will be the two-pass type with a counter-flow arrangement by which the condensate collects and trickles down over the hottest tubes so that it is removed within a few degrees of exhaust-steam temperature. The annular or outer group of tubes forms the first pass and the central group the second pass.

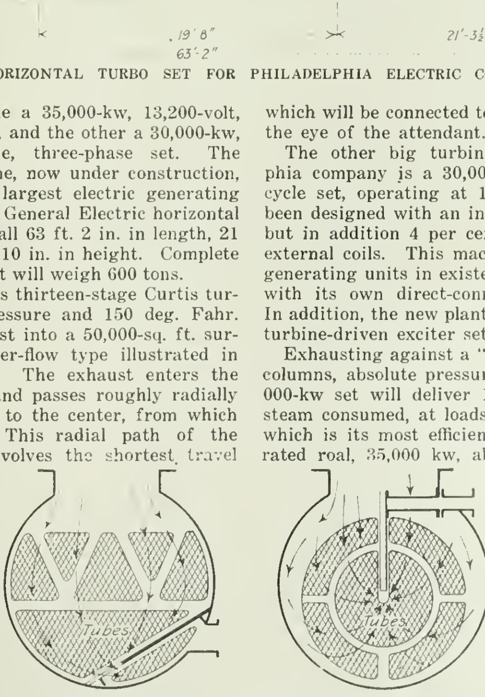


FIG. 2—ARRANGEMENT OF TURBO IN STANDARD AND IMPROVED TYPES OF SURFACE CONDENSERS

The generator element is rated at 13,200 volts, sixty cycles and 35,000 kw and will have a current output of 1460 amp per phase at full load and 90 per cent power-factor. The armature has been designed with an internal reactance amounting to 10 per cent. The six-pole rotating field member is driven at 1200 r.p.m., and carried on the same shaft will be a 150-kw, 250-volt, 600-amp shunt-wound exciter, the stationary parts of which will be supported on a bracket from the outboard generator bearing. To detect and warn of excessive temperatures in the machine, the armature is being provided with thermocouple electric thermometers which will be connected to indicating instruments under the eye of the attendant.

The other big turbine-generator for the Philadelphia company is a 30,000-kw, 13,200-volt, twenty-five-cycle set, operating at 1500 r.p.m. Its armature has been designed with an internal reactance of 8 per cent, but in addition 4 per cent reactance will be added by external coils. This machine, itself one of the largest generating units in existence, will be similarly provided with its own direct-connected bracketed-type exciter. In addition, the new plant will have an auxiliary 500-kw turbine-driven exciter set.

Exhausting against a "vacuum" of 1.5 in. of mercury columns, absolute pressure, it is expected that the 35,000-kw set will deliver 1 kw-hr. for each 11.9 lb. of steam consumed, at loads in the vicinity of 25,000 kw, which is its most efficient point of operation. At full rated roal, 35,000 kw, about 12.6 lb. of steam will be required per hw-hour.

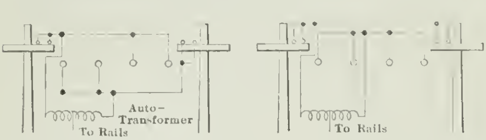
The work of erecting these huge units in the new Christian Street plant at Philadelphia is expected to be begun about September of this year. The General Electric Company is building the turbo-generators. The condensers are being made by the Southwark Foundry & Machine Company, Philadelphia, from designs by the Westinghouse Machine Company, which will also furnish the circulating, air and hot-well pumps.

Minimizing Induction from Single-Phase Railway

Auto-transformer plan for reducing inductive interference in telegraph and telephone lines of the New York, New Haven & Hartford Railroad

Much interest has been manifested in the methods employed to overcome the detrimental effect of the single-phase lines of the New York, New Haven & Hartford Railroad upon neighboring telegraph and telephone circuits. As a result of experiments conducted continuously since the installation of the single-phase system, there have been evolved plans which are now giving excellent satisfaction in practical operation.

On account of the presence of the lead sheath of the underground cables and the overhead steel structures there is practically no trouble from electrostatic induction along the route of the New Haven road. The chief cause of interference has been magnetic induction attributable to the magnetomotive force of the loop formed by the separated outgoing and return current circuits.



FIGS. 1 AND 2—THE BALANCED AND SEMI-BALANCED PLAN

Curative Methods

To overcome the troubles encountered use has been made of two general plans that can best be designated as the curative and the preventive. According to the curative plan, the affected circuits are equipped with transformers which introduce compensating emfs proportional to the disturbances. The transformers have primary windings connected in one or more single-phase lines and secondary windings connected in series with the affected lines, the ratio of transformation being so selected as to produce neutralization. This plan is employed by the American Telephone & Telegraph Company on its New York-Boston underground-conduit lines paralleling the New Haven road at a distance of about 2000 ft.

Preventive Methods

As an outcome of numerous conferences held by representatives of the many interests involved an auto-transformer method of preventing inductive disturbance and simultaneously improving the energy transmission efficiency was adopted. This plan was placed in service on Jan. 25, 1914. Consideration was given by a committee consisting of Mr. W. S. Murray and Prof. C. F. Scott for the railroad, Mr. H. S. Warren for the telephone and Mr. G. M. Yorke for the telegraph interests to three preventive plans, which can conveniently be designated as the balanced, the semi-balanced and the island plan. The general principles of these are as follows:

The balanced plan comprises a three-wire transmission with auto-transformers distributed along the line. These transformers were to be connected across two pairs of feeder wires with 22,000 volts between the two pairs. The mid-points of the transformer windings were to be connected to the track. The feeders were placed two on each side of the track and for convenience may be referred to as the north and south feeders respectively. The generator voltage of 11,000 was to be raised to 22,000 for the line by means of auto-transformers, with their mid-points grounded, installed in the power station.

For the purpose of producing electromagnetic and electrostatic neutralization the north feeder wires were to feed the south trolley wires and vice versa, as shown in Fig. 1. This plan was ideal from the standpoint of transmission economy and of non-interference with foreign lines, but it was felt to be impracticable on account of the difference of potential between the trolley wires, which obviously would be 22,000 volts. This feature would have made the overhead construction difficult, particularly at track switches.

The second plan considered, the one finally adopted, may be called the semi-balanced system. According to this plan all trolley wires are at the same potential, 11,000 volts above the rails. The transmission system and auto-transformer arrangement are as in the first plan except that the trolley wires are connected together and to one terminal of the transformers, while the feeders, in parallel, are connected to the other, as explained further on. Fig. 2 shows by way of contrast with Fig. 1 the general features of the auto-transformer plan.

The third plan considered was one in which the line was divided into a number of sections, insulated from each other, each fed from one or two transformers. By this means the current drawn by a train in any one section could be confined to that section, and the inductive disturbance would be largely balanced out. This plan was not adopted because, in the opinion of the railroad company's engineers, the large expense involved for first cost and annual charges was not warranted by the result to be secured.

Fig. 3 is a simplified diagram of the new arrangement. This is evidently similar to the Edison three-wire system except that the direct load is on one side of the circuit, the other receiving its share through the auto-transformers which perform the same function as balancer sets in a direct-current distribution system.

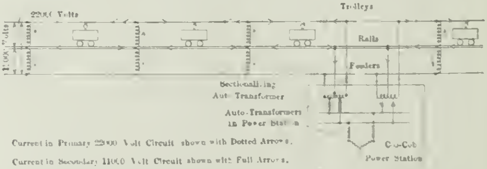

22000 Volts
11000 Volts
Trolleys
Rails
Feeders
Sectionalizing Auto Transformer
Auto-Transformers in Power Station
Current in Primary 22000 Volt Circuit shown with Dotted Arrows.
Current in Secondary 11000 Volt Circuit shown with Full Arrows.
Cos-Cob Power Station

FIG. 3—CIRCUIT DIAGRAM OF PRESENT ARRANGEMENT

The diagram Fig. 4 shows the Cos Cob power station, which contains 11,000-volt, three-phase generators, used single-phase for the railroad electrification but three-phase for the other energy transmission. By means of auto-transformers installed at the power house the voltage is raised to 22,000, and the middle points of the transformers are connected to the rails. Line auto-transformers are arranged along the track and similarly connected for the purpose of reducing the electromotive force to 11,000 volts for the trains. The total number of the sectionalizing bridges at which the transformers are situated is twenty-five, of which seventeen are west of Stamford.

By the above arrangement approximation is made to ideal conditions for eliminating inductive interference. While data are not yet available to show the exact extent of the neutralization, a very large part of the interference has been eliminated. The reduction of interference is not quite so great as it would be with a completely sectionalized line on account of the general tendency for some current to flow back to the generating station through the track. That is to say, the magnetomotive forces produced do not quite balance out. This is due to the impedance of the transformers. The effect is similar to the flow of current in the neutral of a three-wire direct-current system. The magnetic effect could in some cases be reduced by disconnecting the track return at the power station, but this would introduce a hazard to the line transformers if a break should occur in one of the line wires. It would be possible in this case that the nearest line transformer would become a raising transformer for the line beyond the break and might be thus heavily overloaded.

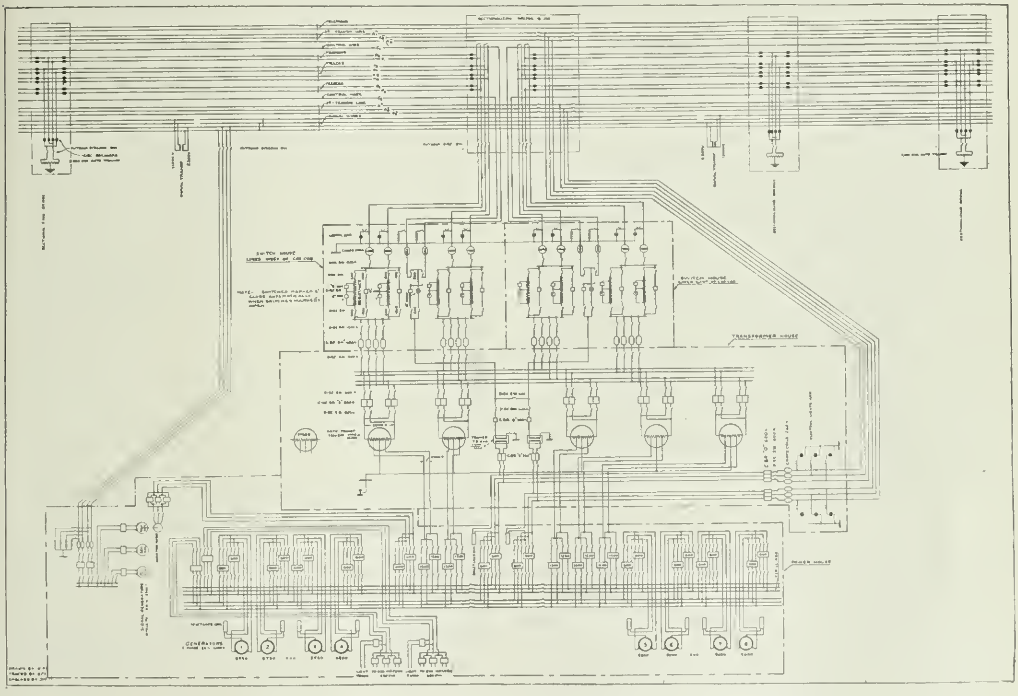

SWITCH HOUSE LINES WEST OF COS COB
SWITCH HOUSE LINES EAST OF COS COB
TRANSFORMER HOUSE
POWER HOUSE
GENERATORS

FIG. 4—WIRING DIAGRAM OF COS COB STATION—PRESENT ARRANGEMENT

The general return of current toward the generating plant is actually not very great, and the disturbance in adjacent lines has been largely removed. The telephone company has been able to cut down the number of curative transformers to a larger extent, thus improving the efficiency of speech transmission.

The improvements on the lines west of Stamford have cost about $750,000. This includes the main line from Stamford to Woodlawn, the New York, Westchester & Boston Railway and the Harlem River Division, comprising altogether 222 miles of single track, exclusive of yards. This cost was higher than it would otherwise have been owing to the necessity for making all changes without interfering with operation, one sectionalizing bridge being changed at a time. On the line east of Stamford, the electrification of which will be completed within a few weeks, a different condition exists. There the auto-transformer system and the 22,000-volt transmission system are being installed on a new line. The result is that the cost is greatly reduced, being roughly for the entire overhead system, including bridges, feeders, catenary and transformers, $40,000 per mile of route or $10,000 per mile of track. This is only about 60 per cent of the cost of the overhead system west of Stamford without the auto-transformer system.

It should be mentioned in this connection that a great improvement in energy transmission efficiency has been obtained in operating at 22,000 rather than 11,000 volts.

Experiments on the New Canaan Branch

Some very interesting and useful experiments are now being made on the New Canaan branch of the New Haven railroad in order to secure a scientific basis for the elimination of inductive disturbances. These tests are being co-operated in by the New Haven railroad, the Westinghouse Electric & Manufacturing Company, the American Telephone & Telegraph Company, the Western Union Telegraph Company, the Southern New England Telephone Company and other interests.

The tests were begun on account of a series of disturbances which occurred in the New Canaan office of the Southern New England Telephone & Telegraph Company. The program of the tests was laid out with a view not only to correcting the local difficulties but also to yield data of reference value in the solution of larger problems. The New Canaan branch is well adapted to these tests as it is off the main line and is not supplied with the auto-transformers like the main line. In fact, it is not suited for this method of compensation, being a stub-end line.

The plans under test consist of two parts and involve a track and line compensator plan, somewhat similar in principle to the scheme already described for the telegraph line. A series of compensating transformers about one to the mile are distributed along the line, which is between 6 and 7 miles long. These tie together either the trolley wire and the track or the trolley wire and the feeder. The transformers have a one-to-one ratio. The general idea can be seen by inspection of Fig. 5. The currents in the primaries and secondaries of the transformers must be substantially equal, hence at the points where the transformers are applied the currents are confined to the circuit in which the transformers are connected. The transformers obviously neutralize return drop.

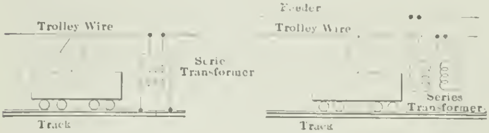


FIG. 5—EXPERIMENTAL PLAN ON NEW CANAAN BRANCH

The tests are being made with and without the transformers and under all conditions of weather and other variables. To make conditions perfectly definite a current of 200 amp is sent through the line for night tests, and during the day measurements are taken under regular operating conditions. The measurements are made on lines in the vicinity of the track and at different distances therefrom. In these lines measurements of voltage, current and phase positions are made.

The New Canaan tests are probably the most elaborate which have yet been made, and the results will be awaited with great interest.

Heating a Large Office with Electric Lamps

At the Electrical Testing Laboratories, Eightieth Street and East End Avenue, New York City, advantage is taken of the heat generated in the lamp-testing racks to deliver pure, electrically tempered fresh air to the general offices, supplementing in this novel way the regular method of heating these rooms by steam. In the life-rack rooms of the Laboratories some 5000 lamps, totaling about 200 kw, are kept burning continuously night and day under carefully controlled voltage conditions. In summer the heat thus generated escapes through ventilators in the roof. At the beginning of the winter season, however, a motor-driven fan is installed to exhaust the heated air from the life-rack room and to deliver it to the offices.

Special Receptacles for Exposition Lighting

The electrical department of the Panama-Pacific International Exposition, to be held at San Francisco in 1915, has developed a new form of lamp receptacle for use in gala and festive lighting. These receptacles are in the form of mission bells and more than 25,000 will be used in a decorative way.

American Electrochemical Society Papers

In addition to the abstracts printed last week of papers read before the meeting of the American Electrochemical Society in New York City on April 16 to 18, the *Electrical World* publishes below a number of others.

Energy Transmission Economics

Mr. P. W. Sothman presented a paper containing data relating to the cost of installing and operating various electrical energy generating and transmitting systems. The author stated that the initial cost of installing generating plants of various types is approximately as follows in dollars per horse-power: Hydroelectric, $125; steam, $100; gas-producer, $100; oil engine, $100.

On the bases of a load-factor of 60 per cent and fixed charges of 11 per cent on hydroelectric and steam stations and 12 per cent on gas and oil plants the cost of energy in mills per kilowatt-hour would be as follows: Hydroelectric, 3.6; steam, 6.25; gas, 4.95; oil, 5.62.

The accompanying table shows data relating to the cost per mile of transmission lines based on the use of No. 000 B. & S. gage copper cables with copper at 18 cents per lb. It is assumed that the wood poles are spaced 120 ft. apart and the steel towers 550 ft.

COST OF TRANSMISSION LINES

Description	Towers or Poles, Including Footings	Cables and Erection	Insulators	Total
12,000 volts, wooden-pole line:				
Double-circuit	$1400 00	$3120 00	$130 00	$5115 00
Single-circuit	1100 00	1600 00	65 00	3042 00
30,000 volts, wooden-pole line:				
Single-circuit	1400 00	1650 00	200 00	3575 00
60,000 volts, steel towers:			Pin type	
Double-circuit	1800.00	3300 00	220 00	5852.00
Single-circuit	1630 00	1700 00	110 00	3784 00
110,000 volts, steel towers:			Suspension type	
Double-circuit	2050 00	3300 00	622 00	6569.00
Single-circuit	1850 00	1720 00	350 00	4312.00

The market price for aluminum cables is generally lower than that for copper cables of equal conductivity, but this advantage is offset by the necessity for using slightly higher towers with aluminum because of the greater sag at the middle of the spans.

With proper care in the design and selection of materials, especially insulators, coupled with the use of suitable protective apparatus, a modern line should give practically uninterrupted service.

Electric Zinc Smelting

The paper by Mr. W. R. Ingalls brought out the fact that electric zinc smelting is still in its infancy and that there are very few data available at present on the cost of production by that method. While some claim that zinc smelting can be done in one operation by the electric method, the author declares that it will require two separate treatments just as with the fire-smelting method, otherwise the furnace will yield blue powder. Electric smelting has the advantage of being continuous, however, instead of being intermittent, as with the fire process.

In smelting 1000 kg (2200 lb.) of zinc ore containing about 25 per cent to 50 per cent zinc, it is estimated that from 900 to 1050 ton-calories (3571 to 4166 ton-Fahr. units) of heat are required, which is equivalent to 1047 kw-hr. and 1221 kw-hr. of electrical energy respectively. At the prevailing rates for electricity it is, therefore, advisable to use coal for heating where possible and employ electricity only when it is especially needed If the operating data on electric zinc smelting in Norway and Sweden were adjusted to American conditions, the author declares, the cost of the electric process would make it prohibitive.

Metal Inventory in an Electrolytic Copper Refinery

A simple and inexpensive method of inventorying the metal used in an electrolytic copper refinery from the time it enters the plant until the finished product is shipped was described in the paper by Mr. Ralph W. Deacon. To facilitate obtaining the efficiency of different processes in the plant the system is subdivided under four general heads: Anode department, tank house, wire-bar department, and silver refinery. The method of accounting is particularly adapted to plants employing the Walker arrangement of the multiple system of refining.

A Microscopic Study of Electrolytic Iron

The paper by Mr. Oliver W. Storey contained forty-eight miscroscopic views of electrolytic iron prepared under different conditions. From a study of the microstructure of this type of iron the author draws the following conclusions: No change in the structure of electrolytic iron can be determined at temperatures below the A_3 range; a fine deposit is more readily changed to grain structure than a coarse deposit; by heating for a short time above the A_3 range a fine deposit is transformed into a fine-grain structure while a coarse deposit becomes coarse-grained, but the latter may be broken down into smaller grains by annealing at the A_3 point or by heating to 1000 deg. or higher, and the grains of electrolytic iron do not grow appreciably at 1150 deg.

Electrodeposition of Cadmium

The suitability of different salts of cadmium to the electrodeposition of the base metal was discussed in the paper by Messrs. Frank C. Mathers and Hugh M. Marble. Fluoride, fluosilicate, fluoborate or perchlorate solutions containing 4 per cent cadmium, with 0.5-5 per cent free acid and 0.2 gm peptone, glue or phloridzin, or four drops of clove oil, gave excellent, smooth deposits. A bath containing 4 per cent cadmium chloride, 10 per cent ammonium chloride, 5 per cent hydrochloric acid (by volume), 0.1 per cent peptone and 10 per cent ferric chloride gave smooth, finely crystalline deposits.

These experiments demonstrated the value of an additive agent, since smooth deposits of cadmium could not be obtained without their use. Clove oil, peptone, glue and phloridzin, which are the same addition substances employed in lead plating, are also valuable in cadmium deposition.

Electrodeposition of Nickel

The paper by Messrs. C. W. Bennett, H. C. Kenny and R. P. Dugliss called attention to the results of early experimenters, showing that stirring the electrolyte of a nickel-plating bath does not affect the efficiency of the deposition, while rotating the cathode lowers it. In each case the iron deposit is increased, unless the cathode is placed in a porous cup containing an ammoniacal solution. Curves were shown indicating the effects on the efficiency of rotating the cathodes, employing a porous cup and increasing the concentration of the ammoniacal solution in the porous cup.

The following conclusions were arrived at: A good deposit of nickel can be obtained from the double sulphate if the solution at the surface of the cathode is kept alkaline. Since the rate of deposition is dependent upon the degree of alkalinity of the cathode films an initially high efficiency can be obtained and maintained by adding a definite amount of ammonium hydroxide to the solution to begin with. The alkaline film can be disturbed and the efficiency of the deposition thereby decreased by stirring the solution vigorously; the iron deposited on a rotating cathode is greater than that formed on a stationary electrode, but the iron content of the anode does not materially affect the efficiency of deposition.

Notes on Some Electrical Properties of Silver Sulphide

Laboratory experiments were described in the paper by Mr. F. A. J. FitzGerald showing that silver sulphide has certain electrical characteristics which make it unsuitable for thermoscopic purposes when employing direct current but quite practicable when carrying alternating current. When unidirectional current flows through silver sulphide its resistance gradually decreases owing to electrolysis forming metallic silver. If placed in an alternating-current circuit, however, silver sulphide will maintain a constant resistance for quite a long period unless heat is applied, when the resistance will drop considerably, depending on the temperature change. The drop in resistance of silver sulphide when subjected to alternating current is attributed to electrolysis caused by the rectifying action of this chemical compound.

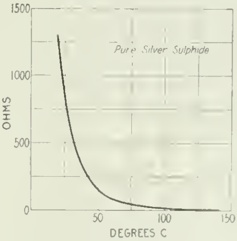


FIG. 1—SILVER-SULPHIDE DISK BETWEEN SILVER DISKS IN OIL BATH

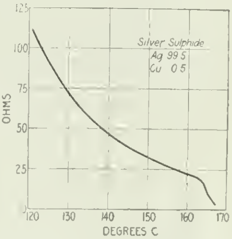


FIG. 2—MACHINED SILVER-SULPHIDE ROD WITH SILVER CAPS

The paper pointed out that the greater the percentage of copper present in the silver sulphide the lower is the critical temperature (that is, the temperature at which the resistance takes a sudden drop). With 0.5 per cent copper present the critical temperature is about 162 deg. C., whereas with 7.5 per cent copper the critical temperature is lowered to 104 deg. C.

The Effect of Addition Substances in Lead-Plating Baths

The paper prepared jointly by Messrs. Frank C. Mathers and O. Ralph Overman pointed out the best substances to incorporate in a lead-plating or refining bath to increase the density, brightness and non-crystalline appearance of the deposited metal. The addition substances recommended in order of their beneficial effects are as follows: Clove oil or eugenol, peptone, phloridzin and gum guaiac. Clove oil is especially recommended for use in lead-perchlorate plating and refining baths, about 0.3 lb. being required per ton of lead.

Addition Agents in the Deposition of Zinc

The paper prepared jointly by Messrs. O. P. Watts and A. C. Shape presented the effects of adding about forty different organic substances to a zinc-plating solution with the hope of improving the character of the metallic deposit. The most satisfactory addition agents found by these experiments were eikonogen, pyrogallol and betanaphtol, the latter being the best. The majority of the substances had injurious rather than beneficial effects. The most common defect in the deposits was the presence of vertical grooves or striations.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

An "Electric Cottage" at Lexington, Ky.

To demonstrate the multitude of uses which can be made of electricity in the home the Lexington (Ky.) Utilities Company has just opened on a prominent and easily accessible corner what it terms the "Electric Cottage." Large advertisements in the Lexington papers and circulars which went out by mail invited the people of the city to make the cottage a down-town convenience and meeting place. The house contains several rooms and is furnished with a complete electrical kitchen, while the other rooms of the house have other electrical conveniences. Demonstrations are in charge of girl graduates of the local Harrison school of applied electricity, assisted by the junior class of the domestic science department of the Kentucky State University, which is in Lexington. Every day at fixed hours cooking is done and the finished products are served to those who come to see. One feature of the exhibition which is attracting much favorable attention is the electric burglar alarm displayed in the bedroom.

A Sign a Day for a Year at Toledo

"Our new slogan sign is a wonder! It is a business getter without an equal!" These and similar sentiments expressed by Mr. F. R. Coates in the recent new-business convention, at Toledo, Ohio, show what the officials of the Toledo Railways & Light Company think of the slogan-sign idea. The new-business department of the company, not to be outdone, has itself adopted a slogan, namely, "A sign a day for a year," and from present indications it will be able to exceed even the letter of the phrase. During the first four months of the campaign more than two hundred signs were sold and the business has now reached a stage where sign companies are shipping completed signs to Toledo in carload lots. Business is being solicited from all classes of customers, and it is hoped that six or eight national advertisers will be induced to erect signs within the next month. All signs are connected on a special sign circuit and are turned on and off by a patrolman.

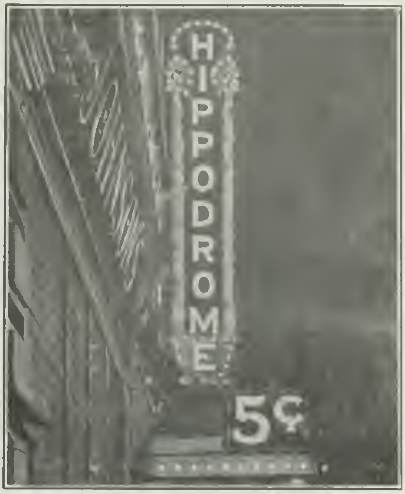


FIG. 1—ONE OF THE SIGNS PHOTOGRAPHED FOR "ADS"

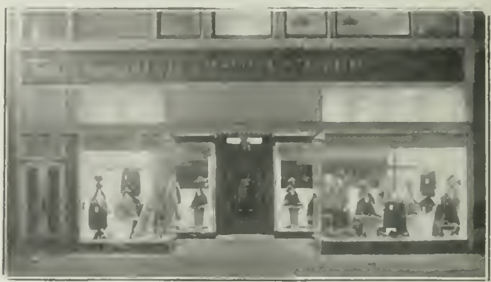


FIG. 2—A TYPICAL WINDOW-LIGHTING INSTALLATION

Energy for sign lighting is sold on a flat rate, 9 cents a lamp a month, this price including lamps, renewals and all other necessary maintenance. The most effective talking point used in connection with this rate is the hourly cost of operation of the sign which the prospective customer appears to favor. This figure is usually considerably less than a dollar for an average-sized sign, and such an advertising rate appeals to the merchant as low in comparison with other advertising mediums. A census of signs thus far erected shows that the average sign contains about 250 10-watt tungsten lamps.

Much of the success of the campaign is attributed to the fact that as soon as a sign is in operation a photograph of it is taken and published in the daily papers, advertising both the electric service and the place of business of the newly acquired sign customer. Distinctive signs are sold in all cases, the company operating on the theory that one original clever design helps to sell other signs to the competitors of the first purchaser. The thoroughness of the methods being employed by the company may be realized when it is stated that two circular letters a week, street-car posters and newspapers are used for advertising, while two sign companies retain salesmen and designers in the central-station company's office to assist the solicitors.

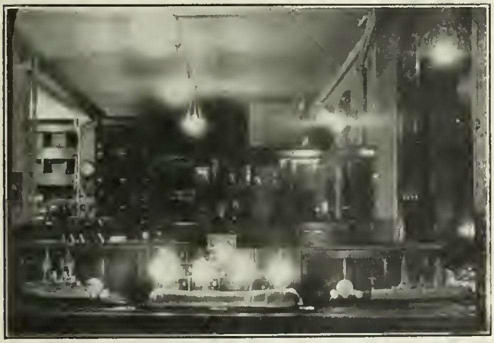
Taking things in logical order, a window-lighting campaign was inaugurated two months before the sign campaign started, the two campaigns continuing together. By beginning the window-lighting campaign first, customers were induced to put in better lighting, although they might not have done so had the sign proposition been broached first. The campaigns are being conducted under the direction of Mr. A. K. Young, new-business manager for the Toledo company, and it is his belief that the mark of "a sign a day for a year" will be exceeded by a goodly number.

Combination Ice-Electric Operation in an Ohio Town

The combination ice-electric plant in an Ohio town of 3500 has an ice-making equipment with a maximum capacity of 10 tons of ice per day. The steam-driven compressor equipment and auxiliary ice-plant apparatus represents an investment of $8,550, added to which is the investment in the building addition amounting to $500, thus making the total added investment required for ice-making $9,050. Year before last this plant made 1057 tons of ice, the gross income from its ice business being $2,677. The preceding season was even better, for that year the plant turned out 1511 tons of ice, bringing in a gross return of $4,215. The ice plant ordinarily operates four months of the year, and distilled water is used for ice making.

A Timely Window Display

Catching a bit of the wartime spirit, the Philadelphia Electric Company has been exhibiting a lamp window display which has attracted much interested attention from the passing public. A "fort" was built of lamp cartons and from its dozen ports, like so many guns, projected 40-watt frosted tubular tungsten maps. Each unit was fitted with a thermostat flasher pocket which caused the lamp to flash briefly at irregular intervals simulating the firing of the gun. "In the offing" at the sides of the window floated two miniature battleships, while from its staff on the topmost parapet of the fortification a small silk American flag fluttered gallantly in the breeze of an 8-in. fan concealed behind the fortress structure. The display caught the eyes of thousands of citizens fresh from a perusal of "scare-head" dispatches from Washington and Vera Cruz, and proved an effective advertisement.



A "WAR-TIME" WINDOW DISPLAY

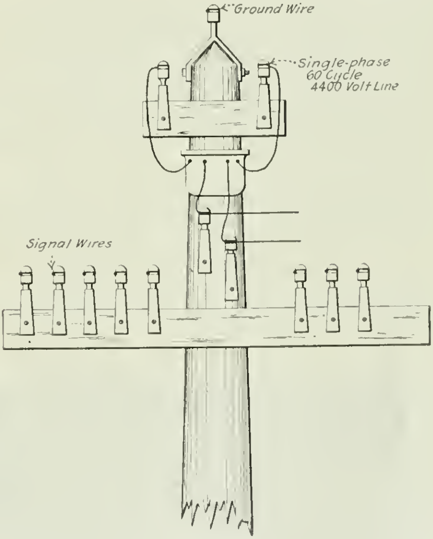
Four Hundred and Sixty-five Miles of Block-Signal System Operating from Central-Station Energy

Eliminating the former standard battery cell and purchasing energy from nine electric-service companies, the Chicago, Milwaukee & St. Paul Railroad Company is now operating 250 miles of its automatic electric block-signal system from central-station energy and has an additional 215 miles of this work under construction. The railroad company's signal practice for this type of work is standard, energy in all cases being received at 2300 volts and conducted through transformers raising the potential to 4400 volts. With two exceptions, these step-up transformers, which range in rating from 12 kw to 40 kw according to the number of block signals served, are situated in the stations of the electric-service company and are controlled from a panel in that plant. Separate pole lines have been built for the 4400-volt circuit and the signal wires which serve the block system.

The type of construction employed, as shown below, consists of a ground wire mounted on a bracket at the top of the pole, a two-pin cross-arm for the single-phase, 4400-volt, sixty-cycle line, and a standard ten-pin arm 2 ft. beneath for the single wires. At points where a 1-kva transformer is installed to serve a block signal, the standard ten-pin arm is lowered to give a 4-ft. clearance to the signal wires.

Wire on the 4400-volt line is No. 4 copper B. & S., while that on the second arm is No. 10 insulated. In some places it has been necessary to carry the transmission circuit and signal wires on the same pole line with telegraph circuits, but even in these instances no trouble has been experienced due to induction.

Mr. J. C. Mill, signal engineer for the Chicago, Milwaukee & St. Paul Railroad, says that for ease of operation central-station energy for block-signal systems certainly commends itself. On the divisions without batteries the operating force has been reduced to one-half its former size, a maintenance man covering one section of track which formerly required the services of a maintenance man and a battery man.



TYPES OF STANDARD CONSTRUCTION FOR BLOCK-SIGNAL SYSTEM

On the Chicago-Omaha branch of the road this system has been installed between the cities of Forreston and Savanna, energy being supplied by the People's Gas & Electric Company, of Savanna, and by the Illinois Northern Utilities Company, of Forreston and Hampshire. On the Chicago-Milwaukee division of the road energy is supplied by the Milwaukee Electric Railway & Light Company. Between Milwaukee and La Crosse, Wis., energy is supplied by the Watertown Gas & Electric Company, the Portage Electric Light & Power Company and the O. I. Newton Sons Company, Sparta, Wis. On the river division between La Crosse and Hastings, Minn., energy is supplied by the Winona Railway & Light Company, the Red Wing Gas Light & Power Company and the Minneapolis General Electric Company.

Central-Station Electro-Therapeutic Bureau

The New York Edison Company has the credit of establishing and maintaining the only central-station electro-therapeutic department in the world. This bureau was organized last May because of the multitude of requests from the medical profession for information regarding the characteristics and reliability of different types of electro-therapeutic apparatus. At that time it seemed impossible for physicians and surgeons to obtain impartial opinions regarding the relative advantages of these devices, so the central-station company, living up to the duties which it felt were implied by its general title of public-service corporation, provided quarters with experts in attendance where all types of electro-surgical apparatus could be displayed and where the medical profession could meet and have informal discussions regarding the merits of the devices.

At first it was difficult to interest manufacturers of electro-therapeutic apparatus sufficiently to obtain devices for equipping this new bureau, but after a few had been induced to submit their products the rest of the manufacturers followed with increasingly generous consignments. Now nearly all reliable types of electro-therapeutic instruments are on display and the exhibit is being constantly replenished with apparatus of latest design.

Every month about 10,000 letters are sent out by the department to the physicians of New York State informing them of the existence of the New York Edison Company's electro-therapeutic department, and of any new device which has been brought out, and inviting them to visit the bureau. Other publicity methods, such as sending out electro-therapeutic advertisements in the form of blotters and paperweights, are also employed to acquaint the surgeons with this department. A portion of the *Edison Bulletin*, published monthly, is also devoted to the subject of electro-therapy. About 6000 doctors in New York City alone are reached through at least one of these means. These men often bring visiting out-of-town members of their profession, and all declare that the department and the information imparted by its expert attendants are of inestimable value to the medical fraternity. Commencing about the middle of February, a register of visiting medical men was established and for a subsequent period of thirty days showed more than 200 callers. The publicity which this department is receiving locally and through outside medical circles is shown by the rate at which the number of callers per day is increasing.

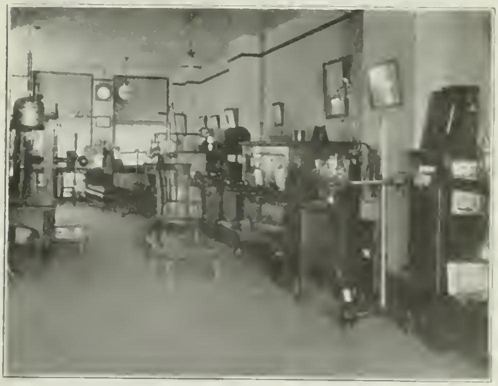


FIG. 1—ELECTRO-THERAPEUTIC EQUIPMENT DISPLAYED BY NEW YORK EDISON COMPANY

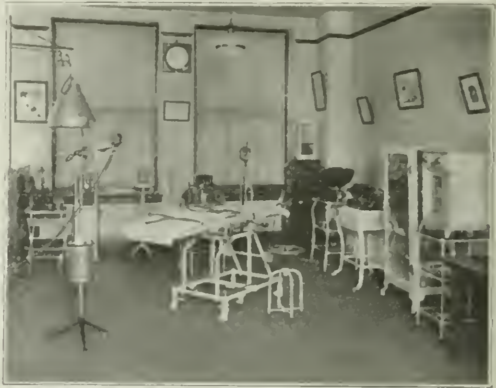


FIG. 2—OPERATING TABLE AND ELECTRIC SURGICAL INSTRUMENTS DISPLAYED BY CENTRAL STATION

The bureau is in charge of two graduate nurses—Misses Winifred Black, manager, and Anne Broome, assistant manager. Part of the time of each is spent at the electro-therapeutic bureau at 124 West Forty-second Street, New York, while a considerable portion is occupied in visiting surgeons and medical institutions in different states to obtain information regarding the uses of electrical apparatus for medical and surgical purposes, the results obtained therewith and the types most suitable for special treatments. The information thus obtained is kept on permanent file at the bureau and is imparted to any of the medical profession desiring information on the subject.

The interest which has been taken in this public-service work is shown by the co-operation received from the New York doctors, who have formed a research committee, with Dr. Edward Titus as chairman, to compile data on the results obtained with different electrical and surgical devices. The committee contemplates conducting experiments to show the relative effects obtained with different X-ray machines.

No apparatus is sold by the Edison company and no financial support is received from the manufacturers through commissions on sales. Only information and demonstrations are given at the bureau. Since being established, however, the electro-therapeutic bureau can trace 250 appliance sales to its efforts, about six of which were for X-ray machines. While in itself the revenue received for energy consumed by these devices offers no incentive for the maintenance of the bureau, yet the company feels that the latter is well warranted by the benefit rendered the medical profession and electrical industries. Moreover, the support of such a department inspires public confidence in the public-service spirit of the company. As an indirect and almost negligible benefit to the central-station company it is declared that the sale of these devices to doctors for residence use has often involved the connection of electric service, which is then also utilized for other purposes, such as lighting, small-motor service, heating, etc.

Illumination and Wiring

Inverted Magnetite-Arc Lighting at Akron, Ohio

The principal streets of the business center of Akron, Ohio, are now lighted by 213 inverted-type luminous-arc lamps spaced at about 60-ft. intervals opposite each other on both sides of the street. The first of these lamps were installed about a year ago, and since that time their number has been increased by frequent additions. Outside the district served by these ornamental lighting standards there are 418 magnetite-arc lamps suspended over the streets. The residence section is lighted by 2000 series incandescent tungsten lamps suspended from brackets borne on poles carrying overhead wires.

Lighting a Famous Relic by Electricity

At the Connecticut State Library in Hartford the table on which Abraham Lincoln signed the Emancipation Proclamation occupies a place of honor among the historic treasures of the building, and concealed electric lighting is effectively utilized to display this famous piece of furniture. As shown in the accompanying photograph, the table stands in a fireproof recess built into the wall, the compartment being about 12 ft. high, 8 ft. wide and 6 ft. deep. Ordinarily illumination is provided by two 40-watt tungsten lamps in the ceiling of the chamber, but when it is desired to increase the lighting of both the table and a photographic reproduction of the proclamation in front of it a row of four 40-watt lamps carried in a reflecting trough about 8 ft. above the floor can be thrown into circuit by a pendent switch situated behind the plate-glass door which protects the priceless relic from handling. None of the lamps is visible from outside the compartment. Service is supplied by the Hartford Electric Light Company.

HISTORIC TABLE LIGHTED BY ELECTRICITY

Two Thousand Nitrogen-Filled Lamps Ordered for Chicago Street Lighting

As a result of tests made by the electrical department of the Sanitary District of Chicago under the supervision of Mr. E. B. Ellicott, electrical engineer of the Sanitary District, the District will use 2000 nitrogen-filled metal-filament incandescent electric lamps for street lighting. These lamps are to be of the 300-watt and 500-watt sizes, the former giving 600 actual cp and the latter between 1100 and 1200 actual cp. The number of each to be ordered has not been determined. The two sizes are ordered for different sections of the city, the smaller lamp being used principally in residential quarters. The new lamps will be operated on straight series-arc alternating-current circuits and will be operated from compensators which give 20 amp in the secondary of the circuit.

A series of tests was made under Mr. Ellicott's direction to see what shocks the nitrogen-filled lamps would stand. With a circuit of 5000 volts, in which enough lamps were used to take up all the voltage except the small proportion required by the regulator, it was possible to short-circuit all of the lamps but two, throwing all the energy on these two lamps with nothing but the regulator to protect them. As a result of nineteen tests not a single lamp filament was broken as the result of this procedure. This test, according to Mr. Ellicott, represents the worst possible conditions that could be met in actual practice. Under these conditions the lamps received at times (depending on the part of the wave in the circuit supplying the lamp at the instant of test) from 25 per cent to 60 per cent excess current for the length of time required for the regulator to adjust itself to the situation. This test shows apparently that the new lamp is a rugged piece of apparatus well suited for its purpose.

Method of Suspension

The nitrogen-filled lamps will be suspended at the same height and in much the same manner as the flame-arc lamps; that is, at about 26 ft. above the street pavement, one lamp being supported by each lamp-post on a bracket. It is understood that the lamp manufacturers have offered a guarantee of 1350 hours of life. This means an average of three lamp renewals a year for these nitrogen-filled lamps. Mr. Ellicott says that there is no question that the lamps will maintain their candle-power within 10 per cent of the initial rating for the whole term of the life of the lamp. Both sizes of lamps take about 30 volts on the series circuits. They have been operated in tests intermingled with flame-arc lamps, and it is practicable, apparently, to operate mixed circuits. However, it is likely in the permanent installation that the nitrogen-filled incandescent lamps will be operated on individual circuits, the number of lamps which will belong to each circuit not exceeding 125.

Mr. Ellicott is decidedly of the opinion that there is a broad field in street lighting for the new nitrogen-filled lamp. He says, however, that in his judgment it will not supersede the flame-arc lamp altogether, as, for instance, in downtown business streets where brilliant lighting with some element of glare is desired by merchants. He points out that in the operation of the new type of lamp proper regulation is an essential. However, regulating apparatus is built which is good enough and quick enough to operate automatically to protect the lamp. The Chicago tests developed the fact that the lamps should be used with compensators, as the latter absorb much of the excess of current and give the regulator a chance to work before it has received the full value of the excess.

Electric Lighting for St. Louis Pageant

Elaborate preparations are under way for the "Pageant and Masque of St. Louis," an outdoor spectacle to be given in the natural amphitheater at the foot of Art Hill, in Forest Park, St. Louis, on May 28-31. Four performances will be given, the pageant beginning at 6 or 6.30 p. m. on each day and lasting an hour and a half. After a half hour's intermission the masque will follow, likewise lasting about an hour and a half. The spectacle is planned on a very large scale, about 7000 persons having parts in the cast. The stage, about 480 ft. wide in the widest part and about 200 ft. deep, will be built on piles over a lagoon. Across 150 ft. of water will be arranged, on the slope of Art Hill, seats for 43,000 spectators. There will be standing room for 30,000 more.

Electric lighting for this spectacle, beginning in waning daylight and ending at night, will be on an unusual scale. Around the concave curve of the lagoon, on the spectators' side, will be 125 shore-line lighting units, each consisting of a 250-watt tungsten lamp and a Benjamin angle reflector. These lamps, which will illuminate the water-borne spectacles, are spaced about 3.5 ft. apart in the center, the distance between lamps being gradually increased to 15 ft. at the ends of the curve. The stage has no roof. At each side of it will be a 40-ft. tower, on which will be mounted spot-lights and flood-lights. The foot-lights will be placed in specially designed reflectors extending along a water-front line of the stage 330 ft. long. These footlight units, consisting of 250-watt lamps, colored red, white and amber, will be spaced 1 ft. 2 in. apart.

For local lighting on the stage eight floor outlets will be provided. One feature of the setting will be "Cahokia Mound." Before this hillock will be an "altar" provided with a 1000-watt nitrogen lamp with parabolic reflector. Two spot-lights (or perhaps 1000-watt tungstens) will be provided well down stage for what is called the "dreaming pageant." In all, eight spotlights will be provided.

The orchestra and chorus will be invisible to the spectators, being at the back of the stage but concealed by a 10-ft. screen. From the top of this screen wires will lead across to the back-drop and from these wires will be suspended sixty-four 60-watt lamps with opaque reflectors to prevent the light going up. The back-drop, 350 ft. from the nearest spectator, will be 40 ft. high.

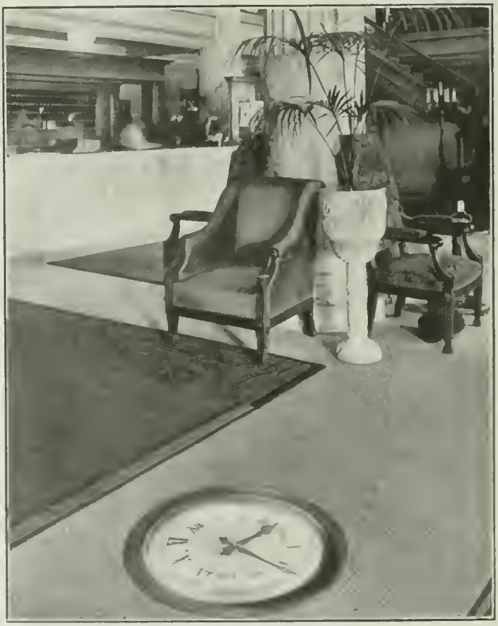
Six 18-in. search-lanterns, placed at advantageous points on the stage, will add to the other lighting effects. A special feature will be the Great Bear constellation. Immediately back of the back-drop and rising 75 ft. above the stage on a tower will be a structure not visible in daylight but arranged to show at the proper time after dark a field of small stars, with the constellation of the Great Bear showing in large stars. Electric lamps will be used for this spectacle, and a twinkling effect will be produced.

To illuminate the seats on Art Hill four 24-in. search-lanterns will be mounted on the roof of the art museum. These lamps will be at the back of the spectators and will be provided with diffusing lenses. In all, about 225 kw of electrical energy will be required—200 kw for the stage and the remainder for the art museum search-lanterns. Alternating current will be provided by the Union Electric Light & Power Company. A special transmission line will be built and there will be a substation at the back of the stage, with transformers and with motor-generators to produce the direct current needed for the spot-lights and search-lanterns. The switchboard will be in one of the 40-ft. towers at the front of the stage. Telephonic communication will be maintained between the chief electrician and all spot-light and search-lantern operators. The working switchboard will represent the stage in miniature, the switches being placed at the parts where the lamps controlled by those particular switches are located. A very striking feature of the performance, as planned, is the rise and flight of an aeroplane containing the "Spirit of St. Louis." Beams from search-lanterns will be concentrated on this aeroplane until it disappears in the distance.

Mr. A. I. Jacobs, supervisor of city lighting for the city of St. Louis, is in charge of the electric lighting of the pageant. His assistant, Mr. Ralf Toensfeldt, is laying out the work.

Novel Electrically Illuminated Clock

In the recently completed Hotel Bancroft at Worcester, Mass., a large self-winding electrically illuminated clock set in the floor of the lobby at the main entrance is a striking feature. The clock is designed with a plate-glass face 1 in. thick and 2 ft. in diameter, supported by bronze rings as shown in the accompanying photograph, and the numerals and minute marks are etched by sand-blasting on the under side of the plate, which thus forms the dial. A rubber gasket placed between the plate and the adjacent bronze ring provides for expansion and contraction. The hands are driven by a spring-operated and balance-wheel-controlled train set in a recess in the floor, the recess being formed by a metal box 10½ in. deep, which is painted white. Eight inches below each numeral is a 10-watt tungsten lamp placed horizontally, and the white finish on the interior of the recess is utilized in reflecting the light from the twelve lamps evenly through the dial. The photograph was taken by an exposure of approximately ten minutes to the light of the dial on a recent rainy afternoon. The clock spring is wound by a



ELECTRICALLY ILLUMINATED CLOCK

small motor operated by three dry cells at intervals of five minutes, and every hour the hands are set correctly by a Western Union telegraph connection. It is estimated that the cells will operate the clock for one year before a new battery will be required. Four ventilating outlets leading to a hollow space between the floor tiles are provided in the containing case to carry off the heat produced by the 10-watt lamps. The clock has been a factor in advertising the hotel and was devised by Mr. L. F. Viner, mechanical superintendent, who has applied for a patent on the design.

Cross-Over Construction Near Denver

The Denver (Col.) City Tramway Company is using a "high factor of safety" construction on one of its newly constructed transmission lines where the latter crosses foreign circuits, rights-of-way, etc. The line operates at 13,200 volts, but 65,000-volt porcelain insulators supported on grounded metal pins are employed. Stranded instead of solid conductors are used, and on each side of a foreign cross-over a permanent ground strap is fastened along the top of each cross-arm to ground any conductor which might break and fall on a circuit below or cause other damage.

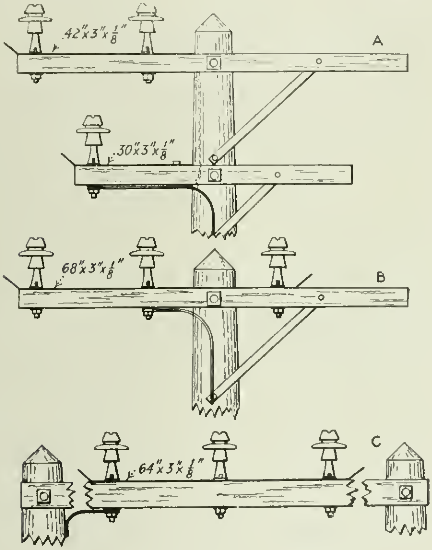


FIG. 1—METHODS OF GROUNDING PINS

The accompanying illustrations show the methods of installing the ground straps, ground connections, insulator pins, guys, etc. The ground straps, which are made of iron 0.125 in. thick and 3 in. wide, lie flat on the cross-arms and extend beyond the ends, being bent upward at a slight angle to prevent an outside conductor from falling to the ground. Each insulator is fastened to the arm by a 0.75-in. bolt passing through the arm and ground strap into the metal insulator pin and drawn up firmly from the bottom by nuts, washers and lock nuts as shown. The bolts also connect the pins electrically to the ground strap.

The ground conductor consists of a No. 2 solid copper wire, which is soldered, wiped and tinned at a point about 8 ft. above the earth to a 1-in. galvanized-iron pipe extending an equal distance into the ground.

The first two poles away from each side of a foreign cross-over are cross-guyed and are equipped with double cross-arms and metallic ground straps. The second and third poles are connected by a single diagonal guy wire.

In one of its official bulletins the company states that "the foregoing method of construction at foreign wire crossings was adopted at an increased cost per crossing, not because our present method, of which we have 131 crossings, has given any trouble in the six years it has been in service, but because we wanted the best obtainable and felt that a type of construction that has the backing of the foremost electrical societies must be the last word in foreign-wire crossing. The plant is no more reliable than the weakest link in the chain, which is naturally the line."

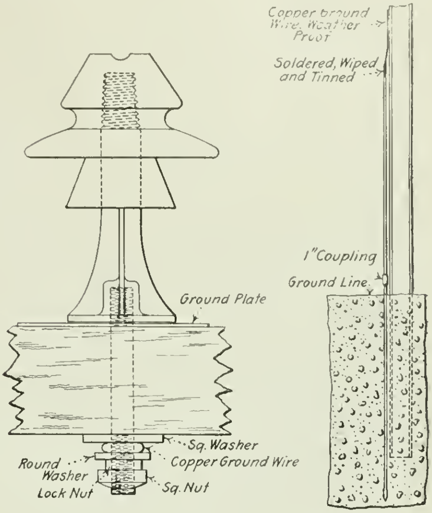


FIG. 2—DETAIL OF METHOD FOR GROUNDING PINS

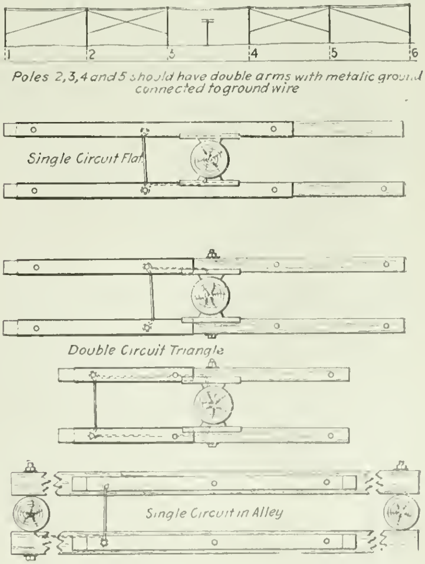

1
2
3
4
5
6
Poles 2,3,4 and 5 should have double arms with metalic ground connected to ground wire
Single Circuit Flat
Double Circuit Triangle
Single Circuit in Alley

FIG. 3—GROUND PLATES AND GUYING OF POLES

Recent Telephone Patents

A protected cable terminal has been patented by Mr. T. B. Farmer, of Baltimore, Md. The terminal is made of metal and is arranged for clamping to the messenger strand. A nipple for the wires is connected directly with the cable sheath. The leading-in wires connect to binding posts outside the box, the other ends of which, inside the box, serve as fuse mountings. Similar posts for the cable wires serve for the second end of the fuses. A block of carbon, which is grounded, lies between these fuse posts. A saw slot in the carbon receives a gutter of mica within which the fuse wire is placed. A perforation in the mica permits discharges from the fuse to the ground.

With automatic systems having message-rate service it is necessary to count each call. At times there are calls which should not be paid for according to current custom. To provide for these is the object of the invention of Mr. M. L. Johnson, of Chicago. He provides a special operator who may be reached without charge and she determines whether or not to let the call go through free. Mr. Johnson has assigned his patent to the Corwin Telephone Manufacturing Company.

To the Automatic Electric Company has been assigned a patent granted to F. Newforth, of Chicago, Ill., for a special arrangement of circuits by means of which the line wires may be connected directly to the contact banks instead of being carried through a normally open cut-off relay. This latter practice was adopted so that the line relay of a called line would not be affected by ringing on that line. The desired result is attained by associating a cut-off relay with a ringing relay and by making the action of the latter very slow so that the cut-off will always occur first.

Intercommunicating Systems

Messrs. W. P. Andrick, Edgar Lowe and H. W. Huff, all of Jamaica, N. Y., are the joint inventors of a key for intercommunicating systems. This key has a number of units set in a row. Each unit has two operative positions for each of which a mechanical lock is provided. The latter consists of a bar which engages a notch in the key lever block. The bar is raised when the hook lever is depressed, and all keys are restored to normal.

Letter to the Editors

Conserving Initiative

To the Editors of the Electrical World:

SIRS:—At first blush it is rather hard to understand why so much interest has been aroused recently in the conservation of our water-powers. At recurring sessions of the legislatures of our different states bills are introduced to do this, that or the other thing for the conservation of the water-powers, and the federal government, in its desire to conserve, has fairly run amuck. Now, one doesn't have any quarrel with conservation of anything, provided the conservation really conserves; but anyone may have a very legitimate quarrel with conservation of the less important things, especially when that conservation is at an expenditure away out of proportion to the results attained.

This brings us back to the initial query: Why all this fuss about the conservation of water-powers? The food products utilized by the average citizen are produced in a manner quite the antithesis of conservative, and yet pretty close to a quarter of the average family's income will have to be spent in buying the mere food supply. Why, then, in the interest of humanity, in the interest of conserving human happiness and human energy for useful labor, should we not be making a much greater fuss for the conservation of farm labor, the conservation of food products, the conservation of the soil, conservation through the proper selection of vegetable and animal types, and so on?

Every article consumed by John Henry, the typical "man in the street," is 90 per cent the product of labor, the other 10 per cent being supplied by stored labor, commonly known as capital, and yet the enthusiastic conservationist has not to date aroused any great public clamor for a conservation of labor through more intelligent and skilful direction.

It is pretty unscientific to venture an assertion not based on definite possession of facts, yet one is safe in saying that the average efficiency of application of labor to the production of *useful* commodities is not markedly above the 25 per cent point.

The actual fact is, of course, that we can see water being wasted, sometimes even when it is not, while it requires pretty close observation to discover the fact that a very busy artisan is perhaps accomplishing next to nothing as a result of all his busy-ness. That seems to be the whole story. Wastes of water-power are conspicuous and spectacular. Much worse wastes in other directions are not conspicuous at all.

And so it comes that the State of New York has to-day before its Legislature three proposed bills for conserving the water-power resources of the State, and so an active propaganda of publicity is being carried on by the extreme advocates of conservation to indicate to the taxpayers, and particularly to the small taxpayer, that through the conservation of our water-powers we may expect cheap, almost costless, light, power and heat.

This publicity campaign has aroused John Henry. It has gone further; it has inflamed him. He has been taught to believe that if he can get this same cheap power through the conservation of our water resources, all his economic disabilities will pass away.

Now the writer is a firm believer in conservation. He is firmly convinced that it is wicked to perpetuate, nay, even to permit, a waste; but, speaking for the moment from the point of view of John Henry: What is there in it for him? John Henry seldom uses more than 25 kw-hr. per month at his home; and it is a fact that a modern steam generating station of 20,000 kw equipment rating, with 50 per cent additional equipment held in reserve, could pay for every speck of fixed, operating, overhead, amortization, obsolescence and every other kind of costs and still turn out energy at something less than ½ cent per kw-hr. at a fairly good load-factor.

If development of our water-powers could be accomplished without one cent of cost, and if the development of our water-powers required not one speck of transmission investment nor one single cent of operating expense, then John Henry might save 10 to 12 cents a month on his 25-kw-hr. power use by hydraulic developments as against the typical steam station.

But, in general, it is going to cost money, and it is going to take some operating labor, and there is going to be some transmission system between the developed water-power and John Henry. Some of our water-powers will at their best require steam standby to equalize flow fluctuations; most of them will require steam standby to take care of transmission interruptions, and steam standby means station labor and banked fires and steam station investment. Hence in such a case the developed water-powers may save to the man in the street as little as 2 mills per kw-hr., which for the ordinary household customer will mean a saving of 4 to 5 cents a month—surely no great place to begin the reduction in the high cost of living.

And then we have electricity on the farms. It may be set down as a pretty sure proposition that something more is needed than merely cheap power to produce electrified agriculture. There is in this case exactly the same discrepancy between the apparent cost of energy as developed and the price to the ultimate consumer as in that of the typical man in the street; namely, the cost of administration, the cost of a distributing system, and all those one hundred and one things which go to make the difference between a possible 12, 10, or 8 cents per kw-hr. to retail customers and the ½ cent per kw-hr. at the station busbars.

If to the average citizen, then, the development of our water-powers means only 5 or 10 or 15 cents a month saved from his electricity bill, it is apparent that the real conservation must come in the reduction of the cost of energy to those consumers who require a minimum of overhead and distribution expense; in other words, the large, steady high load-factor customers, the total cost of serving whom is but slightly above the cost of energy at the switchboard.

The conservation of our water-powers, then, will find its fullest justification, its highest percentage of realization, in the conservation of and for industry. Is it not entirely obvious that it is only in the industrial applications with their high load-factors and relatively low investment for distribution systems that cheap energy will do the most good? And it is not fairly patent that in such case society as a whole will benefit most widely under the assumption that the welfare of the industries must react for the benefit of all the individuals?

If, then, conservation of our water-powers is to be accomplished through industrial utilization, it is important that nothing be done in the process to kill the proverbial goose or to diminish seriously the production of golden eggs. Just this has been contemplated by several bits of proposed legislation introduced at Albany and put into operation in the Province of Ontario. In the one case state development ostensibly for conservation has been prosecuted with ruthless disregard of at least two great industries, and in the other case there is contemplated a similar destructive competition by the state with private industry in a field where every benefit of such competition might be secured by proper regulation.

There can be no question whether the industrial utilization of water-power should be accomplished through a mechanism that threatens explicitly the very existence of one great industry and holds out implicit possibilities of the state's usurping all others. I do not see how such a conservation really conserves at all.

It is a shame that we should waste the power of our streams, or, if one will, the coal which this power would supplant; but it would be a much greater shame to destroy in the very process of saving coal the human initiative which can set both labor and capital at work for the production of economic benefits to posterity.

Such destructive competition as suggested in certain of the conservation bills might easily, and, in fact, would probably through the process of duplication, destroy as much capital investment as the total value of the hydraulic power developed would represent. May we risk the use of specific figures? If the State were to develop a hydroelectric plant of 1 kw rating at an investment figure of $150, and in order to market the production of such a plant were itself to construct a distributing system parallel to one already existent, and costing, let me say, $200, the result would have been a net loss to society of human energy expended to the extent of $50.

The plan suggested by the Empire State Gas & Electric Association in its letter to the Governor of the State of New York seems to avoid most wisely the evils of such a process of duplication, with its attendant destruction of initiative and the products of the initiative of the past, while at the same time enabling the development of our water-powers for the most that may be in them, without the sacrifice by the people of the State of one speck of their equity in such powers.

Under the plan suggested by the Empire State Association, complete control is retained in the regulating bodies with absolute autonomy in the individual corporation making the development.

Perhaps the most valuable feature of such an arrangement is that it offsets the possibility of the development of a bureaucracy with the apparently inevitable characteristics of officialism.

Under the philosophy which avoids the mention of rope in the family of the victim of capital punishment, it may be in ill taste to-day to speak of the possibilities of official corruption, but we may at least speak of the certainties of officialism in the conduct of business by the body politic. The very safeguards of a civil service system, of published specifications and sealed bids which we find it necessary to throw about our democratic government in themselves prevent that elasticity, directness of operation and freedom of personal judgment that make for the best efficiency and the development of the highest type of initiative. These factors, combined with the lack of direct responsibility to the ultimate stockholder, would spell the destruction of aggressive initiative in any state distribution or electric generating scheme.

Against this the plan proposed by the Empire State Gas & Electric Association, while safeguarding public interest through regulation of the corporations, at the same time conserves initiative through the preservation of that direct relation between the ultimate stockholder and the humblest employee which makes all parties alive to the interests of the whole organization.

Let one note the contrast between a state development on the one hand and a corporate development on the other. The state is composed of so many millions of individuals, each of whom may be considered as a stockholder in a possible state development. Each of these stockholders has obviously an equity of only a few cents in any one of the power developments that might be undertaken. He has a multitude of investments as a shareholder in the various enterprises of the state. It is not probable that this interest will be tremendously keen in any one of them, nor that his voice will be very distinctly heard if raised in protection of any one of these investments.

On the other hand, in the public service corporation as at present constituted the stockholder has a relatively large part of his holdings in any one investment and is relatively a much heavier investor in any one of the concerns in which he has placed his money than he is in any one of the state's projects, therefore he will and he can keep a very close watch on the administration of the companies in which he is interested. Through that administration, transmitted through directorate and executive officers in a very simple chain, each last man in the organization is reached and stimulated to do his best to conserve the efficiency of the business, and in the process to conserve his own individual initiative. It is to this end that the plan proposed by the Empire State Association will operate, and it is because of this that the interest of all engineers should be awakened to the significance of political method as a salient feature of the work of conservation and the preservation of the standards of the engineering profession.

Rochester, N. Y. JOHN C. PARKER.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects Questions and Answers

Data on Operation of Iron-Mine Plants

Electricity is employed by Witherbee, Sherman & Company, Mineville, N. Y., for the mining and beneficiation of their magnetic iron ore, the annual output of which is about 700,000 tons. About 80 per cent of this is treated magnetically to separate the gangue. All but about 1.2 per cent of the impurities may be removed in this manner, and from 90 per cent to 98 per cent of the iron content is recovered from the ores obtained from the Lake Champlain region. For about 25 cents per ton of marketable ore it is possible to furnish all of the energy required for mining and loading the ore on cars. This includes hoisting 900 ft., crushing to 0.25-in. or 0.125-in. lumps, and separating the gangue. The production of compressed air requires about 73.5 per cent of the energy used in mining, and milling demands about 22 per cent of the total energy consumed. The total generator rating is about 70 per cent of the motors installed, and the power required for all operations is about 60 per cent of the total motor rating. The average cost of generating energy, including depreciation of plants, is about 1.05 cents per kw-hr. Tabulated herewith is a recapitulation of the energy generated and distributed at these mines in 1913.

TABLE I—OUTPUT OF GENERATING STATIONS SERVING IRON-MINE PLANTS

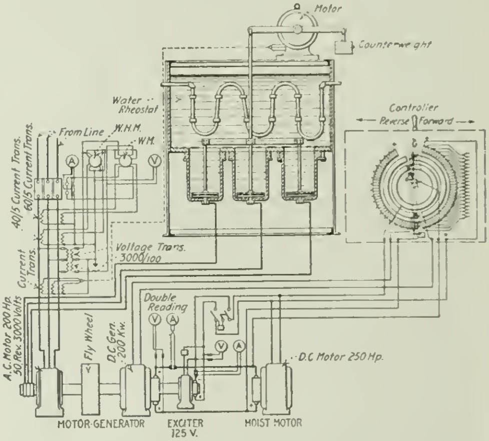
GENERATORS			KW-HR PRODUCED
Type	Kw	Volts	
Turbine	800	6,600	7,453,700
Turbine	1500	6,600	
Engine	750	3,300	4,306,800
Turbine.	750	3,300	
Waterwheel. .	375	6,600	788,300
Waterwheel	800	13,200	1,870,700
Total	4975		14,419,500

TABLE II—CONSUMPTION OF ELECTRICITY IN MINES, MILLS, ETC.

	Hp of Motors Installed	KILOWATT-HOURS		Per Cent of Full Load Rating Used
		Total Used	Per Ton Crude Ore	
Compressors	2100	7,273,365	10.5	93
Hoists	2200	1,664,956	2.5	20
Hoists—new	1200			
Pumps	131	287,554	0.4	60
Haulage		212,083	0.4	54
Mine lighting	275	333,826	0.5	
Total mining	5906	9,771,784	14.3	55
Mills	2094	2,756,408	4.1	76
Carpenter shop and sawmill	95	89,019	0.13	
Sherman mine development		98,084	0.14	
Total used	8095	12,715,295	18.77	60
Commercial purposes	1150 50	1,704,205		
	9295	14,419,500		

Control Equipment for Hoist Operated from Flywheel Motor-Generator

As acceleration is an important consideration in electric hoisting, a variable-voltage-control system is usually preferable. Illustrated herewith is a method of automatically starting and regulating the speed of a hoist motor receiving energy from a flywheel motor-generator set. A shunt-wound motor is used for hoisting in this particular case, and its speed is regulated by a liquid rheostat connected in the secondary circuit of the induction motor driving the generator.



CONTROL EQUIPMENT FOR HOIST OPERATED FROM FLYWHEEL MOTOR-GENERATOR

The three phases of the rotor are connected to stationary plates fastened in the bottom of three separate earthenware vessels containing an electrolyte. Above these plates are three movable ones which are electrically and mechanically connected. The movable electrodes are supported from a lever which is counterweighted and automatically tilted by a small induction motor to regulate the current through the motor driving the generator. If the alternating-current motor receives a larger current than it should (this value may be predetermined and fixed by adjusting the series transformers feeding the rheostat motor) the small motor will raise the rheostat plates and increase the resistance in the rotor circuit. This decreases the motor speed and permits the flywheel to give up some of its stored energy. The foregoing method of control was described in a paper presented at a recent meeting of the A. I. E. E. at Pittsburgh, Pa., by Mr. Harrison P. Reed.

Methods of Handling Electrical Troubles in Cleveland

In the new building of the Cleveland (Ohio) Electric Illuminating Company two rooms have been given over to a department which attends to customers' troubles. Ordinarily only one man is on duty, and he receives all telephone calls from consumers, repair crews and emergency trouble men and assigns work to the men making repairs. This "trouble dispatcher," as he is termed, is surrounded with many interesting devices and aids, which make up a complete system of caring for troubles and checking the movements of the various men in the department.

On a glass-top table near the trouble dispatcher lies a map showing the city divided into eleven districts and each district into sections, of which there are sixty in all. Locations of all repair men and trouble crews are kept constantly before the dispatcher by means of name cards of different colors attached to vacuum stickers and placed on the glass top over the map. The color of the card denotes the type of conveyance which the man is using, namely, a horse, an automobile or the street cars. When any crew is not at work its position in garage, substation or office is also denoted by the vacuum sticker, which is removed to a labeled compartment at the side of the map.

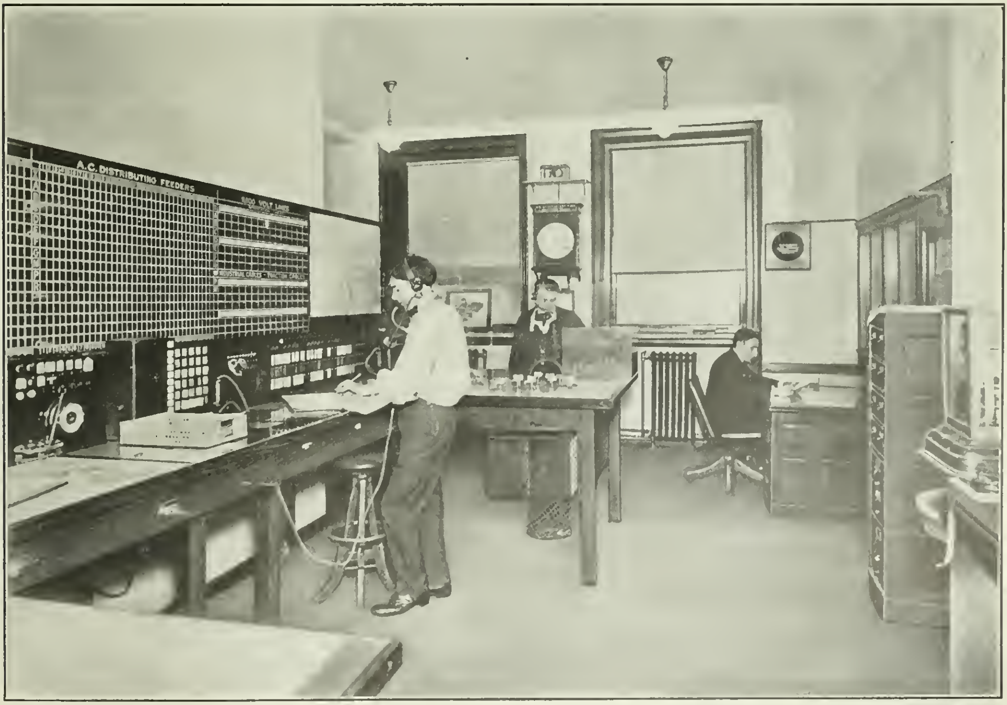
Record of Circuits and Substations

Each substation on the company's system is lettered and the arc-lamp circuits are designated by number. Trouble on any arc-lamp circuit is denoted by a tag which is hung at the intersection of the lines on the blackboard drawn from the letters and from the numbers, as shown in the accompanying illustration. Colored and lettered tags denote whether the line is open or grounded, whether linemen are at work or whether there is a "live cross." Alternating-current distribution-feeder troubles are handled in much the same manner.

Another blackboard in front of the operator carries the position for each 11,000-volt feeder in the company's system. Thus, if the dispatcher is notified of trouble on an 11,000-volt inter-station cable connecting substation A and substation W, he puts a numbered red tag on the square in the board designated as AWV. Here the letters A and W represent the substations between which the trouble occurred, V indicates that the cable was operating at 11,000 volts, and the number on the red tag corresponds with the cable number. If the underground department wishes to work on any of these cables, it must notify the trouble dispatcher by letter. A black tag bearing the words "Hold off" and the number of the cable on which the men are working is then placed upon the board before the operator. Industrial motor-service and traction cables are designated on a similar blackboard by the name of the factory or substation which they serve. A similar system of tags is used to denote trouble or unusual conditions on these cables.

Operation of the System in Times of Emergency

Under ordinary operating conditions records are kept on a daily trouble sheet by the single trouble dispatcher in charge. In case, however, a severe storm arises, all incoming calls are handled through a switchboard in the adjoining room, at which there are six operators' positions. These operators take down on white, blue, red and varicolored slips the consumer's name and details of troubles reported. These slips in-



DEVICES AND AIDS FOR CHECKING MOVEMENTS OF REPAIR AND EMERGENCY CREWS AND CARING FOR TROUBLES dicate respectively "no light," "no power," "wires down," "poles down" and "serious trouble." The slips are then passed through a window to the trouble dispatcher's room. Here they are received by a checker, who eliminates duplicate calls and adds the number of the district and section and numbers each case of trouble. After being classified, these colored slips are placed in pigeonholed compartments according to the district and section of the city in which the trouble has occurred. From this box the chief trouble dispatcher assigns cases to repairmen out in the various parts of the city and places the colored slip in another box to designate that the work has been given out to the troublemen.

A similar system is also used for the telephone reports from troublemen, who upon calling state their name, district and section number, call number, the time the trouble was cleared, details of trouble, and what was accomplished. These facts are set down by the assistant receiving the call.

Prompt Assistance in Accident Cases

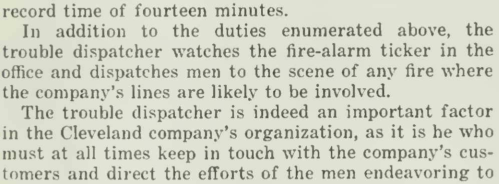
When accidents occur to the company's linemen or to persons coming in contact with live wires the case is handled by the trouble dispatcher in the office. His first duty is to give to the foreman who has reported the accident preliminary instruction as to the care of the injured person, to which hospital he is to be sent, etc, The dispatcher then calls the nearest ambulance, as denoted by colored stars on the map of the city, and then summons in turn the pulmotor operator, a physician, the nearest hospital, the construction superintendent and others whose services are required. Following a recent case in which a lineman received a severe burn the trouble dispatcher completed all of these calls in the record time of fourteen minutes.

In addition to the duties enumerated above, the trouble dispatcher watches the fire-alarm ticker in the office and dispatches men to the scene of any fire where the company's lines are likely to be involved.

The trouble dispatcher is indeed an important factor in the Cleveland company's organization, as it is he who must at all times keep in touch with the company's customers and direct the efforts of the men endeavoring to keep the company's service as good as human endeavor can make it.

Ventilating Coal Pile to Prevent Spontaneous Combustion

In preparing for the biennial bituminous coal miners' strike in the Middle West the Swinehart Tire & Rubber Company, Akron, Ohio, has adopted a scheme whereby it is hoped all danger from spontaneous combustion of the fuel will be eliminated. At 12-ft. intervals throughout an 800-ton pile of coal vertical vent pipes have been placed. These ducts, consisting of a square box made up of 10-in. boards in which 1-in. holes have been bored on 6-in. centers, are placed upright on the site to be used for coal storage and the fuel is dumped about them. Carrying off the heat and gases formed in the interior of the stored coal, thus preventing undue rises in temperature and formation of gas pockets, is the chief function of the wooden ventilators. Mr. H. L. Houk, purchasing agent for the Swinehart Tire & Rubber Company, says that the experience of the company with run-of-mine coal has shown that spontaneous combustion need not be feared with vent pipes placed vertically on 12-ft. centers. However, if slack coal is to be stored, Mr. Houk says he believes it would be good policy to install horizontal vents leading to the vertical risers.



STORING SOFT COAL WITH VENTILATING DUCTS

Pitting of Mica Between Commutator Segments

What is the cause of the pitting or burning out of mica between commutator segments at or near the end of the commutator? The leads to the segments are not loose and the burning occurs in rings from 0.125 in. to 1 in. wide. The mica is charred and the pitting sometimes extends down to the clamping ring where the segments finally become grounded. At the time of starting the motor a ring of fire encircles the commutator but usually is extinguished when the motor reaches full speed. What compound can be employed to fill up the spaces between the segments?
F. C. F.

It is probable from the location of the pitting that the trouble is due to oil from the shaft bearing collecting on the end of the commutator, ensnaring carbon dust from the brushes, and thus bridging the segments. The short-circuit current, together with the peripheral speed of the commutator, probably rids the mica spacers of the carbon dust after the motor has operated a while. After cleaning out the pitted mica with a metal file the space can be filled in with a mixture of powdered mica, with shellac or an insulating varnish. To avoid any likelihood of this trouble recurring it will be advisable to examine the bearing for escaping oil, to provide means for collecting or eliminating such oil as may escape.

Radio-Telegraph Masts and Coils

Please give me some information concerning certain radio-telegraph problems, as follows: (1) What height should the mast be for a circuit of 12 miles, with trees intervening? (2) How many wires should be used in the case? (3) Is a 1.5-in. coil on 70 volts large enough to send a distance of 12 miles? D. T.

It is not possible to define permissible working distance by radio-telegraphy in terms of antenna height, secondary spark-length and primary voltage of induction coil, number of antenna wires and existence of trees between the proposed stations. A 1.5-in. spark coil operating on 70 volts if used in connection with well-designed and carefully tuned oscillation circuits should be able to signal easily over 12 miles of average land, if at the receiver there is used a good crystal or electrolytic detector in conjunction with properly built and adjusted tuning circuits. Suitable antennas would be either an umbrella of four or six 60-ft. rib wires guyed well out from a 60-ft. pole and fed at the top, or a four-wire flat-top slung on 12-ft. spreaders between two 50-ft. masts something over 120 ft. apart, and fed at one end. It must be borne in mind that successful operation will depend far more upon careful design and adjustment of the instruments than on following absolutely the figures here given, which, of course, are not invariable.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Commutation Losses of Direct-Current Machines.—LUDWIG DREYFUS.—An article illustrated by diagrams on the additional commutation losses in direct-current machines. The author discusses the phenomena of interruption of current and commutation first for the case of one conductor per slot and then for the case of any number of conductors per slot and summarizes the laws of the additional commutation losses thereby obtained.—*Elek. u. Masch.* (Vienna), April 5 and 12, 1914.

Three-Phase Motors.—MAX BRESLAUER.—An illustrated article in which the author shows how to find in a series armature those tapping coils which are needed in order to obtain a three-phase winding without having to make a complete drawing of the whole winding scheme. The chief results of the paper are given in two tables, and the method is applied to two examples.—*Elek. Zeit.*, March 26, 1914.

Three-Wire Generator.—A note on a recent British patent (No. 5926, 1913) of F. Newton and Newton Brothers. The machine acts as an auto-transformer, balancer, booster or three-wire generator. The armature winding span is $1/3n$ of the periphery where n is the number of pairs of poles, also spaced a distance of $1/3n$ apart, in combination with $3n$ brushes symmetrically spaced. Interpoles are provided. The main poles are compound-wound.—London *Elec. Eng'ing*, April 9, 1914.

Phase Advancer.—The first Kapp "vibrator" or phase advancer has been built and recently put into regular commercial operation in connection with a 330-hp induction motor in England. The vibrator consists of a magnet frame carrying three sets of two-pole field magnets, in which revolve three armatures of the usual direct-current type. The three armatures are connected in mesh to the slip-rings of the induction motor as shown in Fig. 1, which also shows all the necessary connections (although in some cases it may be desirable to provide an interlocking arrangement to prevent the motor from being started with the vibrator in circuit, that is to say, practically on short-circuit). The field windings are excited with direct current. The low-frequency rotor currents in the armatures cause the latter to rotate first in one direction and then in the opposite direction with the frequency of slip. This rotation induces in each armature voltage which is opposed to the emf of self-induction of the motor and is greater than the latter by an amount sufficient to supply through the resistance of the rotor windings the necessary current to produce the magnetic field of the motor. With normal excitation of the vibrator no magnetizing current flows in the stator windings, and consequently the motor operates with a power-factor of unity. If the exciting current be increased, the greater voltage then induced by the rotation of the armatures will produce in the rotor windings a magnetizing current greater than that necessary to produce the magnetic field of the motor, and consequently a leading current will result in the stator windings. At half load the power-factor was 0.99 leading and at full load 0.96 leading. The corresponding power-factors without the vibrator were 0.76 lagging and 0.87 lagging respectively. The machine was guaranteed to give unity power-factor from half load to full load, and when the field current was adjusted for the latter value the excitation loss in the field coils of the vibrator was only 50 watts. The vibrator will work equally well with an induction machine running either as a motor or a generator without change of connections, so that when used with machines driving winding engines or locomotives complete compensation would be obtained under all conditions. The vibrator not only gives the power-factor but also increases the overload capacity and maximum torque.—London *Elec. Review*, April 10, 1914.

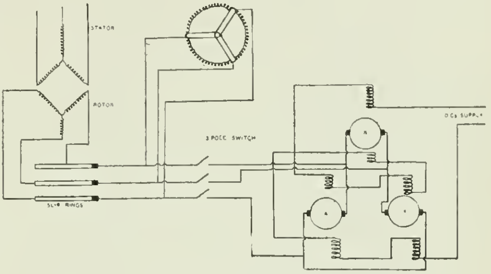


FIG. 1—DIAGRAM OF VIBRATOR CONNECTIONS

Lamps and Lighting

Sintering Tungsten for Lamp Filaments.—A note on a recent British patent (No. 14,795, 1913) of R. B. Walling and the General Electric Company of this country. The broad claim is for sintering metal rods by mounting them without lateral confinement, so that the sintering current can be passed throughout their entire length, whereby the whole rod can be raised to a sintering temperature in an inert atmosphere. The cooled contacts at the ends of the rod are arranged so that they automatically approach and exert sufficient pressure on the rod as it contracts. One of the contacts is floated in mercury for this purpose.—London *Elec. Eng'ing*, April 9, 1914.

Generation, Transmission and Distribution

Ground Wires.—E. PFIFFNER.—An article illustrated by diagrams discussing the principles on which a ground wire is an effective protective device.—*Elek. u. Masch.* (Vienna), March 29, 1914.

Protection Against Dangerously High Voltages.—H. GEWECKE.—In high-tension plants the transformers, the relay coils of oil switches, etc., are liable to be damaged by dangerously high voltages. Effective protection can be obtained by shunt resistors which cause errors of less than 0.5 per cent in the transformation ratio of the transformer. Such shunt resistors are preferably made of silit (silicon carbide). Silit plates are superior to rods.—*Elek. Zeit.*, April 2, 1914.

Protection Against Dangerous Rises of Voltage.—W. PREHM.—The author gives results from practice showing that the protective devices at present available for protection against traveling waves are not as effective as supposed. The author thinks that it is prohibitive to use the condenser as a protective device in extended transmission systems on account of the high first cost and high maintenance cost and the lack of effective protection against traveling waves. The best protection is to provide a sufficiently high insulation of the transformers. The coils where the current enters should be as well insulated as possible.—*Elek. Zeit.*, April 9, 1914.

Traction

Constantinople.—P. POSCHENRIEDER.—An illustrated article on electric traction in Constantinople. The power plant which is in course of erection will contain three steam turbines, each of 10,000 hp, coupled to a 10,500-volt, three-phase generator. The three-phase energy is transmitted to three substations, where transformation to 550-volt direct current takes place.—*Elek. u. Masch.* (Vienna), March 22, 1914.

Installations, Systems and Appliances

Small Three-Phase Station.—CHR. F. WEILAND.—An illustrated description of the arrangement of a small station employing three-phase currents at fifty cycles without neutral wire, with a voltage of 220 volts. It supplies current to a well-to-do village of 2000 inhabitants. The plant consists of two generators each of 10 kva. To supply current during the night a storage battery is provided. The arrangements, which are made in such a way that a single unskilled laborer may attend to the plant, are described and illustrated by diagrams, and figures are given on the cost of operation.—*Elek. Zeit.*, April 9, 1914.

Water Rheostat.—An illustrated description of a water rheostat devised by O. H. Sachers, used in tests in a power plant. The construction is shown in Fig. 2. The tank, of concrete or wood, contains vertical stoneware tubes *T*, through which the water passes upward, flowing over at the top. Three such tubes are provided for a three-phase system. At the bottom of each of the tubes is a small iron sheet *RS* which can be pushed in more or less so as to adjust the quantity of water entering at a certain time. These three iron sheets and the connections at the bottom are carefully earthed to prevent any danger to the attendant. The electrode consists of copper wire wound in a flat spiral so that the water vapor can easily rise upward. This form also prevents formation of sparks such as would occur if pointed electrodes should be used. By adjusting the height of the water level the load can be adjusted between 100 kw and 2600 kw. The construction may also be modified by putting a tube of smaller diameter within each of the main tubes so that the water rises upward in the center tube and flows down in the space between the two tubes. In this case the same resistance can be obtained with one-half the height of the rheostat.—*Elek. Zeit.*, April 2, 1914.

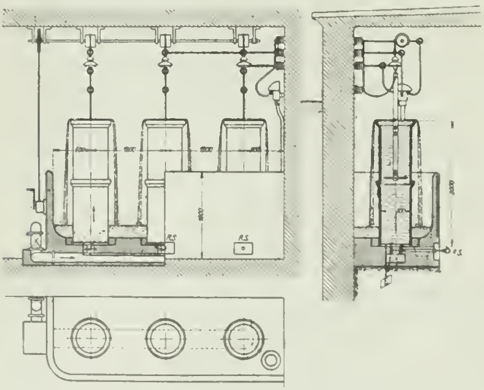


FIG. 2—WATER RHEOSTAT FOR POWER-PLANT TESTS

Wires, Wiring and Conduits

Copper for Conductors.—The new standardization rules of the German Association of Electrical Engineers on copper for conductors require that such copper must not have a higher resistance than 17.84 ohms per km length and square mm cross-section at 20 deg. C. The resistance of a conductor of 1 km length and 1 square mm cross-section increases by 0.068 ohm per degree C. increase of temperature. The international agreements reached by the I. E. C. are also added.—*Elek. Zeit.*, March 26, 1914.

Standardization Rules for Insulated Wires.—A new set of standardization rules for insulated wires prepared by the German Association of Electrical Engineers. These regulations will be in force beginning with Jan. 1, 1915. There are three chapters. The first relates to rubber-insulated wires, giving general notes and regulations on the construction and testing of the wires. The second chapter deals with lead cables (rubber lead-covered cables and paper or fiber lead-covered cables). The third chapter gives tables of the highest load which insulated wires are permitted to carry, both for copper and aluminum.—*Elek. Zeit.*, March 26, 1914.

Suspension Insulators.—REINHOLD RÜDENBERG.—An illustrated article in which the author calculates the non-uniform distribution of the voltage over the different disks connected in series one above the other in a suspension insulator. The distribution of the voltage is illustrated by means of curves which show the unfavorable effect of high capacity to earth of the insulator disks. A method is given for determining the most favorable number of disks for suspension insulators.—*Elek. Zeit.*, April 9, 1914.

Electrophysics and Magnetism

Spectra of the Elements and the Structure of the Atom.—J. W. NICHOLSON.—A highly mathematical paper in which the author refers to the paper by H. G. J. Moseley on some experiments giving a new order of simplicity to the determination of wave-lengths of the characteristic X-radiation emitted from metals, and supplying perhaps the most hopeful way of obtaining a more intimate knowledge of the inner structure of the atom and of the essential relations between the various elements. He also refers to another paper by Bohr and to the supposition that his formula for spectra, applied to the steady states of an inner ring of four electrons rotating round a nucleus whose charge corresponds to the "atomic number" of the element, will account for the principal line found by Moseley in the X-ray spectra of the elements from calcium to zinc in the periodic table. The present paper is not intended as a criticism of Bohr's theory of the origin of spectra in general and of the hydrogen and helium spectra in particular, but it puts forward the view that this particular application of the theory cannot be made in the manner contemplated, without a serious conflict with the recent results obtained by Rutherford Barkla and others as to the number of electrons in atoms, which seem to indicate that the number is about half the atomic weight.—*Philos. Mag.*, April, 1914.

Induction Coil Potentials.—E. TAYLOR JONES.—A third mathematical paper on this subject. The author gives some further applications of the theory of electrical oscillations in coupled circuits. On the whole, the evidence tends to show that the theory described in this and the two former papers is sufficient for the calculation of the secondary potential of an induction coil and the most effective value of the primary capacity.—*Philos. Mag.*, April, 1914.

Thermal Electromotive Forces in Oxides.—CHARLES C. BIDWELL.—An account of an experimental investigation the results of which are given in tables and in a thermo-electric power diagram for various oxides. This diagram brings out some interesting facts: First, the Tait diagram may be extended to include the oxides. Second, the thermo-electric powers for the oxides are of far greater magnitude than for the metals. Above 1000 microvolts per degree are recorded for some oxides, while for the metals 100 microvolts per degree is extreme. It may or may not be significant, but as a general rule both on this diagram and on the Tait diagram for the metals thermo-electric powers are high where resistances are high.—*Phys. Review*, March, 1914.

Valency of Radio-Elements.—G. HEVESY.—An account of an experimental investigation the chief results of which are as follows: The valency of fifteen radio-elements was determined by measuring their diffusion constants in acid solution. The valency thus measured directly agrees without exception with what would be expected from the character of the respective radio-elements determined by their non-separability from an element of known properties. Actinium sends triple charged ions into solution. This fact supports the view that actinium is the subsequent homologue of lanthanum. In alkaline solutions the short-lived and long-lived products of the emanation are present in a colloidal state, in agreement with the views of Paneth and Godlewski. Polonium, in very weakly acid solution and in neutral solution, is also present in a colloidal condition. These particles of the radio-colloids contain in some cases only two or three atoms. The possibility of separating chemically identical elements is discussed. —*Philos. Mag.*, April, 1914.

Electrochemistry and Batteries

Model of the Structure of the Atom.—E. R. LYON.—A paper on an extension of Professor Mayer's experiment with floating magnets. The experiment with floating magnetic needles and an attracting bar magnet, known as Mayer's experiment, has been frequently cited, as demonstrating the periodic grouping of a number of mutually repelling bodies restrained by a central force. This experiment is often shown as an illustration of Sir J. J. Thomson's theory of the atom, according to which the negative electrons are arranged in concentric rings in a positive sphere. The floating magnets take the place of the electrons and a bar magnet above them takes the place of the positive sphere. In the initial experiments a glass battery jar was employed for a container, and it was observed that if the attracting bar magnet were removed the floating magnetized needles would mutually repel one another to the wall of the jar, where they remained, held partly by their repulsion and partly by the surface tension of the water. It was further observed that nearly a solid ring of magnets could thus be formed, and that the inward directed repulsion from this ring was, especially with respect to symmetry, even more efficacious in the formation of the Mayer groups than was a centrally attracting bar magnet. Following this lead, a coil of wire of the same depth and position, and wound upon the outside of the jar, was substituted for the ring of magnets. This coil had forty turns of No. 18 enameled wire, and a current of from 0.25 amp to 0.5 amp was passed through it in such a manner that the magnetic field should repel the floating magnets toward the center of the jar. With this device it was observed that still more symmetrical groups could be obtained, and that, furthermore, groups of as high as thirty and forty needles could be easily studied, without any of the inconvenient over-concentration at the group center and sticking together of pairs of needles, such as had been observed when using the suspended bar magnet to produce the central force. With a sufficiently large tank and repelling coil any sized group can be stated in this way. Results of experiments are given and applied to discussion of Mendeleef's table of elements. —*Phys. Review*, March, 1914.

Units, Measurements and Instruments

Electromagnets.—ERICH JASSE.—A continuation of his former paper on the design of electromagnets. The author deals with rotary magnets such as are used in apparatus and switch construction and discusses the case in which the armature of the electromagnet is provided for a special winding. He shows that with a wound armature it is possible to make the torque four times the value for an unwound armature and the angle of rotation twice the value for an unwound armature. For calculation it is sufficient to consider the conditions in the air-gap only, and in order to take into consideration the saturation it is only necessary to determine one characteristic curve. The results of measurements agree sufficiently well with the theory to lend it support.—*Elek. u. Masch.* (Vienna), March 22 and 29, 1914.

Electrostatic Voltmeter.—JAC. SCHAFFIT.—An abstract of a thesis on a new electrostatic voltmeter of Peukert in which the rotation of a dielectric in a rotary electric field is used. The dielectric has no real hysteresis, but only viscous hysteresis, besides a certain conductivity. As shown in Fig. 3 a glass rod B is mounted on a marble plate A, and from the tube at E is suspended a platinum-iridium wire of 0.1 mm diameter and 23 cm length, which has at its lower end a hard rubber axle of 6 mm thickness carrying the dielectric cylinder Z of 4 cm diameter and 2 cm height. The small mirror S is provided for reading the deflection. F is the damping vanes. The cylinder G of glass (5 cm diameter and 2 mm thickness) is arranged concentrically around the dielectric and is covered with several pieces of tinfoil arranged at constant distances. They have a height of 2 cm. Opposite pieces of tin-

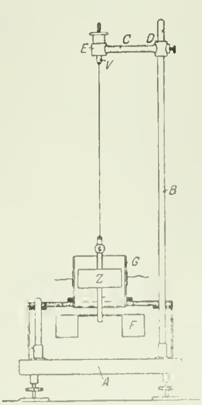


FIG. 3—ELECTROSTATIC VOLTMETER

foil are connected with the high-tension side of the three-phase transformer while the centers of the high-tension coils are connected with the zero point of the low-tension side and earth. In the experiments the frequency could be changed between twenty-five and sixty. The theory shows that the dielectric hysteresis gives only a braking torque, while the driving torque is due to the conductivity. Experiments were made with dielectric cylinders of hard rubber, rubber, porcelain and mica. Mica and porcelain give greater torque than rubber and hard rubber. The instrument must be protected against draft and the humidity of the air. If the proportions are correctly chosen, the deflection of the instrument is proportional to the voltage if the frequency remains constant. On account of its low watt consumption and its high perforation resistance, this voltmeter can be used for measuring high three-phase voltages.—*Elek. Zeit.*, April 9, 1914.

Telegraphy, Telephony and Signals

Munich.—WILHELM SCHREIBER.—The conclusion of his illustrated article on the new long-distance exchange at Munich.—*Elek. Zeit.*, April 2, 1914.

Progress of the Baudot System.—A. C. BOOTH.—Duplex working of the Baudot system continues to yield the excellent results that were obtained from the sets installed at the Central Telegraph Office in 1910. The quadruple duplex on the underground loop circuit between London and Birmingham gives a uniform daily output of some 3600 messages in twelve hours, including the slack hours of the early morning and late evening. Occasionally the daily total has exceeded 4000, while on the day following the fire at the test box of the central telegraph office, London, in August, 1912, the following results were obtained between 10 a. m. and 5 p. m.: There was an average of 550 messages per hour, or 68.75 per channel, making a total of 3851 in seven hours, or 5025 in twelve hours. There was a maximum of 575 messages between 10 a. m. and 11 a. m. The new quadruple duplex sets are fitted with motor-driven receivers having tablet connections for readily changing the entire receiver whenever necessary. During the period of nearly four years that the sets have been working not more than six serious stoppages have occurred; hence it does not appear necessary at present to provide two distributors at each end. On comparatively short lines the time of propagation of a signal over a line is small, but on the long circuits with one or more repeaters, such as on the London-Berlin double-duplex circuits the propagation time ranges up to four segments or 120 deg.—that is, about one-ninth of a second—and varies some 60 deg., apparently in accordance with the way in which the relays and repeaters are adjusted.—London *Electrician*, April 10, 1914.

Portable Wireless Apparatus.—PHILIP R. COURSEY.—An article on recent advances in the design of portable wireless-telegraph apparatus. Instead of stations mounted in cars as employed in the Russian-Japanese war, stations transported by pack horses are now used. In order to secure secrecy of communication as far as possible the waves emitted by the transmitter were formerly very sharply tuned, but the practice is now the reverse, namely, to use a transmitter that is not very sharply tuned—that is, one having a flat resonance curve—while the receiver is arranged to be as sharply tuned as possible so as to be able to differentiate between different transmitting stations to the utmost degree.—London *Electrician*, April 10, 1914.

Wireless Telegraphy on Board Ship.—H. THURN.—An illustrated description of the wireless-telegraph equipment of the steamship *Imperator*.—*Elek. u. Masch.* (Vienna), March 22, 1914.

Book Reviews

HIRSCH-WILKING ELEKTRO-INGENIEUR KALENDER. 1914. With notebook supplement. Berlin, Germany: Oscar Coblentz. 386 pages, illus. Price, 2.50 marks.

This is the fourteenth annual edition of a handy engineer's pocket-book. It is divided into fifteen sections dealing with the following topics: Tables; station construction; choice of machinery; prime movers; mechanical power transmission; electric generating stations; conductors; substations; power distribution; electric railways; economics; laws and regulations; first aid to the electrically injured; tariffs; costs. The book is especially well developed on the side of costs, expenses and economics. Although designed for the electrical engineer, it is likely to be also of service to mechanical engineers acquainted with the German language and interested in German practice.

DIE ELEKTRISCHEN METALLFADENGLÜHLAMPEN. By C. Heinrich Weber. Leipzig, Germany: Dr. Max Jänecke. 454 pages, 216 illus. Price, 16 marks.

A good textbook on the history, chemistry, construction and testing of incandescent lamps, especially with relation to metallic-filament lamps. The book is divided into two principal chapters. The first deals with the historical development of the metallic-filament lamp, and the second with the tungsten lamp. The book is particularly well prepared from the standpoints of the chemical and mechanical manufacture of the metallic filaments. The successive steps in construction are abundantly illustrated. It will recommend itself to all who are interested in the manufacture of lamps in Europe and who are acquainted with the German language. An extensive subject index makes the book the more useful as a reference volume.

HANDBOOK OF TECHNICAL INSTRUCTION FOR WIRELESS TELEGRAPHISTS. By J. C. Hawkhead. London: The Marconi Press Agency, Ltd. 296 pages, 169 illus. Price, 3s. 6d.

This book was written as a guide for radio operators using British Marconi apparatus or intending to qualify for the British Postmaster-General's examinations. The ground covered is perhaps unnecessarily large, since to touch upon all the subjects noted requires a sketchy treatment which is of little use to the beginner. The entire first section of the book, given over to theoretical considerations, appears to be more suitable for use as a radio-school textbook than as part of a manual for self-instruction. The illustrations are rather crude, though in most cases they indicate clearly the essential points. Part II contains a discussion of electrical and other wave motions and states several of the relations between frequency, wave-length, decrement and circuit constants. If the groundwork of the first ten chapters were a little more thorough, this section should be of much value to the unassisted operator or student, but as now introduced the lack of system in employment of units and symbols is likely to prove confusing. Nevertheless, the final chapter of Part II, on receiving circuits, contains one of the clearest explanations that have been published as to the function of a magnetic telephone receiver in translating the energy of incoming signal waves. Part III of the book, which is given over to a detailed description of standard ship sets according to English practice, will be useful to those who handle this type of apparatus. It is not likely that data for adjustment of these instruments will help American operators, though many of the general instructions are excellent.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Small Switchboard Ammeters and Voltmeters

A 5-in. direct-current indicating meter for small isolated plants, yachts, battery-charging panels, etc., is shown herewith. The meter is equipped with a moving coil and a permanent magnet and it operates on the d'Arsonval principle. The complete moving parts are mounted in the case as a unit. The moving element can be released by removing two screws on the side of the pole-piece support. The entire moving element with its bearings can then be lifted out and can be replaced as it was before. The meter may be repaired, therefore, without disturbing the alignment of the magnetic circuit. An aluminum pointer makes the use of a light counter-weight possible. The scale is 4 in. long, and the full length of the pointer shows on the dial. The movement is thoroughly damped to secure dead-beat readings. This meter is manufactured by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

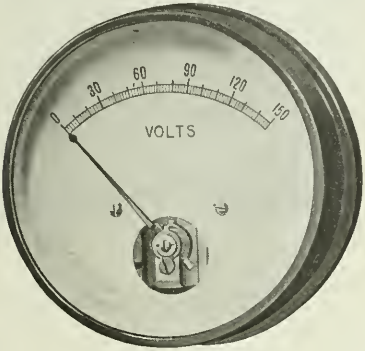


FIG. 1—EXTERIOR OF DIRECT-CURRENT METER

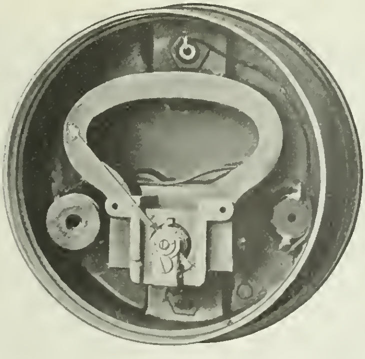
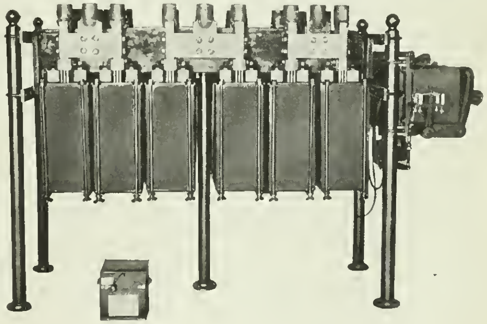


FIG. 2—INTERIOR OF DIRECT-CURRENT METER

4000-Amp Oil Switch

A 4000-amp oil switch, declared to be the largest of its type in this country, has recently been put into service at the plant of the Ludlow Manufacturing Associates, Ludlow, Mass. The switch is used for the control of a 2500-kw, three-phase, forty-cycle, 575-volt turbine-driven alternator operating with a power-factor of 80 per cent and at approximately 4000 amp per phase.

Two switch elements are arranged in multiple for each pole. The stationary contacts are made of large blocks of copper. The live parts are supported by insulators clamped to the main frame. All the parts through which the switch terminals pass or which are surrounded by the electric circuit are made of composition material. Each pole of the switch is provided with three terminal lugs to accommodate three 1,400,000-circ. mil rope-core cables. The moving contacts are of the laminated-brush type and are sectionalized, each part bearing independently on the stationary contact. Auxiliary contacts of non-arcing metal are provided for the arcing that occurs in making or breaking the circuit.



4000-AMP SWITCH FOR 2500-KW TURBINE

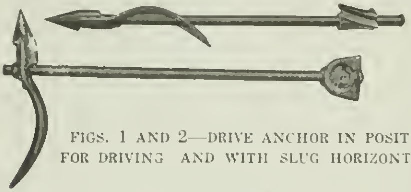
The tanks are of boiler iron and are electrically welded. Instead of being supported at the top to the frame, these tanks are held up by long rods bolted through lugs welded onto the tank bottom and attached to a deflector plate at the top which is attached to porcelain insulators. This deflector plate prevents the throwing of oil and it also serves as a guide for the brushes.

A test showed that the variation in contact resistance of the two legs of the switch was about 5 per cent. On a heat run of five and one-half hours with a load of 4000 amp the temperature rise of each leg was 26.5 deg. C. and the current density 660 amp per sq. in. The tanks showed a temperature rise of 18 deg. C. except on the adjacent faces, where on account of the total flux of the two conductors there was a rise of 31 deg. C. The switch withstood a pressure test of 10,000 volts between the terminals and the frame, and the operating coils withstood a pressure of 1000 volts between windings and frame. The closing magnets require a total of approximately 80 amp and the tripping magnet 2.2 amp at 110 volts.

This oil switch was manufactured by the Condit Electrical Manufacturing Company, Boston, Mass., and was installed under the direction of Lockwood, Green & Company, architects and engineers, Boston, Mass.

Drive Anchor

A three-piece drive anchor is being manufactured by the Universal Cable Grip Company, Syracuse, N. Y. The device consists of a slug, a guy rod and a thimble. The guy rod is upset at the upper end for withstanding the strain of pounding and hammering, and a forged shoulder at the other end eliminates the need of threads or holes.


FIGS. 1 AND 2—DRIVE ANCHOR IN POSITION FOR DRIVING AND WITH SLUG HORIZONTAL

The slug, as shown in the illustration, has one end pointed and the other curved end flattened out. When being driven into the ground the slug takes the position shown in Fig. 1, and when being pulled out that in Fig. 2. A toggle joint which engages the forged shoulder of the rod enables the slug to turn from the upright position to one at right angles to the rod. When in a driving position the lower end of the rod fits in a step at the base of the pointed part of the slug, thus transmitting the full force of the blow at the upper end of the rod directly to the point and also holding the slug in a rigid upright position until the anchor is driven to the required depth. A slight upward lift on the rod disengages the end from its step. The forged shoulder works in a slot in the slug, and on account of the resistance to an upward pull caused by the fluke of the anchor the slug turns to a horizontal position. The slug can turn no further since the toggle-joint slot is so designed that it is held in this position.

Arc Welding

Arc welding is receiving considerable attention at the present time from railways and industrial concerns. It is particularly well adapted for use in machine shops and foundries. Worn parts of machines, for instance, can be built up prior to machining, broken parts of steel castings can be welded together, and often defects developing in new castings after considerable machining has been done can be obliterated by means of the electric arc. In steam-locomotive and electric-railway shops, steel mills, etc., numerous other applications can be made.

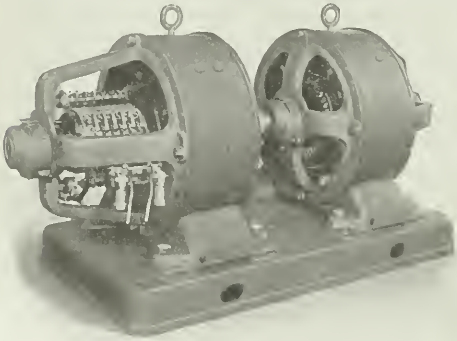


FIG. 1—MOTOR-GENERATOR SET FOR ARC WELDING

In Fig. 1 is shown a motor-generator set used for arc welding. The equipment is built in four different sizes, rated at 200 amp, 300 amp, 500 amp and 800 amp respectively. The generator is a 75-volt commutating-pole machine and can be operated either by belt or by motor drive. The instrument and control panels are made up of two sections. The upper section contains the indicating instruments, protective apparatus and switches for regulating the welding current, and the lower the starting and protective equipment for the motor-generator set. It is often desired to have several welding circuits connected to one generator, and when this is the case a control panel is provided for each circuit. Metal or carbon welding can be done from any of these panels independently of the others, and one arc can be used, or more than one simultaneously.

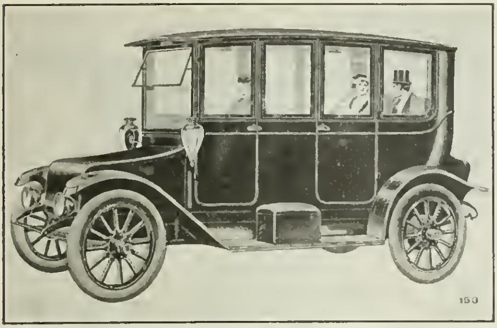
FIG. 2—ARC WELD ON BACK FLUE SHEET OF LOCOMOTIVE

The accessories furnished with this welding outfit consist of a carbon holder, a hood for protecting the operator, a shield and a metal-pencil holder for each welding circuit. This arc-welding equipment has been developed by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

FIG. 3—VIEW OF AN OPERATOR MAKING A WELD

Electric Limousine

The electric limousine illustrated herewith is being manufactured by the Anderson Electric Car Company, Detroit, Mich., and is known as the "Detroit." In the rear compartment three persons can be accommodated on the rear seat and two more on auxiliary seats. Two persons including the driver can be seated in the front compartment. The wheelbase of this car measures 112 in. and the tread 56 in. The battery is made up of 60 A-6 Edison cells. The car may be operated at speeds of 5, 8, 13, 17 and 20 miles per hour. The mileage on one charge ranges from 50 to 75. Wheel steer is used and the car is controlled by means of a lever on the steering wheel. The width of the rear seat, top of cushion, is 47 in. and the depth is 20 in. The two auxiliary seats are of the folding type and are 14 in. by 14 in. The driver's seat is 43 in. wide and 22 in. deep. The width of each of the two rear doors and of the two front doors also is 22 in.



SEVEN-PASSENGER ELECTRIC LIMOUSINE

50-Hp Oil Engine

Several changes have recently been made in an oil engine described in the *Electrical World* of June 29, 1912. All of the bearings are oiled automatically by means of a Detroit forced-feed mechanical oiler. When the engine stops the flow of oil also stops. The outboard bearings are equipped with renewable phosphor-bronze bushings and are oiled by rings. The governor gives a regulation of less than 2 per cent from no load to one and one-quarter load. This governor is equipped with a recoil clutch, shown in Fig. 2, which absorbs the shock caused by the explosion in the engine. The piston is fitted with six rings instead of four as formerly. The piston is made with a convex head, thus centralizing the force of the explosion and avoiding severe strains in the cylinder walls. The design of the taper wrist pin has been changed so as to provide for larger wearing surface. An improved spray, the manufacturers claim, atomizes the oil and delivers it into the vaporizer in such condition that not a trace of carbon is left in the vaporizer or vaporizer cap when using 34-deg. distillate fuel oil. About 130 gal. of cooling water is required per hour. The engine is built by the Covington Machine Company, Covington, Va.

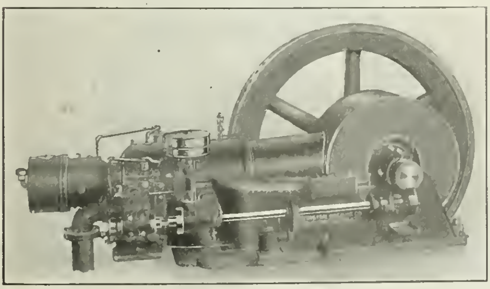


FIG. 1—50-HP OIL ENGINE

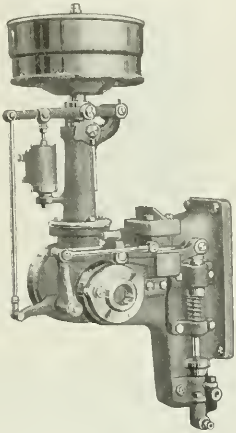
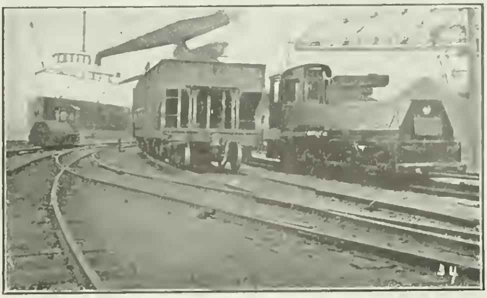


FIG. 2—MECHANISM SHOWING RECOIL CLUTCH

Electric Locomotive

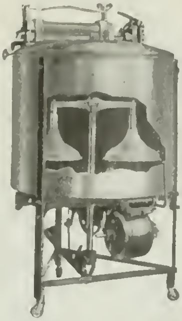
Three locomotives of unusual design have recently been built for the Pennsylvania Railroad to handle cars at its Cleveland ore docks. The most unusual feature in connection with these locomotives is that they do not run on the same tracks as the cars they handle but on narrow-gage parallel tracks, which are 42 in. wide. They are not attached to the cars by couplings, but each locomotive is equipped with an arm on each side which can be lowered by means of compressed air controlled from the cab. This arm acts as a pusher, as shown in the illustration. Single cars or trains can be handled and cars can be shifted and cut out from trains with little trouble. These locomotives are of the Baldwin-Westinghouse make and weigh 25 tons each. The motors are of the Westinghouse commutating-pole type. Energy is obtained from two rails lying inside the rails on which the locomotives operate. These rails are protected by a wood covering.



ELECTRIC LOCOMOTIVE WITH SIDE-ARM PUSHER

Electric Washing Machine

The electric washing machine illustrated below cleanses the clothes by air pressure and suction instead of by friction. The machine is provided with two suction basins which work up and down, forcing the water through the clothes and sucking it back again. Every time they reach their uppermost position these basins turn automatically to a new position on the downward movement. This operation produces a strong agitation of the water through the clothing without subjecting the clothing to the deleterious effects of rubbing. The tub is made of cold-rolled copper, the walls of which are securely double-seamed and soldered to the bottom. The tub is 24 in. in diameter and 18.5 in. deep. The machine is operated by a ⅛-hp motor, which is attached to the supporting plate by two thumbscrews, making it easily detachable for operating other machinery if desired. By pulling a lever the motor is shifted from the washer to the ringer and the speed of the motor is reduced. Instant reverse of the wringer is secured by means of a small lever conveniently located near the end of the upper roll.


ELECTRIC WASHER

This electric washing machine is built by Messrs. Dodge & Zuill, Syracuse, N. Y., and is driven by a motor furnished by the Robbins & Myers Company, Springfield, Ohio.

Motor-Driven Combined Coal-Cutting and Loading Machine

In a combined coal-cutting and loading machine designed recently for operation by electricity, the essential parts are an under-cutting chain, two vertical sheering chains, a pick, a stationary frame, or pan, on which the cutter head can be fed forward or backward, a receiving conveyor and separate loaders for lump and slack coal. The apparatus, which operates similarly to a breast machine, can be placed in the working space of the mine and need not be removed until the coal is all worked out. Entries, rooms or break-throughs of any desired width can be cut with this combination machine. Cutting, feeding and loading operations are performed by a motor and are controlled from levers on the side of the apparatus. The particular machine illustrated herewith is capable of mining and loading 100 tons in about eight hours. It is built by the Jeffrey Manufacturing Company, Columbus, Ohio.

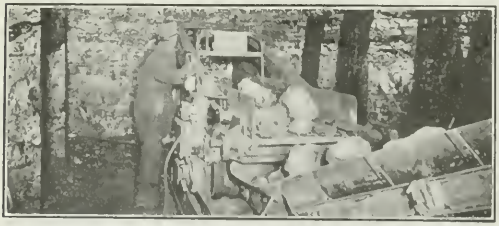


FIG. 1—COMBINATION MINING AND LOADING MACHINE IN OPERATION

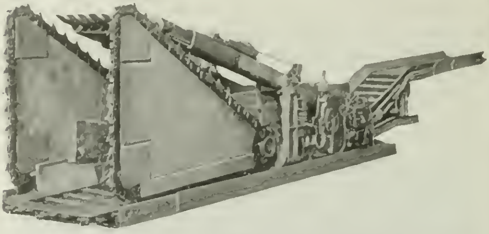
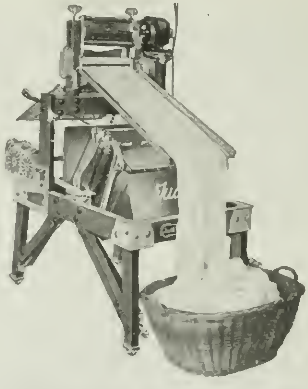


FIG. 2—ELECTRICALLY OPERATED MINING AND LOADING MACHINE

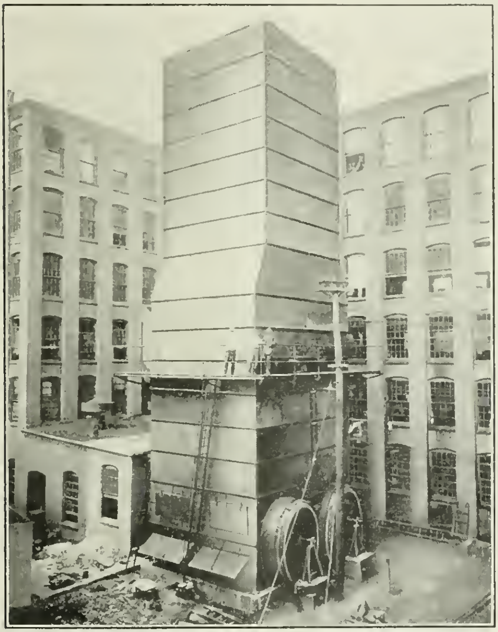
Reciprocating Electric Washer

Changes have recently been made in the reciprocating electric washing machines manufactured by the Judd Laundry Machine Company, People's Gas Building, Chicago. The wooden and fiber tub ends have been eliminated, and the entire receptacle for clothes is now made of heavy copper, thus making the interior of the tub smooth and free from projections. Formerly a single spring was used on the driving mechanism, but now the original spring has been made longer and another spring has been added. A pair of wooden rolls has been placed 1.5 in. in front of the rubber wringer rolls to add to the safety of the operator. A permanent discharge connection has also been added, and the driving gears and driving mechanism have been made heavier. The manufacturers claim that the reciprocating motion of the tub imparts impetus to the water. The improved machine is shown in the accompanying illustration.


RECIPROCATING ELECTRIC WASHER

Cooling Tower

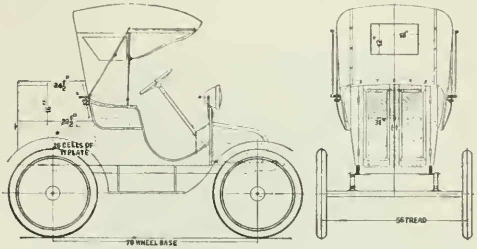
A large twin forced-draft cooling tower which was installed by the Wheeler Condenser & Engineering Company, Carteret, N. J., at New Britain, Conn., for the American Hardware Company, is shown in the accompanying illustration. The equipment is designed to cool 132,000 gal. water per hour from 100 deg. Fahr. to 80 deg. Fahr. The tower proper terminates just above the platform on which the men are standing, as shown in the illustration, the steel-plate work above consisting of a stack to convey the vapors above the roof of the building and also to provide natural draft for operation in cold weather. The tower is built with special air inlets which are opened when the fans are not in use. The stack supplies the draft. The inlets are closed by counterweighted doors. The equipment consists of two towers side by side, each 11.5 ft. wide and 18.25 ft. long, erected over a reservoir. The chimney is 18.25 ft. square and the height from the base of the tower to the top of the stack is 70 ft. Forced draft is supplied by four 108-in. fans.



TWIN FORCED-DRAFT COOLING TOWER INSTALLED AT NEW BRITAIN, CONN.

Light-Weight Meter Wagon

To satisfy the demand for electric vehicles especially adapted to the needs of electric service companies for meter work, lamp trimming and light deliveries, the Buffalo Electric Vehicle Company, Buffalo, N. Y., has designed and put on the market several light-weight electric wagons. The same chassis is used for the different types. The speed of these wagons is from 16 miles to 18 miles per hour. In the vehicle shown herewith the loading space is in the rear of the seat. Folding doors opening at the rear give access to the loading compartment and to the battery. The space above the battery is 16 in. high by 24.5 in. wide by 31 in. long, and the space to the rear of the battery is 10 in. by 14 in. by 31 in. A carbon box is placed on the dashboard. The driver's seat is upholstered in leather. The hood over the seat is provided with front storm curtain and side curtains.



LIGHT-WEIGHT VEHICLE SUITABLE FOR LAMP-TRIMMING OR METER WAGON

Porcelain-Clad Transformer for Operating Bells and Buzzers

A small porcelain-clad transformer suitable for residence doorbells, buzzers and various kinds of light signal work is shown in the accompanying illustration. The porcelain may be white, brown or blue. The core is of silicon steel and the coils are form-wound and vacuum-treated. The entire case is filled with insulating compound. The transformer is wound to operate with alternating current at pressures ranging from 100 volts to 130 volts. The length of the device is 3.25 in., the width 3 in., the height 3.5 in. and the weight 1.75 lb.

PORCELAIN-CLAD TRANSFORMER FOR DOORBELLS AND SIMILAR LIGHT SIGNAL WORK

The transformer described above is being placed on the market by the Packard Electric Company, Warren, Ohio.

Jobber, Dealer and Contractor

Semi-Annual Convention of the Iowa Electrical Contractors' Association

Lively interest marked the papers and discussions on accounting, modern business methods, compensation insurance and co-operation with central stations at the second semi-annual meeting of the Iowa Electrical Contractors' Association, Cedar Rapids, April 22 to 23. In a paper, "Modern Business Methods in Electrical Contracting," by Mr. Edward Kunkel, of Davenport, Ia., the idea of exercising friendly co-operation instead of vindictive enmity and distrust was pressed home forcibly. Among the ideas emphasized were the value of good service and high quality as against cheap prices and inferior work, the keeping of accurate records and the possession of a well-planned organization instead of one that is haphazard and wasteful, the necessity of thoughtful planning and of honest business ethics in place of cunning and sharp practices, kind and considerate but firm handling of employees, and honest effort with legitimate profit. The speaker said an intelligent and consistent advertising scheme, prompt and accurate estimating methods, concise and definite closing of contracts and other business, careful and systematic handling of work after it has been secured, a well-arranged stockroom and a systematic plan for checking its contents, tastefully arranged salesroom for retail supplies, appliances and fixtures, and prompt and insistent collection of accounts were all important to the modern electrical contractor.

Inasmuch as the Iowa workmen's compensation law goes into effect July 1, the question of insurance was of keen interest among the contractors. Mr. George O'May, of Sioux City, gave a brief talk at the first session of the convention covering the cost of insurance to contractors. Following a few questions on the subject of insurance, Mr. C. E. Browne, of the American Electric Supply Company, of Chicago, outlined a record-keeping and cost-accounting system applicable to the contractors' business. "Watch each piece of material no matter how small" was the keynote of the talk.

Mr. J. W. Parry, of the engineering extension department of the Iowa State College, spoke on the possibility of the department increasing its scope to help the contractors by training their men to be more efficient in doing work and handling business.

Use of Old-Code Wire in Iowa

In spite of the fact that the Underwriters' Laboratories inspected and labeled about 1,000,000,000 ft. of rubber-covered copper wire, including flexible cord and fixture wire, during 1913, the use of old-code wire is still somewhat prevalent in the State of Iowa, according to the statements of Mr. J. E. Latta, who, as representative of the Underwriters' Laboratories, has been making investigations. The so-called old-code wire is insulated with a product made from an asphalt base, and this composition when it has dried rapidly loses its insulating properties. Wire made according to the 1913 code specifications carries enough rubber in the insulation to make it a durable and safe product.

Facts concerning wire were pointed out by Mr. Latta before the contractors' convention and also before the Iowa State Section of the National Electric Light Association. The Iowa Electrical Contractors' Association in executive session passed a resolution pledging the members to discourage the use of old-code wire and use none but new-code wire and approved fittings.

On Wednesday afternoon there was a joint session with the Iowa State Section of the N. E. L. A.

In a talk at the Thursday morning's session Mr. Israel Lovett, of Council Bluffs, told of his methods of handling workmen. To secure efficiency, said the speaker, it is necessary to get the men properly and promptly started on the job and watch the progress of the work. It is the business of the contractor to think for his men, laying out their work so that they will proceed along lines producing economic results. Following this talk a further discussion on compensation insurance ensued, occupying the greater part of the forenoon.

Contractors Forego Pleasure for Business

Foregoing the pleasure of a trolley trip to Iowa City, the contractors held a business session Thursday afternoon and also listened to a paper, "System of Bookkeeping for Electrical Contractors," by Mr. W. J. Ball, of Moline, Ill. Mr. Ball told of the importance of "turning over" stock and not keeping on the shelves material for which there was little or no call. Money invested in such stock can better be kept in a bank, where it will draw at least 3 per cent interest. The practice of separating accounts was also taken up, the speaker pointing out that each branch of the business should be self-supporting, and that if it is not the contractor should know it. Just what branches of a business are the producers can be known only by keeping proper accounts. Mr. Ball brought out the value of the inventory by showing how important such data would be in case the store of a contractor was destroyed by fire. An up-to-date inventory is also a convincing argument if presented to a banker when a contractor wishes to borrow money. The value of co-operation was emphasized, the speaker claiming that no one can climb to the pinnacle of business success over the necks of his competitors.

There was no election of officers, as those now serving were elected last February. Mr. M. A. McCarten, of Marshalltown, is president, and Mr. M. T. Humphrey, of Waterloo, is secretary of the contractors' association. It is probable that the next meeting of the association will be held in the western part of the State so that the following spring meeting can convene in Keokuk simultaneously with that of the Iowa State Section of the N. E. L. A.

Results of Co-operative Wiring Campaign at Toledo, Ohio

Working together, the wiring contractors and the electric-service company at Toledo, Ohio, have succeeded in wiring 600 houses during the last four months. Perhaps the most remarkable thing about this record is the fact that all of the houses are on streets where lighting lines existed. When the Toledo property was taken over by the Doherty Operating Company a canvass showed that a very low percentage of the available houses were wired; hence the making of extensions was postponed until the present lines should reach a more saturated condition. Even now, in the fifth month of the campaign, the electric-service company's solicitors are turning in signed lighting contracts at the rate of twenty-five a week, so it will be seen that the wiring business continues to flourish.

According to the terms of the contract under which this business is solicited prospective customers pay the contractor 25 per cent of the total wiring bill when the application is accepted and pay 10 per cent of the remainder on the first of each month at the office of the electric-service company. The contractor receives the full amount of the bill at the completion of the work, collecting the additional 75 per cent of the bill from the lighting company. The accompanying table, which is part of the contract, gives the prices of wiring houses having from five to sixty outlets. Fixtures are not included in this contract, and although the central-station's solicitors carry a booklet showing a simple set of lighting units, customers are generally encouraged to install better fixtures, as it has been found that better satisfaction will result if a higher grade is selected in the first place at the completion of wiring.

HOUSE-WIRING SCHEDULE, TOLEDO, OHIO.

No. of Outlets	Single Flooring	No. of Outlets	Single Flooring	No. of Outlets	Single Flooring	No. of Outlets	Single Flooring
5	$15.85	19	$38.45	33	$58.05	47	$79.81
6	17.85	20	39.85	34	59.45	48	81.45
7	19.85	21	41.25	35	60.85	49	83.09
8	21.85	22	42.65	36	62.25	50	84.73
9	23.85	23	44.05	37	63.65	51	86.37
10	25.85	24	45.45	38	65.05	52	88.01
11	27 25	25	46.85	39	66.69	53	89.65
12	28.65	26	48.25	40	68.33	54	91.29
13	30.05	27	49.65	41	69.97	55	92.93
14	31.45	28	51.05	42	71.61	56	94.57
15	32.85	29	52.45	43	73.25	57	96.21
16	34.25	30	53.85	44	74.89	58	97.85
17	35.65	31	55.25	45	76.53	59	99 49
18	37.05	32	56.65	46	78.17	60	101 13

The status of each wiring job is kept before the assistant new-business manager, Mr. C. H. Felker, by means of addressed postal cards mailed from the offices of contractors and fixture men when they have completed their part of the work.

Business Methods in a Modern Electrical Jobbing and Retail Establishment

Customers patronizing electrical stores like personal attention from members of the firm, and for this reason in the store of the Avery-Loeb Company, Columbus, Ohio, the desks of Mr. Oscar Avery, president, and Mr. A. E. Loeb, vice-president, have been placed well toward the front of their main store on Third Street. Instilling this spirit of courtesy and personal service into the six men representing the sales force of the company, says Mr. Loeb, has been responsible for doubling the incandescent-lamp business of the company annually. The sales force consists of two salesmen who travel in the territory adjacent to Columbus within a radius of 75 miles, two city salesmen, one handling construction work and the other merchandise sales, and two men in the main retail store. To aid in handling the sales of supplies in the adjacent territory branch stores have been established at Mount Vernon and at Newark.

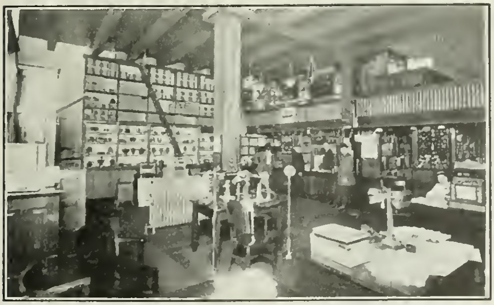


FIG. 1—INTERIOR OF ELECTRICAL STORE, COLUMBUS

As a means of fostering the spirit of co-operation and loyalty, sales meetings are held on every second Monday night, some meetings being devoted to discussion of problems brought up by the various heads of departments, while at other times representatives of electrical manufacturing establishments are invited to talk before the employees. Alternating with the sales meetings the construction men also get together on Monday nights. Their meetings are largely educational, the lessons being along the line of record keeping and shop management. Average attendance for both sales and construction men is estimated at 98 per cent.

FIG. 2—SIGN OF COLUMBUS JOBBING HOUSE

Practically all of the main floor of the building, occupying a space 35 ft. by 70 ft., is given over to retail business. The front room of this floor is shown in Fig. 1. Wiring devices and supplies of each manufacturer are mounted on display boards hung just back of the counter. In the row of shelves behind each one of these displays, broken packages of the goods of the respective manufacturer are kept. For demonstrating the relative illuminating value of the various sizes of lamps, a circuit has been arranged above the counter within easy reach of both the customer and the salesmen. Above the counter at the right of the illustration common types of reflectors have been installed in a like manner to help the customer to his choice. In the rear of the broken-package shelves are the headquarters of a shipping department and the wiremen. Small coils of wire and broken lots of lamps are stored on a mezzanine floor. On this mezzanine floor is also the desk of a special vacuum-cleaner salesman, who has his headquarters in the store of the company but operates on a commission basis. The company's shops are in the basement.

On the second floor are the offices of Mr. C. W. Hammond, secretary and treasurer, together with those of the bookkeepers, cashier and stenographers and the filing room. The conference room in which employees' meetings are held adjoins this suite of offices on the rear. At one end of the building is a stockroom.

Being within a few doors of the contract department of the Columbus Railway & Light Company, the busiest days for the Avery-Loeb Company generally fall between the sixth and tenth, when customers paying their electric-light bills purchase lamps. The electric sign shown outside the building contains 500 2.5-watt lamps and was the first electric sign to be purchased by an electric jobbing house in Columbus.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Specialty Manufacturer Sees Improvement Ahead.—The Fahnestock Electric Company, of Brooklyn, N. Y., is finding the demand for its product of spring connector clips rather dull at present, but conditions give some promise of improvement. This company is not now working on any new devices.

A State Prison Takes Electric Service.—By the terms of a contract between the Consumers' Power Company, of Stillwater, Minn., and the Minnesota State Prison at that place, the latter is served with the excess energy developed at the Apple River hydroelectric plants. When operating at full capacity the state prison, with its shops, requires 1500 kw of electrical energy.

Removal of H. M. Byllesby & Company.—The removal of the general office of H. M. Byllesby & Company in Chicago was effected on April 18. The new location is on the nineteenth floor of the new Continental & Commercial Bank Building, at the southwest corner of South LaSalle and West Adams Streets. The new offices take up about one-half of an entire floor of the large building.

Lamp Business Dull.—The Bryan-Marsh Electrical Works of the General Electric Company are finding business slow at this time. The recent reduction in prices of tungsten-filament lamps has made hardly any noticeable difference in the lamp situation, at least as far as the territory around New York is concerned, but it is expected to help in driving the carbon-filament lamps out of extensive use.

Instrument Maker Adds to Factory Facilities.—Owing to the increased demand for its product of electrical testing instruments, the Thompson Levering Company, of Philadelphia, Pa., has been forced to make an addition to its factory facilities. This change gives the factory about double its former capacity. The company has found its business so far in 1914 larger than in the corresponding period of last year.

General Motors Truck Sales Progressing.—The recent sales of electric trucks by the General Motors Truck Company, of Pontiac, Mich., have included ten cars to the Loose-Wiles Biscuit Company, six trucks to the Merchants' Auto Delivery Company, of Galesburg, Ill., and an electric flushing machine to the city of Birmingham, Ala. The latter car consists of a water tank and pressure sprinkler, which has a larger capacity and wider range than the usual form of horse-drawn gravity sprinkling cart.

Sealing Compound Approved by Underwriters.—What is described by the manufacturer as an insulating wax and sealing composition has just been examined and approved by the National Board of Fire Underwriters. Fred M. Williams, of 16 Wellington Court, Brooklyn, N. Y., is the maker, and he states with regard to this product that it is made in four colors, red, brown, white and black, and is used for sealing in screws and current-carrying parts in switches, sockets and other electrical fittings. He has sold many tons of the material during the two years that he has been making it.

Automatic Control for Lamps in Large Detroit Hotel.—In the August 30, 1913, issue of the *Electrical World* a note appeared on the automatic door-bolt solenoid switch perfected by the Hart Manufacturing Company, of Hartford, Conn., for use in controlling the lamps in hotel guest rooms, a device which insures the lamps burning when necessary and being out of circuit at other times. It has just been learned that this type of switch has been specified for the new Statler Hotel, in Detroit, Mich., and the manufacturers consider this as a special indorsement, as the switch was tried out in the Statler Hotel in Cleveland, Ohio, owned by the same interests.

Exporter of Electrical Supplies Deplores Dull Conditions.—A representative of the Federal Electric Company, of 141 Broadway, New York, stated in an interview during the past week that the export business in electrical supplies is very dull. To quote him exactly, his company is "still paying the rent," but he could give nothing more cheerful than that. Questioned as to the outlook, he said that there are no signs of any change either for the better or worse, and that this characterizes the export business in the line handled by his company.

New Plant to Be Constructed for Electrical Manufacturer.—The Bodine Electric Company, Inc., of 564 West Randolph Street, Chicago, Ill., is planning to build within the coming year a new manufacturing plant with a floor area of 30,000 sq. ft. This company was recently organized to take over the copartnership business established in 1905 by C. D. Bodine and P. J. Bodine. It plans to carry on this business on a much larger scale than under the old system. Its present line consists of small tool-drive, generators and special electrical apparatus, and it is now developing a line of fractional horse-power single-phase motors which will be ready for the market at an early date. The officers of the new corporation are C. D. Bodine, president; J. P. Bodine, vice-president, and P. J. Bodine, secretary and treasurer.

Large Order Placed for Ornamental Lighting Standards.—From W. L. Fairchild, of the Union Metal Manufacturing Company, 110 West Fortieth Street, New York, information comes of the placing of a large order for ornamental lighting standards by the Syracuse Lighting Company, of Syracuse, N. Y. This order is for No. 5 standards and is the second order for 500 poles placed by this company with the above manufacturer within a short time. The Union company recently secured contracts for supplying a number of poles for the special lighting at the Panama-Pacific Exposition, and it is now very busy. Mr. Fairchild stated that there is an increasing demand for poles with a low-pedestal design and that lantern-style globes are being specified to a growing extent. He sees a gradual tendency toward the single lamp unit in place of the usual cluster design, but this will probably not be a ruling factor for some time.

Booming Industrial Applications.—The Bristol (Tenn.) Gas & Electric Company is making use of an interesting and novel method of popularizing electricity among the manufacturers, as well as the general public in its territory. The plan of this company is to give a series of industrial displays in the front windows of its office building on State Street. Here every manufacturer in the vicinity is entitled to one week in which to display in one window his finished product and in the other window a part of the manufacturing process. These displays have been in progress for six weeks and have proved valuable to the company and the exhibitors and most interesting to the public. The window space and the electric light and motor drive required for these displays are furnished free to the exhibitors, and the display, besides covering the particular product and process which may be occupying the window at any special time, furnishes a continual exhibit of the application of electricity to these processes.

Wire Manufacturer Finds Present Conditions Satisfactory.—During February of this year the capacity of the Pennington (N. J.) mills of the Peerless Insulated Wire & Cable Company, 18 Broadway, New York, was increased by about 40 per cent, and the company's present business is good. It finds satisfactory conditions obtaining in its raw-material markets. The product of this concern, it is claimed, occupies a middle ground between the ordinary grades of weatherproof wire and the rubber-insulated wire already on the market. In the manufacture of weatherproof wire the bare wire is coated with insulating compound, then a thick covering of unspun cotton is wrapped spirally around the wire, and this cotton is impregnated with the insulating compound. The whole is then finally covered with a single braid. One of the strongest claims made for this insulation is that many hours' soaking in water will not penetrate its shell, and it offers a high resistance to abrasion, besides being tough and flexible. It is used largely in outdoor work, and one of the largest individual purchasers of this product is the Postal Telegraph Company.

Western Electric Company to Market Conlon Washing Machine.—An alliance has been formed between the Conlon Electric Washer Company, of Chicago, and the Western Electric Company. Under the arrangements the entire line of the well-known Conlon electric washing machines will be marketed exclusively by the Western Electric Company under the trade name of the "Western Electric Conlon." This selling arrangement involves no changes in the manufactory. Ample stocks will be carried at each of the twenty-eight Western Electric distributing houses at shipping centers throughout the United States. The Western Electric Company is planning a sales campaign, a feature of which will be a complete merchandising plan which will enable the central stations and electrical dealers to push the sale of the machine aggressively.

Building Government Wireless Towers at the Isthmus.—The contract for erecting three steel towers for wireless-telegraph purposes in the Panama Canal Zone has been let to the Childers Construction Company, of Columbus, Ohio. J. L. Childers, one of the company's engineers, sailed recently for Panama to start the preliminary work. The steel is being fabricated at Toledo, Ohio, and part of it is ready for shipment. Each of the towers will be 600 ft. high, with a 150-ft. triangular base tapering to a 10-ft. triangle at the top. These towers will be planted about 90 ft. apart and close to the site of the Gatun Locks and will require a total of 1000 tons of steel. The work is expected to cover a period of about five months. J. L. Childers and his brother, W. B. Childers, who is associated with him, were both prominently connected with the building of the Gatun gates as engineers with the McClintic-Marshall Company, of Pittsburgh.

Conditions as a Wire Manufacturer Sees Them.—The Belden Manufacturing Company, of Chicago, Ill., manufactures a line of insulated wire and insulation for various electrical uses. Joseph C. Belden, the president of the company, speaking on conditions in the insulated-wire field, as well as of business in general, says the company's raw materials consist of copper wire, cotton, silk and rubber, and it finds present conditions in these markets satisfactory, prices having been reasonably stable for some time. Labor conditions are also fairly good. Mr. Belden states that he usually has to hire four people to fill two positions, but that there is plenty of work for all of fair ability who want to work. This company finds transportation conditions generally good, except that the railroads will, as a rule, evade all just claims until forced to settle. The parcel post has been found very useful. The rapid growth in the automobile industry has vastly increased the demand for the Belden company's goods.

Electrical Appliance Manufacturer on Present Conditions.—Some interesting information on electrical manufacturing conditions in the Middle West is given by J. A. Winger, of the Automatic Electric Washer Company, Newton, Ia. This company finds its raw-material markets in a satisfactory state, and it is able to buy at reasonable prices and in desired quantities, while deliveries are prompt. No trouble is experienced in obtaining intelligent labor. There are no labor unions and no labor troubles. Day wages are paid, and Mr. Winger states that this system of remuneration has produced more satisfactory results than the piece-work plan, which has been tried by some other manufacturers in the same vicinity. The nature of its work has not been such as to necessitate special training of its men by this concern. The product of this company is most largely used in the Central and Western States, although there is no reason as far as the management knows why this should be so. Proceeding on the supposition that it may be due to lack of information in the East on the product in question, the company has been advertising in Eastern papers, and this is stated by Mr. Winger to have somewhat increased its distribution in that territory. Concerning transportation conditions, the present railroad service is found by this company to be fairly satisfactory and shipments are generally handled quite promptly. The parcel-post service is used largely by this company and is proving very valuable. While professing uncertainty as to the merits of the recent request for an increase in freight rates, this company thinks that the delay in settling the question one way or the other is hurting business. It also thinks that the public can stand a 5 per cent increase in rates better than it can a 20 per cent decrease in business.

Sale of Electrical Apparatus to Industrial Companies.—Among recent sales of electrical apparatus by the General Electric Company, some of the larger orders have been secured from companies in different lines of manufacturing. The fact that these companies are widely scattered geographically, as well as in the variety of their product, seems to indicate that there is some activity in the industrial field, in spite of the general dullness now prevailing. The American Cement Plaster Company, Fort Dodge, Ia., will install electric-drive equipment, comprising thirty-four motors, ranging in size from 7½ hp to 75 hp, with switches and auxiliaries. Electric-drive equipment, consisting of thirty motors of from 1-hp to 35-hp rating, is to be installed in the Duluth (Minn.) plant of the Western Rug Company. An order for forty motors, ranging from fractional up to 125 hp, together with switchboard and accessories, has been placed by the American Bottle Company, of Streator, Ill. From the California Portland Cement Company, Colton, Cal., an order has been received for electric-drive equipment, consisting of thirty-five motors from 10 hp to 50 hp, and for a 25-kw motor-generator set, with relay panels, switches and other auxiliaries. The Power & Mining Machinery Company, Cudahy, Wis., is shortly to install thirty-three motors ranging from ⅜ hp to 150 hp. Three 1250-hp, two 1000-hp, one 300-hp, one 100-hp, and two 50-hp induction motors have been ordered by the St. Lawrence River Power Company for installation in its aluminum plant at Massena, N. Y. The drive equipment of the Crestmore (Cal.) plant of the Riverside Portland Cement Company is to be extended by the addition of nine motors of ratings between 10 hp and 200 hp, recently ordered, together with a complement of transformers and switches. The Ottawa Silica Company, Ottawa, Ill., has ordered six motors of from 35 hp to 100 hp, together with a 50-kw motor-generator set and auxiliaries. Thirty-eight 30-hp induction motors are to be placed in the Bedford (Ind.) plant of the Indiana Quarries Company in the near future. From the Iowa Portland Cement Company, Des Moines, Ia., an order has been received for a 160-kw motor-generator set and a 165-hp induction motor with switchboard and accessories. A 400-hp induction motor has been ordered by the State Phosphate Company, of Alafia, Fla. In the Whipanny (N. J.) plant of the Hanover Brick Company there are to be installed fourteen motors of ratings between 3 hp and 75 hp.

NEW YORK METAL MARKET PRICES

Copper	Apl. 21		Apl. 28	
	Bid	Asked	Bid	Asked
Standard spot*	13.40	14.00	13.37½	14.00
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	64 6 3		63 15 0	
Prime Lake	14.50	to 14.75	14.37½	to 14.62½
Electrolytic	14.20	to 14.30	14.10	to 14.20
Casting	14.05	to 14.15	14.00	to 14.10
Copper wire base	15.50	to 15.75	15.25	.....
Lead	3.80		3.90	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.15	to 5.25	5.00	to 5.10
Tin, spot	35.45	to 35.65	34.37½	to 34.62½
Aluminum:				
Prompt delivery	18.00	to 18.25	17.75	to 18.00
Future	17.87½	to 18.12½	17.75	to 18.00

*OLD METALS

Heavy copper and wire	13.25	13.25
Brass, heavy	8.62½	8.62½
Brass, light	7.62½	7.62½
Lead, heavy	3.80	3.90
Zinc, scrap	4.15	4.15

*COPPER EXPORTS

Total tons to Apl. 28..............................28,901

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*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Decision Reached on American Water-Works Voting Trustees.—The reorganization committee of the American Water Works and Guarantee Company has selected to act as voting trustees of the new American Water Works & Electric Company E. C. Converse, W. N. Cromwell, Howland Davis, Andrew Squire and A. H. Wiggin. These trustees will control the votes of the three classes of stock for a period of five years. Robert Wetherhill has agreed to serve on the board of directors of the new company.

Portland Railway, Light & Power Note Sale.—E. W. Clark & Company, of Philadelphia, Pa., have sold a five-million-dollar issue of one-year 5 per cent gold notes of the Portland Railway, Light & Power Company, the notes being dated May 1. Security for these notes has been provided by the deposit of $5,000,000 of the first mortgage, sinking-fund, thirty-year gold bonds of the Mount Hood Railway & Power Company, maturing in 1937, and of the entire capital stock (excepting directors' shares) of the same concern. The $25,000,000 capital stock of the Portland company is 75 per cent paid up, and the company is earning enough to pay dividends of 4 per cent on the full capitalization.

New Orleans Railway & Light Company Report.—The operating revenue of the New Orleans Railway & Light Company during the year ended Dec. 31, 1913, was $6,894,432, an increase of 4 per cent over 1912. Of this amount $4,401,152 was received from the railway department, $1,335,186 from the electric department, and $1,158,094 from the gas department. The operating expenses were $3,600,381, divided between the different departments as follows: Railway, $2,542,886; electric, $608,046; gas, $449,449. The net operating revenue was $3,294,051, an increase of 2.7 per cent. over 1912. Taxes were $724,535 and uncollectible consumers' accounts were $6,661, a total of $731,196. This left a net operating income of $2,562,855. Income from outside operations was $11,791, making a total operating income of $2,574,646. Miscellaneous income was $34,762. The gross income therefore was $2,609,408. Income deductions, including $23,375 for amortization of funded debt, discount and expense, were $1,731,879. This left a net income before deduction of dividends of $877,529, or after provision for dividends on a small amount of stock in affiliate companies owned by others, of $872,759. This is a decrease of 12.3 per cent. Hugh McCloskey, chairman of the board of directors, says in the annual report to stockholders that the decrease in net income, as compared with 1912, is due entirely to the increase in taxes. The board of taxation increased the assessment approximately $3,520,000, or 20 per cent. The increased cost of operation, due to increase in cost of materials and increased amount set aside to cover renewals and replacements, was $180,025. Charges for maintenance during the year amounted to $814,400, an increase of 4.1 per cent over the previous year. In addition, the company expended $225,230 for renewals and replacements, of which $180,812 was charged to operating expenses and $44,418 to depreciation reserve. Capital expenditures during the year amounted to $685,658. The company produced during the year 90,468,528 kw-hr.

Niagara Falls Power Company Report.—The combined income account of the Niagara Falls Power Company and the Canadian Niagara Power Company for the year ended Dec. 31, 1913, shows gross earnings of $2,742,192, an increase of $244,996 over the preceding year. Operating expenses, including $100,000 charged for obsolescence, inadequacy and as a reserve against extraordinary casualties, were $540,265, an increase of $75,167. They were equal to 19.7 per cent of gross earnings in 1913, as compared with 18.62 per cent in 1912. Net earnings were $2,201,927 last year and $2,032,099 in 1912. Other income, amounting to $116,058 in 1913, was composed of $77,153 interest and $38,905 dividends on stock owned. In 1912 the other income aggregated $148,564, of which $49,434 was interest and $99,130 was dividends on stock owned. The decrease is due to the discontinuance of dividends of the subsidiary, Cataract Power & Conduit Company and Tonawanda Power Company, following the order of the New York Public Service Commission, Second District, reducing power rates in Buffalo. Net income was $2,317,985 in 1913, as compared with $2,180,663 in 1912. Interest charges were the same in both years, $994,760. The other three items of charges show a slight decrease. Taxes were $194,162, as compared with $195,520. Insurance was $10,280, as compared with $10,561. Canadian Park rental was $48,673, as compared with $51,964. The total fixed charges, therefore, were $1,247,875, as compared with $1,252,805. The surplus income was $1,070,110, as compared with $927,858. Dividends of 8 per cent were paid on Niagara Falls Power Company stock. The combined balance sheet of the two companies as of Dec. 31, 1913 shows $886,220 reserve for accrued amortization of capital. Earnings of the subsidiary Cataract Power & Conduit Company for 1913 were $1,729,779; this, however, includes an item of $249,651, by which the total will be reduced if rates ordered by the New York Public Service Commission, effective from May 1, 1913, are finally upheld by the courts. Gross earnings of the Tonawanda Power Company in 1913 were $224,175, an increase of $14,140 over 1912.

Allis-Chalmers Annual Report.—The first annual report of the Allis-Chalmers Manufacturing Company shows the following items of income and expense for the fiscal period April 16 to Dec. 31, 1913: Sales billed, $11,127,621; cost, including depreciation and development expenditures, $9,503,472; factory profit, $1,624,149; selling, publicity, administrative and general expenses, $1,017,553; net manufacturing profit, $606,596; interest on investments, bank balances and discounts, $148,528; net profit, $755,124. A statement to shareholders by Otto H. Falk, the president, says that at the close of the year, Dec. 31, 1913, the unfilled orders on hand amounted to $3,358,684. Mr. Falk said: "There has been a marked decline in volume of business each month since Aug. 1, 1913, in sympathy with a general recession of business throughout the country. The plants engaged in manufacturing operations are in good condition at present and of ample capacity to handle a much larger volume of business, and with the changes and economies that have been effected in the various departments throughout the organization there is every prospect, with the revival of business, that the Allis-Chalmers Manufacturing Company will earn substantial profits. During the fiscal period there has been invested in marketable securities the sum of $1,862,038, which, together with other securities previously acquired of $240,050, gives a total of $2,102,088. An agreement has been consummated whereby the preferred stock of the Bullock Electric Manufacturing Company is to be exchanged for first mortgage 6 per cent bonds of that company at the rate of $80 in bonds for $100 of preferred stock and the payment of the accrued and past due dividends on the preferred stock of the Bullock company to Jan. 1, 1914, amounting to 7½ per cent. After this exchange is completed the Allis-Chalmers Manufacturing Company, which now owns all the common stock, except directors' qualifying shares, will be the sole stockholder of the Bullock Electric Manufacturing Company. The Allis-Chalmers Manufacturing Company has agreed with the holders of the preferred stock to purchase at any time on or before Feb. 1, 1915, all or any part of such bonds as may be tendered at 95 per cent and accrued interest. The board of directors carefully considered the question of the declaration of a dividend on the preferred stock out of the surplus profits of $755,124, but in view of the present depressed conditions concluded to adopt the conservative policy and defer taking action thereon until such time as current profits and future prospects would justify a reasonable assurance of the continuance of dividend payments." In certifying to the report, Price, Waterhouse & Company say: "We have satisfied ourselves that the properties and assets acquired as of April 16, 1913, have been properly recorded on the books, and that during the period to Dec. 31, 1913, only expenditures on actual additions and extensions to the properties have been charged to capital account, and that, having regard to the amounts expended during the period for maintenance of plant and equipment, reasonable provision has been made for depreciation and accruing renewals. All expenditures incurred during the period on experimental and development work have been charged off as operating expenses and the item of deferred charges includes only advance payments pertaining to the operations of subsequent years. Adequate provision has been made for doubtful notes and for all ascertained liabilities."

Business Notes

The Busch-Sulzer Brothers Diesel Engine Company, of St. Louis, Mo., has appointed W. S. Heger as manager of its Pacific Coast sales division, with offices in the Rialto Building, San Francisco, Cal. H. S. Jones and W. S. Heger, Jr., will be associated with him in the sales promotion in this territory.

The Franklin Electric Manufacturing Company, of Hartford, Conn., has appointed Benjamin Hayllar, Jr., as manager of its Philadelphia office at 1625 Real Estate Trust Building. Mr. Hayllar, Jr., was formerly district manager of the Westinghouse Lamp Company in the territory including Philadelphia and Baltimore.

The Edward Darby & Sons Company, Inc., has recently announced the completion and starting of a new manufacturing plant at 412-20 North Eighteenth Street, Philadelphia, Pa. The old plant of this company was destroyed by fire in February and a special effort has been made to resume operations at the earliest possible moment.

F. H. Lovell & Company, of Arlington, N. J., manufacturers of electrical specialties, announce the election of F. H. Lovell, Jr., to the offices of president and treasurer, succeeding J. H. Callender, former president, treasurer and general manager. Mr. Lovell is also president and treasurer of the Lovell-McConnell Manufacturing Company, of Newark, N. J. Mr. A. D. Hobbie, vice-president of the latter concern, has been elected general manager of the first-mentioned. Both of the new officers have been connected with F. H. Lovell & Company in the past.

New Industrial Companies

The Electric Refining Company, of Quincy, Ill., has been incorporated with a capital stock of $5,000 to manufacture metal and wood material, etc. The incorporators are Robert W. Daniels, Robert M. Nivan and Frank T. McDermott.

The Utilities Equipment Company, of Boston, Mass., has been incorporated with a capital stock of $25,000 to manufacture water, gas and electric meters. The incorporators are C. W. Trask, president; Fred J. Parker, of Jamaica, treasurer, and P. N. Jenkins.

The Alpha Electric Company, of New York, N. Y., has been granted a charter with a capital stock of $25,000 to manufacture and deal in electrical apparatus and supplies. The incorporators are G. H. Makepeace, J. M. Ferry and P. J. Carbone, of New York, N. Y.

The Kelvin Electric Company, of New York, N. Y., has been incorporated with a capital stock of $25,000 to manufacture and deal in electrical machinery, apparatus and supplies. The incorporators are C. McMillan and K. Tikios, both of New York, and S. Popper, of the Bronx.

The F. B. Grant Electric Company, of Cleveland, Ohio, has been incorporated by F. B. Grant, M. L. Thomsen, H. B. McGraw, Frederick A. Henry and Vernon A. Davis. The company is capitalized at $10 000 and proposes to deal in all kinds of electrical supplies; also to do wiring and construction work.

The Line Material Company, of South Milwaukee, Wis., has annouced that L. E. Hendee, vice-president, has taken active charge of its sales department, while W. D. Kyle, general manager, who formerly had charge of this department, will now devote more of his time to investigation and development work, in connection with the line of street-lighting fixtures and line-construction material made by the company.

The Richmond Electric Works, Richmond, Va., manufacturers of alternating-current motors, who have for a number of years been represented in the Philadelphia territory by E. B. Day, have discontinued their agency with him and have opened up their own offices at 1418 Walnut Street, Philadelphia, to take care of Maryland, New Jersey, Delaware and eastern Pennsylvania. A large stock of Richmond motors will be carried in Philadelphia to facilitate prompt deliveries. L. F. Johnston has been placed in charge of the Philadelphia branch office.

Trade Publications

Electro-Chemical Apparatus.—The Arthur H. Thomas Company, of Philadelphia, Pa., has lately issued some folders descriptive of the Troemner analytical balance and the Northrup high-temperature electric furnace, both of which pieces of apparatus it handles.

Limit Switches.—Bulletin 1037 of the Electrical Controller & Manufacturing Company, of Cleveland, Ohio, describes the company's type B limit stops for direct-current motors. Dimensions and prices are given, together with a brief note on the design and operation.

Belt Dressing.—"How a Central Station Can Overcome Its Belt Troubles" is the name of the latest pamphlet put out by the Cling Surface Company, of New York. The answer advocated is "Use Cling Surface," and the booklet indicates that a number of central stations do so.

Lighting Fixtures.—The Beardslee Chandelier Manufacturing Company, Chicago, Ill., has recently added some attractive designs to its line of chandeliers for semi-indirect lighting. These are illustrated—a single design on a sheet —on some recent additions to its loose-leaf catalog.

Lighting Glassware.—A card illustrating its "Intaglio" glass for semi-indirect lighting service has just been sent out by the Gleason Tiebout Glass Company, of New York City. Another card refers to the use of its "Albedoglas" and "Camia" glassware in the new Lord & Taylor store in New York.

Sewing-Machine Motors.—The Emerson Electrical Manufacturing Company, St. Louis, Mo., has just issued a catalog on its direct-current and alternating-current motors for use in operating sewing machines. Facts of interest to possible purchasers of such equipment are contained in the booklet, along with prices on the same.

Guy Anchors.—Matthews guy anchors are illustrated and described in a folder recently issued by W. N. Matthews & Brother, St. Louis, Mo. A leaflet has also been published on Type C Matthews "teleheight." This device gives the exact height in feet of any object from 18 ft. to 60 ft. above the point on which the observer is standing.

Insulated Wire.—The Peerless Insulated Wire & Cable Company, of 18 Broadway, New York, has just issued a small folder of interest to the prospective purchaser of insulated wire. In it are given the results of some recent tests made by the Electrical Testing Laboratories on samples of this company's product immersed in water for various periods. These tests indicate a high insulation standard for the product in question.

Portable Meters.—The latest publication of the Wagner Electric Manufacturing Company is entitled "A Manual of Electrical Testing," and Wagner portable instruments furnish the theme. The design, manufacture and use of these meters are first discussed, and after that, under the heading of general notes on electrical testing, a number of test methods are described in which Wagner meters can be used to advantage. Data on the various types of these meters are given at the end of the pamphlet.

Meter.—The Blonck boiler efficiency meter is the subject of a pamphlet recently published by W. A. Blonck & Company, Fisher Building, Chicago, Ill., bearing the title "A Key to Higher Efficiency in the Boiler Plant." Some practical information is given as to the actual performance of the Blonck meter, accompanied by numerous curves and diagrams. This device will, it is claimed, give instantaneous indication of any abnormal condition leading to the waste of fuel and will indicate the relative load being carried by the boilers.

Mechanical Transmission by Flexible Wires.—An eight-page pamphlet has been issued by the J. S. Bretz Company, 250 West Fifty-fourth Street, New York, importer of the Bowden wire mechanism for the transmission of reciprocating motion through a flexible and tortuous route. A full description of the uses of the device and a few hints on fitting the mechanism are given; also an illustration showing the principle of operation. Another pamphlet issued by this company gives the United States Price List for Bowden control apparatus for motor cycles, motor cars and other Bowden accessories.

Personal Mention

Mr. B. J. Grigsby, managing director of the Benjamin Electric, Ltd., of London, England, sailed from that city on April 24 for an eight weeks' trip in the United States in the interests of his company.

Mr. H. H. Rice, president of the Waverley Company, Indianapolis, Ind., manufacturer of electric vehicles, was elected president of the National Metal Trades Association at its recent convention in Worcester, Mass.

Mr. Dana Pierce, electrical engineer and agent at New York of the Underwriters' Laboratories, sailed on May 2 for England to visit the recently established London office of the laboratories, which is engaged in the examination and test of electrical and other goods manufactured in Great Britain.

Mr. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, has been elected president of the West Penn Traction Company of Pittsburgh, Pa. The latter company is controlled by the West Penn Traction & Water Power Company, which is in turn controlled by the reorganized American Water Works & Electric Company.

Mr. W. B. Brockway, who has been connected in executive capacities with various Ford, Bacon & Davis properties since 1900, has resigned from that firm to become comptroller of the Berlin Mills Company, with general offices at Portland, Maine. Mr. Brockway was identified with steam-railroad operating and accounting work prior to 1896. From 1896 to 1900 he was secretary and treasurer of the Toledo, Bowling Green & Fremont Railway, Toledo, Ohio. In 1900 he was appointed secretary-auditor of the New Orleans & Carrollton Railroad, Light & Power Company, New Orleans, La., and soon after became general auditor of the various Ford, Bacon & Davis and Newman properties in the South and West. In this responsible position Mr. Brockway acquired a very extensive knowledge of electric railway, lighting and gas accounting property under different conditions, and his experience on these lines became very valuable. He has also done a great deal of work and occupied executive positions during the past fourteen years with various public utility properties with which Ford, Bacon & Davis were connected, among others that of secretary and treasurer of the Sierra & San Francisco Power Company, which supplies power to the United Railways of San Francisco. Mr. Brockway has always taken a prominent part in the affairs of the American Electric Railway Accountants' Association. In 1906-7 he served as its president. He is the author of "Electric Railway Accounting," published in 1906. The Berlin Mills Company, with which Mr. Brockway becomes connected, is the outgrowth of the business established in 1852. The company manufactures newspaper, sulphite, fiber and timber. It has a paper mill at Berlin, N. H., with a capacity of 250 tons a day. Its timber lands are situated in Maine and New Hampshire, and it has extensive timber rights in Canada.

W. B. BROCKWAY

Mr. John P. Mallett, who has been engaged by the Society for Electrical Development, Inc., to investigate the application of electricity in the arts and industries, is a graduate of Tufts College, where he took a course in electrical engineering. His experience includes six years with the Westinghouse Electric & Manufacturing Company, eight years as chief engineer of the Northern Electric Manufacturing Company, and five and a half years as engineer in charge of the department of the development of special apparatus for commercial and government work at the Diehl Manufacturing Company.

Mr. S. B. Way has been made general manager of the Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company, the election being announced by Mr. James D. Mortimer, president of the North American Company, on April 21. Mr. Way became assistant general manager of the Milwaukee companies in November, 1911, and early in the year 1912 was elected vice-president. He is now placed in charge of the local management of the companies, his promotion being a deserved recognition of the ability he has demonstrated as a public-utility manager and executive. Mr. Way is thirty-nine years old and received his technical education at Drexel Institute, Philadelphia. He began his business career with the Electric Storage Battery Company of Philadelphia, for which he became erecting engineer. In 1898 he left the service of that company to become electrical superintendent of one of the electric-service companies in St. Louis, which later became the present Union Electric Light & Power Company of that city. Mr. Way remained in the service of the St. Louis company until appointed assistant general manager of the Milwaukee companies as related. In addition to his duties in Milwaukee Mr. Way is also actively interested in the management of the Wisconsin Gas & Electric Company, operating in Racine and Kenosha; the Watertown (Wis.) Gas & Electric Company, the Burlington (Wis.) Electric Light & Power Company, and the North Milwaukee Light & Power Company. He has been identified with public-utility business for nearly sixteen years, and during practically all that time has been associated with the interests that pertain to the North American Company.

S. B. WAY

Mr. Ernest Gonzenbach, formerly president and general manager of the Sheboygan (Wis.) Railway & Electric Company, has been appointed general manager of the Empire United Railways, Inc., of Syracuse, N. Y. The latter is a consolidation of the Rochester, Syracuse & Eastern Railway, the Syracuse, Lake Shore & Northern Railroad and the Auburn & Northern Electric Railroad. The company controls 138 miles of line, and affiliated with it are the Syracuse, Watertown & St. Lawrence River Railroad, the Newark & Marion Railway, the Sagamore Navigation Company and the Skaneateles Lake Transportation Company. Mr. Gonzenbach, who is well known in the electric-railway field and is the author of "Engineering Preliminaries for an Interurban Electric Railway," took charge of the property at Sheboygan in 1905 as general manager. He was later elected treasurer and subsequently vice-president and president. He is Swiss by birth and education and after acquiring electrical experience in power-house work in Chicago he completed the Thomson-Houston course at Lynn, Mass. In 1895 he constructed several electric-light plants in St. Johnsbury, Vt., and vicinity. Three years later he entered the employ of the Westinghouse Electric & Manufacturing Company, leaving that company in 1900 to become electrical engineer of the Albany and Hudson Railroad, one of the early third-rail roads. Subsequently he accepted a similar position with the Aurora, Elgin & Chicago Railroad, then under construction, after which he was engaged as consulting engineer, principally in the construction of the Youngstown & Southern Railway. In 1909 Mr. Gonzenbach was elected president of the Wisconsin Electrical Association.

ERNEST GONZENBACH

Construction

New England

BAR HARBOR, MAINE.—The Bar Harbor & Union River Pwr. Co., of Bar Harbor, is planning to extend its transmission line from Ellsworth to Blue Hill, a distance of 18 miles.

MONTPELIER, VT.—The Consol. Ltg. Co., of Montpelier, has begun work on the construction of a transmission line from No. 5 station, the upper Corry Deavitt Frost electric plant, to Plainfield, a distance of 6½ miles. The line will connect with the Molly Falls circuit at a station near the railroad depot.

FALL RIVER, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 25, for alterations in the heating, lighting systems, etc., in the United States custom house and post office in Fall River, in accordance with drawings and specifications. For details see proposals columns. O. Wenderoth is supervising architect.

HUNTINGTON, MASS.—The Boston & Abany R. R. Co. is planning to erect an electric power plant near the station in Huntington to furnish electricity for lighting its signals along the line between this station, the Chester and the Westfield stations.

MARION, MASS.—The Marion Gas Co. is reported to be securing the right-of-way for a transmission line through Wareham, which is to extend to Bourne and Carver, connecting with the extension now being erected by the Plymouth El. Lt. Co. on the South Meadow and Federal Furnace roads in Plymouth to the Carver line.

NORTH ABINGTON, MASS.—The El. Lt. & Pwr. Co., of Abington, is erecting a high-tension transmission line from the local station to the Cohasset station and thence to Greenbush, where the company will furnish 300 hp to the parties who have the contract for cutting away Coleman's Hill.

UNIONVILLE, CONN.—Within the next eight months the Union El. Lt. & Pwr. Co., of Unionville, expects to erect a new substation and about 8 miles single-circuit, 2200-volt, three-phase transmission line.

WILLIMANTIC, CONN.—The installation of an ornamental street-lighting system on Main Street, from Windam Street to Lincoln Square, is under consideration. The present plans provide for the installation of fifty-one ornamental iron poles, carrying one 100-watt lamp and four 60-watt lamps.

Middle Atlantic

DUNDEE, N. Y.—The Town Council has granted a franchise to Evelyn H. Bailey, owner of the local electric-light plant, to erect transmission lines and supply electricity in the towns of Starkey and Lakemont, about 3 miles distant.

EDEN, N. Y.—The installation of an electric-light plant in Eden is under consideration. E. C. Warner is interested.

LESTERSHIRE, N. Y.—The installation of a new street-lighting system in the near future is under consideration. The plans provide for the erection of 155 lamps, one for every street corner, and boulevard lamps on Main Street.

MIDDLETOWN, N. Y.—The Public Service Commission has granted the Orange County Ltg. Co., of Middletown, permission to issue $73,400 in bonds, the proceeds to be used for additions and improvements to its lighting system.

NEW YORK, N. Y.—The contract for installing electrical equipment in Public School 51, borough of Bronx, has been awarded by J. B. Snyder, superintendent of school buildings, to the New York Constr. Co., at $10,840.

NEW YORK, N. Y.—The contract for the construction of Section No. 1 of Routes 4 and 38 of the Seventh Avenue subway in the borough of Manhattan has been awarded to the Rapid Transit Subway Construction Co., at $2,121,077.

NIAGARA FALLS, N. Y.—The Board of Public Works has approved the proposal to extend the ornamental lighting system on Main Street to Falls Street, at a cost of $20,000.

ROCHESTER, N. Y.—A permit has been granted to the Cutlery Realty Co. for the erection of a central power plant (49 ft. by 70 ft.) at Euclid and Atlas Streets. A chimney 160 ft. high is also to be built.

ROCHESTER, N. Y.—The question of erecting lamps on the East Henrietta Road from Elmwood Avenue south has been taken up with the Rochester Ry. & Lt. Co. by Supervisors Hiram Shaw and DeForest Harmon. The district will include a part of the old fair grounds, later known as Crittenden Park.

WEEDSPORT, N. Y.—A special election will be held May 4 to submit the proposal to issue $18,000 in bonds to establish a municipal electric-light system. It is proposed to secure electricity from the Niagara Power Co. to operate the plant. The taxpayers will also vote on a proposition to contract with the Empire Gas & El. Co., of Auburn, to furnish street-lighting for a period of five years, at $2,296 per year.

DORMONT, PA.—Bids will be received by C. D. Dorning, borough clerk, 2967 Epsy Avenue, Pittsburgh, until May 8 for furnishing 50 or more (gas or electric) lamps for a period of two, three or five years, the contract to date from July 25, 1914, as follows: Electric lamps—100-watt street series tungsten lamps, 250-watt street series tungsten lamps, arc lamps; gas lamps —80-cp single inclosed Welsbach lamps.

LANCASTER, PA.—Bids will be received by A. F. Mowery, superintendent of the Frank E. Wilson Mfg. Co., corner Columbus and Wheeling Streets, Lancaster, Ohio, for construction of building, including general construction work, electric lighting, electric elevator, complete with safety devices, hot-water-heating system, etc. Plans and specifications may be obtained on application to A. F. Mowery, superintendent.

LEBANON, PA.—Plans are at present being considered for the installation of an electric-light plant in Lebanon to supply electricity for lamps and motors in the Lebanon valley. It is proposed to utilize the overflow water from the mineral spring in the Columbia Hall property in Lebanon Springs.

SCRANTON, PA.—Improvements will be made by the Scranton El. Co. in Scranton and the valley during the year, involving an expenditure of about $1,000,000. A large portion of this will be used for the installation of new machinery at the suburban plant on North Washington Avenue and the illuminating plant on the bank of the Lackawanna River.

SOMERSET, PA.—P. J. Morrissey, of Johnston, general manager of the Penn Pub. Ser. Co., has submitted a proposal to the Borough Council for the installation of a new street-lighting system, one for a three-year, one for a five-year and one for a ten-year term. The proposal provides for changing the 37 arc lamps now in use for 77 incandescent lamps, of which 33 would be of 200 cp, 19 of 100 cp and 26 of 80 cp.

YORK, PA.—Plans are being prepared for an addition to the steam auxiliary power plant of the Edison Lt. & Pwr. Co. at the rear of West Philadelphia and Water Streets, to increase the output of the plant by 6000 hp. The cost of the work is estimated at $200,000.

BUTLER, N. J.—The water and light committee has recommended to the Council the construction of an electric-light plant, the cost not to exceed $30,000.

CAMDEN, N. J.—The Public Ser. El. Co. has asked for permission to place underground conduits on Federal Street, from Cooper Street to the Delaware River.

NEWTON, N. J.—The Board of Public Utility Commissioners has instructed the Newton Gas & El. Co. to make improvements and necessary additions to its gas and electric plants to provide proper and adequate local service. W. L. Keplinger is receiver for the company.

SAYREVILLE, N. J.—The township committee is contemplating the installation of a street-lighting system in the Morgan Heights section. The Sayreville El. Lt. & Pwr. Co. furnishes the local service. Josiah Tice, township engineer, will have charge of the work.

EASTON, MD.—A commission, consisting of Martin M. Wright, Harry Clark, T. Hughlett, Col. James C. Mulliken and M. M. Higgins, has been appointed to take charge of construction of a municipal electric-light plant, to cost about $30,000. The proposed plant will furnish electricity for lighting the town and for power purposes.

MOUNT RANIER, MD.—The laws passed at the last session of the State Legislature authorizing the Mayor and the Council to issue $125,000 in bonds for the installation of an electric-light plant, waterworks and sewer system were ratified by the voters on April 23.

FAIRMONT, W. VA.—The Fairmont & Clerksburg Pwr. Co., of Fairmont, has applied to the Public Service Commission for permission to construct a dam and power plant at Valley Falls in Marion and Taylor Counties for the development of hydroelectric power. In addition to the Valley Falls project the company contemplates building a dam on the Buckhannon River and another power plant and dam near Pleasant Creek. It is understood that the dam at Audrey, which was first proposed by the company, has been abandoned.

MORGANTOWN, W. VA.—The Morgantown & Wheeling R. R. Co., it is reported, is contemplating the erection of two substations in connection with the construction of 15 miles of trackage between Morgantown and Wheeling.

LYNCHBURG, VA.—The city of Lynchburg, it is reported, is contemplating the installation of an electric-light plant.

LYNCHBURG, VA.—The Southern Ry. Co., it is reported, contemplates the construction of a power plant in Lynchburg to supply electricity to operate block signal and buildings and equip substations at other points. B. Herman, of Washington, D. C., is chief engineer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 19, for furnishing at the various navy yards and naval stations supplies as follows: Portsmouth, N. H., Schedule 6689—two 20-hp boilers complete. Brooklyn, N. Y., Schedule 6712—5400 ft. steel-armored submarine (twisted-pair) five-pair telephone cable; Schedule 6713—90 round standing lamps, miscellaneous lead pipe for lining steel tubing; Schedule 6691—one motor-driven, band-sawing machine, one motor-driven, vertical mortiser, one motor-driven revolving grinder and oilstone; Schedule 6701—miscellaneous No. 1, Morse taper shank, straight, right-hand end mills. Washington, D. C., Schedule 6699—1165 lb. miscellaneous cold-rolled sheet copper, 5025 lb. miscellaneous chemical lead pipe. Norfolk, Va., Schedule 6714—one horizontal single feed pump. Philadelphia, Pa., Schedule 6690—four right-hand and left-hand motor-driven 3-in. horizontal centrifugal pumps. Bids will also be received until May 26 as follows: Charleston, S. C., Schedule 6711—one motor-driven radial wall drill, two punching machines, one single-end shearing machine, two motor-driven squaring or gate shears, three sets bending rolls; Schedule 6710—one motor-driven bulldozer bending machine; Schedule 6704—one electric freight elevator. Washington, D. C., Schedule 6703—one electric furnace for shrinking pit for 5-in. 50-caliber gun; Schedule 6709—100 head telephone sets. Philadelphia, Pa., Schedule 6706—one motor-driven wet and dry grinder. Bids will also be received until June 30 for furnishing at the navy yards at Brooklyn, N. Y., Boston, Mass., Norfolk, Va., and Charleston,. S. C., 42 searchlights, spare parts and signaling shutters, 24 in., as per Schedule 6694. Applications for proposals should designate the schedule desired by number. T. J. Cowie is paymaster-general, United States Navy.

North Central

HIGHLAND PARK, MICH.—The installation of an ornamental street-lighting system is under consideration. Electricity for maintaining the lamps will be supplied by the Edison Illg. Co., of Detroit, pending the construction of a municipal electric-light plant.

ISHPEMING, MICH.—The Marquette County Gas & Elec. Co., of Ishpeming, contemplates making improvements to its electric-lighting and gas systems this summer. As soon as the weather will permit work will begin on the erection of a high-tension line to Palmer. A. C. Harrington is general manager.

MANISTEE, MICH.—We are informed that the city of Manistee does not contemplate the construction of a municipal electric plant as it is under contract with a private company for lighting until 1918. Reported in the issue of April 11 that the proposal to issue $35,000 in bonds to construct a gravity dam and power plant would be submitted to the voters this month. J. Christensen is city clerk.

NORTHVILLE, MICH.—The Edison El. Illg. Co. of Detroit has submitted a proposal to the Council offering to purchase the municipal electric-light plant and furnish electrical service here.

PONTIAC, MICH.—A committee has been appointed by the Pontiac Commercial Association to promote the installation of a new street-lighting system in the business section of the city.

UNIONVILLE, MICH.—Preparations are being made to install a municipal electric-light plant here, to cost about $8,000.

FREMONT, OHIO.—The Home Tel. Co., of Fremont, contemplates improvements to its system, including new cable lines, etc., to cost about $40,000. George W. Seaman is manager.

FREEPORT (PRAIRIE DEPOT), OHIO.—Contracts have been awarded by the village of Fremont to C. H. Holles, of Prairie Depot, for lighting the streets and municipal buildings in Freeport for a period of ten years.

LIBERTY CENTER, OHIO.—The contract for installing the electric-light system has been awarded to the D. R. Shea Elecl. Construction Co., of Defiance. Electricity for operating the system will be obtained from the Defiance-Toledo transmission line of the Auglaize Pwr. Co., of Defiance. Tungsten lamps will be used for street lighting.

OAK HARBOR, OHIO.—Contracts have been awarded by the Board of Public Affairs for the construction of the municipal electric-light plant as follows: To W. G. Nagel Co., of Toledo, for switchboard, at $1,302; Joseph Skeldon Engineering Co., of Toledo, for pumps, at $1,340; for general construction to the Gangle-Harbaugh Co., of Akron, at $7,169.

PORTSMOUTH, OHIO.—Bids will be received by the Portsmouth St. R. R. & Lt. Co. until May 15 for furnishing material and building 22 miles of electric railway. Plans and specifications may be obtained upon application to the company, for which a deposit of $10 will be required, to be refunded upon return of plans.

SPRINGFIELD, OHIO.—Plans, it is reported, will be prepared by M. J. Bahin, city engineer, for a cluster-lamp lighting system in the central section of the city.

SULLIVAN, OHIO.—The Council is considering the question of establishing an electric-light system in Sullivan.

WEST UNION, OHIO.—We are informed that as yet definite action has not been taken in regard to the installation of a municipal electric-light plant. C. W. Riffle is engineer in charge of the plans.

HODGENVILLE, KY.—C. L. Herron, owner of the local electric-light plant, is considering a proposal to furnish electrical service in Buffalo, from the plant in Hodgenville.

HOPKINSVILLE, KY.—The Kentucky Pub. Ser. Co. will replace the present arc-lamp street-lighting system with incandescent lamps. The new system will consist of 20 lamps of 600 cp, 80 lamps of 400 cp and 51 lamps of 80 cp; the 600-cp and 400-cp lamps to be of the nitrogen type. General Electric fixtures and Bryan-Marsh lamps will be used. A. C. Choate is superintendent.

LAWRENCEBURG, KY.—The Kentucky Public Utilities Co., it is reported, is remodeling the ice plant of the old Lawrenceburg El. Lt. Co. and will equip it with electrically operated machinery

LOUISVILLE, KY.—Plans are being considered by D. Long Miller and others to organize a company, to be known as the Bluegrass Improvement Co., to construct a hydroelectric plant. It is proposed to obtain permission from the government to develop water-power at Dam No. 41 on the Ohio River.

McBRAYER, KY.—Davis Brown, of J. T. S. Brown & Sons, it is reported, will install an electric plant to furnish electricity for lamps and motors for his new summer residence and for lighting the brewery and warehouses in McBrayer.

CRAWFORDSVILLE, IND.—Within the next 30 days the Crawfordsville El. Lt. & Pwr. Co. expects to purchase one two-circuit 100-lamp mercury rectifier and 10 magnetite arc lamps. F. H. Miller is superintendent.

EDINBURG, IND.—Within the next two months the Board of Electric Light Commissioners expects to purchase two 250-hp steel-incased return tubular boilers. George R. Mutz is superintendent.

LIGONIER, IND.—Within the next six months Lyon & Greenleaf, owners of the local electric-light plant, expect to purchase one boiler.

RENSSELAER, IND.—The city of Rensselaer expects to purchase at once conduit for ornamental street-lighting system and to purchase within the next few months 42 ornamental lamp standards. C. S. Chamberlain is superintendent.

APPLE RIVER, ILL.—The Warren El Pwr. & Lt. Co., of Warren, recently granted a franchise in Apple River, has been awarded a contract for lighting the streets of the village. E. J. White is village clerk.

CHICAGO, ILL.—The Sanitary District of Chicago has awarded the contract for electrical equipment, etc., for the Lincoln Street and Rice Street substations to the W. A. Jackson Co., of Chicago, at $26,800.

CHICAGO, ILL.—The engineering committee of the Sanitary District has voted to advertise for bids on 2000 new nitrogen lamps which are to be supplied to the city also to advertise for bids on synchronous condensers.

CHICAGO, ILL.—Bids will be received by John McGillen, clerk of the Sanitary District of Chicago, South Michigan Avenue, Chicago, Ill., until May 7 for furnishing electrical apparatus and supplies, including impedance coils, steel poles, arc-lamp windlasses, ornamental pole bases, base pole seats and insulated lead-covered cable. For further details see proposals columns.

EAST DUBUQUE, ILL.—The citizens have voted to authorize the City Council to grant the Union El. Co., of Dubuque, Ia., a franchise to furnish electricity in East Dubuque for street-lighting and for operating the municipal water department. The company agrees to furnish an all-night street-lighting service and to install 26 arc lamps of 400 cp. E. M. Walker is general manager of the Union El. Co.

FREEBURG, ILL.—Within the next two months the town of Freeburg expects to purchase equipment to change the municipal electric-light plant from direct to alternating current. The street-lighting system will also be changed to alternating-current series system. Oliver Hankammer is superintendent.

MONTICELLO, ILL.—The Monticello El. Lt. & Pwr. Co. may possibly purchase within the next few weeks two generators (60 cycles) and exciters to replace the 133-cycle generators now in use. John A. Glover, of Urbana, is general superintendent.

ROCK ISLAND, ILL.—The city is negotiating with the People's Pwr. Co., of Rock Island, for a new contract for street lighting. Under the new arrangement there will be about 610 street lamps against 300 under the present contract, of which 440 will be tungsten lamps and 200 arc lamps.

STERLING, ILL.—The Northwestern Barb Wire Co., of Sterling, expects to purchase a 300-kw, three-phase, 60-cycle, 200-volt directly connected generating unit.

EAU GALLE, WIS.—The Durand Lt. & Pwr. Co., of Durand, is reported to be contemplating the construction of a new power house and the installation of new equipment in Eau Galle, at a cost of about $10,000. H. A. Miles, of Durand, is manager.

PRESCOTT, WIS.—The New River Falls Pwr. Co., of Prescott, it is reported, has decided to build another hydroelectric plant and a 90-ft. reinforced concrete dam across the Kinnickinnic River at a point about a mile above the present power plant at Clifton.

UNION GROVE, WIS.—The village of Union Grove has voted to grant William Hardy a franchise to construct and operate an electric-light plant here. Under the terms of the franchise Mr. Hardy is to furnish 30 street lamps of 120 cp.

WEST SALEM, WIS.—Preparations are being made by the Neshonac Lt. & Pwr. Co., of West Salem, for the construction of a hydroelectric power plant. The equipment will consist of one 120-hp waterwheel, 150 r.p.m., operating under a 10-ft. head, and Lombard governor for same; one 75-kw, three-phase, 150 r.p.m., umbrella-type generator; one 60-kw, three-phase generator, belted; one switchboard for three-phase current; ten 1-kw, five 10-kw and three 5-kw transformers; 40 30-ft. (6-in. top) poles, some 35-ft. (6-in. top) poles, and some lightning arresters. Wire and insulators for transmission line have been purchased. Work will soon begin on the plant E. C Swarthout is president and manager.

COMFREY, MINN.—Bids will be received by G W Schaffer, village clerk, until May 5 for the erection of an electric light plant as follows: (1) Brick building (2) oil engines, (3) electrical equipment, (4) pole line Bids will be received on the whole or on separate divisions. W. C Buck, 151 Curtis Court, Minneapolis, is consulting engineer.

MINNEAPOLIS, MINN.—During the coming year the Twin City Rapid Transit Co. will expend about $2,000,000 in extensions and improvements to its properties in Minneapolis and St. Paul, part of which is already under way. At least one-quarter of the amount will be expended on the new generating station in Minneapolis. In addition, about 16 miles of extensions will be built in this city

MINNEAPOLIS, MINN—Bids will be received by the State Board of Control, State Capitol Building, St Paul, until May 11 for the construction of a Ladies' Gymnasium Building of the University of Minnesota, including general contract work, heating and ventilating, plumbing and electrical work, in accordance with plans and specifications prepared by C H. Johnston, architect, Capital Bank Building, St Paul. Bids will be received collectively and separately. Copies of plans and specifications may be seen at the office of the State Board of Control, at the office of George H. Hayes, comptroller University of Minnesota, and at the St. Paul and Minneapolis Builders' Exchanges.

ST. PETER, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until May 7 for the fireproofing and improvements to South Wing, first and second stories, second hall section, State Hospital, St. Peter, including general contract work, heating and ventilating, plumbing and electric work in accordance with plans and specifications furnished by C. H. Johnson, architect, Capital Bank Building, St. Paul. Bids will be received collectively and separately. Copies of plans and specifications may be seen at the office of the State Board of Control; at the office of the superintendent of the St. Peter State Hospital, St. Peter, and the St. Paul and Minneapolis Builders' Exchanges.

ST. PAUL, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, Minn., until May 15, for additions to Crippled Children's Hospital, Phalen Park, Minn., including general contract work, heating and ventilating, plumbing and electrical work, in accordance with plans and specifications furnished by C. H. Johnston, architect, Capital Bank Building, St. Paul. Bids will be received separately or collectively. Copies of plans and specifications may be seen at the office of the State Board of Control, Crippled Children's Hospital, Phalen Park, and the St. Paul and Minneapolis Builders' Exchanges. Extra copies of plans and specifications may be obtained on application to the architect on payment of cost of duplication.

ADAIR, IA.—Within the next three months the town of Adair expects to erect a transmission line to Casey, Ia. A 150-hp Ridgway engine, a 100-kw generator and switchboard were installed in the municipal electric-light plant last February. C. E. Morse is manager.

AFTON, IA.—Within the next four months the managers of the municipal electric-light plant expects to purchase material for 2 miles of new line. L. T. Brown is superintendent.

ALBIA, IA.—Within the next six months the Albia Interurban Ry. Co. expects to erect 17 miles of transmission lines; also within the next two months to purchase a 200-kw rotary converter, transformers, poles, transmission towers, insulators, incandescent lamps, etc. E. C. Manning is general manager.

CEDAR RAPIDS, IA.—The State Railroad Commission has granted the Iowa Ry. & Lt. Co., of Cedar Rapids, a franchise to erect a transmission line from Cedar Rapids to Tama, as part of the proposed line to Marshalltown. The company, it is said, will eventually extend the line to Boone.

DOWS, IA.—The Dows El. Lt. & Pwr. Co. expects to erect about 1 mile of pole-line extension within the next six months; also to purchase 24 fans (various types), six washing machines, and 24 "Hotpoint" stoves. G. D. Remer is superintendent.

MASON CITY, IA.—The Council has called a special election to be held May 11 to submit the proposal to grant a franchise to the People's Gas & El. Co., of Mason City, for a period of 25 years.

ROCKWELL CITY, IA—The Calhoun County Pub. Ser Co., of Rockwell City, expects to erect within the next 6 months 16 miles of transmission lines and three outdoor substations and to purchase equipment for same; also posts for lighting system. L. S Boyce is manager.

KANSAS CITY, MO—The Board of Park Commissioners is considering two propositions calling for overhead wiring in Swope Park. A proposition has been submitted to install a trackless trolley in the park. The board will choose between this system and granting a franchise to the Metropolitan St Ry Co, which would allow the latter to extend its lines into the park. The Council has passed ordinances providing for the installation of tungsten lamps on certain streets

PALMYRA, MO—Plans are being prepared by Freeman D Martin, engineer, 420 Rialto Building, Kansas City, Mo., for an electric-light plant for Palmyra, to cost about $30,000.

ST. LOUIS, MO—The El. Co. of Missouri, with headquarters in St. Louis, is contemplating extending its transmission lines to several towns in St. Louis County, including Manchester, Ellisville, Crescent, Eureka and Glencoe.

LANKIN, N. D.—Steps have been taken by the Village Board to secure street-lighting service in Lankin.

PORTAL, N. D.—The installation of a central power plant in Portal to supply electricity in Portal, Bowbells and Flaxton, and possibly one or two other cities, is under consideration. The cost of the plant is estimated at $35,000.

IROQUOIS, S. D.—The local electric-light plant is reported to have been purchased by Clayton Stoner and William Jordan.

SIOUX FALLS, S. D.—Bids will be received until May 21 by Bishop Biller, Sioux Falls, for construction of a fireproof building, to be known as the Bishop Hare Memorial, for All Saints' School at Sioux Falls, including heating, ventilating, plumbing and electric wiring, in accordance with plans and specifications prepared by Robert Perkins, architect, copies of which may be obtained on application to Bishop Biller. Plans are on file at the Builders' Exchange in Minneapolis, Minn.

GREELEY, NEB.—The Commercial Club of Greeley is reported to be negotiating with Frank Arnold, of Fullerton, for an electric-light system for Greeley. Mr. Arnold proposes to establish a plant and furnish electrical service to a number of towns.

MEAD, NEB.—All bids received April 17 for construction of a municipal electric-light plant were rejected. New bids will be asked for in the near future. E. E. Fetz is chairman of lighting committee.

ORD, NEB.—The property of the Ord El. Lt. Co. is reported to have been purchased by Peter and H. O. Hallen, of Iowa. The new owners, it is said, propose to make improvements to the plant.

SUPERIOR, NEB.—The Southern Nebraska Pwr. Co., of Superior, has applied to the Nebraska Railway Commission for authority to issue $100,000 in capital stock and $200,000 in bonds, the proceeds to be used for the construction of a hydroelectric power plant on the Republican River, near Superior. The company proposes to furnish electricity to about 20 towns in Nebraska, to which high-tension transmission lines will be erected.

WAKEFIELD, NEB.—The town of Wakefield has granted G. Wendt, of Winside, a franchise to construct and operate an electric-light plant here for a period of 15 years.

DODGE CITY, KAN.—The Midland Wtr. Lt. & Gas Co., of Dodge City, it is reported, is contemplating extending a transmission line to the Plains Academy near this city.

EFFINGHAM, KAN.—Bonds to the amount of $12,000 have been voted for the installation of a municipal electric-light plant in Effingham.

GARDEN CITY, KAN.—The Garden City Irrigation Pwr. Co., recently incorporated as a subsidiary of the Garden City Sugar & Land Co., has been granted permission to sell electricity in Kansas and is planning to extend its transmission lines 40 miles up the Arkansas Valley. The company will supply electricity for irrigation projects.

HORTON, KAN.—The contract for the erection of the new city hall is reported to have been awarded to Scott Brothers, of Concordia. A lighting plant, it is understood, will be installed in connection with the building.

PITTSBURG, KAN.—The Kansas Utilities Commission has authorized the Fort Scott & Pittsburg Ry. Co., of Pittsburg, to issue $950,000 in bonds for the construction and equipment of its proposed railway.

PITTSBURG, KAN.—The contract for furnishing poles for lighting 22 blocks, of the combined trolley-pole type with four pendent lamps and ball globes, has been awarded to the United Iron Works Co., of Pittsburg, at $12,384. L. E. Curfman is city engineer.

VERMILLION, KAN.—Bonds to the amount of $7,000 have been voted for the erection of a transmission line from Vermillion to Frankfort. Electricity for operating the local system will be supplied from the electric plant in Frankfort.

Southern States

BEAUFORT, N. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 23 for one 200-ft. steel tower with concrete foundations at the radio station at Beaufort. Plans and specifications can be obtained on application to the bureau. H. R. Stanford is chief of bureau.

WARSAW, N. C.—The city of Warsaw has engaged the J. B. McCrary Co., of Atlanta, Ga., to survey site, prepare plans and estimates of cost of installation of an electric-light plant, water-works and sewer system: the cost is estimated at from $35,000 to $50,000.

FLORENCE, S. C.—The city of Florence has closed a contract with the Florence El. & Utility Co., whereby a complete new street-lighting system will be installed. The new contract calls for the new nitrogen lamps to be erected on brackets.

CALDWELL, GA.—The installation of a municipal electric-light plant in Caldwell is reported to be under consideration.

CARTERSVILLE, GA.—The Georgia Pwr. Co., of Atlanta, it is reported, is contemplating the construction of a hydroelectric power plant (to develop 30,000 hp) on the Etowah River, 4 miles from Cartersville.

EATONTON, GA.—The City Council is contemplating issuing bonds for the construction of a hydroelectric plant. The city may purchase the Griffin mill water-power site on Little River.

LAWRENCEVILLE, GA.—The city of Lawrenceville expects to purchase within the next six months some medium-sized 30-ft. chestnut poles, a few lightning arresters for 2200-volt transmission line, 50 or more 6.6-amp tungsten street lamps (100 cp to 200 cp). The city would also like to receive catalogs on cooking devices, electric irons, etc. Edward Tarpley is city electrician.

MANSFIELD, GA.—At an election held April 20 bonds to the amount of $15,000 were voted for the installation of a municipal electric-light plant. J. G. Harwell, Jr., is town clerk.

DAYTONA, FLA.—It is reported that J. W. Wilbur, of Brookline, Mass., is interested in a project to establish an electric-light plant at Wilbur-by-the-Sea.

JACKSONVILLE, FLA.—The contract for remodeling the old water-works station as a substation and pumping station has been awarded to F. W. Long, of Jacksonville, at about $35,000.

MICANOPY, FLA.—Arrangements are being made for the installation of a municipal electric-light plant, for which bonds to the amount of $10,000 have been voted.

TAMPA, FLA.—Bids will be received by the Board of Public Works, Tampa, until May 12 for the construction of city hall and police headquarters. Bids will also be received at the same time for furnishing and installiing complete elevator equipment in both buildings. Plans and specifications may be obtained upon application to Bonfoey & Elliott, architects, Tampa, for which a deposit of $50 will be required, $40 of which will be refunded upon return of plans. D. B. McKay is chairman of board.

WEST PALM BEACH, FLA.—The Arsiton Ice & El. Co., of West Palm Beach, has recently completed the installation of a 300-kw General Electric turbo-generator set. C. H. Ellis is manager.

CHATTANOOGA, TENN.—Electricity for operating the new plant of the American Home & Singletree Co. in Chattanooga will be supplied by the Chattanooga Ry. & Lt. Co. About 150 hp will be required.

ELKMONT, TENN.—The Appalachian Club is contemplating enlarging its electric-light plant and water-works system here. For further information address the secretary of the club at Knoxville.

JACKSON, TENN.—An electric light and power plant, it is reported, will be installed in the new town settlement that the Wolf Valley Coal Co. is building for its employees in Eastern Kentucky, near the town of Jackson.

GADSDEN, ALA.—The Gulf States Steel Co., it is reported, has practically closed a contract with the Alabama Pwr. Co., by which the latter will furnish 3000 hp to operate the Gadsden steel mills. The steel company, it is understood, will install new electrical machinery, at a cost of about $40,000.

HARTSELLS, ALA.—The City Council has granted J. R. White a franchise to construct and operate an electric-light plant in Hartsells for a period of 30 years.

OZARK, ALA.—Bonds to the amount of $25,000 have been voted for improvements to the municipal electric-light plant and water-works system. B. C. Bowling is superintendent.

RAMSAY SPRINGS, MISS.—The Ramsay Mineral Springs Co., recently organized with a capital stock of $20,000, contemplates the installation of an electric-light plant to furnish electricity for lamps, fans and ice machinery for hotel and bungalows to be erected by the company. G. A. McHenry, of McHenry, is interested in the company. Ramsay Springs has not a post office.

CLARKSVILLE, ARK.—Preparations are being made by the Clarksville Lt. & Wtr. Co. to establish a 24-hour service May 1.

MAGNOLIA, ARK.—Arrangements are being made by the Arkansas Pwr. Co., which recently purchased the local electric plant, to change the street-lighting system. The number of lamps will be doubled. The plant will be rebuilt, new machinery installed and the output increased.

SNYDER, ARK.—The Renner Mill Co., of Snyder, it is reported, will install an electric-light plant.

NEW ORLEANS, LA.—Bids will be received at the office of the supervising architect, Treasury Department, New Orleans, La., until May 14, for furnishing and installing lighting fixtures in the United States post office and court house at New Orleans, in accordance with drawings and specifications, copies of which may be obtained at the above office or at the office of the custodian, New Orleans. O. Wenderoth is supervising architect.

FORT SILL, OKLA.—Bids will be received at the office of the quartermaster, Fort Sill, Okla., until May 20 for the construction, plumbing, heating and lighting of bachelor officers' quarters at Fort Sill.

EL PASO, TEX.—The El Paso El. Ry. Co. is contemplating the installation of additional machinery in its power plant.

Pacific States

EVERETT, WASH.—The City Council has signed a contract with the Puget Sound Trac., Lt. & Pwr. Co. for the installation of 539 incandescent lamps, ranging from 350 cp to 100 cp. The city is now lighted by 260 arc lamps. It is understood that work will soon begin on the installation of the new system.

MOUNT VERNON, WASH.—The commissioners of Skagit County have granted the Pacific Northwest Trac. Co., controlled by the Puget Sound Trac., Lt. & Pwr. Co., a franchise for the extension of its transmission lines throughout the county. Several smaller towns will be connected with the main transmission line.

SEATTLE, WASH.—The lighting department has accepted the recommendation of J. D. Ross, superintendent, authorizing the purchase of 2000 Sangamo meters and 1000 Westinghouse meters.

SEATTLE, WASH.—Within the next two months the Board of Public Works expects to erect a 500-kw substation at Henderson Street and Ninth Avenue, S. W., Seattle, to furnish electricity for the Lake Burien railway; also to purchase a year's supply of distributing transformers. A contract has just been awarded to W. R. Hendrey & Co., of Seattle, for 10,000 5-kw Fort Wayne meters. Glen Dunbar is chief electrical engineer.

SPOKANE, WASH.—The Spokane & Inland Ry. Co. is contemplating the construction of a new substation at McGuire's, on the Coeur d'Alene division of the road. The building will be 25 ft. by 45 ft., equipped with a rotary converter.

BAKER, ORE.—The power house of the Eastern Oregon Lt. & Pwr. Co. was recently destroyed by fire, causing a loss of about $75,000.

DRAIN, ORE.—The Council has passed an ordinance authorizing the construction of a municipal electric-light plant and a $15,000 bond issue to provide funds for same.

GOLD HILL, ORE.—The Rogue River Pub. Ser. Corpn., of Eugene, it is reported, will build a 5000-hp hydroclectric power plant, at a cost of $500,000, near Gold Hill. It is also reported that a similar plant will be built between this city and Grant's Pass. Both plants will furnish electricity for lamps and motors in nearby towns. George E. Sanders, of Eugene, is president of the company.

PORTLAND, ORE.—Within the next three months the Portland Ry., Lt. & Pwr. Co. expects to purchase regular supplies, including approximately 60 kw in small transformers, 600 poles, etc.; also a regular supply of incandescent lamps and electrical appliances and supplies. O. B. Coldwell is general superintendent.

THE DALLES, ORE.—It is reported that the United States Government machine shop and electric-light plant on the Dalles-Celilo canal project, at Big Eddy, was recently destroyed by fire, causing a loss of about $40,000.

BAKERSFIELD, CAL.—Bids wiill be received by the Board of Supervisors of Kern County, County Court House, Bakersfield, until May 12, for furnishing and installing crushing plant at Keene, near Woodford, on the Southern Pacific Railroad. Competitive designs and bids to be submitted by contractors for an electrically equipped plant of 1000 tons capacity in eight hours. An outline of general requirements and contour maps of the quarry site may be obtained at the office of the Kern County Highway Commission, Bakersfield.

FALL RIVER MILLS, CAL.—The California Pwr. & Mfg. Co., which was recently granted a franchise to furnish electricity in northeastern Shasta County, has begun operations. A transmission line is being erected to Glenburn, where electricity will be supplied for irrigation purposes. The local power plant, owned by Florin Brothers, upon which the company holds an option, is to be enlarged and the water-power of Fall River utilized as at present. The company also proposes to build another plant at the falls of Hat Creek. Leo Haas, of San Francisco, general agent, is preparing to open an office here.

GLENDALE, CAL.—The Board of Trustees is considering the installation of an electrically operated fire-alarm system. Residents living on the west side of the city have petitioned the city trustees for the installation of electroliers in that section. It is understood that electroliers carying five-lamp clusters, uniform with those already installed in the city, will be erected on two streets.

LOS ANGELES, CAL.—The city officials are considering the installation of an elaborate fire-alarm and police telegraph system in Los Angeles. The safety commission, consisting of Councilman Snowden, Fire Chief Eley, Chief of Police Sebastian and City Electrician Manahan, has charge of the matter.

OCEANSIDE, CAL.—Within the next six months the Oceanside El. & Gas Co. expects to extend its 6600-volt, three-phase transmission line to San Luis Rey and possibly to Carlsbad, also to purchase a four-pole, 50-amp, double-throw oil switch. Eugene V. Griffes is general manager.

RIVERSIDE, CAL.—The Southern Sierras Pwr. Co., of Riverside, is expecting to erect within the next three or four months 165 miles of 55,000-volt (wood-pole line), from San Bernardino to El Centro; also to erect two 900-kva substations and one 3750-kva station, with a 2000-kva synchronous condenser, at El Centro.

SACRAMENTO, CAL.—The city of Sacramento has just completed the installation of an electrolier street-lighting system, consisting of 560 cast-iron electroliers, carrying five-lamp clusters, at a cost of about $100,000. The city is about to advertise for bids for the installation of a municipal street-lighting system, which will consist of 825 6.6-amp magnetite arc lamps to be controlled by rectifiers and regulators, to cost approximately $113,000. The electrolier lighting system is maintained by underground wires. The new street-lighting system will be of aerial construction. All electrical construction is done under the supervision of the Department of Electricity. G. Stanley Pearce is city electrician.

SAN FRANCISCO, CAL.—Preparations are being made by the Pacific Gas & El. Co., of San Francisco, for extensions and improvements to its gas and electric service, at a cost of about $1,000,000. Contracts have been placed by the company for a series of motor-generator sets to enable the company to supply the demand for energy to operate the municipal street-railway system. In connection with this work and also the work about to be undertaken for the Panama-Pacific Exposition, the company finds it necessary to make material additions to its various substations. A new substation will be erected on Twenty-fourth Avenue. The company has entered into a contract with the Sierra & San Francisco Pwr. Co. for additional power to meet the demands of the exposition.

SOUTH PASADENA, CAL.—It is reported that the city has decided to adopt a uniform system of ornamental electroliers throughout the entire city. The standards are to be of steel with copper sheathing.

BOISE, IDAHO.—An order has been issued by Judge Frank S. Dietrich, of the federal court, authorizing the receiver of the Idaho-Oregon Lt. & Pwr. Co., Boise, to issue a receiver's certificate to the amount of $250,000, to be used for the completion of the Oxbow power plant on the Snake River, between Idaho and Oregon.

MOUNTAIN HOME, IDAHO.—Preliminary surveys are being made of the North Fork River for C. C. Burton, recently granted a franchise by the Arkansas Railroad Commission to construct hydroelectric plants on the White, Norfolk and Buffalo Rivers. The first dam, it is said, will be built near the mouth of Otter Creek

BRIGHAM CITY, UTAH.—The City Council is contemplating remodelling the municipal electric-light plant.

CASPER, WYO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 29 for the construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office in Casper. Drawings and specifications may be obtained at the above office or from the custodian of site at Casper. O. Wenderoth is supervising architect.

Canada

CAMROSE, ALTA.—The by-law providing for extensions to the municipal electric-light plant has been approved by the municipal Council.

EDMONTON, ALTA.—The City Council has passed the by-law providing $120,693 for extensions to the light and power system and $61,320 for telephone extensions.

KAMLOOPS, B. C.—Plans have been completed by Dueane & Dutcher, consulting engineers, Rogers Building, Vancouver, for the construction of a power house for the municipal electric-light plant.

KELOWNA, B. C.—The City Council is considering the question of appropriating $16,000 for the installation of a new generating unit in the municipal electric-light plant and $16,000 for additions to the water-works system.

VANCOUVER, B. C.—The City Council has passed an ordinance providing for the installation of cluster lamps on Seymour Street, to cost about $12,560.

FORT GARRY, MAN.—The City Council has passed a by-law authorizing the execution of an agreement between the municipality of Fort Garry and the city of Winnipeg, whereby the latter will furnish electricity for this municipality. Steps have been taken by the city to erect a $40,000 distributing system. Fort Garry has not a post office.

OTTAWA, ONT.—The City Council is considering plans for extension to the electrical station on Laurier Street East, for which new machinery will be required.

TILSONBURG, ONT.—The Council is considering the purchase of an electrically operated pump for the municipal electric plant.

WALLACEBURG, ONT.—The Wallaceburg Gas Co. has submitted a proposal to Mayor Dundas offering to sell its electrical plant for $30,000, on condition that hydroelectric power is connected with its lines by Dec. 31, 1914. The proposition will be submitted to the voters, together with a by-law appropriating $36,000 for equipment for the hydroelectric station. Electricity for operating the system will be secured from the Hydro-Electric Power Commission.

WINDSOR, ONT.—The Hydro-Electric Power Commission, it is reported, is contemplating the purchase of 2000 cedar poles, 25 ft. to 50 ft. long. D. Bowlby, 322 Sandwich Street West, Windsor, is chairman of commission.

WINDSOR, ONT.—Contracts have been awarded for the substations in Windsor and Walkerville for the Hydro-Electric Power Commission system. The contract for the Windsor station was secured by H. J. Christman, of Hamilton, at $10,000, and the Walkerville station was given to Wells & Gray, of Windsor, for $9,650.

LAKE MEGANTIC, QUE.—The Municipal Council has accepted plans prepared for the installation of a hydroelectric power plant, to cost about $150,000. E. A. Evans, 92 St. Peter Street, Quebec, is engineer in charge.

KAMSACK, SASK.—Tenders will be received by A. A. Crawford, secretary and treasurer, Kamsack, until May 13 for the following work: (A) For laying watermains and sewers; (B) power house and filter house; (C) furnishing material and erecting water tower; (D) cast-iron pipe; (E) fire hydrants and valves; (F) furnishing and installing pressure filters; (G) pumping machinery; (H) boilers; (J) steam engine; (K) generator; (R) furnishing material and constructing concrete reservoir; (S) sewer pipe; (X) furnishing material and construction of sewage-disposal works. Alternative bids will be received for gas producers and engines in place of boilers and steam engine of same capacity. Plans and specifications may be seen at the office of Chipman & Power, engineers, Toronto, Ont., and Winnipeg, Man.

SASKATOON, SASK.—By-laws are being advertised in Saskatoon to provide for loan on debentures in the sum of $200,000 for extensions to the municipal electric light and power plant as follows: For erection of new power house and purchase of site for same, $15,000 and $85,000 for extension to the electric light and power system.

Miscellaneous

JUNEAU, ALASKA.—The City Council has granted the Juneau-Douglas Tel. Co. a franchise to install a telephone system here.

JUNEAU, ALASKA.—The Alaska El. Lt. & Pwr. Co., of Juneau, expects to erect within the next six months a new power house and a 10,000-barrel oil tank for fuel oil; also to purchase a new 250-hp boiler and ½ mile of pipe (24-in. to 32 in. in diameter) and the usual amount of supplies to maintain plant. E. J. Margrle is manager.

New Incorporations

DOVER, DEL.—The South Kentucky Pwr. Co. has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $100,000. The incorporators are F. D. Buck, G. W. Dillman and M. L. Horty, of Wilmington. The company proposes to operate power plants, street railways, etc.

MARION, ILL.—The Ohio Valley El. Co. has been incorporated by E. H. Wykes, E. Lewis and E. T. Gallagher. The company is capitalized at $2,500 and proposes to construct and operate an electric light and power plant and transmission lines, etc. Dennison & Spiller, of Marion, are attorneys.

KINGSTON, N. Y.—The Kingston-Ellenville Trackless Trolley Co. has been incorporated with a capital stock of $5,000 by John Purce, 27 East Twenty-first Street, Paterson, N. J.; George J. Giger and Frank Leonard, of Paterson, N. J.

WAYNESBORO, MISS.—The Waynesboro Electrical Co. has been incorporated with a capital stock of $30,000 by C. C. Green, O. R. Green and J. Legett.

DALLAS, TEX.—The Belmont El. Co. has been organized with a capital stock of $5,000 by J. A. Sanders, H. W. Broure, and E. W. Morton, Jr. The company proposes to construct electric street and suburban railways and belt railways in and around Dallas.

BRANDON, VT.—The Hortonia Pwr. Co. has been incorporated with a capital stock of $50,000 by Edward D. Blackwell, Frank E. Chandler, of Brandon; A. G. Stone and A. W. Hyde, of Sudbury, and others. The company proposes to build a power plant in Hortonville. The office of the company is in Brandon.

SOUTH BEND, WASH.—The Willapa Pwr. Co. has been incorporated with a capital stock of $1,000,000, by Williamson S. Summers, Frank Mackean, M. R. Harriman, Lane Summers, C. R. Harold, Percy J. Perry, R. Stafford, S. Samuel C. Slaughter, of Seattle, Wash., and Frank Balcon, of Grand View.

RIGAUD, QUE., CAN.—The Rigaud El. & Milling Co. has been incorporated with a capital stock of $149,000 by J. A. Bourbeau, A. Mercier and J. Lafleur.

Directory of Electrical Associations, Societies, Etc.

Alabama Light and Traction Association. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala. Semi-annual meeting, Mobile, Ala., May, 1914.

American Association for the Advancement of Science. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

American Electric Railway Accountants' Association. Secretary-treasurer, E. B. Burritt, 29 West 39th St., New York.

American Electric Railway Association. Secretary, E. B. Burritt, 29 West 39th St., New York.

American Electric Railway Engineering Association. Secretary, E. B. Burritt, 29 West 39th St., New York.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Electro-Therapeutic Association. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

American Institute of Consulting Engineers. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual meeting, Detroit, Mich., June 23-25, 1914.

American Physical Society. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

American Society of Refrigerating Engineers. Secretary, William H. Ross, 154 Nassau St., New York City.

American Society for Testing Materials. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

American Society of Heating and Ventilating Engineers. Secretary, Edwin A. Scott, 29 West 39th St., New York.

American Water Works Association. Secretary, J. M. Diven, 47 State St., Troy, N. Y. Annual meeting, May.

Arkansas Association of Public Utility Operators. Secretary, W. J. Tharp, Little Rock, Ark.

Association of Edison Illuminating Companies. Secretary, Geo. C. Holberton, Pacific Gas & Electric Co., San Francisco, Cal.

Association of Iron and Steel Electrical Engineers. Secretary, W. T. Snyder, McKeesport, Pa.

Association of Railway Electrical Engineers. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, New Orleans, May 19-22.

California Electrical Contractors' Association. Secretary, W. S. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

Canadian Electrical Association. Affiliated with N. E. L. A. Secretary-treasurer, J. H. Larmonth, 610 Confederation Life Bldg., Toronto, Can.

Colorado Electric Club. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

Commercial Section, N. E. L. A. Secretary J. F. Becker, 1170 Broadway, N. Y.

Eastern New York Section, N. E. L. A. Secretary, C. S. Van Dyck, Schenectady, N. Y.

Electric Club of Chicago. Secretary, Fred M. Rosseland, Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

Electrical Contractors' Association of Greater Boston. Secretary, R. S. Hale, 39 Boylston St., Boston.

Electrical Contractors' Association of Massachusetts. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

Electrical Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

Electrical Contractors' Association of the City of Chicago. Secretary, M. N. Blumenthal, 179 West Washington St. Meets at noon on the second and fourth Wednesday of each month at 424 South Wabash Ave.

Electrical Contractors' Association of State of Missouri. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

Electrical Contractors' Association of Wisconsin. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

Electrical Credit Association of Chicago. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

Electrical Credit Association of Philadelphia. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa.

Electrical Salesmen's Association. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Next meeting Atlantic City, N. J., May 12-14.

Electrical Trades Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

Electric Vehicle Association of America. Executive secretary, A. Jackson Marshall, United Engineering Societies Building, 29 West 39th St., N. Y. Sections in New England, Chicago, Philadelphia and Washington.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

Faraday Electrical Association. Secretary, W. J. Collins, 1129 Masonic Temple, Chicago. Meets at noon on the first and third Wednesday of each month at Planters' Hotel.

Gas, Electric and Street Railway Association of Oklahoma. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual meeting, May 13-15, 1914.

Hydroelectric Section, N. E. L. A. Secretary, S. A. Sewall, 29 West 39th St., N. Y.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

Independent Electrical Contractors' Association of Greater New York. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

Independent Telephone Association of America. Secretary, W. S. Vivian, Grand Rapids, Mich.

Indiana Electric Light Association. Secretary, Thomas Donahue, Lafayette, Ind.

Institute of Operating Engineers. Secretary, L. Houmiller, 29 West 39th St., New York.

Institute of Radio Engineers. Secretary, E. J. Simon, 81 New St., New York.

Internal Combustion Engineers' Association. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex.

International Electrical Congress. Secretary-treasurer, Preston S. Millar, 80th St. and East End Ave., New York. Congress, San Francisco, Sept. 13-18, 1915.

International Engineering Congress. Secretary-treasurer, W. A. Cattell, Foxcroft Building, San Francisco, Cal. Congress, San Francisco, September, 1915.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 6-11, 1915.

Iowa Electrical Association. Affiliated with N. E. L. A. Secretary, H. B. Maynard, Waterloo, Ia.

Iowa Street and Interurban Railway Association. Secretary, H. E. Weeks, Davenport, Ia.

Jovian Order. Jupiter (president), W. N. Matthews, St. Louis, Mo.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

Kansas Gas, Water, Electric Light and Street Railway Association. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan.

Louisiana Electrical Contractors' Association. Secretary, J. J. Ziegler, 227 Bourbon St. Meeting every Wednesday, Audubon Building, New Orleans.

Maine Electric Association. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

Michigan Electric Association. Affiliated with N. E. L. A. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich. Annual convention, Detroit-Thousand Islands, June 17.

Minnesota Electric Association. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

Mississippi Electric Association. Affiliated with the National Electric Light Association. Secretary-treasurer, Frank J. Duffy, Natchez, Miss.

Missouri Electric, Gas, Street Railway and Water Works Association. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis. Annual meeting, May 21-23.

National Arm, Pin and Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Association of Electrical Inspectors. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

National District Heating Association. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, Rochester, N. Y., May 26-28.

National Electric Light Association. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, Philadelphia, June 1-5.

National Electrical Contractors' Association of the United States. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago. Annual meeting, June, 1914.

National Fire Protection Association. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass. Open meeting, New York, March, 1915.

National Independent Telephone Association. Secretary-treasurer, J. B. Earle, Waco, Tex.

Nebraska Section, N. E. L. A. Secretary-treasurer, S. J. Bell, David City, Neb.

New England Electrical Credit Association. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Section, Electric Vehicle Association of America. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass.

New England Street Railway Club. Secretary, H. A. Faulkner, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New England Section, N. E. L. A. Secretary, Miss O. E. Bursiel, 149 Tremont St., Boston, Mass. Annual meeting, Narragansett Pier, R. I., Sept. 2-4.

New Orleans Electrical Contractors' Association. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

New York Electric Railway Association. Secretary, Charles C. Dietz, 239 W. 39th St., New York.

New York Electrical Credit Association. Affiliated with the National Electrical Credit Association. Secretary, Franz Neilson, 80 Wall St., New York.

New York Electrical Society. Secretary, G. H. Guy, 33 West 39th St., New York. Annual meeting, New York, June, 1914.

Northwest Section N. E. L. A. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash.

Northwestern Cedarmen's Association. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

Oregon Electrical Contractors' Association. Secretary, F. C. Green, 291 East Morrison St., Portland, Ore. Annual meeting, Portland, June 8-9.

Pennsylvania Electric Association (State Section N. E. L. A.). Secretary-treasurer, S. C. Pohe, Bloomsburg, Pa.

Railway Signal Association. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

Society for Electrical Development, Inc. General manager, J. M. Wakeman, 29 West 39th St., New York. Annual meeting, New York, May 12.

Society for the Promotion of Engineering Education. Secretary, Prof. H. H. Norris, Ithaca, N. Y. Annual meeting, Princeton, N. J., June.

Southeastern Section, N. E. L. A. Secretary-treasurer, A. A. Wilbur, Columbus, Ga. Annual meeting, Isle of Palms, Charleston, S. C., Aug. 19-21, 1914.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. Annual convention, Galveston, Tex., May 20-23.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill.

Western Society of Engineers, Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

Wisconsin Electrical Association. Secretary, George Allison, 1410 First National Bank Bldg., Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 21, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,093,594. Phase Balancer; E. F. W. Alexanderson, Schenectady, N. Y. App. filed June 20, 1912. For polyphase transmission systems.

1,093,596. Electric Block-Signal Apparatus; J. Beaumont and F. G. White, Chicago, Ill. App. filed March 21, 1912. For use at main track and side track.

1,093,597. Electric Block-Signal Apparatus; J. Beaumont and F. G. White, Chicago, Ill. App. filed March 21, 1912. For side-tracking switch.

1,093,607. Junction Box for Electrical Conductors; C. W. Davis, Edgeworth, Pa. App. filed March 24, 1909. Distributing box.

1,093,614. Brush for Dynamo-Electric Machines; E. G. Gilson, Schenectady, N. Y. App. filed Jan. 29, 1913. Molded mass of copper, graphite, tin and more than a trace of iron.

1,093,615. Circuit for Electric Lighting or Power; M. H. Gray, Springfield, Ohio. App. filed Nov. 5, 1912. Internal-combustion storage-battery system.

1,093,621. Indicator; A. B. Hazard, Chicago, Ill. App. filed June 22, 1911. For indicating the operation of a switch, mail box, etc., at a distant point.

1,093,622. Automatic Switch and Locking Device for Lever Control of Steering Posts; R. Herman, Crafton, Pa. App. filed March 8, 1910. For locking the control levers in zero position with ignition circuit interrupted.

1,093,631. Brush Holder; A. Krauss, Cannstatt, Germany. App. filed May 23, 1911. For distributers of multi-cylinder engines.

1,093,650. Electric Generator or Motor; W. Rodgers, Hamilton, Ontario, Canada. App. filed Sept. 13, 1913. Dovetailed plates for securing laminations to frame.

1,093,670. Motor-Control System; M. A. Whiting, Schenectady, N. Y. App. filed Jan. 18, 1913. Electric motor and its control apparatus; protects against overload.

1,093,679. Auxiliary Alarm System; C. E. Beach, Binghamton, N. Y. App. filed June 30, 1913. Improved annunciator system.

1,093,702. Relay; I. Kitsee, Philadelphia, Pa. App. filed March 31, 1911. Polarized relay of moving coil type.

1,093,717. Rectifier of Electric Currents; T. J. Murphy, Rochester, N. Y. App. filed July 24, 1908. Has rotating electrodes.

1,093,754. Expansion Member for Electric Heating Devices; H. P. Ball, Pittsfield, Mass. App. filed Dec. 14, 1912. Heating units mounted in sheet-metal portions.

1,093,791. Electric Flatiron; C. P. Madsen, Chicago, Ill. App. filed Sept. 26, 1912. Has quick make-and-break pushbutton switch in the handle thereof.

1,093,792. Armored Electric Heating Unit; C. P. Madsen, Chicago, Ill. App. filed Feb. 3, 1913. Heating unit covered with wrapping of fireproof fibrous material incased in a continuous layer of powdered silica.

1,093,793. Electric Switch; J. F. McElroy, Albany, N. Y. App. filed. Aug. 11, 1911. Double-throw type.

1,093,794. Telephone Signal System; J. Meyerhoff, Chicago, Ill. App. filed Nov. 15, 1912. Connections made without any conversation between the user and the exchange operator.

1,093,801. Signal System; G. W. Phelps, Chicago, Ill. App. filed April 24, 1913. For bank cashiers.

1,093,803. Combined Telephone-Mouthpiece Guard and Advertising Device; G. Ross, Chicago, Ill. App. filed March 14, 1913. Hinged cover which may be lowered over the mouthpiece to exclude local talk.

1,093,809. Lock Construction; H. G. Voight, New Britain, Conn. App. filed April 17, 1913. With annunciator to indicate when the bolt is projected or retracted.

1,093,810. Lock Mechanism; H. G. Voight, New Britain, Conn. App. filed April 19, 1913. Annunciator indicates time elapsing between retraction of bolt by a particular key and the subsequent projection of said bolt.

1,093,857. Electric Igniting Device for Explosive Engines; L. C. Jackson, Buffalo, N. Y. App. filed May 16, 1906. Make-and-break igniter.

1,093,875. Electromagnetic Separator; B. T. Mottinger, Youngstown, Ohio. App. filed Aug. 4, 1913. Materials passed through openings in pole plates.

1,093,888. Current-Amplifying Apparatus and Circuits; H. E. Shreeve, Millburn, N. J. App. filed Aug. 20, 1912. Repeater apparatus for amplifying wireless signals.

1,093,893. Mounting for Fuses; C. G. Stoll, Brooklyn, N. Y. App. filed April 1, 1907. Has tubular porcelain shell.

1,093,926. Signaling System; R. H. Gaylord, Pasadena, and G. B. Capps, Los Angeles, Cal. App. filed April 28, 1913. For elevators.

1,093,947. Unit and Process of Making the Same; M. H. Rice, New Rochelle, N. Y. App. filed Oct. 1, 1913. Passes current through a carbon rod placed in powdered enamel contained in protective casing so as to fuse the enamel to said rod.

1,093,951. Case and Cap for Telephone Receivers; L. Steinberger, Brooklyn, N. Y. App. filed Jan. 13, 1913. Reinforcing rings on the receiver case and cap.

1,093,955. Combination Sash Lock and Alarm; J. Tregoning, New Haven, Conn. App. filed Nov. 27, 1912. Alarm given when sash is opened more than the predetermined extent.

1,093,957. Electrode; E. Weintraub, Lynn, Mass. App. filed April 6, 1912. Carbon, calcium cyanamide, titanium oxide and rutile.

1,093,968. Electric Furnace; R. S. Bicknell, New York, N. Y. App. filed Oct. 25, 1913. Non-metallic resistors; resistance varied by changing path of current.

1,093,972. Wire Connector; W. C. Cady, Middletown, Conn. App. filed July 11, 1913. Spring-pressed clamping plate retracted by pressure on exposed buttons.

1,093,983. Repulsion-Motor Control; F. Eichberg, Berlin, Germany. App. filed Nov. 18, 1911. Reversal obtained by shifting the brushes while maintaining the proper phase relations.

1,093,997. Conducting Seal for Vacuum Containers; C. A. Kraus, Newton Highlands, Mass. App. filed April 5, 1912. Tube of conducting material sealed through the container wall.

1,094,030. Electric Fuse; S. D. Sprong and W. E. McCoy, New York, N. Y. App. filed Sept. 6, 1912. U-shaped fuse strips for controlling two circuits.

1,094,036. Fuse Plug; S. Terada, Seattle, Wash. App. filed May 22, 1913. Fuse cartridge insertible in body of plug.

1,094,051. Ignition Device; J. Berg, Chicago, Ill. App. filed Sept. 18, 1912. For lighting cigars.

1,094,073. Controlling Device for Subsequently Identifying Persons at a Business Negotiation and the Like. A. Ilg, Zurich, Switzerland. App. filed March 25, 1913. Time stamp closes circuit through camera, which takes an identifying photograph of the person involved in the transaction.

1,094,077. Variable-Speed Dynamo; H. Leitner, London, England. App. filed April 11, 1912. For train lighting.

1,094,083. Electric Sign; A. C. Meyer, San Diego, Cal. App. filed Oct. 23, 1912. Flasher and sign changer.

1,094,102. Repulsion Motor; A. Simon, Milwaukee, Wis. App. filed Nov. 29, 1907. Electromotive force of one or both sets of displaced primary coils varied to change the angular position of the primary flux.

1,094,103. Automatic Block Signaling System for Electric Railways; O. E. Stevens, New York, N. Y. App. filed Nov. 3, 1908. Rails conductively continuous to propulsion current with cross bonds at ends of blocks.

1,094,104. Automatic Block Signaling System for Electric Railways; O. E. Stevens, New York, N. Y. App. filed Dec. 31, 1908. Employs a reactance device consisting of a magnetic core, a fixed coil and a movable coil.

1,094,106. Electromagnetic Fishing Tool; C. N. White, Maricopa, Cal. App. filed Dec. 23, 1912. For recovering drilling tools from a well.

1,094,109. Conduit; C. J. Alpaugh, Trenton, N. J. App. filed July 29, 1913. Sheet-metal trough and cover.

1,094,121. Resistance Unit for Controllers; H. W. Cheney, Milwaukee, Wis. App. filed Oct. 6, 1909. Heat-dissipating means for compression resistances.

1,094,125. Magnetic Separator; R. W. Cousins, Chicago, Ill. App. filed Sept. 11, 1908. For treating comminuted cinder and flue dust from blast furnaces.

1,094,137. Contact-Shoe Device for Third-Rail Systems; H. S. Farquhar, Bryn Mawr, Pa. App. filed Aug. 14, 1912. Contact shoe automatically thrown out of or into operative position.

1,094,141. Process of Electric Welding; G. Gnüchtel, Lauter, Germany. App. filed Jan. 15, 1913. Places an intermediate layer requiring a higher welding heat between the electrodes and the parts to be welded.

1,094,156. Battery Regulator; E. Lowe, New York, N. Y. App. filed July 26, 1913. Regulating resistance for telephonic outfits used by the deaf.

1,094,170. Bell Ringer; J. E. Scovill, Chicago, Ill. App. filed Sept. 13, 1911. Electromagnetically released trigger locks hammer in retracted position.

1,094,173. Battery Terminal; J. M. Skinner, Philadelphia, Pa. App. filed Nov. 16, 1912. Annular flanges on terminal prevent creeping of electrolyte.

1,094,206. Pull Socket; C. R. Hare, Hartford, Conn. App. filed Dec. 18, 1913. Shell lining is bulged outward adjacent to chain slot to provide clearance.

1,094,224. Process for Producing 1, 3-Diols; L. P. Kyriakides and R. B. Earle, Cambridge, Mass. App. filed Dec. 21, 1912. Electrolytic reduction of ketone-alcohols in acid media.

1,094,238. Electrically Driven Pendulum; G. Nobis, Davenport, Ia. App. filed June 2, 1913. T-shaped circuit-breaker swung by the pendulum.

1,094,292. System for Operating or Controlling Time-Indicating Devices; L. J. Aron, London, England. App. filed May 17, 1912. Master and secondary clock system.

1,094,352. Refractory Fibrous Material and Process of Making the Same; E. Weintraub and F. A. Kroner, Lynn, Mass. App. filed May 2, 1913. Contains silicon, carbon and oxygen; for heat insulating purposes.

1,094,354. Electric Furnace and Process of Heating Substances; E. F. Von Wilmowsky (deceased), Boston, Mass. App. filed Oct. 28, 1896. Produces a "traveling" or an "oscillating" arc.

1,094,355. Electric Furnace and Process of Heating Substances Uniformly and at a Controllable Temperature; E. F. Von Wilmowsky (deceased), Boston, Mass. App. filed Oct. 28, 1896. Magnetic field disperses or spreads the arc, and a current of gas is led past the arc.

1,094,356. System of Automatic Block Signaling for Electric Railways; S. M. Young, New York, N. Y. App. filed Feb. 8, 1906. Traffic rails divided in blocks and bonded to form separate returns for propulsion current.

1,094,362. Thermostat; J. Boekel, Philadelphia, Pa. App. filed Feb. 12, 1913. One contact floated on a mercury column and partly immersed therein.

1,094,371. Process for Extracting Metals from Ores; H. S. MacKay, Norwich, Conn. App. filed April 16, 1913. Extracts copper by roasting in presence of sulphur, leaching and electrolyzing.

1,094,381. Electric Furnace for and Process of Heating Substances Uniformly and at a Controllable Temperature in an Electric Arc; E. F. Von Wilmowsky (deceased), Boston, Mass. App. filed Oct. 28, 1896. Passes the substance through a diffused electric heating discharge.

1,094,389. Electric Motor; W. K. Howe, Rochester, N. Y. App. filed Aug. 8, 1911. Parts are cased in to prevent entry of foreign material between stator and rotor.

1,094,407. Means for the Regulation or Control of Railway and Like Traffic; H. Von Kramer, Birmingham, England. App. filed Feb. 5, 1913. Line wire parallel to track and inductive frame carried by vehicle.

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Limits on the Rate of Return At a recent meeting of the Finance Forum of the Young Men's Christian Association in New York Mr. Calvert Townley mentioned what he termed the principal object of regulation of public utilities by the public, namely, limitation of the rate of return. His conclusion was that in its efforts to limit the return the public should not go too far, that it should see that the return permitted is as large as it ought to be. The times are hard for the borrowing corporation. While the public has introduced methods of regulation that tend to keep the rate of return down, the financial markets of the world have exacted higher interest rates. Between the desire of the public to prevent high rates of return and the refusal of investors to advance more money at doubtful or inadequate rates of return, the corporations are in serious danger of not being able to obtain the capital needed for extensions. If the public chooses so to do, it can decide that the rate of return on capital investment already sunk in a property shall be limited to a certain rate. But it cannot decide arbitrarily what rate future capital investment shall earn. It can say what rate it would like to allow, but if it cannot get the capital at that rate it loses the benefit that investment of the capital would give. If it says that bondholders should be content with 5 per cent and they will not buy at better than 6 per cent, those who have the capital desired can dictate the terms on which they will lend it. The public should not deal unfairly with capital that is already sunk in a property and then, only under compulsion, deal fairly with the owners of new capital awaiting investment. If it attempts this, holders of the new capital will be afraid that they will be subjected later to the same treatment that is given to the owners of the initial investment and will withhold their money. If investors withhold their money for a long period of time the effect will be a suspension of all new construction by the companies. Such a result is a grave detriment to the prosperity of a community.

Financing Amalgamation in London The financing of the plan discussed for amalgamation of the supply of electrical energy in the city of London is a matter of vital concern. It serves to test the economic worth of the scheme. It is natural that the community should wonder what the new undertaking can do in the way of financing itself. The conclusion of Messrs. Merz and McLellan is that, assuming that all the existing generating plants in the central area were under one control, it would pay to shut them down and sell most of the plants and generate all the energy produced in centralized plants on the Thames River. The saving in operating cost is estimated at not less than 18 per cent, or about £170,000 a year, after allowance for all capital charges on new plants and mains. According to the figures submitted, this saving, together with the present sinking funds, would permit the writing off of the existing generating plant by 1931, or in seventeen years. The initial capital outlay required, allowing for growth of demand during the next four years, is stated at between £6,000,000 and £7,000,000. The suggestion is, in effect, that part of the saving in operating cost due to the amalgamation be applied toward amortization of the abandoned plant. In order that disappointment may not follow any over-enthusiasm in the advance estimates, it is important that the figures be reviewed with great care and conservatively. The best way of attaining the advantages sought is to recognize that capital losses are unavoidable and that proper provision should be made for them within a reasonable period of years. There should be an agreement between the constituted authorities and the public, and the facts should be clear. This country has much to suggest to London in examples of concentration in energy generation, but it has not dealt as frankly with the public as the London report on the question of abandoned elements of plant cost. The report therefore carries a lesson to central-station managers here.

Telegraphing Photographs A very interesting group of photographs reproduced electrically over telegraph wires have recently appeared in the columns of the *Elektrotechnische Zeitschrift*, with a description by Prof. Artur Korn. The photographs have been made by a sort of telautographic process. The sending-end portrait is mounted on a revolving cylinder like a phonograph cylinder, and a conducting stylus traces a spiral over it in such a manner that the current transmitted from the stylus to line varies, from moment to moment, with the photographic-layer thickness. At the receiving end a string galvanometer is used to control an intense and focused beam of light incident on the photographically sensitive surface of a similar and synchronously revolving cylinder. The string in the galvanometer carries a minute opaque shutter, so that the intensity of the photographing beam varies, from moment to moment, with the strength of the current received over the line. The freedom of the vibration galvanometer string from inertia enables the process to be applied very rapidly, and with strikingly satisfactory results, as compared with those obtained by older methods.

The Study of Street Lighting

Mr. James R. Cravath's notes on street lighting bring to the front the new problems which have been introduced by recent illuminants. Until within two or three years the introduction of powerful light sources in street illumination implied the use of arc lamps. At the present time, thanks to the nitrogen lamp, this situation is entirely changed, so that the old relations which existed between large and small units with respect to costs have undergone considerable alteration. No one yet knows the effect of these recent powerful incandescent units on the economy of the situation. They are efficient and simple to operate. They do not require trimming in the sense in which even the longest-burning arc lamps require it, and save for the lamps themselves there are no considerable repairs or renewals to be taken into account. Furthermore, even if the economic features of the new lamps were known at the present moment, the situation is liable to sudden change if the price of lamps should be altered, as experience shows is likely to be the case. Nor have the fixtures for nitrogen lamps been so far standardized that one can safely estimate the best spacing and height for the several units. As a matter of fact, the fixtures cannot be standardized successfully until the sizes and shapes of the bulbs for these lamps are also standardized. As Mr. Cravath plainly shows, we are starting out on a new experimental period in which all these relations must be established.

It is a matter for congratulation that some of the problems set out by Mr. Cravath fall within the sphere of action of experimental work projected by the street-lighting committee of the National Electric Light Association. An actual attempt to determine lighting effects over a considerable extent of street by the use of variously arranged illuminants is likely to lead to results possessing at least a direct bearing upon the questions which are now set before the illuminating engineer. Even larger, however, than the purely technical problems thus to be considered are the psychological ones. From the standpoint of the citizens who, in the last resort, pay for street lighting, the effect is as important as the measured amount of illumination or the characteristics of its distribution. It is undoubtedly true that, retaining the same total light flux on the street, one could produce good or bad illumination from either arc or incandescent lamps. Goodness and badness are not to be measured in lux from the standpoint of any knowledge at present available, nor can they yet be defined in terms of any definite specification. Indeed, the same specifications may lead to good lighting in one place and bad lighting in another. It is very noticeable, for instance, that the proposed standard specifications brought forward in England last year would lead to radically different arrangements of the units under British and American conditions.

It is to be hoped that in the work undertaken by the National Electric Light Association particular attention will be paid to that psychological phase of the matter which determines the pleasant or unpleasant impression produced by various methods of lighting upon the man in the street. The facts in the case are not easy to discover, since one has to deal not only with perhaps widely different viewpoints among individuals but also with very intricate and troublesome phenomena of suggestion. It is one matter to provide suitable types of illumination to be observed, and quite another matter to ascertain the spontaneous opinions of observers about them and the definite reasons, if any, upon which these judgments are based. Whatever concrete results may be reached by the N. E. L. A. committee, it is certain that just at the present moment street lighting is in a phase of rapid transition, the result of which cannot yet be safely predicted.

Polyphase Radio Transmitters

Since the polyphase radiotelegraph work of Eisenstein in Russia began, some eight years ago, radio engineers have shown much interest in the use of polyphase current for charging condensers which thereafter discharge to produce electrical oscillations in radiating antenna systems. From the beginning of work in this direction it has been clear that if enough equally displaced phases are used, or if the frequency of each phase is sufficiently great, waves can be radiated in groups at a very high group frequency. It has appeared that by this method, when circuit reactions are minimized and if the regular operation of each phase circuit is assured, it is possible to emit from an antenna radiant energy in a practically unbroken stream.

In the original polyphase transmitter use was made of a plurality of antennas, each being charged in its turn by one phase of the exciting current and then discharging to ground, with oscillations, across its own series spark-gap. Various other schemes have been proposed from time to time, and some have been put into more or less successful operation. In this issue Mr. Edward G. Gage describes a sending apparatus, comprising quenching spark-gaps and a special 6000-cycle, three-phase alternator, with which he has experimented. With this arrangement of instruments it is possible to secure group frequencies as high as 36,000 per second—a value entirely above the upper limit of audibility in telephone receivers. Such radiation has many of the characteristics of sustained waves as produced by a radio-frequency alternator and may be used for wireless telegraphy with receivers intended for continuous wave transmission, or for radiotelephony. In fact, at a wave frequency of 150,000 per second—wave-length 2000 meters—and a group frequency of 30,000, a new wave train will start at about each fifth oscillation, so that if the antenna damping is not unduly high the emitted wave will be practically sustained. It appears that for best results the wave frequency should be chosen an exact multiple of the number of groups per second, for then there will still exist a fixed phase relationship between the last wave of each train and the first of the succeeding group.

The trend of long-distance radiotelegraphy seems to be away from grouped-wave transmission and toward continuous radiation. In radiotelephony arcs producing sustained waves are being abandoned, and in their stead appear various types of spark oscillators capable of creating large numbers of wave groups per second. The multiphase transmitter, as described, may be considered to occupy a middle ground; although its emission is not absolutely continuous, yet its group frequency is far above the minimum of, say, 4000 per second upon which excellent radiotelephonic speech can be transmitted. It seems possible that the flexibility of the apparatus will commend it for many purposes and that the polyphase method or some development of it will find useful application in the near future.

Compulsory Sale of Utilities

As noted in our Digest, the London *Electrician* is opening a discussion of the relations of public utilities to municipalities which promises to bring the facts of the case before the public eye in a way to compel attention. The situation in England is somewhat different from that ordinarily found in this country, but the underlying principles of the relation of utilities to the community are not confined to any one quarter of the world. The point of the matter is that our English friends have experimented with municipal ownership until the whole situation is greatly confused. Beyond doubt some of the British municipal plants have been highly successful, owing to skilful management and especially because of the very limited territory served by the average plant of this kind. There have been many other municipal plants which, if not absolutely and disastrously unprofitable, are struggling along without showing to the taxpayers a very creditable balance sheet. In this respect the situation is simply what is to be expected. That is, when an enterprise is well handled under favorable conditions it succeeds whether publicly or privately owned; if the management is bad and the conditions unfavorable—a situation more likely to arise in the case of a municipal plant than one privately owned—the results are unsatisfactory.

So far as London is concerned, the greater part of the electricity supply is in the hands of private companies, which have spent in the aggregate some $70,000,000 in development. At the present time consideration is being given to a project for wholesale electricity supply throughout the entire district in the interest of economy, and such supply, doubtless, if carried out, sooner or later would take over as customers most of the municipal plants. But there stands before the eyes of British investors a threatening specter in the form of the compulsory sale of their properties seventeen years hence to the London County Council, if it elects to take them over. This situation is of importance to American investors since within late years not a few franchises have been granted for public utilities with similar provisions for purchase incorporated therein. The terms of a liberal franchise seems long from the nearer end, and investors too often think merely of current profits and well-nigh certain growth, without remembering what may happen at the termination of the franchise. The London companies are in a situation where the end looms large, and from their plight investors here may well take warning. The terms of compulsory sale are based on the value of the plant, buildings and mains at the time of purchase, without regard to good will, a specification which has a somewhat familiar sound to American ears. Just what price could be obtained under such an arrangement is uncertain until the courts have passed upon it, but it assuredly is not such a price as the enterprise would bring at private sale to a new group of investors. In most states of our own country there are provisions for municipal ownership by buying out the existing plant on a valuation excluding franchise values. In the few cases where such a purchase has actually been made the value of the plant as a going concern has been maintained high enough to permit the owners to obtain a fair amount of compensation. The British provision is more burdensome and the end is sufficiently near at hand to discourage great activity in building up an investment which must evidently in considerable measure be sacrificed. That phase of the matter was well shown in the taking over of the telephone properties by the British government, the results of which are certainly not encouraging to those who believe in a general public ownership of utilities. What keen interest can the owners of private plants have in a system of unified supply, which might greatly benefit the consumer, if the business must be sold on its physical valuation at the end of a short term of years? The owners would be more than human if they were not tempted so to operate the property as to secure the maximum profits.

The London situation is nearly enough related to our own to be worth critical study. English opinion, indeed, seems to turn favorably toward the recent American rule of commissions as a successful remedy for the disease of deferred and uncertain municipal ownership. It is clear that under American conditions municipal ownership and operation of electric supply is likely to prove disadvantageous—even more so than the activities of the most unwise commission. Municipal partnership as tried in Germany is a possible middle course, yet the results obtained from it have not always been encouraging.

The fundamental purpose either of municipal ownership or municipal and state regulation is to furnish to the consumer the best facilities for supply at a reasonable price. The situation in London is not such as to compass this desirable end finally, and it looks very much as if the American commission system, with all its faults, were a more promising solution of the manifold difficulties. Commissions are learning by experience, and unless the present trend of affairs changes they are likely to end, on the whole, in giving far more nearly proper treatment to all parties than can be obtained by the more drastic methods now threatening supply companies in London.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Tax Suggested for Water-Power Bill

An annual federal tax of 25 cents per hp on all power developed by hydroelectric corporations on government water-power sites was urged as an amendment to the administration water-power bill on May 4 by Mr. M. O. Leighton, an engineer formerly with the reclamation service. Mr. Leighton appeared before a committee of the House of Representatives.

A. I. E. E. Annual Meeting

The American Institute of Electrical Engineers will hold its regular annual business meeting at the Engineering Societies Building, New York, on Tuesday, May 19, at 8:15 p. m. Following this meeting a technical session will be held, the program for which was arranged by the committee on the use of electricity in marine work. Two papers will be presented, "The Future of Electric Heating and Cooking in Marine Service," by Mr. H. J. Mauger, and "Electricity, the Future Power for Steering Vessels," by Mr. H. L. Hibbard.

Legislation on Trust Regulation

A sub-committee of the committee on interstate and foreign commerce of the Senate has reported the text of the omnibus trust regulation bill to the full committee. The bill represents substantially the legislation on the subject which the committee will recommend to the Senate, although it is, of course, subject to amendment by the full committee. The bill provides for an interstate trade commission with power of supervision over holding companies, issues of securities and interlocking directorates.

On May 2 Chairman Clayton of the committee on the judiciary of the House of Representatives moved a special rule for the consideration of the omnibus trust regulation bill which the committee ordered reported favorably. There are a number of differences between this bill and the bill drafted by the sub-committee of the Senate committee.

Contest Against California Compensation Law

The Great Western Power Company and the Southern Pacific Company are leading an attack upon the compensation law which went into effect in California on Jan. 1, 1914. This law gives a commission practically unlimited authority in the award of damages and the decision on the question of requiring special equipment in manufacturing plants. The companies mentioned, which are taking the initiative in the contest against the law, are prominent exponents of the "safety first" movement, but feel that the new measure is so radical that it is necessary for them to take steps against it. The companies are supported generally in their decision by manufacturers and employees of the State, who fear that the power granted the commission under the law might be abused if political changes should place the control of the commission in other hands.

Disposal of Riverside Plant Recommended

Mr. Joseph H. Cox, general manager of public utilities of Riverside, Cal., has recommended that the city dispose of its existing steam plant. The recommendation is before the Board of Public Utilities for action. The steam plant was installed in 1900 and has been maintained as a reserve supply. The municipality has contracts for electrical energy with the Southern California Edison Company and the Southern Sierras Power Company which will last until 1917, with privileges of renewal. Mr. Cox says that it would be to the interests of the city to sell stock carried for house-wiring purposes to electrical contractors. He believes that this policy would mean that the private contractors would become in effect new-business solicitors for the city.

Convention of National Fire Protection Association

The annual convention of the National Fire Protection Association opened in Chicago Tuesday with an attendance of about 250. One feature of the report of the executive committee was the recommendation which was adopted that no action be taken in relation to changing rules or standards without consulting the manufacturers or others interested. Resolutions were adopted advocating certain measures to prevent fire waste. These measures include the adoption of fire-resistive building construction, the installation of automatic sprinkler systems and the like. The proposal to change the name of the organization to the American Fire Protection Association was deferred for future action. Mr. R. W. Campbell, of Chicago, president of the National Council of Industrial Safety, addressed the convention, as did Mr. Robert Adamson, Fire Commissioner of New York City, and others. New specifications for electric fire pumps were approved.

The Southwestern Association Convention at Galveston

The tenth annual convention of the Southwestern Electrical and Gas Association will be held from May 20 to 23 at Galveston, Tex., with the Hotel Galvez as headquarters. Supplementing the general sessions, at which will be discussed matters of importance to the different utilities represented, separate and distinct sessions have been arranged for gas, for street and interurban railway and for electric light and power companies, with a special session for accountants. The sessions have been planned so as not to interfere one with the other. The papers and discussions will include personal points of view and experiences in connection with a given subject, and among the more prominent features will be a symposium on "Safety First." "Fire

Prevention Versus Fire Protection," "The Public Policy of Public Corporations," "The Practical Side of the Commercial Department" and "Economy in the Use of Power in the Operation of Cars" are some of the subjects that will be discussed. A symposium on rates by specialists in the study of this matter is also scheduled. The Jovians have planned a parade for Friday, May 22, which is to follow the rejuvenation proceedings. Mr. H. S. Cooper, 405 Slaughter Building, Dallas, Tex., is secretary of the association.

Plan for Water-Power Development at Washington

Senator Norris, of Nebraska, has introduced a bill in the Senate as an amendment to the river and harbor bill for the development of water-power on the Potomac River above Washington and for the construction of a power plant to furnish electric light and power for use in the District of Columbia. It also provides for an increase in the water supply for Washington. The amendment authorizes the expenditure of $15,021,600 to meet the expense of the project.

The river and harbor bill is in the Senate commerce committee and will not be completed, it is said, for two weeks. Senator Norris appeared before a sub-committee on May 5 and urged that his measure be inserted in the bill. He told the committee that ultimately the work could be continued so as to supply all the needs of the District of Columbia for light and power.

Annual Meeting of Chicago Section, E. V. A.

At the annual dinner and meeting of the Chicago Section of the Electric Vehicle Association of America Tuesday night officers were elected as follows: Chairman, Mr. W. J. McDowell, of the General Motors Truck Company; vice-chairman, Mr. Louis E. Wagner, of the Baker Electric Sales Agency; secretary-treasurer, Mr. F. E. McCall, of the Commonwealth Edison Company; executive committee, Messrs. H. E. Niesz of the Commonwealth Edison Company, C. B. Frayer of the Edison Storage Battery Company, Harry Salvat of the Fashion Automobile Station and D. C. Arlington of the Philadelphia Storage Battery Company. Mr. Niesz, the retiring chairman, presided at the dinner, and Mr. John F. Gilchrist, of the Commonwealth Edison Company, acted as toastmaster. The report of Mr. McDowell, the retiring secretary, showed the section membership to be 119. Mr. Gilchrist said that five Edison substations in Chicago are now equipped for boosting battery charges as high as 200 amp. Addresses were made by Mr. J. E. Hale, of the Goodyear Rubber & Tire Company, on "Tires," and Mr. D. M. Simpson, of the Electric Storage Battery Company, on "The New System of Constant Potential Charging for Garages." Mr. Frank W. Smith, of New York, president of the national body, made an interesting address in which he said there are now 675 members in the society and seven local sections. He reviewed the work of the association, mentioning the fact that Mr. Alexander, of the General Electric Company, had been secured for chairman of the educational committee and Mr. W. W. Freeman as chairman of the central-station co-operation committee. Mr. Smith dwelt especially on the work of the parcels-post committee under the chairmanship of Mr. J. H. McGraw. New work will be undertaken by the E. V. A. in an attempt to relieve freight terminal congestion through the use of electric trucks co-operating with railroads. Dean H. A. Raymond of the Armour Institute of Technology announced the establishment of a ten weeks' course in fundamentals underlying electric-vehicle operation. This course will be given by Prof. D. P. Moreton and at first will be for night-class students. Armour Institute, he said, is glad to co-operate in this matter with the educational committee of the Electric Vehicle Association. Mr. W. C. L. Eglin, of Philadelphia, made a spirited appeal for co-operation in advancing the electric vehicle.

Special Meeting of the Ohio Electric Light Association

A special meeting of the central-station interests in the State of Ohio was held Wednesday at Columbus, Ohio, under the auspices of the Ohio Electric Light Association to consider the questions of policy involved in obeying the recent order of the Ohio Public Utilities Commission requiring the valuation and appraisal of all public utilities in the State by August 1, for rate-making purposes. The executive committe of the Ohio Electric Light Association met on Tuesday and presented its report at the meeting on Wednesday, which resulted in the appointment of two special committees. About seventy-five central station companies were represented at the meeting, which was presided over by Mr. J. C. Martin, of Wilmington, president of the Ohio Electric Light Association, and Mr. D. L. Gaskill, secretary of the Ohio Electric Light Association, acted as secretary of the meeting.

At the request of the Ohio Public Utilities Commission, a committee on uniform accounting to co-operate with the commission was appointed, as follows: Messrs. L. K. Funkhauser, of Dayton; K. Scobel, of Cleveland; M. Galish, of Cincinnati; R. Stevens, of Youngstown, and F. W. Drager, of the American Gas & Electric Company, New York. The following committee on appraisal was also appointed to co-operate with Ohio central stations in an advisory capacity in making the valuations and appraisals ordered by the commissions: Messrs. F. M. Tait, of Dayton; F. W. Milliken, of the American Gas & Electric Company, New York; Robert Lindsay, of Cleveland; F. K. Gerge, of Toledo, and W. W. Freeman, of Cincinnati.

Both committees will meet during the coming week to organize and to adopt ways and means and plans. They will also act as a clearing house for information for the Ohio central stations in this important matter. Headquarters will be secured in a Columbus office building, where all meetings of both committees will be held.

Developments in Cleveland Rate Case

The initial hearing in the case of the Cleveland Electric Illuminating Company and other companies concerned which have appealed to the Ohio Public Utilities Commission in regard to the 3-cent rate ordinance passed by the City Council of Cleveland is to be held on May 25.

It is expected that the new plant of the city of Cleveland will be in operation about the middle of June. Construction of this plant was started in 1911, and an issue of $2,000,000 bonds was made to meet the cost. This plant is situated at the foot of Fifty-first Street on the shore of Lake Erie, adjoining the water-works. When completed it will have a 24,000-kw equipment. Its principal units consist of three Allis-Chalmers generators of 5000 kw normal and 7500 kw maximum rating. The principal engineering feature about the plant is the boilers, of which there will be six. They are of the Stirling type, similar to the Delray boilers installed at Detroit.

The city of Cleveland has at present two municipal plants, one in Brooklyn and one in Collinwood, which are former suburbs annexed to the city. From these plants energy is furnished to about 5000 residence and commercial customers and 1500 street lamps. When the Fifty-first Street plant is placed in operation these plants will be closed down and all energy will be supplied from the new plant. The equipment of the two plants will be maintained to furnish service when needed.

The municipal plant will embark in a competitive business. Its rates are fixed by city ordinance at 3 cents per kw-hr. maximum for all classes of service and 1 cent minimum. Energy for residences will be furnished at 3 cents and that for motor service at from 1 cent to 3 cents. The motor-service schedule has been changed since it was first made public. Before these rates were established the city plants charged rates which averaged about 6 cents. This was near the average rate of the local company, which, for residences, is about 6¼ cents. Since the announcement of its new rates the city has secured, it is said, from forty to fifty motor-service customers. The two plants are now fully loaded.

Mr. Stage, director of utilities, declares that contracts issued upon the basis of the schedule originally announced by the city will be recalled and changed. Errors were found in the schedule which would have involved the city in heavy loss, according to the statements made in Cleveland. Officials of the law department of the city are declared to have said that if the holders of the contracts refuse to surrender them, the contracts will be declared legal by the courts.

Bill in Congress Regulating Dams Across Navigable Rivers

A bill to amend the law regulating the construction of dams across navigable rivers has been introduced in the House of Representatives by Congressman Adamson. The bill was referred to the committee on interstate and foreign commerce. It provides that plans for the construction of such dams shall be submitted to the Secretary of War and the Chief of Engineers for their approval. Such conditions may be imposed as they deem necessary.

The approval shall provide the reimbursement to the United States of all expenses incurred with reference to the project and for the payment to the United States of reasonable charges for the benefits which may accrue to the project through the construction, operation and maintenance by the United States of headwater improvements, including storage reservoirs, on any such stream. Such charges are to be fixed by the Secretary of War and the Chief of Engineers and are not to exceed in any one year an amount equal to 5 per cent of the total investment cost in addition to the necessary annual expense of operation of such headwater improvement.

Any grantee who shall fail or refuse to comply with the order of the Secretary of War, made in accordance with the act, shall be deemed guilty of a misdemeanor and on conviction shall be punished by a fine not exceeding $1,000. In addition to such penalty the court may decree a revocation of the rights and privileges held under the act. The right granted shall continue for fifty years from the date of completion of the structure, and after the expiration of the fifty years such rights shall continue until compensation has been made to the grantee for the fair value of the property.

The fair value of the property and the reasonableness and good faith of existing contracts shall be determined by agreement between the Secretary of War and the owners of the property. In the event of failure to agree proceedings may be instituted by the United States or by any person authorized by Congress in the United States District Court. No value shall be claimed or allowed for the rights. In cases where the electric energy generated enters into interstate or foreign commerce the rate for service shall be just and reasonable. In any valuation of the property for rate-making purposes there shall be included the cost of the construction of a lock or locks or other aids to navigation and all other capital expenditures required by the United States. Conflict with state regulation of rates and service is to be avoided if the regulation is not unduly discriminatory against the service or rates in any other states.

Connecticut Get-Together Club

The Connecticut Get-Together Club was formed at a meeting in New Haven, Conn., on May 1, its object being to increase acquaintance and sociability among the men connected with the electrical industry in Connecticut, to increase the membership of the New England Section of the National Electric Light Association, and to bring about instruction in and discussion of ways and means to "do it electrically." Mr. A. J. Campbell, of Waterbury, was elected chairman, and Messrs. W. P. Schwabe, of Thompsonville, and W. R. Hoppen, of New Haven, were elected as members of the executive committee. At a dinner in the Café Mellone preceding the meeting Mr. L. D. Gibbs, of Boston, spoke of the necessity of men connected with the electrical industry getting together. Mr. J. M. Wakeman discoursed on the advantages of co-operative effort and outlined the present plans of the Society for Electrical Development, Inc. Prof. C. F. Scott made an interesting talk upon the Sheffield Scientific School and its work, and Messrs. C. A. Leonard, of Meriden, and Harrison B. Freeman also spoke upon co-operation. Mr. H. E. Page, of Hartford, acted as chairman.

Power Bond Election in Los Angeles

The election over the question of the issue of $6,500,000 bonds for the municipal power development at Los Angeles, Cal., was held on May 8. A telegram to the *Electrical World* on May 7 said that both sides were fighting intensely and that meetings were being held each night in dozens of places throughout the city. A vote of two to one was required to carry the bond issue. Of the total amount of bonds proposed $1,250,000 would be used for completion of the plant and $5,250,000 for construction of a distributing system or for the purchase of the existing system of the Southern California Edison Company by condemnation. The system which it was proposed to purchase by condemnation reaches 45 per cent of the consumers in the city. Of the existing three companies two companies would remain in the field to compete for the rest of the consumers.

In the controversy preceding the election, Mr. J. A. Lighthipe showed that the plant of the city cannot be finished for the amount estimated and that an adequate distributing system cannot be built or acquired for the amount named for that purpose. Mr. E. F. Scattergood, city engineer, admits the insufficiency of the estimate. As the tax burden of the city of Los Angeles is large and the bond limit would be extended if the power bonds are issued, bankers have taken an interest in the campaign. E. H. Rollins & Sons have warned citizens to vote against the proposed issue. Incidents of the campaign of the last few days are the daily house-to-house canvass made by the Edison company, the distribution of an enormous amount of literature by both sides and the use of entire pages for advertisements in the daily newspapers. It was announced definitely that if the issue of bonds receives the approval of the electorate, the Edison company will carry the condemnation case to the Supreme Court.

Preliminary Program of National Electric Light Association's Convention

A preliminary outline of the work to be done at the convention of the National Electric Light Association at Philadelphia, June 2-5, has been given out by the association. For convenience, the program herewith is divided into general, technical, commercial, hydroelectric and accounting sessions. There is a general session on the morning of June 2, with three simultaneous sessions during the afternoon of that day. Three simultaneous sessions have also been arranged for the morning of June 3. No sessions are scheduled for the afternoon of that day, but during the evening there will be a general and executive session followed by the public policy session at which the report of the public policy committee will be presented. Three simultaneous sessions will be held on the morning of June 4 and two during the afternoon of that day. On June 5 there will be a general session in the morning, after which the convention will adjourn.

General Executive and Public Policy Sessions

Tuesday, June 2, 10 a. m.

(1) Welcome to the city. (2) Address of President McCall. (3) Announcements. (4) Report of committee on organization of the industry, by Mr. Holton H. Scott. (5) Report of secretary, by Mr. T. C. Martin. (6) Report of insurance expert, by Mr. W. H. Blood, Jr. (7) Report of committee on progress, by Mr. T. C. Martin. (8) Report on the "Question Box," by Mr. S. A. Sewall. (9) Paper, "Safety First," by Mr. Paul Lupke.

Wednesday, June 3, 8 p. m.

(1) Action on report of public policy committee, presented by Mr. Arthur Williams. (2) Presentation of proposed constitutional amendments, by Mr. F. W. Frueauff. (3) Report of treasurer, by Mr. W. F. Wells. (4) Election of nominating committee. (5) Appointment of committee on resolutions. Music.

Wednesday, June 3, 8:45 p. m.

Public Policy Session: (1) Reading of report of public policy committee. (2) Address. (3) Music.

Friday, June 5, 10 a. m.

(1) Report of committee on award of Doherty medal. (2) Symposium, relations with geographical sections. (3) Report of committee on memorials, by Mr. T. C. Martin. (4) Report of committee on constitutional amendments, by Mr. F. W. Frueauff. (5) Vote on constitutional amendments. (6) Report of committee on resolutions. (7) Report of nominating committee. (8) Election of officers. (9) Adjournment.

Technical Sessions

Tuesday, June 2, 2:30 p. m.

(1) Report of committee on meters, by Mr. P. H. Bartlett. (2) Paper, "A New Demand Indicator for Small Consumers," by Mr. R. C. Lanphier. (3) Report of committee on grounding secondaries, by Mr. W. H. Blood, Jr. (4) Report of committee on electric measurements, by Dr. A. E. Kennelly. (5) Address, "The Electric Vehicle," by Dr. C. P. Steinmetz.

Wednesday, June 3, 10 a. m.

(1) Report of committee on electrical apparatus, by Mr. L. L. Elden. (2) Paper, "Temperature and Its Relation to the Limiting Capacity of Electrical Apparatus," by Mr. F. D. Newbury. (3) Report of committee on underground construction, by Mr. P. Torchio. (4) Report of committee on overhead-line construction, by Mr. Thomas Sproule.

Thursday, June 4, 2:30 p. m.

(1) Report of committee on prime movers, (a) steam, by Mr. I. E. Moultrop; (b) hydraulic, by Mr. J. F. Vaughan. (2) Selection of hydraulic turbines, by Mr. Charles V. Seastone. (3) Report of committee on street lighting, by Mr. J. W. Lieb, Jr. (4) Report of committee on accident prevention, by Mr. M. J. Insull.

Commercial Sessions

Tuesday, June 2, 2:30 p. m.

(1) Address of the chairman of the section, by Mr. T. I. Jones. (2) Report of finance committee, by Mr. E. L. Callahan. (3) Report of membership committee, by Mr. J. F. Becker. (4) Report of publications committee, by Mr. Douglass Burnett. (5) Report of committee on education, by Mr. F. C. Henderschott.

Wednesday, June 3, 10 a. m.

(1) Report of committee on rate research, by Mr. E. W. Lloyd. (2) Address. (3) Report of lamp committee, by Mr. F. W. Smith.

Thursday, June 4, 10 a. m.

(1) Report of committee on non-peak and high-load-factor business, by Mr. G. H. Jones. (2) Report of committee on interurban lighting of highways, by Mr. G. B. Tripp.

Thursday, June 4, 2:30 p. m.

(1) Report of committee on wiring of existing buildings, by Mr. R. S. Hale. (2) Report of committee on electrical merchandising and advertising, by Mr. Parker H. Kemble. (3) Report of nomination committee. (4) Election of officers.

Hydroelectric Sessions

Thursday, June 4, 10 a. m.

(1) Address of chairman of section, by Mr. W. W. Freeman. (2) Report of committee on hydro-progress, by Mr. T. C. Martin. (3) Paper, "The Nature of Electrical Disturbances in Transmission Work," by Mr. D. B. Rushmore. (4) Report of committee on distributing lines, by Mr. P. M. Downing. (5) Report on permanent methods of measuring water in water-power plants, by Mr. D. W. Mead. (6) Paper, "Water-Power-Plant Economics," by Mr. O. B. Coldwell.

Thursday, June 4, 2:30 p. m.

Second hydroelectric session held in conjunction with third technical session.

Accounting Sessions

Tuesday, June 2, 2:30 p. m.

(1) Address of the chairman of the section, by Mr. H. M. Edwards. (2) Report of library committee. (3) Report of "Question Box" committee. (4) Paper, "Cost and Statistics," by Mr. T. J. Walsh.

Wednesday, June 3, 10 a. m.

(1) Report of committee on uniform system of accounts. (2) Address. (3) Paper, "Variation in Public Service System of Accounting," by Mr. E. C. Scobell.

Thursday, June 4, 10 a. m.

(1) Paper, "Accounting for Merchandise Sold," by Mr. H. B. Lohmeyer. (2) Paper, "Suspense Accounts," by Mr. Fred Schmitt. (3) Paper, "Mechanical Sorting and Tabulating Systems," (a) in connection with disbursement accounts, by Mr. F. A. Birch; (b) as applied to inventory of transmission and distribution systems, by Messrs. G. L. Knight and C. V. Woolsey.

Transportation Arrangements

Mr. George W. Elliott, master of transportation, announces four special trains, to be known as the green, brown, golden poppy and magnolia specials. The first will leave Chicago over the Pennsylvania lines on May 31. The second will leave Chicago over the Lake Shore road on May 31, passing over the tracks of the Lehigh Valley Railroad from Buffalo to Philadelphia. The "golden poppy" special will leave San Francisco May 26, making stops at Salt Lake City and Ogden, where the train will be augmented by the Seattle and Pacific Northwest contingent. The Colorado delegation will board the train at Denver, after which the train will proceed to Philadelphia with probable stops at Chicago and Pittsburgh. The "magnolia" special will leave Atlanta, Ga., May 31 over the Southern Railway. In view of the excellent regular train service into Philadelphia from nearby cities, no other specials will be run.

Future Regulation of Public Utilities

Mr. William D. Kerr, director of the Bureau of Public Service Economics, was the speaker at the Finance Forum at the West Side Branch of the Young Men's Christian Association in New York on May 4. His topic was the "Future Regulation of Public Utilities." Mr. Calvert Townley, assistant to the president, Westinghouse Electric & Manufacturing Company, who introduced the speaker, brought up the question of the rate of return. He declared that the principal object of regulation of public utility corporations by the public is to see that the profits are not too great. He emphasized, however, the fact that it is also to the interest of the public to see that the rate of return thus limited be not made too low.

Mr. Kerr described the commission as a clearing house to consider the testimony from the standpoint of the public and the corporations and to decide the issue involved in each case. He showed how capital turns itself over in from four to six years in public utility industries and said that capital must be provided and paid for. The turnover is so infrequent as compared with other classes of business that the charge on consumers to make proper provision for the capital is proportionately large. Mr. Kerr discussed the subject of depreciation at length and explained the necessity of a provision for the retirement of apparatus before it reaches the end of its normal life in many cases. The expense of keeping the plant abreast of the progress of the art must be borne as part of the cost of the service. Mr. Kerr also took up the matter of profits, saying that the men who bring the capital together and put it to the most efficient use must receive an adequate return for their services. Regulation should not deny promoters a profit commensurate with their efforts and risks.

When there was complaint about service of public utilities in the past the idea of the public was to permit a competitive company to get a franchise. The inevitable result of this policy was a duplication of plants and capital investment for which the public had to pay. Mr. Kerr referred to the new municipal plant at Cleveland, saying that there is no expectation that the city will be reimbursed for its investment in this property. It is impossible to compare a plant of this kind with a plant that is responsible to its owners for a return on the investment.

Public ownership is likely to be, and in most cases is, unregulated monopoly, lacking initiative such as characterizes the public utilities under corporate management. As to the future, Mr. Kerr said that the companies must place their cards on the table and show the facts. In the majority of cases the companies are meeting the conditions fairly and working out the problem in an open and honest manner. The intelligence of the public should be represented in the laws creating commissions, and there should be no question as to the authority of the commission to deal with the problem. Men of the right character and standard must find commission service attractive. The alternative to regulation is public ownership. Mr. Kerr said that the judgment of the country for a great many years to come would stand by private operation and ownership.

Mr. Kerr gave data compiled from reports of the Railroad Commission of Wisconsin on the operations of plants in that State. The average cost of plant and property per kilowatt of maximum demand for the following thirteen plants was $510: Oshkosh, Green Bay, Superior, Beloit, Appleton, Milwaukee, La Crosse, Manitowoc, Madison, Janesville, Fond du Lac, Sheboygan and Wausau. The annual fixed charges on these plants at the rates of interest given were: At 10 per cent, $51; at 15 per cent, $76.50; at 20 per cent, $102.

The average cost of plant and property per kilowatt of connected load for the following fifteen plants was $197: Eau Claire, Oshkosh, Beloit, Appleton, Superior, Fond du Lac, Kenosha, Watertown, Janesville, Green Bay, Milwaukee, La Crosse, Madison, Chippewa Falls and Wausau. The annual fixed charges at the rates of interest given were: At 10 per cent, $19.70; at 15 per cent, $28.55; at 20 per cent, $39.40.

The average cost of property and plant per kilowatt-hour generated for the following fifteen plants was 22 cents: Eau Claire, Watertown, Oshkosh, Appleton, Beloit, La Crosse, Janesville, Milwaukee, Fond du Lac, Manitowoc, Madison, Green Bay, Wausau, Sheboygan and Kenosha. The annual fixed charges at the rates of interest given were: At 10 per cent, 2.2 cents; at 15 per cent, 3.3 cents; at 20 per cent, 4.4 cents.

Investments in Mexican Public Utilities

Interest in the public utilities of Mexico is at present aroused owing to the unsettled state of affairs in that unfortunate republic. Contrary to the prevailing impression, the amount of American money invested in the public utilities of Mexico is not very large. To be sure, all the large public utilities are owned by outsiders, but most of the companies have been financed by English capital and are controlled abroad.

The principal public utilities in Mexico are the Mexican Light & Power Company, the Mexican Tramways Company, the Guanajuato Power & Electric Company, the Mexican Northern Power Company, the Sultepec Electric Light & Power Company, the Monterey Railway, Light & Power Company, the Puebla Tramways, Light & Power Company and the Pachuca Light & Power Company. Of these the only ones in which American capital is interested to any extent are the Guanajuato Power & Electric Company, operated in the state of Guanajuato with power plants at El Platanal, El Sabino and El Botella, and the Sultepec Electric Light & Power Company of Toluca, State of Mexico, with power plants at Temascaltepec and San Simonito.

The former company is controlled by the interests associated with W. P. Bonbright & Company, of New York, and operates a large transmission and distribution system. Its power plants are rated at approximately 23,000 hp. Its capitalization consists of $1,500,000 6 per cent preferred stock, $3,500,000 common stock and $3,170,000 bonds. Its gross earnings are about $700,000 a year. It has suffered practically no interruption from the revolution. The Sultepec Electric Light & Power Company is controlled by Brooklynites formerly connected with the Brooklyn Rapid Transit Company, Mr. T. S. Williams being vice-president of the company and Mr. C. L. Rossiter secretary and treasurer. The company has a capitalization of $566,700 and outstanding bonds of $639,000. Its hydroelectric plants are rated at approximately 2500 kw. Its operations have not been affected by the revolution.

The Mexican Light & Power Company, the Mexican Tramways Company and the Pachuca Light & Power Company are controlled by the Dr. F. S. Pearson interests and are financed by English capital. The Mexican Tramways Company has a capitalization of $15,000,000 stock and $8,000,000 bonds. The Mexican Light & Power Company has $19,000,000 common stock, $6,000,000 preferred stock and $21,203,333 in bonds, while the Pachuca Light & Power Company has $4,000,000 in stock and $4,000,000 in bonds. The three companies have earnings of approximately $6,000,000 a year, and while they have continued to operate steadily and have sustained practically no damage, the high rate of exchange and other difficulties have resulted in a suspension of the 7 per cent dividends on their common stocks and on the preferred stock of the Mexican Light & Power Company. The latter has the largest hydroelectric station in Mexico (65,000 kw), situated at Necaxa. From it the city of Mexico is supplied with electricity.

The Mexican Northern Power Company was financed in England and is controlled by interests associated with Sperling & Company, bankers, of England. A hydroelectric development of 25,000 hp was started near Santa Rosalia in the State of Chihuahua in 1910, but owing to the unsettled conditions in northern Mexico and the depredations of the rebels was not completed. The company has $12,600,000 in stock and $10,000,000 in first mortgage bonds. It ceased paying bond interest in 1913 and is now asking the holders to relinquish their interest for two and one-half years and also to authorize the issue of lien bonds to finance the company. The company has brought a suit against S. Pearson & Son, Ltd., contractors, of England, to recover a million dollars damages for alleged failure to carry out the contract to build the Conchos River development, claiming that the contractors stopped work, so that the company itself was compelled to take it over and finish it. The Monterey Railway, Light & Power Company, which controls all the utilities in and around the city of Monterey and also operates the water-works, is owned by the Mackenzie-Mann interests of Toronto. Its capitalization consists of $4,500,000 common, $500,000 preferred and $6,000,000 debenture stock. The Puebla Tramways Light & Power Company is controlled by English interests, headed by Sir C. B. Hyde. It operates all the utilities in the city of Puebla and the surrounding country and owns 44 miles of electric railway and a hydroelectric development rated at 45,000 hp. It has transmission lines to Vera Cruz and to other points. Its capitalization comprises $6,500,000 in stock and $7,349,000 of bonds.

Mexico is a country of many wonderful water-powers, and under normal conditions the hydroelectric possibilities of the country would be rapidly exploited by American and foreign capital.

Convention of Arkansas Association of Public Utility Operators

As announced in last week's issue, the seventh annual convention of the Arkansas Association of Public Utility Operators was held at the Marion Hotel, Little Rock, April 21, 22 and 23. The attendance at the opening session was much larger than at any previous convention. Owing to the removal from the State during the year of Mr. Walter J. Gillette, general manager of the Fort Smith Light & Traction Company, who was elected president of the association at its last meeting, and in the absence of the first vice-president, Mr. E. C. Bellamy, manager of the Mammoth Spring Electric Light & Power Company, the meeting was presided over by Mr. C. M. Richards, manager of the Hope Water & Light Company, second vice-president.

The meeting was opened April 21 by an address of welcome by Mr. C. E. Taylor, Mayor of the city of Little Rock, and the first business session was held that afternoon. The report of the executive committee was submitted by Chairman C. J. Griffith, general manager of the Little Rock Railway & Electric Company, and was followed by the report of the secretary and treasurer, which showed the association to be in good financial condition. A short address was then made by the acting president, Mr. C. M. Richards, following which a paper on "Transformers" was read by Mr. Fred Johnson, district manager of the Wagner Electric Manufacturing Company.

Mr. Byron C. Fowles, treasurer and general superintendent of the Pine Bluff Corporation, reviewed the government statistics pertaining to gas, water, electric-light and street-railway properties. He also dwelt upon the sound financial condition of public utility properties and said they occupy a place among the most substantial investments in the world.

Immediately after the adjournment of the meeting there was a rejuvenation of the Sons of Jove, at which time about thirty members were initiated. In the evening the delegates attended a musical festival.

The Wednesday morning session was opened by Mrs. LaSalle Stoops, president of the Stuttgart Water & Light Company, who made her report as representative of the Arkansas Association of Public Utility Operators to the convention of the National Electric Light Association at Chicago, Ill., in 1913. Mrs. Stoops enjoys the distinction of being the only woman in the United States who operates a combined water and electric company. Her ability as an operator has been demonstrated by the success of her property. She told of the warm welcome she received from the officials of the N. E. L. A. in Chicago.

A paper, "Relation of the Incandescent Lamp to Lighting Service," by Mr. R. E. Campbell, of the National Lamp Works, Cleveland, Ohio, brought out the important factors of voltage regulation from a revenue and operating standpoint. Mr. Campbell recommended separate circuits in residences for electrical appliances.

Mr. H. J. Lehman, secretary of the Citizens' Railway, Light, Water & Gas Company, of Hot Springs, presented a paper on accounting for railway, electric-light, gas and water companies. This paper was discussed by Messrs. W. L. Wood, Jr., manager of the Southwestern Gas & Electric Company, Texarkana; W. J. Tharp, auditor of the Little Rock Railway & Electric Company; R. B. Fowles, auditor of the Pine Bluff Corporation; B. C. Fowles, treasurer and general superintendent of the Pine Bluff Corporation, and C. J. Griffith, general manager of the Little Rock Railway & Electric Company. The secretary was instructed to write to all public utility companies in the State of Arkansas for a copy of their forms pertaining to accounting, so that any member of the association could at any time examine them. This action was taken with a view to standardizing the accounts of all public utility companies throughout the State so as to conform as closely as possible to the Interstate Commerce Commission forms.

The president was also authorized to appoint an advisory committee, composed of many members in different sections of the State, so that any member within the district may always be able to get in touch with a member of the advisory committee in his section. It was also proposed that this advisory committee act as a membership committee, and start a campaign to try to enlist every central station in the State. The association membership at this time is 103, and there still remain about thirty-five or forty properties in the State not affiliated.

A meeting of the Class B members was held, and Mr. W. R. Herstein, secretary and treasurer of the Electric Supply Company of Memphis, Tenn., was elected president, and Mr. C. R. Croninger, of the General Electric Company's St. Louis office, was elected secretary. The secretary reported an increase of about 20 per cent in Class B membership during the past year.

The afternoon session was opened by a paper on "Modern Methods of Street Lighting," by H. G. Hoke, of the Westinghouse Electric & Manufacturing Company. This paper was discussed very freely, as it was on a subject in which every operator at the meeting was much interested. Numerous lantern slides, showing the various methods of street illumination in cities throughout the country, were shown on the screen.

A paper on "Affiliation of Class A Association to Class B Association," by Mr. L. S. Hunt, general sales manager of the Commercial Electrical Supply Company of St. Louis, Mo., clearly showed the necessity for the affiliation of the different classes of members to make the association a success. A banquet was tendered to the Class A members by the Class B members on Wednesday evening at the Marion Hotel. The usual custom of speechmaking was dispensed with. Mr. C. J. Griffith acted as master of ceremonies.

The only paper presented on Thursday was a joint one on "Increasing the Day Load," by Messrs. A. E. Smith, sales manager of the Little Rock Railway & Electric Company, and Minor Q. Woodward, sales manager of the Pine Bluff Corporation. The authors pointed out many ways for increasing the day load. A very general discussion followed, during which Mr. W. L. Wood, Jr., manager of the Southwestern Gas & Electric Company of Texarkana, informed the association of the results of an "electrical show" which he had in Texarkana. His policy during this show was to give a rebate ticket to the amount of 50 cents, to be applied to lighting bills, with every piece of heating apparatus sold, for each 100 watts of power used by the heating appliance.

The following are the newly elected officers: President, Mr. C. J. Griffith, manager of the Little Rock Railway and Electric Company; first vice-president, Mr. W. L. Wood, Jr., manager of the Southwestern Gas & Electric Company, Texarkana; second vice-president, Mr. H. C. Hoagland, manager of the Fort Smith Light & Traction Company; third vice-president, Mr. H. M. Bowen, manager of the Seven Cities Company of Russellville; secretary-treasurer, Mr. W. J. Tharp, auditor of the Little Rock Railway & Electric Company.

Mr. Charles J. Griffith, the newly elected president, was born in Rochester, N. Y., on Feb. 15, 1865, and was educated in Lafayette, Ind. He engaged in the telegraph business until 1889, when he became associated with the Municipal Light & Power Company, St. Louis, Mo., and the Missouri-Edison Electric Light & Power Company. In 1889 he was associated with the Pine Bluff (Ark.) Water & Light Company. In 1892 he entered the service of the Little Rock Traction & Electric Company, but resigned from that company in August, 1897, to accept a position with the Brown Electric Company, Little Rock, as superintendent of construction. This company constructed an electric light plant for the State of Arkansas to light all of the State institutions at Little Rock. Mr. Griffith afterward superintended the installation of the electric light plants in the Peabody and the Cordova Hotels at Memphis, Tenn., and supervised the installation of an electric light plant at Crystal Springs, Miss. In 1899 he became associated with the Southern Engineering Company, St. Louis, Mo., and superintended the installation of the municipal electric light plant at Hastings, Neb., and the electric light and water-works in West Plains, Mo. In 1902 he re-entered the service of the Little Rock Railway & Electric Company as master mechanic and was appointed superintendent of the railway department in 1905 and general manager in 1912.

PRESIDENT C. J. GRIFFITH

Merz and McLellan on London Electricity Supply

Much valuable information concerning the electrical-energy systems in London and other large cities of the world was given in appendices of the report of Messrs. C. H. Merz and W. McLellan to the London (England) County Council, mentioned on page 971 of our issue dated May 2, 1914.

In 1912 seventy bodies were authorized to supply electrical energy in the county of London, of which sixty-five were delivering energy from seventy generating stations containing 560 engines having an average output of 550 kw. In the central area of London there are forty-one generating stations exclusive of eight which carry only a traction load and two from which energy is transmitted into the area. The average size of the generating units is 787 kw. Thirty-one systems of generation are in use and eight frequencies.

Statistics relating to capital expenditure on London electricity undertakings are given in Table II. The companies' capital expenditure in Greater London during the last eleven years has averaged £663,687 per year, while the London County Council has sanctioned loans for electricity to the various borough councils amounting to £6,400,000.

Messrs. Merz and McLellan point out that in a number of cities in Great Britain the supply of electrical energy was first in the hands of private companies, which were bought out at an early stage by the municipality. In America municipal electrical undertakings usually confine themselves to the supply of energy for street lighting, and this practice has been generally followed in Canada. In Australia the supply of electricity in large cities is usually in the hands of the municipalities, while in South Africa both systems of control are about equally used. In newer countries, like those of South America, supply is still in the hands of private companies, as it is in the majority of great European cities. There is a general tendency, however, for municipal authorities to take a closer interest in the supply of electricity, in some cases by acquisition and operation of the private undertakings, but more frequently by acquiring part ownership, or at least insisting on a share in the profits of the private undertakings, as the price of renewing the concession. On the technical side there is a general tendency in all great cities, except London, toward a reduction in the number of controlling concerns and different systems of generating stations. In New York, for instance, the fifteen or twenty systems which existed twenty years ago have now been reduced to four, and the same applies in Boston, Chicago and elsewhere. In Paris the number of utilities has now been practically reduced to one, while in Hamburg and Berlin the supply is in the hands of one company. In Paris the supply will be given hereafter from two stations for the whole of the city, while there is a general tendency evident to reduce the number of stations employed, and greatly to increase their size in all the above-mentioned cities. Table III gives some details of the systems employed in certain of the cities mentioned, and these details are amplified below.

TABLE I—STATISTICS OF STATIONS IN GREATER LONDON—1912

	COUNTY		OUTER LONDON		Total
	Local Authorities	Companies	Local Authorities	Companies	
Total capital outlay..	£6,581,198	£14,437,257	£3,267,174	£1,711,770	£25,997,399
Total expenditure on plant and machinery	£1,792,700	£4,651,431	£1,115,573	£499,897	£8,059,601
Total kilowatts connected	137,249	266,510	96,392	23,714	523,865
Total plant installed, kw.	80,603	153,479	53,070	20,186	307,338
Sum of maximum demands, kw.. ..	54,474	96,651	31,824	13,772	196,721
Units sold per head of population.	21.5	35.5	24.25	11.7	48.5
Kilowatts connected per head of population.	0.03	0.06	0.04	0.01	0.07
Average price obtained, all purposes......	2.06d.	2.62d.	2.06d.	1.96d.	2.29d.

TABLE II—CAPITAL EXPENDITURE ON STATIONS IN GREATER LONDON

	TOTAL TO DATE		Average per Annum
	1901-2	1912-13	
County of London:			
Local authorities	£2,127,493	£6,853.796	£429,664
Companies	9,053,943	14,613,196	505,387
Total	£11,181,436	£21,466,992	£935,051
Outer London:			
Local authorities	£963,958	£3,498,626	£230,424
Companies	220,072	1,961,366	158,300
Total	£1,184,030	£5,459,992	£388,724
Greater London:			
Local authorities	£3,091,451	£10,352,422	£660,088
Companies....	9,274,015	16,574,562	663,687
Total.. ..	£12,365,466	£26,926,984	£1,323,775

TABLE III—DETAILS OF SYSTEMS IN THE LARGE CITIES OF THE WORLD

City	Population	Area in Square Miles	Generating Stations.*	Average Size of Generating Stations, in Killowatts	Kw-hr. per Head of Population	Systems of Generation, Transmission and Distribution
Paris ...	2,800,000	31	(*a*) 10 (*b*) 6	(*a*) 36,000 (*b*) 54,000	27 (Sold—Public Supply Cos. only)	Two-phase, forty-two cycles, 12,300 volts, and three-phase, twenty-five cycles, 10,150 volts, transformed to direct current and low-tension alternating current for lighting 2x110 volts, and for traction and power various voltages.
Berlin	2,200,000	24	(*a*) 6 (*b*) 3	(*a*) 25,000 (*b*) 40,000	111 (Sold—Public Supply Co. only)	Three-phase, fifty cycles, 6000 volts, transformed to direct current 2x240 volts for lighting and 550 volts for tramways; various voltages for power.
Hamburg..	1,000,000	30	(*a*) 4	(*a*) 11,000	43 (Sold—Public Supply Co. only)	Generation both direct current and at 5000 volts, three-phase transformed to direct current at 2x110 volts for lighting and 550 volts for tramways.
New York	4,754,000	131	(*a*) 7 (*b*) 3	(*a*) 42,000 (*b*) 94,000	360† (est.)	Three-phase, twenty-five cycles, 6600 volts and 7500 volts, sixty cycles, transformed to continuous and alternating current low-tension supply, at 2x110 volts for lighting; other voltages for power.
Boston	1,051,907	597	(*a*) 5 (*b*) 2	(*a*) 20,000 (*b*) 49,000	400† (est.) 112 (Edison Co. only)	Three-phase, sixty cycles, 13,600 volts, transformed to single and three-phase 2300 volts and 4000 volts and 115-230 volts, three-wire direct current.
Chicago	2,185,283	191	(*a*) 7 (*b*) 3	(*a*) 47,000 (*b*) 90,000	425†	Three-phase, twenty-five and sixty cycles, 4500 and 9000 volts, transformed for long-distance transmission to 20,000 volts and for supply to consumers for lighting at 110 volts and 220 volts direct and alternating current and 600 volts direct current for traction
Detroit	570,000	105	(*a*) 3	(*a*) 32,000	330†	Three-phase, sixty cycles, 4600 volts, transformed to low-tension direct current for supply to consumers.
Buenos Aires	1,400,000	60	(*a*) 7 (*b*) 2	(*a*) 16,000 (*b*) 41,000	123	Three-phase, twenty-five and fifty cycles, 6000 volts and 12,000 volts, transformed to 220x440 volts direct and alternating current.
Greater London	7,252,963	693	(*a*) 70	(*a*) 5,400	130† (est.) 18.5 (Public Supply only)	Very various.

*Excluding traction except where traction supply is given by public supply authority.
†These figures represent output for all purposes and from all sources, other than private plants.
(*a*) Total, including peak, standby and temporary.
(*b*) Main stations only

Paris.—Area served, 31 sq. miles. Population, 2,800,000. Supply company, Cie. Parisienne de Distribution d'Electricité. Total kw connected, 226,890

(1912). Total kw-hr. sold, 76,461,411 (1912). Average price obtained, 10.2 cents per kw-hr. (1912).

Berlin.—Area served, 24 sq. miles. Population, 2,200,000. Supply company, Berlin Electricity Works. Total kw connected, 255,721 (1913). Average price obtained, 3.4 cents per kw-hr. (1913).

Hamburg.—Area served, 30 sq. miles. Population, 1,000,000. Supply company, Hamburg Electricity Works. Total kw connected, 99,031. Average price obtained, 6.16 cents per kw-hr.

New York.—Area served, 131.07 sq. miles. Population, 4,754,000. Supply companies: In Manhattan and Bronx, the New York Edison Company and the United Electric Light & Power Company, both controlled by the Consolidated Gas Company; in Brooklyn, the Edison Electric Illuminating Company and Flatbush Gas Company. Kilowatts connected: New York Edison Company, 594,334; United Electric Light & Power Company, 58,697; Edison Illuminating Company of Brooklyn, 122,620; Flatbush Gas Company, 7,031. Average price obtained, New York Edison Company, 5.2 cents per kw-hr.

Boston.—Area served, 597 sq. miles. Population, 1,051,907. Supply company, the Edison Electric Illuminating Company; also three small companies not included in following particulars. Total kw connected, 175,146. Average price obtained, Edison company, 5.4 cents per kw-hr.

Chicago.—Area served, 191.3 sq. miles. Population, 2,185,283 (1910 census). Supply company, Commonwealth Edison Company. Total kw connected, 545,235 (1912). Average price obtained, including charges for special services rendered by the company to their consumers, 2.18 cents per kw-hr. (including traction).

Detroit.—Area served, 105 sq. miles. Population, 570,000. Supply company, Detroit Edison Company, except for public lighting and municipal purposes, which are supplied by municipal plant. Total kw connected, 184,000 (approximately). Average price obtained, 2.86 cents per kw-hr. (approximately).

Buenos Aires.—Area served, 60 sq. miles. Population, 1,400,000. Supply company, La Compañia Alemana Trasatlantica de Electricidad and La Compañia Italo-Argentina de Electricidad. Total kw connected, 265,000. Average price obtained, 5.5 cents per kw-hr.

Steam Turbines Versus Gas Engines for Steel-Mill Power Plants

At a joint meeting of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section of the Western Society of Engineers on April 27, Mr. F. G. Gasche, of the Illinois Steel Company, Chicago, delivered an address entitled "Power Problems in Steel Mills." Grouping the facts in his talk under three general subdivisions, namely, the laws of thermodynamics, direct commercial problems, and serviceability of the equipment, Mr. Gasche endeavored to show that for steel-mill operation gas engines have never been able to give the satisfactory results obtainable with steam turbines for driving alternating-current generators.

Basing his statement upon experience with a station containing several 2000-kw gas-engine-driven units and upon recently published steam-turbine data, the speaker said that steam turbines showed a rate of fuel consumption that was 37 per cent higher than the rate for gas engines operating under the same load conditions. Claims have been made that steam turbines use two and one-half times the amount of fuel consumed by gas engines, but these statements, made by gas-engine exponents, said Mr. Gasche, are without foundation in fact.

Taking up the commercial side of the problem, the speaker said that a gas-engine installation for steel mills would cost approximately $100 per kw, while a steam-turbine installation of the same character would cost about $55 per kw. Assuming a fuel cost of 0.003 cent per kw-hr. and 6000 hours' annual service, the fuel cost per kilowatt for the steam turbine would amount to $18 annually, while gas engines could produce the energy for $13.10 a year. This shows a saving of $4.90 in favor of the gas engine. However, taking the fixed charges on both plants at 15 per cent, the annual charge per kilowatt would be $8.25 for the steam engine and $15 for the gas engine, showing in this instance $6.75 saving in favor of the steam-turbine installation. Balancing the fixed charges against the fuel cost shows that, considering fixed charges and fuel only, a saving of $1.85 per kw per annum exists in favor of the steam-turbine installation. Consideration of operating expense and other items, said the speaker, will widen this margin considerably.

From lantern slides of crank-effort diagrams Mr. Gasche contended that the inherent features of the gas engine made it necessary for the rotating masses of an installation to drag the heavy reciprocating parts of a gas engine when heavy and quickly fluctuating loads were to be carried. He said further that flywheels large enough to eliminate the difficulty are "commercially and physically preposterous." In spite of the often-discussed high thermal efficiency of the gas engine, the speaker said that the mechanical efficiency of the double-tandem gas engine at fractional loads has proved a disappointment, while even at full load this efficiency is seldom as high as 85 per cent. The great friction load affects operation at fractional load to such an extent, according to Mr. Gasche, that a plant operating with 70 per cent load-factor will be attended with an over-all thermal efficiency of not more than 16 per cent.

In closing, the speaker recommended that where large amounts of by-product gas are at hand for power purposes the use of steam boilers and turbines should be resorted to as a means of delivering the energy from the gas to the shafts of alternating-current generators.

Discussion

In discussing the paper, Mr. W. B. Jackson, Chicago, said that, although he had never been able to advise clients to purchase gas engines in place of steam turbines, he believed it no mistake to develop the gas engine, as it was a step away from the steam cycle and might lead to developments of economic importance.

Mr. Taliferro Milton, Chicago, speaking of speed regulation in steel-mill power plants, told of an installation of storage batteries in a large mill which were used to aid gas engines in carrying fluctuating loads. Mr. Milton said that the Electric Storage Battery Company stands ready to guarantee storage-battery installations to take up the fluctuating load and regulate the speed of the prime movers until within 6 per cent above and below normal. The charge for maintenance and depreciation on such batteries, he said, would be less than 6 per cent.

Mr. E. W. Allen, Chicago, said that the product from steel mills operated with steam-power plants was better than that from gas-engine-driven stations on account of the better speed regulation of the former. He said further that the cost of necessary storage-battery equipment was prohibitive.

Mr. Wilfred Sykes, Pittsburgh, Pa., in commenting upon flywheel action in connection with gas-engine-driven units, said that the addition of heavy flywheels to such a system aggravated peak-load troubles.

Mr. O. H. West, Gary, Ind., in speaking of the advantages of gas-engine-driven stations, pointed out the fact that gas-engine units can be placed in service from standstill in about one and a half minutes. He said further that the energy cost in steel mills driven by gas engine stations was considerably lower than that in steam plants. Others who discussed the paper were Mr. D. W. Roper and Mr. E. B. Waite, Chicago.

Revenues of New York Edison Company

The New York Public Service Commission, First District, has made public a statement regarding the results of operation of the New York Edison Company for the year ended Dec. 31, 1913. The sources of the operating revenues are shown in the accompanying table.

OPERATING REVENUES OF THE NEW YORK EDISON COMPANY

Class of Revenue	Quantity Delivered to Consumers, Kw-hr.	Rate or Average Price, Cents	Total Gross Price
Municipal street lighting—arc....	23,554,721	3.25	$766,073
Municipal street lighting—incandescent	1,198,629	7.79	93,395
Lighting municipal buildings—electric (a)	8,487,794	5.02	426,330
Municipal heat and power—electric	283,662	6.00	17,020
Miscellaneous electric revenue—municipal	843,300	10.04	84,649
Commercial metered lighting (b)	261,777,624	6.61	17,310,229
Commercial metered power (c)...	28,337,168	7.95	2,252,328
Railroad corporations (d).......	124,242,460	.53	659,762
Other electrical corporations (e).	67,040,299	1.32	884,517
Breakdown service (f)..........	1,808,681	7.34	132,808
Miscellaneous sales of energy (New York City aqueduct)...........	22,454,439	1.57	352,314
Total from sales of energy.....	540,028,777	4.26	$22,979,425
Electric merchandise and jobbing revenue...........			30,944
Joint electric rent revenue..........................			825
Total electric revenues..........................			$23,011,194

(a) Retail, 3,633,287 kw-hr. at $236,985; wholesale, 4,854,507 kw-hr. at $189,345.

	Number of Consumers	Quantity Delivered, Kw-hr.	Total Gross Price
(b) Commercial metered lighting:			
General rate	117,520	169,855,782.8	$13,658,431
Wholesale	471	91,890,301.8	3,649,043
Electrical show	55	5,696.0	171
Prepayment meters	233	25,843.5	2,584
(c) Commercial metered power:			
Motor	13,983	24,840,264.6	2,104,199
Charging vehicles	150	18,038.6	1,804
Storage battery	102	3,478,864.8	146,325

(d) Includes 123,098,460 kw-hr. to Third Avenue Railway Company, for which $636,902 was charged.

	Kw-hr.	Cents	Revenue
(e) Sales to other electric companies:			
United Electric Light & Power Co.	54,906,519	1.32	$725,956
New York & Queens Electric Light & Power Co.	726,580	.55	3,996
Yonkers Electric Light & Power Co.	10,074,044	1.29	130,233
Westchester Lighting Co.........	1,333,156	1.83	24,332

(f) Number of contracts, 232; kw-hr. consumed, 1,808,681; total receipts for energy consumed, $132,808, including $36,641 on ninety-eight contracts under which the service charges ($30) were not absorbed in the price charged for energy.

Public Service Commission News

Ohio Commission

While the Public Utilities Commission of Ohio has passed the order providing for valuation of public utilities and interurban railroads, it has allowed several applications in specific cases for extensions of time for filing inventories. Originally the commission expected to require the information to be filed as of April 1, 1914, but later it decided to order that the information requested should be filed on or before Aug. 1, 1914, thus allowing an extension of time amounting to four months for the preparation of the necessary data.

Wisconsin Commission

The decision of the Railroad Commission of Wisconsin fixing a compensation to be paid the Manitowoc Electric Light Company by the city of Manitowoc for the property of the company has been mentioned in the *Electrical World.* The full text of the decision gives data regarding depreciation. A study of forty-two physical valuations of plants varying from one to twenty-four years in age shows the following descriptive data of the ratio of present value to cost new: Minimum, 64.6 per cent; average, 76.6 per cent; medium, 74.7 per cent, and maximum, 97.7 per cent.

California Commission

The Supreme Court of California has rendered a decision reversing the order of the Railroad Commission of California in which permission was denied to the Oro Electric Corporation to supply electrical energy in the city of Stockton. The decision declared that if the State had empowered the city to grant a franchise it also empowered the grantee to exercise the privilege, and that there is nothing to support the contention of the commission that a dual system of control would be created which was never contemplated and that two utilities would be in operation, one under city control, the other under commission control. The court declares that cities have control of their utilities regardless of whether or not they were in operation when the commission was created, and therefore the order denying the Oro company the right to exercise its franchise was outside of the jurisdiction of the commission and null and void.

New York Commissions

The New York Public Service Commission, First District, has granted applications of the New York Edison Company and the Astoria Light, Heat & Power Company to issue additional stock and bonds. Commissioner Eustis broke the deadlock in the commission, voting with Chairman McCall and Commissioner Williams. Commissioners Cram and Maltbie voted no on the questions involved.

The action of the commission authorizes the New York Edison Company to issue $15,800,000 additional capital stock and the Astoria company to issue $5,000,000 of 5½ per cent bonds and $9,500,000 in capital stock.

Commissioner Maltbie took the position that there was not sufficient proof that all of the money borrowed by the Astoria company from the Consolidated Gas Company, which is to be repaid by the issue of securities, was spent on accounts properly chargeable to capital. He also argued that the rate of interest on the Astoria bonds was too high.

Commissioner Eustis filed an opinion in which he explained that he considered the matter of interest rate one for the directors to decide unless there was a chance that the rate charged would increase operating expenses at some future time should a case involving the price to consumers arise.

Current News Notes

"The Jovian."—The name of the monthly journal published by the Jovian Order has been changed from *The Jovian Bulletin* to *The Jovian*. Mr. Ell C. Bennett, 1415 Syndicate Trust Building, St. Louis, is the editor.

* * *

Completion of Shawinigan Development.—The fifth unit has just been installed in power plant No. 2 of the Shawinigan Water & Power Company, Shawinigan Falls, Quebec. The station, which was described in the *Electrical World* of May 4 and May 11, 1912, has a maximum rating of 100,000 hp. The maximum rating of power house No. 1 is 60,000 hp, giving the company 160,000 hp. Outside of the development at Niagara Falls, Ont., that of Shawinigan Falls is the largest at present in operation in Canada.

* * *

Pole Men Exhibit at Forest Products Show.—Representing the twenty-eight company members of the Northern White Cedar Association, formerly the Northwestern Cedarman's Association, an attractive exhibit of white cedar poles and posts was displayed at the Coliseum, Chicago, during the Forest Products Show. Straight, good-looking 25-ft. and 30-ft. poles of standard sizes, with cross-arms and properly guyed, formed the feature of the exhibit. Mr. N. E. Boucher, Minneapolis, Minn., is secretary of the Northern White Cedar Association.

* * *

Jovian Procedure.—A neatly printed "Handbook for Jovian Procedure," written by Mr. Ell C. Bennett, the reigning Mercury, has been published by the Jovian Order. The book consists of a pamphlet of over 100 pages giving information relating to the organization and conduct of rejuvenations and joviations and local Jovian leagues and clubs. The book is interesting to all Jovians and indispensable to statesmen and others who undertake the responsibility of organizing and directing the work of the order in various electrical centers. It is copyrighted by Mr. Bennett for the Jovian Order. The office of Mercury is in the Syndicate Trust Building, St. Louis.

* * *

Ohio State University Electrical Show.—The Ohio State University branch of the American Institute of Electrical Engineers gave a very successful show in the Electrical Building of the University at Columbus, Ohio, April 16, 17 and 18. The building was suitably decorated for the occasion, and forty-eight booths were given over for exhibition purposes. The three local concerns, the Erner & Hopkins Company, the McKeaver Electric Company and the Avery-Loeb Electric Company, each had a large booth at the west end of the building, and the Columbus Railway, Power & Light Company showed a complete line of cooking utensils and household appliances in operation. The spectacular part of the exhibit was in charge of students and comprised an exhibition of 400,000-volt high-frequency current, frying eggs on ice by the aid of hysteresis and eddy currents, etc. About 3000 people attended the show.

* * *

Electric Vehicle Growth in Boston.—Since the Edison Electric Illuminating Company of Boston began its vehicle campaign three years ago there has been an increase of 250 per cent in the number of electrical commercial vehicles in Boston, while the number of electric passenger cars has increased over 110 per cent. The number of cars and garages in Boston on Jan. 1 was 463, there being 208 commercial cars, 255 passenger cars and 185 garages, as compared with 50, 117 and 57 respectively on Jan. 1, 1911. The Edison Electric Illuminating Company of Boston operates the largest fleet of cars, the express companies have nearly fifty trucks and the coal companies more than twenty. The breweries also operate more than twenty trucks.

* * *

SOCIETY MEETINGS

Rejuvenation of Southern California Jovians.—The Jovian Electrical League of Southern California will hold a rejuvenation at Clark's Hotel, Los Angeles, on May 15 at which forty candidates will probably be initiated. At the luncheon held on April 22 District Attorney J. W. Ford delivered an address on the duties and responsibilities of a district attorney.

* * *

Chicago Electric Club Smoker.—About 400 men, comprising members of the Electric Club of Chicago and guests, attended a pleasing entertainment in the Hotel Sherman, Chicago, on the evening of April 29. There was a good vaudeville entertainment, and refreshments were served. Mr. William C. Berry, of the Commonwealth Edison Company, chairman of the entertainment committee of the club, was in charge.

* * *

Value of Associations.—Mr. W. S. Vivian, secretary of the Independent Telephone Association of America, speaking before the Chicago Jovian League on May 4, cited several particular instances in which his association had been of service to its members. In most instances the value of these services repays the annual membership fee many times. Mr. E. C. Lewis spoke on the "Big Brother" movement being carried out under the direction of the Order of Elks and sought to interest Jovians in the work.

* * *

May Meeting of Electric Vehicle Association.—The May meeting of the Electric Vehicle Association scheduled for May 22 will be held in the new auditorium of the Consolidated Gas Company, 130 East Fifteenth Street, New York City. The topic for the evening will be the electric vehicle in parcels-post service for economy and reliability. The general subject will be presented by Mr. G. S. Thompson, Public Service Electric Company, Newark, N. J. Mr. Frank W. Frueauff, chairman of the parcels-post co-operative committee of the National Electric Light Association, will present the workings of his committee, discussing the subject from the viewpoint of the central stations. Mr. James H. McGraw, chairman of the parcels-post delivery committee of E. V. A., will indicate the work accomplished by his committee and show the great influence of the development.

* * *

Meeting of Radio Engineers.—At the May meeting of the Institute of Radio Engineers, which has been postponed until Wednesday, May 13, and is to be held in Fayerweather Hall, Columbia University, Messrs. L. L. Israel and E. J. Simon will present a paper on "The Operating Characteristics of a Three-Phase, 500-Cycle Quenched-Gap Transmitter." In this paper the authors review experiments conducted last November in the New York Navy Yard radio station, together with the observations recorded at the Bureau of Standards and at the Arlington radio station, near Washington. Lantern slides of the apparatus will be shown, and the limitations and possibilities of the system discussed. Mr. John Stone Stone, vice-president of the Institute, will talk on the subject of "The Resistance of the Spark and Its Effect on the Oscillations in the Primary and Secondary Circuits."

Unmarketable Coal Used for Generating Electricity—I

Features of generating station, transmission lines and substations of the Lehigh Navigation Electric Company, Hauto, Pa.—Culm used as fuel with special grates—Water stored for condensing purposes

At Hauto, Pa., is situated the newly constructed generating station of the Lehigh Navigation Electric Company, which was built by the Lehigh Coal & Navigation Company for the purpose of utilizing the refuse coal from the breakers and washeries where the commercial sizes of anthracite are prepared. Heretofore there has been no profitable market for this refuse coal, although it possesses a fairly high heat value, from 9000 to 11,000 lb.-Fahr. units per lb. On account of the large percentage of coaldust in this refuse it can be burned to advantage only in special furnaces. The cost of transportation of the low-grade material is the same as for the higher grades of anthracite, and consequently the demand for the low-grade coal has been very limited. Provision has been made at the Hauto power station for reducing to a minimum the cost of transportation, as the refuse coal is taken from the breakers and washeries directly to the power-house coal bunkers in gondola cars. The furnaces and grates have been specially designed to burn this refuse coal with a minimum of labor and a maximum of economy. In the production of "stove coal" of commercial sizes the Lehigh Coal & Navigation Company turns out annually enough coal refuse to maintain in continuous operation a 100,000-kw generating plant. The initial capacity of the Hauto power plant is 30,000 kw, and plans are in preparation for the ultimate extension of the plant to 100,000 kw.

The energy which is generated in the Hauto plant is now transmitted to coal mines, cement mills and various other industries in the vicinity, but the entire State of New Jersey and the cities of Philadelphia and New York are within the present commercial limits of electric transmission. The Quaker City is only 73 miles from the station by the shortest route and New York is about 98 miles. The transmission line has been designed for long-distance work, the circuits being run in duplicate to insure uninterrupted service, and a working pressure of 110,000 volts is being employed or has been provided for, except on those circuits supplying electricity in the immediate vicinity of the station.

The station at present is in the shape of a T, the base of which abuts a foothill, and is connected to a railroad track thereon by an elevated steel structure supporting standard-gage tracks. The head of the T contains the generating, switching and transforming equipment, while the stem houses the boilers, which are arranged in a single row beneath the tracks and overhead bunkers. The station exterior is of pleasing design and an unusual amount of window area has been provided to furnish good light and ventilation. An innovation—that of connecting the smoke uptakes with the stacks above the roof instead of inside the building—has also been made in this installation to minimize the cost of the building. While this construction gives a peculiar appearance to the structure, it permits of installing economizers on the roof at any time in the future if desirable.

Coal and Ash Handling

Aside from utilizing the refuse from coal washeries, the striking feature of the plant which makes for economical operation is the method of handling the coal and ashes without the use of conveyors or hoists. Coal is obtained at the washeries near by and is conveyed to the station over an elevated structure in standard-gage 50-ton gondola cars. The tracks enter the building at the rear of the boiler house and extend over each firing

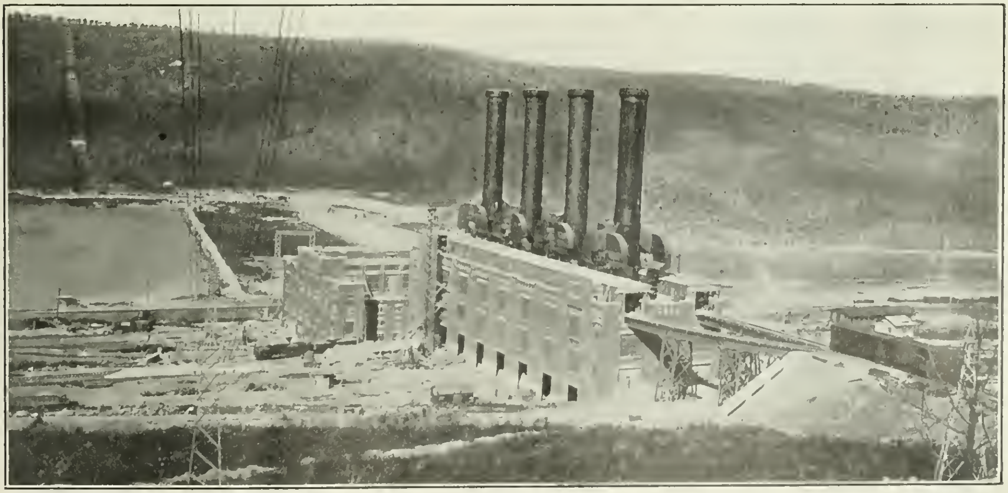


FIG. 1—EXTERIOR OF PLANT, SHOWING STORAGE RESERVOIR AND SMOKE UPTAKES

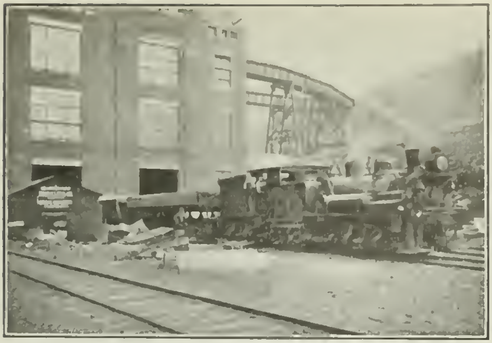


FIG. 2—ASH-HANDLING LOCOMOTIVE

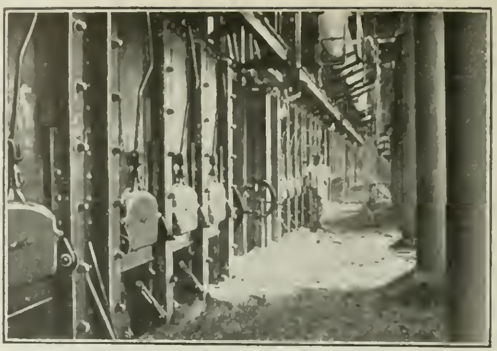


FIG. 3—BOILER-ROOM FIRING AISLE

aisle, there being sufficient space provided to unload six cars on each track at the same time. The cars dump the fuel into concrete bunkers where a supply sufficient to operate the plant two days can be stored. Larger coal-storage facilities are not required as the mines, breakers and washeries are so close that there is never any danger of running short of fuel. Ashes are disposed of by running cars into the basement under the ash hoppers. The loaded cars are pulled out over an inclined track to the main line, by which they can be taken away and the ashes disposed of as desired.

Boilers

Satisfactory combustion of the low grade of coal employed requires use of very large grate areas and combustion chambers. Eight Babcock & Wilcox double-end units are installed at present, each of which is provided with four grates, half of each set being fired from one side and half from the other. The boilers are of the five-drum bent-tube type equipped with superheaters and designed for 225 lb. steam pressure. Exclusive of the superheaters, each boiler has 10,000 sq. ft. of heating surface. Six of the boilers are equipped with hand-fired dumping grates of special design, and the two remaining units are being equipped with automatic traveling grates which are a development of the Coxe design.

Design of Grate

In the case of the hand-fired furnaces the grates are 12 ft. deep and 8 ft. wide, making the total grate area per boiler 384 sq. ft. Four of the boilers are provided with Acme slotted-top grates and two are equipped with pin-hole tops. In each case about 6 per cent of the total grate area is occupied by air apertures, the holes or slots being about 3/32 in. wide. The apertures are at the bottom of grooves molded across the grate tops at right angles to each other, giving the appearance of a waffle-iron. The grooves are provided to prevent the coal from choking the apertures and thereby hindering a free circulation of air through the furnace.

One of the two furnaces which are being equipped with automatic stokers will have "piano-key" grate tops supported on the carrier bars, while the other furnace will be equipped with bars having pinhole apertures.

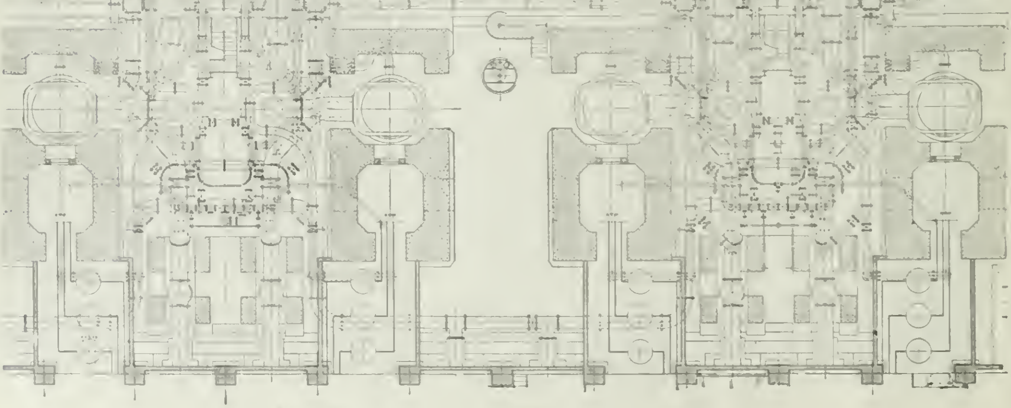
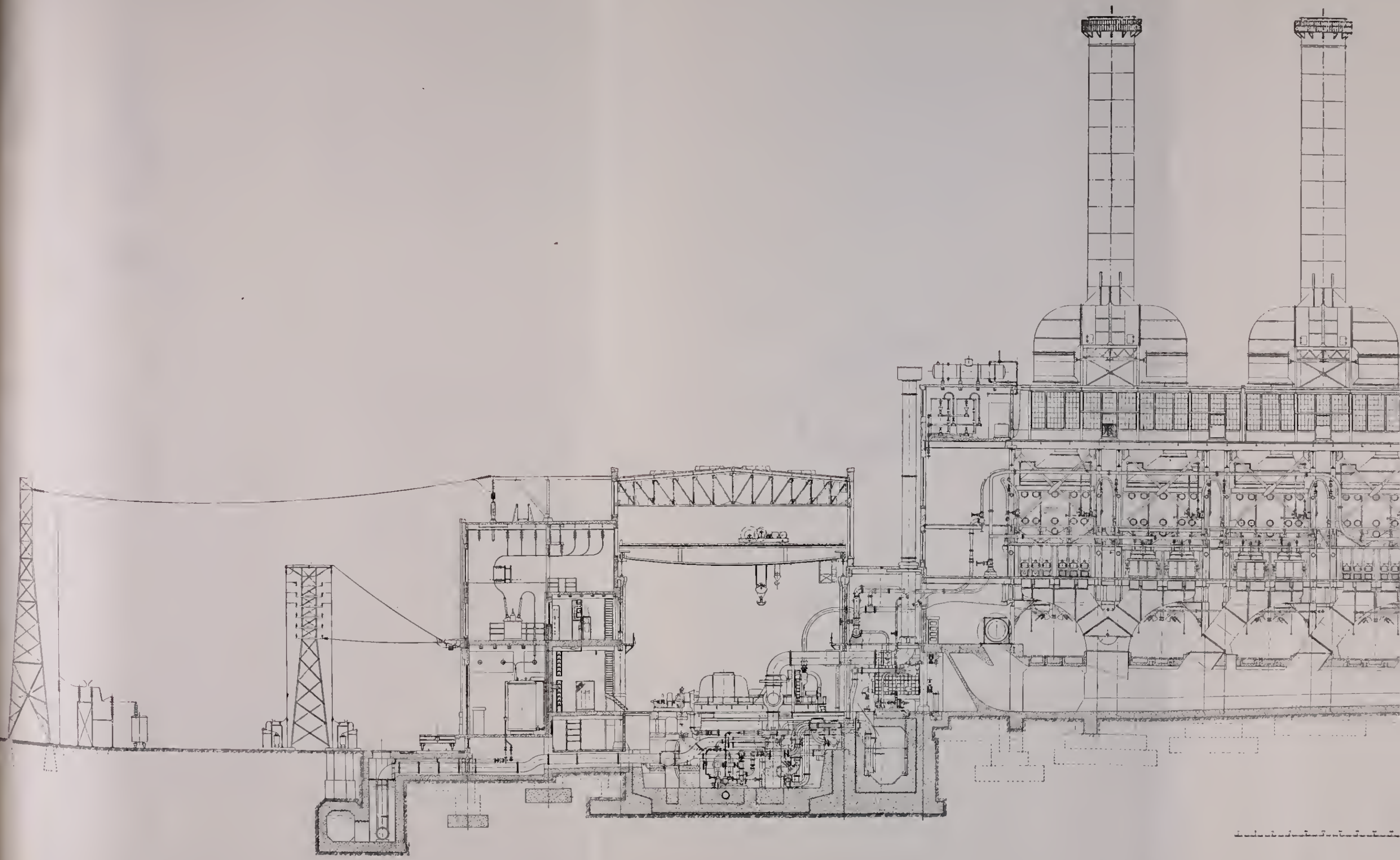
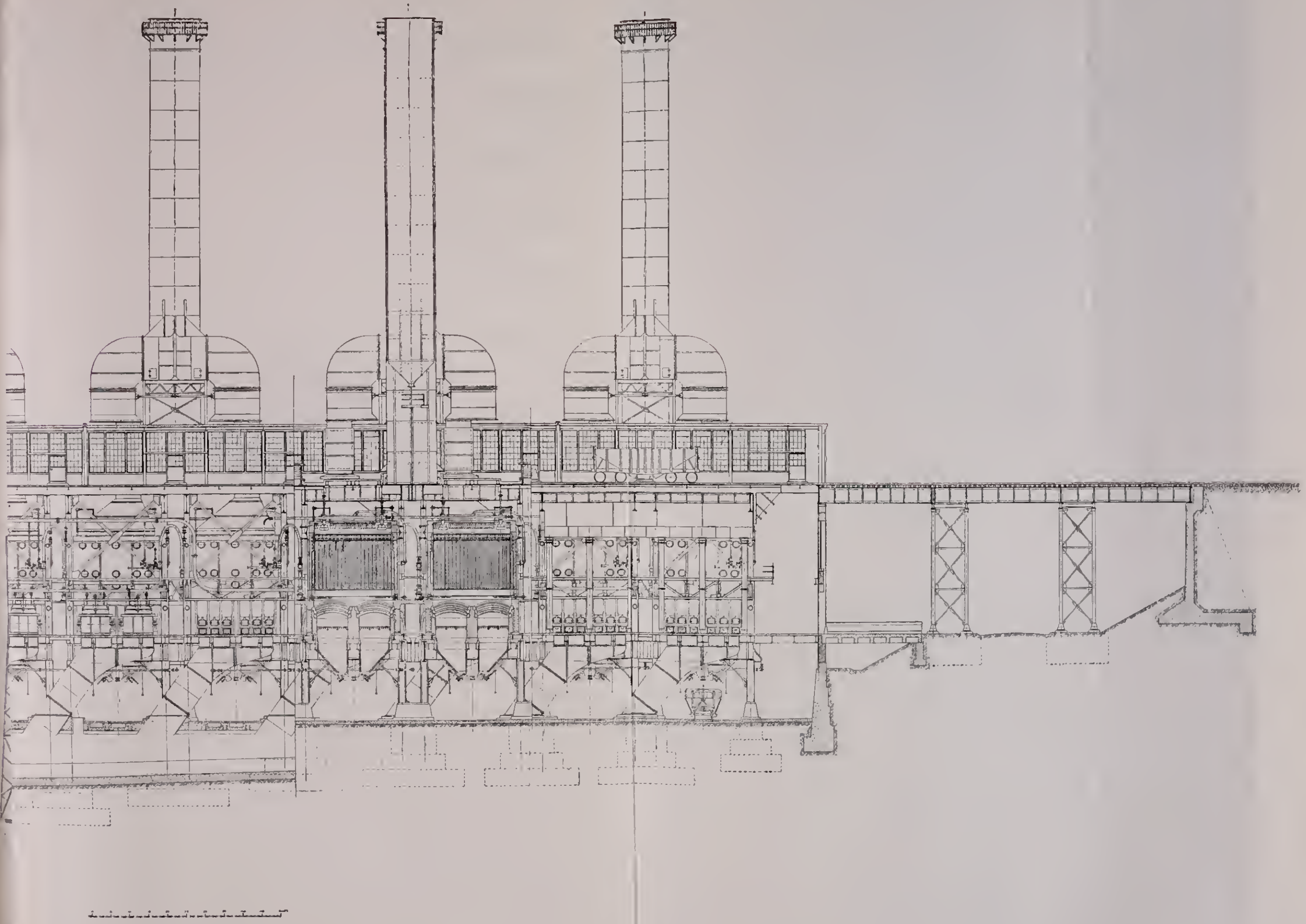


FIG. 4—SYMMETRICAL ARRANGEMENT OF PIPING TO TURBINES



LONGITUDINAL CROSS-SECTION OF HAUTO POWER PLANT, SHOWING COAL-DELIVERY TRACK AND OUTGOING



ELIVERY TRACK AND OUTGOING TRANSMISSION LINES AT OPPOSITE ENDS.

The "piano-key" tops have projections on their adjoining edges which will allow air to enter the furnace between the bars. The bar type of automatic grate top, which is 6.5 in. wide and 8 in. long, has grooved tops similar to those employed in the hand-fired furnaces. Both types of automatic-stoker grate tops are arched to "bite" the fuel and thereby feed it into the furnace. Each top is fastened to its respective carrier bars by a T-slot joint and can be removed only by sliding it off the end of the carrier bar.

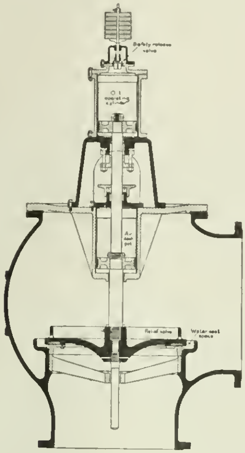


FIG. 5—SPECIAL ATMOSPHERIC RELIEF VALVE

Provision for Expansion of Grate Tops

Lateral expansion of the "piano-key" tops is compensated for by expansion plates placed on each end of the carrier bars. These plates are supported on the carrier bars in the same manner as the tops, but inclined springs attached to the plates pulling from each side of the grate toward the center press the tops together laterally. One of the sprocket drums supporting each chain grate is supported so that it can move horizontally and at right angles to its axis, against the pressure of springs. When the tops change in temperature the expansion plates on the grate separate or approach each other to allow for expansion or contraction as the case may be; likewise the horizontal movement of the sprocket drum allows for longitudinal expansion of the tops.

The plate type of automatic stoker top is fastened at its center to the carrier bar so that it expands in all directions, but cannot creep along the bar; therefore no expansion plates are required on the grates so equipped. Horizontal movement of the sprocket drum is also provided as described above. Both types of traveling grate tops overlap each other in the direction of their travel so as to allow for clearance in passing around the drum and still not offer an opening through which coal can sift into the ash pit. As more air is likely to leak through the overlapping clearance than at other points in the grate top, the arched-top design serves another purpose, that of maintaining a thicker bed of coal over high leakage points than at others.

Other Features of Boiler Equipment

Other features of the furnaces are the use of vertically sliding furnace doors, recessed ash-pit doors and shaker handles to prevent obstruction to the firing aisles, double fire arches, cinder catchers, ventilation of fire wall to prevent burn-outs, and independent brick settings which are not affected by expansion of the metal parts.

Sliding doors were preferred to swinging furnace doors, as the latter are usually faced with firebrick, which attains a very high temperature and therefore becomes objectionable to firemen when the door is opened. The doors employed are counterweighted and are operated by pulling on a vertical rod hanging over the firing aisle in front of the furnace door. Double superposed fire arches are provided so that if the lower one burns out the upper one will come into use. Between the superposed arches is an air space through which air is allowed to circulate slowly in order to prevent the firebrick temperature from reaching such a value that the material deteriorates. The space over the grates is practically a reverberatory furnace, which insures the complete combustion of the fuel even if the draft does lift it off the grates as soon as a fresh charge is thrown into the furnace. The fire arch is 9.5 ft. long and covers over two-thirds of the grate area.

The combustion chamber above the bridge wall is unusually large and is so designed as to reduce the velocity of the gases and allow any unburned fuel to drop back into the fire and be consumed. The gases from four furnaces under each boiler pass up through the central combustion chamber and then divide at the top, going through two passes, striking the flues and superheaters (of which there are two to each boiler),

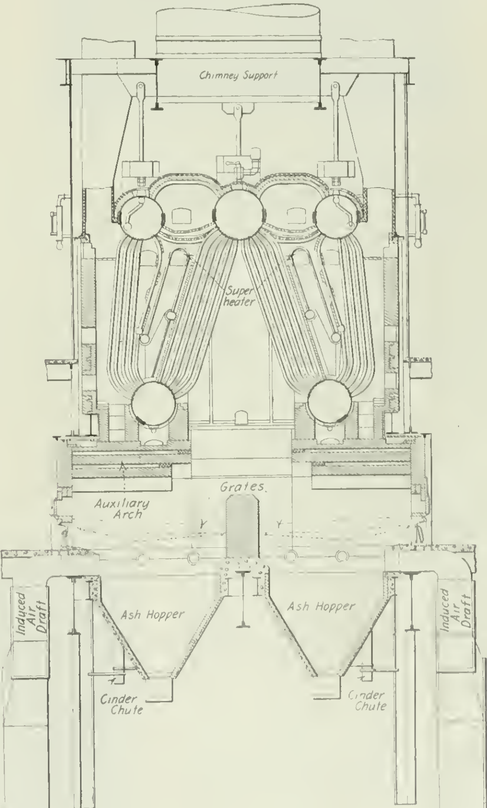


FIG. 6—DOUBLE-END BOILERS FOR BURNING CULM

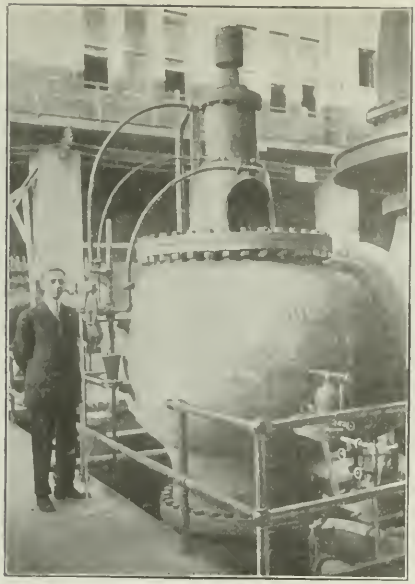


FIG. 7—ATMOSPHERIC-RELIEF VALVE FOR 12,500-KW UNIT

and then following the vertical uptakes at the boiler heads to the roof of the station, where they join a common stack. Whatever unburned fuel or cinder may be carried over into the first pass of the boilers is thrown out by centrifugal force at the bottom of the pass into a cinder catcher. This receptacle is provided with a down-take communicating with the ash-disposal basement. These chutes are normally sealed at the bottom by spigot-type valves which prevent air leaking into the flue space and thereby decreasing the draft over the grates. The cinder catchers consist of inverted steel hoppers which prevent any accumulation of material because of the absence of pockets.

Connection of Uptakes and Stacks

By joining the uptakes with the stacks above the roof of the building several advantages have been obtained, chief among which are the aforementioned saving in building cost and provision for future economizer installation. In addition, a shorter stack could be used and supported on the roof trusses, and facilities are provided for collecting the stack cinders at the bottom of the chimney and conveying them by gravity to cars in the basement.

Steam Headers

The absence of valves in the boiler headers is one of the features of the piping installation. Each set of four boilers is provided with its own open-loop header, which is independent of the headers carrying steam from other groups of boilers. Each loop passes down the firing aisle on one side of the boiler through a valve and thence returns along the other aisle, the two ends being connected in a pipe gallery to separate main headers.

The manner in which the boilers are connected to the boiler headers is also of interest. Separate pipes lead from the two outer upper drums of each boiler to separate superheaters whose outlets connect with a ball check valve supported on a pedestal beside the boiler. From the top of the valve the steam passes through a vertical pipe and another check valve into a horizontal pipe having valves on each side of the juncture. The ends of this pipe connect with opposite sides of the boiler-header loop so that steam may be fed into one or both sides of the loop. The feed-water piping is arranged similarly.

Main-Head Gallery

To provide support and convenient access to the main headers and at the same time lessen the danger to station attendants in case one of the pipes develops a fault while under pressure the main headers are installed in a pipe gallery. Duplicate headers run the entire length of this space, but each is divided into sections about the length of a boiler. Adjacent sections of the same header are joined by wide radius loops to allow for expansion. Each section may be directly supplied with steam from either of two sets of four boilers or from both.

All steam pipes are drained of condensation. In the high-pressure system both the "Holly-drip" and the "open-blow" system are employed. The "open-blow" discharges into the exhaust main passing through the feed-water heaters. The low-pressure system drains into sump pits which are emptied automatically by motor-driven pumps discharging into three tanks on the roof of the boiler house. This water is used exclusively for sprinkling ashes.

Forced-Draft Equipment

Installed at one end of the boiler room next to the pipe gallery are three motor-driven Sirocco blowers which furnish air for the furnaces. The fans take air from a vertical air shaft and discharge into a duct connecting with two tapering concrete tunnels running the length of the ash room under each firing aisle. Risers inclined in the direction of the motion of the air in these tunnels connect them with the air space under each furnace. Except in the case of the furnaces nearest the blowers (where four furnaces are fed from one riser) each riser supplies air to two furnaces. The draft in the furnaces is controlled by valves in the risers. The tunnels are cross-connected at the end nearest the blowers so that any one of the blowers may

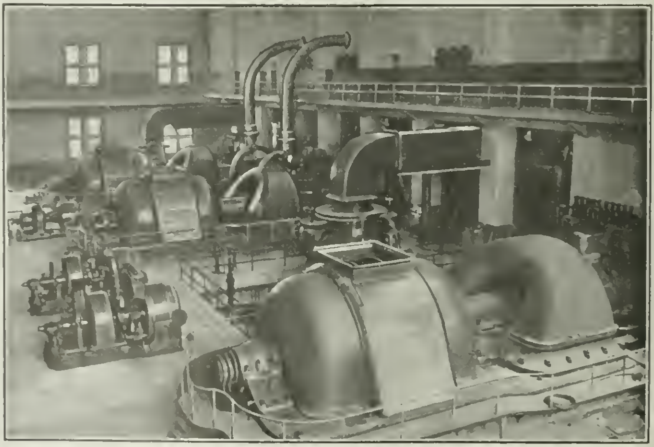


FIG. 8—MAIN ENGINE ROOM

be used to supply air to both tunnels. Sufficient air can be supplied by two of the blowers to operate eight boilers carrying full load. The third blower is installed as reserve equipment. The suction side of the fans may take air either from outdoors, from the top of the boiler room, from the pipe gallery or from the engine room. This flexible arrangement of the air intake permits of ventilating any of the heated portions of the building in the summer and also prevents the chilling of the building during the winter, by drawing air directly from outdoors.

Engine Room

Installed in the engine room now are three 12,500-kw, 11,000-volt, twenty-five-cycle turbo-generators the piping for which is laid out so that when more units are added it will be symmetrical about a center line between each pair of generators. This arrangement will facilitate following the connections to each unit when the plant becomes more complex, for if the connections to one turbine are known the others are also.

The method of connecting the turbine headers onto the main header is rather novel. Tapped into the lowest side of each main header is a short vertical pipe which connects with the middle point of a "bottle" consisting of a relatively short horizontal drum. Two turbine headers connect with the upper side of the drum at each end and extend through the pipe-gallery wall to connect with the turbine casing in a long radius bend. The ends of the "bottle" connect with pipes leading to auxiliary headers. The boiler, turbine and auxiliary header valves are placed in their respective pipes in the pipe gallery, but the valve stems extend through the pipe-gallery wall into the engine room, where they can be operated by the engine-room attendant.

Turbine Characteristics

The blading of the turbines is a modification of that used in the Rateau machine as developed by the Allgemeine Elektricitäts Gesellschaft, while the governing parts, impulse nozzles and their wheels are essentially the same as those employed in the Curtis turbine. When operating at full load and maximum efficiency these units consume 12.3 lb. of steam per kw-hr. with a vacuum of 28 in.

Condensing-Water Supply

To obtain water in sufficient quantity for condensing and boiler-feed purposes is a problem of no small import in anthracite-coal regions, as it is practically impossible to obtain water by sinking wells and streams are usually scarce and of such size as to give inadequate supply, or else are filled with acid and sulphur from the washeries.

Prior to the construction of the station large quantities of water were used in the coal washeries in this vicinity. The supply was obtained from mountain streams about 3 miles to the north of Hauto and was stored in a pond near the site of the present plant. The pond did not have sufficient capacity, however, to supply the combined needs of the washeries and the new plant, so a new dam was constructed giving a pondage of 269 acres and a capacity of 1,000,000,000 gal. The depth of the water in the reservoir is 25 ft.

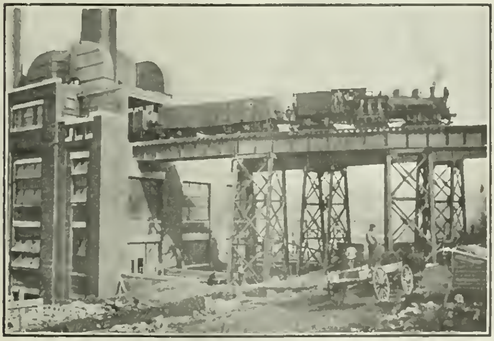


FIG. 9—COAL-DELIVERY TRESTLE

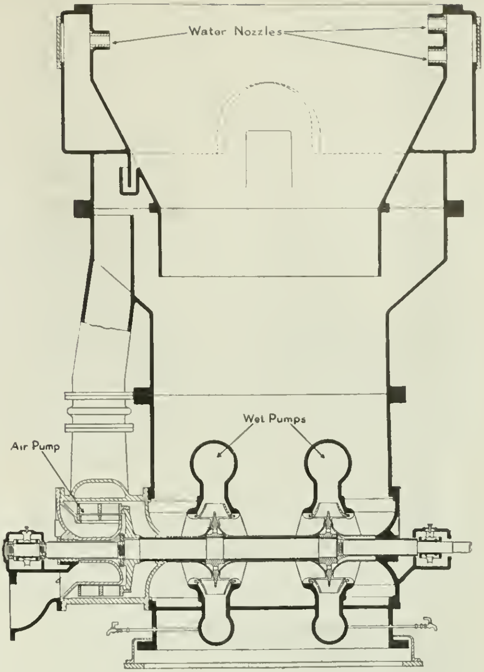


FIG. 10—12,500-KW JET CONDENSER

The dam is made of earth excavated for the most part from the site of the power plant. It is 1800 ft. long, 30 ft. high, 15 ft. wide at the crest, and slopes two to one on both sides. The upstream face is protected with concrete slabs, the joints being filled with bitumen. This facing is carried down over the front, thus forming a concrete cut-off wall that protects the mass of the dam from contact with the water.

No coal washeries are situated above the plant, so that the water is not contaminated or made unfit for boiler purposes. The general scheme for supplying water to the plant is to take water from a point about 2500 ft. above the dam, deliver it to the condensers and discharge the hot water into the pond again about 2100 ft. above the station, or about 4000 ft. above the intake. The water is thus used over and over again. The water in flowing back to the intake is cooled enough to meet the requirements of the service since a relatively large radiating surface is furnished in the discharge canal and in the pond.

Near the suction end of the intake tunnel is a head-house in which are installed two steam-driven 70,000-gal. centrifugal emergency pumps which are employed to supply water to the intake tunnel when the pond level falls below normal. The pumps are equipped with hydraulically operated throttling valves which are partly closed when the load on the turbines is light. Unlike ordinary valves of this type, they can be maintained at any desired opening by properly setting the remote-control switches installed in the power house. The intake tunnel, which is 13.5 ft. square, connects with another tunnel running parallel to the engine room but accessible from the exterior of the plant. From the latter duct 30-in. intake pipes about 112 ft. long lead to each turbine's condenser.

The condensers are of the Leblanc jet type and are the largest of their kind ever built. The wet-air and dry-air pumps, which are mounted on a common shaft driven by a turbine, are both inclosed in the exhaust casing leading from the turbine. The entire condenser unit is suspended from the lower side of the turbine. The condenser pumps are both of the centrifugal type, and the turbine driving them is rated at 445 brake hp. With the barometer reading 29.1 in. and when condensing 150,000 lb. of steam per hour these condensers will provide a vacuum of 28.1 in. The condensers are primed by allowing water to run into the rotating air pump until sufficient vacuum is obtained to lift the water from the pond into the condensers by barometric pressure. A priming tank is being constructed near the station which will be about 70 ft. in diameter and will discharge water by gravity into the condensers when they are being primed. A 24-in. main will connect this tank with the condensers.

Water from each condenser will flow through 30-in. pipes about 28 ft. long into a discharge tunnel running parallel to the engine room directly beneath the pipe gallery. At one end of the tunnel where it emerges from the building and joins the discharge canal is a weir having an adjustable crest which maintains a definite water level on the discharge side of the condensers and provides a water seal for the pipes emptying into the tunnel.

The canal is trapezoidal in cross-section and has earth and clay sides. It is 6 ft. deep, 18 ft. wide at the bottom, and the sides have a two to one slope. The water is discharged into the pond about 2100 ft. north of the plant or about 4000 ft. above the intake. As the power plant is enlarged and the generating equipment increased the length of the canal will be increased to allow the water to have more time in which to cool before it is drawn into the condensers again.

Special Atmospheric Relief Valves

Each pair of turbines is equipped with an atmospheric exhaust. Condensers of the size employed impose especially severe conditions upon the opening and closing of the atmospheric relief valves, so that they had to be designed with this in view. The valve used is provided with an air dash-pot in conjunction with the oil-operating cylinder. The oil-controlling cylinder has a dead-weighted piston on its upper side so that if the operating valve is left in the non-automatic position the piston will rise and allow the relief valve to open in case the vacuum fails. Another feature of this relief valve is the use of a Müller float valve for maintaining a constant level in the water seal and preventing any water running over and being wasted.

Two open feed-water heaters are installed, each one being capable of taking care of eight boilers. Three turbine-driven pumps draw water from these heaters and discharge into the boiler-feed headers, which are laid out on the same scheme as the steam headers and are controlled from the feed-water attendant's gallery. Each pump is rated at 450 gal. per minute.

The equipment of the Hauto power station is arranged on the unit system so that each turbine with its corresponding bank of boilers, together with each generator with its corresponding bank of transformers and outgoing feeders, may be operated independently as a unit. This unit system is carried out almost as completely in the control of the apparatus.

Papers and Discussions at the Session of the Iowa Section, N. E. L. A.

In the last issue of the *Electrical World* an account was published of the joint session of the Iowa State section of the National Electric Light Association and the newly formed Iowa Electrical Contractors' Association at Cedar Rapids on April 22 to April 24, and an extended account of the contractors' meeting was given. Below are abstracts of papers and addresses at the sessions of the State section, with notes on the discussions and other convention proceedings:

In opening the convention President A. L. Dodd, of Charles City, Ia., speaking of the events of the past year alluded to the death of George Westinghouse and cited many of his achievements. Attention was also called to the introduction of the nitrogen-filled tungsten lamp. Commenting on the outlook, Mr. Dodd said that in spite of the service rendered by the central stations in Iowa a few municipal lighting plants have been started. President Dodd advised owners of electric-service properties not to let an additional 1 per cent dividend blind them to the trend of public opinion. He also said that in his opinion the time is at hand when it is as uneconomical for small towns to operate electric plants as it is for a small manufacturer to operate an isolated plant. The speaker saw no reason why the entire State of Iowa should not be supplied with electrical energy from a station in the central coal district of the State. While business elsewhere had not been at its best, the load curves of the central stations throughout Iowa had all shown marked increases over the same months for last year, indicating that the sale and consumption of electrical energy were not affected by general business conditions to any noticeable extent.

Society for Electrical Development—Its Aims and Purposes

A paper on the aims and purposes of the Society for Electrical Development, written by Mr. J. M. Wakeman, New York, was read by Mr. H. B. Maynard, Waterloo, Ia., outlining the plans which had been formulated to unify and mass sales effort for the benefit of the entire electrical industry. A brief outline of the national advertising campaign to be conducted through newspapers, technical and trade journals, and through the Jovian Order and other similar societies, was given, showing how the general public, and more especially architects and builders, were to be interested in making electrical applications wherever possible. It was urged that the society should receive the moral support of enthusiasm, which is as necessary as financial aid.

Joint Meeting with the Contractors

Reading a paper on "Co-operation of the Contractor and the Central Station" before a joint meeting of the two societies, Mr. J. T. Marron, Rock Island, Ill., declared that central stations should do no wiring and advised that sales of appliances and electrical apparatus be made by the stations at fair prices. On the other hand, the electrical contractor should devote himself to the work for which he is best fitted, broadening out as he is able, for the bigger and broader the contractor the more he can help the central station.

Where co-operation is lacking, said the speaker, it is generally the fault of the contractor. He should know the manager of the electric-service company and solicit his aid. In Rock Island the contractors and the electric-service company have formed a plan for co-operative advertising, taking a large space in the local newspapers twenty-seven times a year. Referring to the jobber, Mr. Marron said that the practice of extending credit to unreliable wiremen and others made the jobber appear to the legitimate contractor as an incubator for curbstone contractors.

In discussing the paper, Mr. A. L. Dodd, Charles City, stated that in his city the central station did wiring but the contractor was really on the company's payroll, receiving 10 cents for each outlet he wired.

The Compensation Law and Insurance

Considerable time in the afternoon session was given over to Mr. G. A. Wrightman, of Des Moines, who explained the Iowa workman's compensation law, which takes effect July 1. Mr. Wrightman, as secretary of the Iowa State Manufacturers' Association, offered the electrical men inexpensive insurance in a mutual company formed by the manufacturers.

A lengthy discussion followed the offer. Those taking part were Messrs. F. H. Bellamy of Knoxville, J. P. Ingle of Keokuk, A. D. Ayres of Keokuk, A. L. Dodd of Charles City, Thomas Ferris of Osage, and Rufus E. Lee of Clarinda.

Data on the Operation of Keokuk Station

In a paper entitled "A Few Features of the Operation of the New Keokuk Development," Mr. A. D. Ayres gave a general description of the equipment installed in the great hydroelectric station on the Mississippi. Since the system had been operated on a plan analogous to the common train-dispatching scheme, with operators repeating their orders, no mistakes have been made to impair the service. The fifteen units now in the station delivered 923,000 kw-hr. in the month of December, 1913.

The Utility and the Law

In the absence of Mr. A. C. Huey, Chicago, Mr. F. W. Stearns, general counsel for H. M. Byllesby & Company, read a paper entitled "The Conduct of Public Utilities Under Commission Supervision," presenting the subject from the lawyer's standpoint. In general, said the speaker, the state commissions have been patient with the operators of utilities and the latter have been making an honest effort to conduct their business as the commissions dictated. Although there has been much talk about commission regulation, very few utilities would elect to return to the former system of municipal regulation.

Even commissioners entering office with the avowed notion that utilities' rates were high have been frank enough to admit, after being in office for a time, that in many cases the rates were not high enough to cover adequately proper charges for interest and depreciation and give a reasonable return on the investment. Speaking on the subject of securities, Mr. Stearns brought out the fact that with utility securities passed on by commissions this class of stocks and bonds is lifted from the speculative to the investment class.

To induce utilities under commission regulation to economize in operation. Prof. A. H. Ford, Iowa City, suggested that a clause be inserted in state laws creating commissions saying that when once rates had been regulated no further revision shall be made till the earnings pass some minimum and maximum limits, such as, say, 5 per cent and 12 per cent.

A Trip to Iowa State College

Thursday afternoon a joint party composed of the members of the Iowa State Section of the National Electric Light Association and the Iowa Street and Interurban Railway Association visited Iowa City, where Prof. A. H. Ford, of Iowa State College, delivered a paper on "High-Tension Lightning Protection." After a series of demonstrations showing the action of different types of lightning arresters, Professor Ford said that in purchasing insulators for high-tension lines he should demand one which would flash over at a potential of 50 per cent below its puncture voltage. This, he said, would eliminate the necessity of long service interruptions while linemen hunted for a punctured insulator. The speaker also showed the action of arcing rings and arcing points in protecting insulators from flash-over strains.

Affiliation with the N. E. L. A.

Mr. E. W. Lloyd, Chicago, vice-president of the National Electric Light Association, addressed the convention on the subject "The Objects and Results of Affiliation," telling how the local sections were aided by the national organization. Referring to each of the divisions of the national body in turn, Mr. Lloyd showed how member companies could keep themselves informed and solve their own problems by seeing what others had done under similar circumstances. The annual income of the association is at present about $100,000, an inadequate sum to carry out the work at hand. In closing, the speaker intimated that a movement was on foot to subdivide the National Electric Light Association into sections each dealing with a particular branch of the industry.

Convention Resolves Against Old-Code Wire

Following a paper by Mr. J. E. Latta, of the Underwriters' Laboratories, it was moved that the use of old-code wire be discouraged and the use of none but standard wire and approved fittings be countenanced. The motion was passed unanimously.

Saturation Point in the Sale of Electricity

In a paper entitled "Is There a Saturation Point in the Sale of Electricity?" Mr. J. S. Forbes, Cedar Rapids, said that the manager of the small central station who thought his business had reached a condition even approximating saturation was sadly lacking in initiative. Mr. Forbes recommended that in all small towns the lighting company should have a new-business department, even though the manager of the property had to look after it himself. Speaking of old-house-wiring campaigns, Mr. Forbes stated that the best plan yet evolved in Cedar Rapids consisted of offering complete wiring and fixtures for a fixed sum of $21. The Iowa Railway & Light Company, Cedar Rapids, now has 90 per cent of the motor load available but does not despair of the other 10 per cent. For getting the rural business the Cedar Rapids company has been encouraging the formation of farmer companies to finance the building of 2300-volt lines which will in time be taken over by the central station in return for energy supplied. It is estimated that there should be six customers for each mile of line costing about $600. Bills of farmer lighting customers average about $1.25 a month, and if motors are also operated about $2.50 more is added. Mr. Forbes suggested that a committee draft a standard form of contract covering agreements between such farm customers and the Iowa central stations.

Mr. F. S. Dewey, Davenport, in discussing the paper said he thought the cost of line construction for the proper type of 2300-volt line would cost more nearly from $800 to $1,000. He also cited the practice of the Davenport company where a minimum bill of $4 is charged each farmer to encourage the use of motors and appliances.

Facts and Factors

Mr. Austin Burt, Waterloo, chairman of the committee on facts and factors, reported to the convention the data collected with the help of the engineering experiment station at Ames, and given elsewhere in this issue.

Application of Polyphase Currents to Radiotelegraphy

Description of high-frequency polyphase generator and outline of tests made during use in radio service. By Edward G. Gage

THE production of continuous oscillations in an antenna for transmitting radiant energy has long been a favorite problem for engineers, and several methods have been produced by which this could be accomplished. Almost without exception when applied to radiotelegraphy the object sought hitherto has been to lower the decrement of the transmitter. This has given rise to the attendant practical advantages of probable small atmospheric absorption, sharp tuning, and incidentally the optional elimination of the rectifier or chemical detector from the receiving circuit. In dealing with continuous oscillations it is well to remember that for certain purposes it is necessary to have only practically continuous oscillations, the dividing line being the group frequency analogous to inaudibility in acoustics. The success of continuous oscillations is due not only to the fact that the transmitter emits undamped wave trains but in part to the additional fact that rectification of received signals by a "detector," with its attendant losses, is not required.

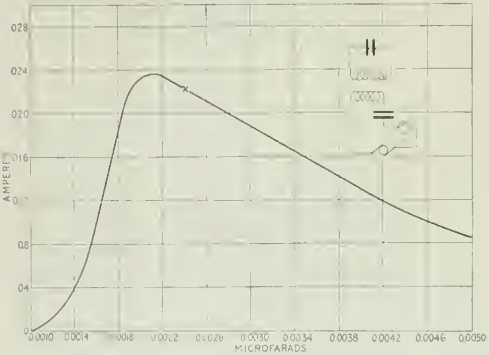


FIG. 1—RESONANCE CURVE OF 6000-CYCLE TRANSFORMER

To determine to what extent polyphase currents might be utilized for wave production, the experiments described below were carried out upon a machine (shown in Fig. 4) designed for the work and presenting some unusual and possibly advantageous features.

In this polyphase alternator the armature and the field structures revolve in opposite directions, each being driven by a 1-hp series-wound motor directly connected to the shaft and capable of running at from 3000 to 3500 r.p.m. Alternating current can be taken from either of the revolving members. The armature is a laminated unit having laminations 0.02 in. in thickness. Fig. 5 represents various field and armature parts, all of which are interchangeable upon the same shaft. Even the windings are all easily removable, and they are interchangeable. This feature of flexibility has been embodied for laboratory purposes only, but any of the various combinations excepting one could be adopted as a fixed design. The machine can deliver alternating currents at 6000 cycles, either single-phase, two-phase or three-phase, arranged to deliver either 9000 cycles or 18,000 cycles single-phase current, though the power obtainable at 18,000 cycles is very small.

The arrangement with which this article has to do can hardly be considered a true three-phase system, as known in alternating-current practice, since the phases are individually connected to their separate transformers. It is simply three single-phase quenched-spark sets, each operating at 6000 cycles and so arranged that the discharges take place in regular rotation, producing a resultant of 36,000 sparks per second at maximum speed of the alternator.

Theoretically it appears that the best results would be obtained when the group frequency equaled the natural frequency of the antenna. This result can be obtained, but because the radiation resistance of normal antennas increases rapidly as the working wave-length becomes much larger than the fundamental, it is not always advisable to meet this condition. For example, in a case cited where the group frequency is 36,000 the most efficient wave-length to employ would be that derived from the group frequency, i.e.:

$$\lambda = \frac{300{,}000{,}000}{N} = 8333 \text{ meters,}$$

where λ = wave-length in meters and N = group frequency per second. To tune an average antenna to so long a wave would necessitate loading with inductance

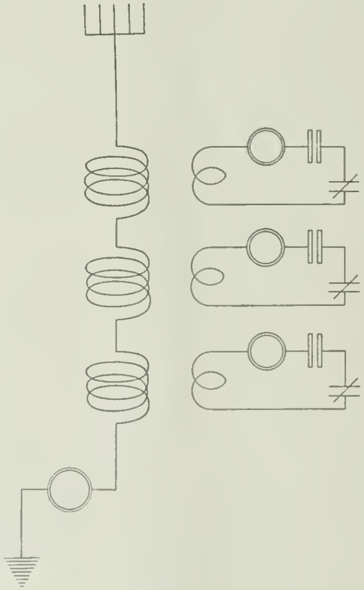


FIG. 2—OSCILLATING CIRCUIT DIAGRAM

to such an extent that its total resistance would no longer permit efficient radiation of energy.

Although the apparatus necessary for experiment may appear to be complicated, the system is in reality very simple, as the circuits of Fig. 2 show.

Before beginning experiments the first difficulty that came to mind was that of obtaining a clear note, and maintaining it on each phase so that the resultant would give silence in the receiving telephones. Since much trouble is experienced in 500-cycle outfits in keeping the note pure, it was only natural to expect the same difficulties here. As a matter of fact, however, the note was the least troublesome of any of the features, and it might be of interest to show how the problem was solved by the careful selection of proper transformer constants by trial.

Each transformer core comprises a bundle of silicon-steel strips bent into [illegible] open ring to allow for a leakage gap. The primai [illegible] nsists of a single layer of No. 20 wire wound fo [illegible] w inches in the middle of the ring. The seconda [illegible] a coil of No. 24 double cotton-covered wire impr [illegible] d, having an inductance when free from iron of 6 [illegible] lihenrys. The coupling between the primary and t [illegible] secondary can be varied simply by sliding the secor [illegible] coil along the core or by tipping it at an angle.

It was found impossible [illegible] without iron. With air-core transformers the [illegible] lution is simpler, but although at the available power and frequency of 6000 cycles very little iron is needed, the laminated core cannot be omitted. The final tuning of the transformer is obtained by means of variable condensers, even though according to a transposition of the usual formula

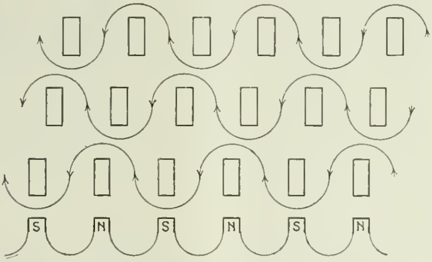


FIG. 3—ARRANGEMENT OF ARMATURE AND FIELD POLES

$$P = \frac{\frac{1}{2} CE^2 N}{10^6}$$

where C = secondary capacity, E = secondary voltage, N = primary frequency and P = primary power, this does not permit maximum efficiency. In this case it is advantageous to sacrifice over-all efficiency to regularity of operation, though the efficiency is kept reasonably high, nevertheless, by carefully proportioning the circuits to agree with the formula as nearly as possible.

Since low voltages are employed (about 4000 volts at the transformer secondary), ordinary rotary variable receiving condensers with oil dielectric can be used. By combining these with Leyden jars it is possible to adjust the secondary capacity as closely as may be desired. Fig. 1 shows the effect on primary 6000-cycle current obtained by varying the secondary capacity. The cross shows the most satisfactory value.

A quenched gap is used in each phase and consists of two copper plates with radiating flanges, paper gasket and parallel copper sparking surfaces. A pressure plate placed on top of each gap holds the units in position. A single gap is employed for each phase and is quite sufficient for the voltages present.

The inductance coils used in the oscillating circuits are made of "litzendraht" (stranded wire) wound on hard-rubber spools. Since the secondary inductance common to each phase when in operation consists of the three secondaries in series, it is found much better to keep both primary and secondary windings fixed in self-inductance value and to allow for variation of coupling only. In the apparatus used each coil has an inductance of 100 microhenrys. This change can be obtained simply by placing the primary coil in various positions with regard to the secondary. Excellent flexibility in tuning is found possible by use of these simple arrangements since the variable condenser across the transformer secondary, the variable compensating capacity in the transformer primary circuit and the variable coupling afford entirely adequate means for preserving the regularity of note and radiation. Further adjustments are possible by varying the alternator-field strength (and hence the primary voltage) or by altering the value of reactance coils in primary or secondary circuits.

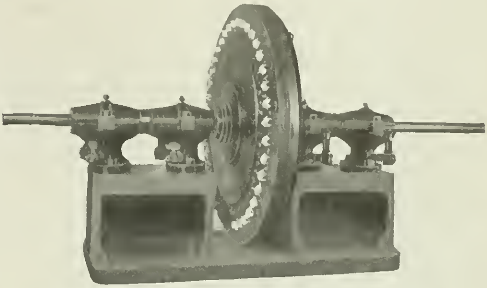


FIG. 4—6000-CYCLE, THREE-PHASE ALTERNATOR

The compensating capacities (of 1.2 microfarad) used on the primary side are ordinary rolled-paper condensers placed in series, so arranged that any unit may be disconnected at will. The high frequency of the alternator makes practicable this use of condensers directly in series in the primary circuit.

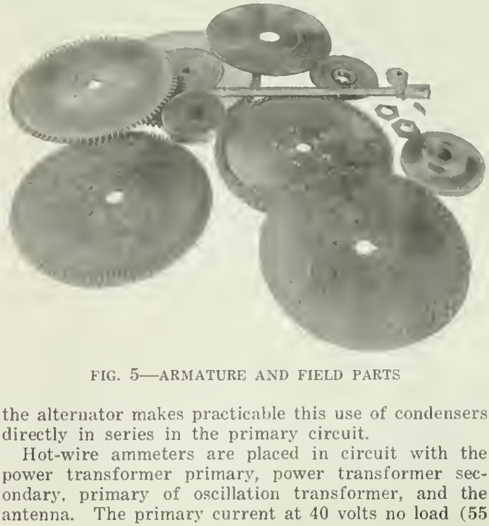


FIG. 5—ARMATURE AND FIELD PARTS

Hot-wire ammeters are placed in circuit with the power transformer primary, power transformer secondary, primary of oscillation transformer, and the antenna. The primary current at 40 volts no load (55 volts on resonant load) is 3.2 amp.

In the first tests of the apparatus, which were made in 1912 and 1913, an artificial antenna was used for very long wave-lengths. For working at higher wave frequencies a real antenna of 0.001 microfarad capacity and 4 ohms apparent resistance at the working wave-length, or 1050 meters, consisting of an inverted "L" 100 ft. in height and having a single vertical lead, was utilized.

At first great difficulty was encountered in the adjustment of all three phases to resonance at the same period, so that the resultant would be a single wave. A great deal of time was spent on this problem, and it was found that the electrical constants of each phase must be identical to accomplish the desired end. Not only must the oscillation constants be the same, but a uniform decrement must hold throughout, and no coupling can exist between separate phase circuits.

Imperfect balancing of one of the motors prevented the continuous use of 6000 cycles per phase, so that 4000 cycles was employed in most cases. This lower frequency was secured by running the field at reduced speed and produced a resultant of 24,000 groups per second.

Using a wave-meter calibrated to 15,000 meters maximum wave-length, with a rectifier as receiver, 8000 sparks per second on one phase produced an antenna current of 0.6 amp, with a clear, piercing note, there being no sign of partial discharges. Adding the second phase, the note corresponding to 16,000 sparks could be heard, but although each phase taken separately produced an apparently absolutely clear note, when they were run together a faint hissing entered into the tone given by the receiving telephone. Upon cutting in the third phase the antenna current increased to 1.5 amp, all sense of musical pitch became lost and the hissing slightly increased. It must be understood that this hissing sound was much smaller in amplitude than that of the musical tone. In fact the hiss was hardly distinguishable and could not be heard when the musical note was present. The reason for this is probably that an absolutely clear note was not obtained on each phase, and that the weak partials existing in it became prominent when the musical tone was increased in pitch to a point above the upper limit of audibility. The only fact to dispute this explanation is that partials usually have a definite wave-length, whereas the slight hissing could be heard throughout the range of the wave-meter. The effects were the same when a small antenna in another building was used for receiving, so that it is evident that the wave-meter was not excited by purely local disturbances.

It was found very difficult to measure the decrement of each phase accurately because of the close coupling of the wave-meter necessitated by the small power used. However, it seemed easy to obtain small decrements, and values greater than 0.1 per complete cycle did not appear unless circuits were purposely thrown far out of resonance. Decrements less than 0.04 per complete cycle per phase were not actually measured, but the results indicated that lower decrements were obtainable.

Interesting results were secured in the measurement of decrement of the resultant wave, with all three phases in operation. This quantity was evaluated both with and without interrupters in the antenna circuit, and identical results were had in both cases. It was found impossible to obtain for the resultant wave as small a decrement as that of any phase taken separately. The importance of this observation would seem to be that the value of polyphase currents used according to this method is not great for obtaining *undamped* oscillations. This conclusion refers only to cases where there are employed wave-lengths shorter than the value indicated as best by the group frequency of the resultant as outlined above. However, their extremely small decrement is not the only feature that makes continuous or practically continuous oscillations of marked value; if the decrement can be kept reasonably small (say 0.1 per period as in an actual case), there remain other advantages such as (1) comparatively low potentials in all circuits; (2) a constantly excited antenna circuit which is well adapted for the use of the sensitive heterodyne receiver; (3) flexibility, in that by use of an interrupter any audible note may be produced if it is desired to telegraph by the usual group frequency method, (4) sufficiently persistent excitation to permit wireless telephony, and (5) the possible use of the tikker receiver.

In the experiments the continuous or practically continuous oscillations were broken up into audible groups by means of a small commutator driven by a motor and connected in series with the transmitter primary or either the sending or receiving antenna. A machine with a disk cut so as to produce the letter "D" in Morse when driven by a small motor was also used for this purpose. The revolving interrupter was found convenient, since the same apparatus could be used at either the sending or the receiving end for breaking up the oscillations into definite groups. When an ordinary vibrating contact tikker is used there is no such positive action.

No special long-distance tests were made, but single-phase signals of 8000 group frequency were heard by several stations over 15 miles away and were reported as very clear and readable. The same stations (which used rectifying detectors) were unable to hear the 16,000 or 24,000 group frequency unless an interrupter was inserted in the antenna circuit. Both these latter group frequencies were heard very loudly when received by a small testing station located on the same grounds as the transmitting station and employing a tikker.

It was found that placing an interrupter in the transmitting antenna circuit to produce audible groups of waves gives no advantage in so far as loudness of signals is concerned. The apparatus used did not seem to produce an entirely clear musical note, perhaps because in this instance accumulations of oxide in the rotating commutator interfered with its regular action. In sustained wave practice there would seem to be no reason for its use, since the tikker may be advantageously employed, and when it is desired to use rectifiers as receivers a better way to render the signals audible would be to operate at a lower group frequency by running each phase on a lower octave.

The fact that the single-phase quenched-spark system is now well understood and almost universally employed in modern apparatus is an argument in its favor where limitations of power do not handicap it. In high-powered sets the synchronous rotating-gap method is certainly sufficiently capable of extension to permit signaling over great distances. In both of these the audible high-group-frequency method introduced by Professor Fessenden, a pioneer in both damped and continuous wave transmission, seems at present to be the choice for commercial work and is used almost exclusively by the leading navies of the world.

To sum up, the results of the experiments described would tend to prove that the application of polyphase currents to radio practice is perfectly feasible. The polyphase principle has been largely employed by the writer during the last two years, but since the work has been mainly of an experimental nature it has not yet proved its superiority by wide commercial application.

A. I. E. E. Papers at the Washington Meeting

Solenoids, lightning protection for buildings, transmission-line surges, theory of the corona and milliampere series transformers the subjects discussed

AS stated in the report printed last week of the meeting held at Washington, D. C., on April 24 and 25, under the joint auspices of the electrophysics committee of the American Institute of Electrical Engineers and the American Physical Society, five papers by members of the former association were read. Abstracts of these papers follow.

Solenoids

In the paper by Mr. Charles R. Underhill it was pointed out that Maxwell's law does not hold for the attraction between two halves of the plunger in an electromagnet if it has an air-gap between the cores. This was explained by the fact that the flux in the cores is to a large extent independent of the reluctance in the air-gap on account of the magnetic leakage from the inner end of either core back to the other end of the same core. An equation was deduced for computing the pull of an electromagnet of this type with a fixed stop. The author states that in any case the attraction that draws the plunger within the coil is proportional to the product of the average intensity of magnetization within the structure of the plunger and the average magnetizing force within the solenoid. The total pull in kilograms for a plunger electromagnet with or without an iron frame is

$$P = \left(\frac{\varphi_g{}^2}{247\,S} + \frac{\varphi_i inh}{1962\,L} \right) 10^{-4}$$

where φ_g is the flux in the air-gap, S is the cross-sectional area in sq. cm, φ_i is the flux in the plunger, i is the current in amp, n is the number of turns in the solenoid, and h is the coefficient of magnetizing force which is proportional to the length L (in cm) and average radius of the solenoid.

Dr. C. W. Burrows suggested that some of the assumptions made by Mr. Underhill involved approximations that reduced the accuracy of the figures in the tables submitted. He also questioned the method of dividing into two parts the magnetomotive force, as utilized by the author in his discussion.

In a written communication Mr. E. R. Carichoff characterized the paper as a notable contribution to the subject and added comments on the formulas employed.

Lightning Protection for Buildings

The paper by Mr. L. A. DeBlois contained an account of some very extensive experiments to ascertain the effects of different methods of lightning protection on direct lightning strokes. It also described some of the dynamic and static inductive effects produced in a building in the vicinity of a direct lightning stroke. An analysis by oscillograph of the secondary currents induced by actual lightning discharges in vertical earthed conductors seems to indicate that such currents are non-oscillatory and aperiodic, though occurring in either the negative or positive direction. The phenomena generally attributed to high-frequency oscillations is explained by the existence of unidirectional waves of almost vertical wave fronts. Experiments were also conducted to observe the effect which cloud height, lightning-rod arrangement and building materials have on direct strokes between a cloud and an isolated building located directly beneath it on the earth.

As a result of the experiments it was recommended that the following practice be observed in protecting buildings against lightning:

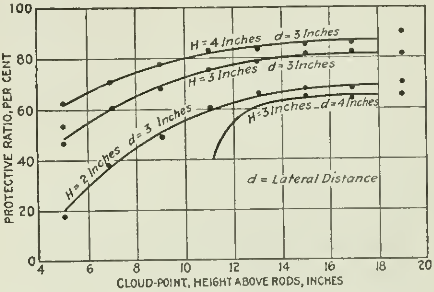


FIG. 1—EFFECT OF CLOUD HEIGHT ON ROD EFFICIENCY

A series of vertical isolated rods of iron pipe should be placed outside and surrounding the buildings and grounded to annular conductors buried in the earth at least as low as the water pipes, with extensions running out radially at the corners; metallic roof projections such as ventilators should be eliminated as far as possible; metallic roof and floor coverings should be grounded at their salient angles; overhead pipe lines and other metal conductors should be grounded at intervals and also where crossing the annular conductor; lightning arresters should be provided for outside electric lines and also for the lowest points of the building wiring (to remove static charges), and all metal objects in the interior of a building should be interconnected and grounded.

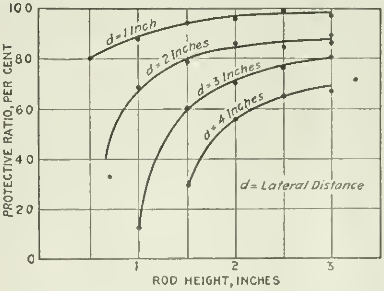


FIG. 2—EFFECT OF HEIGHT AND SPACING

In opening the discussion on Mr. DeBlois' paper Mr.

E. E. F. Creighton commented on the small amount of study hitherto accorded the subject of direct lightning strokes. The natural frequency of lightning is still, he said, rather questionable, but observations have certainly shown in some cases the presence of high frequencies. In such strokes part of the discharge at least was proved to have been oscillatory.

Mr. G. R. Olshausen exhibited some interesting pictures taken with a rotating camera. One of these clearly showed an initial slight discharge followed almost instantly by a heavy flash. After a perceptible interval there was then another flash tapering off into a bandlike continuous discharge, and this in turn was followed by several heavy flashes which were accompanied by closely laminated smaller discharges suggesting very strongly an oscillatory character. Cases where lightning discharges have magnetized iron objects show clearly, said Mr. Olshausen, that these flashes at least were unidirectional.

Dr. A. G. Webster emphasized the point that in advance of a lightning flash there is always an initial discharge which ionizes and heats the air, preparing the way for the main flash. He also suggested that such a heated air path may have a comparatively low resistance.

Dr. Elihu Thomson mentioned having heard telegraph sounders and telephone bells click during thunderstorms, and declared that these impulses must have been caused by direct-current discharges since high frequencies could never have traversed the coils of the apparatus. At the beginning of a lightning discharge, he said, "feeder" lines are often seen—branching in all directions over the cloud surface and thus discharging great areas into the central direct flash. As viewed in perspective such feeders sometimes appear as branches, although a little reflection will reveal their true relation as tributaries to the main lightning stroke. In answering a questioner who had asked for an explanation of the frequent destruction of barns by lightning, as compared with other buildings, it was pointed out that the ammonia salts present in the earth beneath a barn invariably make it the best "ground" to be had. Lightning-rod constructors should accordingly take the hint and ground their conductors within the saturated area of the barn rather than a few feet outside as is the common practice.

Dr. W. J. Humphreys said that many flashes show branch paths near angles, although these invariably recur in both the same position and direction in successive discharges, thus affording testimony that these main discharges were all in the same direction rather than of an oscillatory nature.

Mr. T. D. Yensen submitted a written discussion confirming the results of Mr. DeBlois' experiments.

In the absence of the author Mr. Burton McCullom next abstracted in brief Professor Franklin's paper on transmission-line surges. He also cited an instance where a lightning discharge had entered a station and reversed the polarity of the fields of the machines.

Some Simple Examples of Transmission-Line Surges

The paper by Prof. W. S. Franklin treats of the true wave phenomena which take place in transmission lines when switches are opened or closed. The phenomena are practically the same in alternating-current and direct-current circuits for transmission lines up to, say, 150 or 200 miles long. The "ribbon wave" was employed to represent line surges graphically. When a wave is reflected from the open end of a line either the voltage, or the current, or both, will be reversed. The total voltage at the end of the line may have any value, but the total current must be zero. If the voltage is reversed, an excessive potential will be produced when the reflected and original waves overlap. Consequently a cable capable of withstanding only 2000 volts should be protected by a spark-gap arrester which will break down at 1000 volts. If a line is short-circuited at the opposite end from the energizing source, the reflected wave will have the same voltage and current as the original, but one will be reversed. The total current at the end of the line may be any value, but the total voltage must be zero.

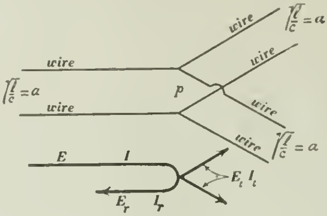


FIG. 3—WAVE PARTLY REFLECTED AT A POINT WHERE AN AIR LINE CONNECTS WITH AN UNDERGROUND CABLE

When a non-inductive resistance is connected across a line the reflected voltage and current must bear the same ratio as in the original wave except for reversal of sign. If the value of the resistance is equal to the original $E \div I$, there is no reflected wave; if greater than this ratio, there is partial reflection with reversal of current, and if smaller than $E \div I$, there is partial reflection with reversal of voltage.

If an inductive receiving circuit is shunted across a line, there will be a complete wave reflection with reversal of current the instant the ribbon wave strikes the inductance. A current is slowly established through the receiving circuit, however, and the reflected wave grows weaker, passes through zero and builds up in the opposite direction with reversal of voltage.

A method was described for plotting a curve to show the potential at any point in a line at any time after a generator has been connected thereto. The wave is reflected from the distant end of the line with reversal of current or voltage, depending on whether the line is closed or open.

Examples were also given showing how to determine the reflected and transmitted waves which occur when an aerial and underground line are connected in series and when a transmission line is connected to branch circuits. When a circuit-breaker opens, the arc usually persists for a long time, relatively speaking, but the open gap, which is a fairly good conductor, gradually loses its conductivity. Therefore, it is nearly impossible to produce a characteristic line surge by opening a circuit in this manner. The formation of a long arc between line wires in air, and the rapid extinction thereof, is the only way, in the author's knowledge, of producing a wave disturbance from opening a transmission-line circuit of moderate length.

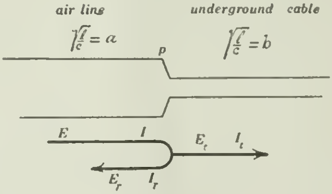


FIG. 4—WAVE PARTLY REFLECTED AT A BRANCH POINT OF AN AIR LINE

Mr. J. M. Weed declared that while the steepest wave fronts are caused by the direct making or breaking of the circuit, by the time such waves have traveled any considerable distance they will be quite tapered.

Dr. A. G. Webster next presented some sound analogies to explain electrical surges and described an experimental method for observing the propagation of a charge along a wire.

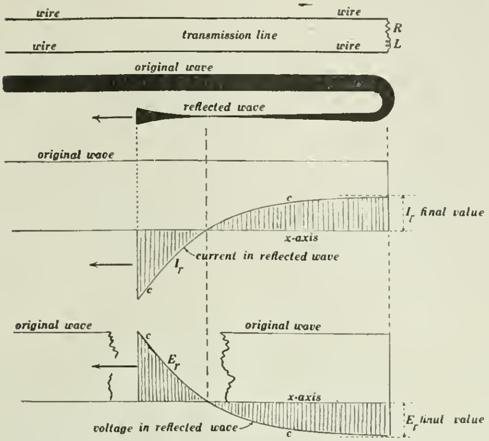


FIG. 5—REFLECTION OF A RIBBON WAVE FROM A RECEIVING CIRCUIT OF RESISTANCE R AND INDUCTANCE L, WHEN $R = \frac{1}{3} a$

Theory of the Corona

A theory of the causes and factors governing corona discharge was developed in the paper by Mr. Bergen Davis, the hypothesis being based on the known laws of electrical discharge through gases and the assumption that ionic density is increased by ionic impact when the potential gradient is high enough. The manner in which the ionization builds up around a conductor subjected to a high potential is shown graphically by the accompanying curve. After a number of cycles the density of ionization at the surface of the conductor assumes a constant value and if it is high enough corona discharge will occur. Equations which were developed from theory and plotted to indicate when corona would appear agreed remarkably well with similar curves obtained by experiment.

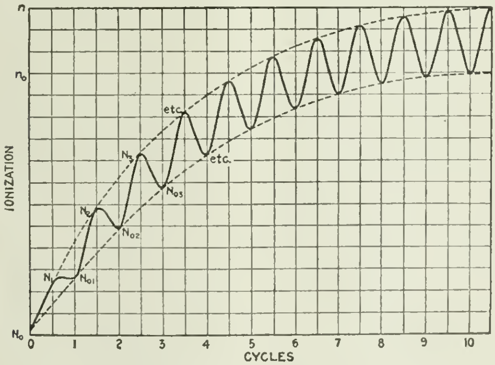


FIG. 6—INCREASE OF IONIC CONCENTRATION WHEN CONDUCTOR IS ENERGIZED

The paper pointed out that the real dielectric strength of air is not altered by the curvature of a conductor in contact with it, but the apparent dielectric strength is. Above the potential which is required to produce a corona discharge the rate of energy loss into the surrounding medium increases very rapidly. To produce corona around a conductor surrounded by a metallic cylinder requires a considerably higher surface potential gradient than when the wire is supported in the open. When high-potential conductors are hung parallel to each other in the open and brought near together without causing a flashover the surface gradient becomes nearly as great as for wires surrounded with cylinders. As an illustration—when two conductors of 0.1 cm radius are supported 20 cm apart the gradient is 58,000 volts per cm, while if they are 7 cm apart the gradient is increased to 61,000 volts per cm.

Milliampere Series Transformer

The construction and characteristics of a 100-to-1 milliampere series transformer for studying the charging currents of single high-tension insulators was described in the paper by Mr. Edward Bennett. A vector diagram was shown indicating the phase relations of current, voltage and magnetic flux in this device when delivering 0.05 amp (one-half of its rated output) to the secondary circuit. Methods of obtaining the transformer constants at normal and high frequencies were outlined and a number of applications of the device to the study of corona, high-tension insulators and leakage currents in evacuated lamps were suggested. Several oscillograph curves obtained with the help of the transformer were included in the paper.

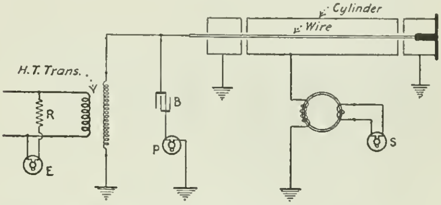


FIG. 7—CONNECTION FOR STUDYING CURRENT DURING CORONA DISCHARGE

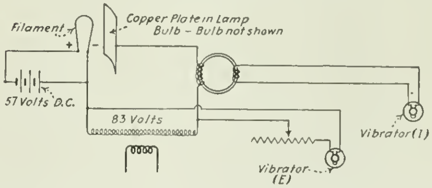


FIG. 8—CONNECTION OF MILLIAMPERE CURRENT TRANSFORMER FOR STUDYING LEAKAGE IN LAMP BULBS

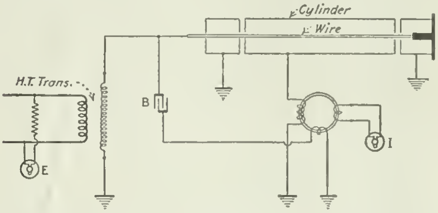


FIG. 9—CONNECTIONS TO SHOW REPRODUCTIONS OF HARMONICS

Hearing of Missouri Commission on Accounts

The hearing before the Missouri Public Service Commission on April 15 in regard to the tentative system of accounts has been mentioned briefly in the *Electrical World.* A more extended account of the proceedings is published herewith.

Utility Men Report on Depreciation

After the preliminary announcements by Mr. Atkinson, the first procedure in the businesslike hearing of April 15 was the presentation by Chairman Philip J. Kealy, of the Kansas City Railway & Light Company, of the report on depreciation adopted by the Missouri Electric, Gas, Street Railway & Water Works Association. Two principal subjects were considered by the committee—first, the deduction of reserve for depreciation from fixed capital as provided in Schedule No. 7 of the tentative draft of the annual-report form for electrical corporations; second, the seeming intention of the commission to consider the depreciation reserve as a fund and to require interest to be set aside on this fund. In relation to the first subject the committee recommended that the commission be petitioned to consider the depreciation charge as reserve account, unless, in the judgment of the commission in individual cases, it should be otherwise ordered.

In relation to considering the depreciation reserve as a fund, the committee judged it to be the intention of the commission to require the depreciation reserve to be invested in securities of immediate market value. While this method may have theoretical advantages, the committee pointed out two objections: First, the plan will tend to increase the cost of service to the ratepayer; second, the method, in so far as the financial condition of a large number of companies in Missouri is concerned, is impossible of fulfilment. In very many cases it is absolutely essential, if the wants of a growing community are to be served, that the depreciation reserve be invested in new plant. Mr. Kealy's committee cited the case of the Kansas City Electric Light Company to prove this.

In equity it is right to allow interest on the depreciation fund or depreciation reserve. Where the financial returns of a company permit a sufficient amount to be set aside annually to provide for depreciation, it is immaterial to the company whether this total amount be considered solely as principal or as principal and interest. The point of the matter here is that each company should set aside a determined sum of money, and the amount, not the source of it, is the important consideration. The particular circumstances surrounding the management of each individual company should be considered before a decision is made in this matter of interest on the fund. In addition to Mr. Kealy, the report was signed by Messrs. C. E. Brenton, St. Louis, Union Electric Light & Power Company; Charles E. Foster, St. Joseph Railway, Light, Heat & Power Company, and R. C. Russum, Joplin, Empire District Electric Company.

Discussion on Depreciation

There was an interesting discussion on the important subject of depreciation. At the outset the atmosphere was cleared considerably by the statement of Mr. McShane that the commission does not intend to reduce capitalization by the amount set aside for depreciation. This amount should not be written off. As to depreciation considered as a fund, Mr. McShane remarked that this is required by the public service law. The speaker did not see any real objection to the use of this fund for plant extension. Mr. Kealy said there was no objection to paying interest on the depreciation reserve. If it is required that there be an actual fund of marketable securities, this will increase the cost of service. Mr. McShane thought that a company might be permitted to borrow from its own depreciation fund, replacing the amount taken by betterment notes bearing interest, say, at 4 per cent. This would keep the fund intact and at the same time meet the requirements of the companies.

Mr. Russum asked what the commission would require if a utility company really did not have enough net earnings to set aside anything for depreciation. Mr. McShane answered that every company should provide for depreciation. Mr. Hugo Wurdack, of the Light & Development Company, St. Louis, said that the condition mentioned by Mr. Russum is a very real one. He thinks the public is interested in service first. By the introduction of an adequate and scientific system of accounting many of the small utilities of the State would find that they are not making any money. The company should be required to keep its plant up to 100 per cent efficiency, and perhaps that will do. The commission should have an option in the matter of requiring the setting aside of a depreciation fund.

Mr. J. N. Chester, of the Jefferson City Water Company, said that every plant should earn a depreciation reserve every year. If necessary, the rates should be raised to permit this. There should be no such thing as deferred maintenance. Mr. Stanley Young, Kansas City, of Arthur Young & Company, and president of the Missouri Society of Accountants, pointed out the necessity of providing for obsolescence and inadequacy, even if the plant is kept at 100 per cent efficiency. If depreciation in this sense is not provided for, the company is operating at a loss even if the books do not show it. The speaker did not approve of the funding of depreciation. But depreciation reserve may be reinvested in new plant. Mr. Young warned his hearers, however, that it is dangerous not to set aside a depreciation reserve. Depreciation is a part of the cost of operation. Mr. Kealy remarked that the whole idea of a depreciation fund is to equalize maintenance. It is necessary at all times to keep the fund there for the protection of the property. However, this "fund" is never to be distributed, and it is to be remembered that amortization is altogether different from depreciation. If it is borne in mind that a public utility is always to be regarded as a going concern, it will be seen that the depreciation reserve, or so-called "fund," can never be distributed.

Mr. James B. Campbell, St. Louis, of Marwick, Mitchell, Peat & Company, chartered accountants, said that two factors must be considered—first maintenance and then depreciation. The depreciation fund belongs to the stockholders. It is proper to reinvest it in the property of the company. Betterment notes may be issued for this purpose. So far Mr. Campbell agreed with the preceding speakers, but here he made the rather unexpected statement that interest on these betterment notes should go into the surplus of the company. It is very difficult, he said, to tell what is depreciation and what is maintenance. In answer to a question, Mr. McShane said at this point that he did not think that the permission of the commission would be required to authorize a company to issue betterment notes allowing it to borrow money from its depreciation fund for replacements. This point was brought up because the law requires the commission to supervise the issuing by utility companies of notes which are sold to the public. Mr. I. R. Kelso, of St. Louis, a lawyer, declared that in any event the depreciation question rests in the discretion of the commission. Mr. J. C. Adams, of St. Joseph, a water-works man, also took part in the discussion. Mr. McShane pointed out that the blank schedules sent out require the companies to set aside a reasonable depreciation, leaving it to the company to decide what the rate of depreciation should be. He also emphasized the point that in preparing these schedules and rules the commission had intended them to be of benefit to the companies as well as to the commission.

Mr. Chester said that an average rate for waterworks depreciation would range from one-half of 1 per cent to 2 per cent. If one general flat rate of percentage for depreciation could be adopted in the case of each individual plant, it would simplify matters greatly. Mr. Chester laid considerable stress on this proposal. Mr. Kealy said that this suggestion could not be carried out very well by street-railway and electric-service companies. For these utilities the detailed schedule seems to be necessary. Mr. Wurdack saw no objection to figuring depreciation on a large number of items because the depreciation on the various items might change from year to year, and the commission would want to know why the rate of depreciation was changed (if it was changed) in the case of each individual concern.

Historical Data Required

Mr. Wurdack, of St. Louis, presented to the commission the report of the Missouri Electric, Gas, Street Railway and Water Works Association committee on the historical data requirements of the proposed classification of accounts.

Mr. James L. Harrop, chief engineer of the Public Service Commission, declared that the information in relation to the consumption of various classes of consumers is needed for rate-making purposes, and that it is asked by the commissions in both New York State and Wisconsin. Mr. Kealy remarked that there is only one company in the State that could fill out Schedule No. 75 properly, and he did not see how the smaller companies could hope to do so. Mr. Brenton, auditor of the Union Electric Light & Power Company, St. Louis, the company referred to, explained how the Hollerith card-classification machines were used by his company.

Classification of Accounts

Mr. Edwin Gruhl, of the Union Electric Light & Power Company, St. Louis, as chairman of a committee of the Missouri Electric, Gas, Street Railway and Water Works Association, read a report on the proposed classification of accounts, particularly as related to the smaller companies, but also as applied to the larger ones. Mr. Gruhl's committee, after comparing the proposed classification of accounts in Missouri with the classifications of other state commissions and those of the Interstate Commerce Commission, urged that considerable simplification be adopted in Missouri and that an effort be made to have the classification conform to that of other states. Further, Mr. Gruhl's committee urged that for purposes of classification the electric-service companies of the State be divided in three classes, one having gross annual incomes of $10,000 and less, one having incomes between $10,000 and $50,000, and a third having incomes of over $50,000. The last class probably would be able to comply with the classification of accounts substantially as proposed by the Public Service Commission, but a simpler classification should be provided for the other two classes. In the case of water-works there might be two classifications, one applying to companies having gross incomes of $25,000 a year or less and the other to companies having larger incomes. Mr. Gruhl took up the proposed schedules in considerable detail and analyzed them. Among other things he called attention to the fact that some items of utility-company expense were omitted. One of these is compensation for injuries and damages; another is public service commission expense, and there are some others. Mr. Gruhl remarked that the classification of the Missouri commission follows rather closely those of the New York and New Jersey commissions.

At the conclusion of this committee report Mr. McShane said that it is true that the tentative draft of uniform accounts sent out under general order No. 12 was not suitable for small companies. Indeed, it was not the intention of the commission to require the smaller companies to use these tentative forms. The idea was to reach an agreement with the utilities as to general principles and then adopt a simpler classification for the smaller companies. As to electric-service corporations, Mr. McShane thinks that two classifications ought to be enough, but possibly three are necessary.

As to Municipal Utilities

The chairman called on representatives of the municipal utilities to express their views on the proposed classification of accounts. Mr. McShane declared that he thought the municipalities need accounting systems more than private corporations do. If a proper cost system were installed by the municipalities, they would find out what the service really costs and could make corresponding charges. Furthermore, requiring both municipal and private companies to use the same report forms would make possible a fair comparison between municipally operated and privately operated utilities.

All Agree to the Appointment of a Conference Committee

At this point Mr. McShane suggested the appointment of a committee of utility men, particularly those connected with the great interstate syndicates having to do with state commissions in other states. He said he thought that his department would be able, after conferring with such a committee, to arrive at a common ground, and that the classification of accounts might be condensed and simplified for the smaller companies.

After the adjournment of the formal hearing, the utility men held a meeting at which Mr. Kealy presided, and members of the conference committee of twelve on classification of accounts were appointed as follows: Messrs. P. J. Kealy, Kansas City Railway & Light Company; Edwin Gruhl, St. Louis, Union Electric Light & Power Company (North American Company); Hugo Wurdack, St. Louis, Light & Development Company; F. B. Saunders, Lexington, Missouri Gas & Electric Service Company (Middle West Utilities Company); J. C. Adams, St. Joseph Water Company (American Water Works & Guarantee Company); R. C. Russum, Joplin, Empire District Electric Company (Doherty Operating Company); J. M. Scott, Kansas City Gas Company (United Gas Improvement Company); H. H. Gansloser, Springfield Gas & Electric Company (Federal Light & Traction Company); W. J. Achelpohl, Jefferson City Light, Heat & Power Company (Western Railways & Light Company); J. N. Chester, Jefferson City Water Company (American Water Works and Guarantee Company); representatives of the St. Louis water-works department and the Kansas City water-works department, to be named later.

Bond Discount

Mr. McShane said he thought that bond disconut ought not to be classed as a part of the cost of the plant. Mr. Chester pointed out that a water-works company, for instance, must pay more for money when money is high, just as it must pay more for iron pipe when pipe is high. In both cases it would seem that this added expense should be considered as part of the plant cost and charged to capital account.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

A Household Appliance Campaign at Louisville

The Louisville (Ky.) Gas & Electric Company is pushing its campaign for the wiring of houses on the instalment plan and in connection with its advertising is calling attention to the numerous articles of household use which can be thus made available to the woman who has not had electricity in her home. Special attention has been paid in this advertising to the vacuum cleaner and to the great amount of labor that one of these appliances saves. On other days emphasis is placed on electric cooking utensils and the unusually good coffee which can be made quickly and easily in an electric percolator. The advantages of the electric fan will be urged during the summer.

Operation of Small Refrigerating Machines Using Electrical Energy

At the weekly luncheon of the Chicago Jovian League on April 27 the principal speaker was Mr. R. J. Stewart, manager of the insulation department of the Chicago office of the H. W. Johns-Manville Company. Mr. Stewart read a paper descriptive of the Audiffren-Singrun refrigerating machine, which is marketed in this country by the Johns-Manville Company and built under contract at the Fort Wayne works of the General Electric Company. These machines, used both to produce refrigeration and to make artificial ice, are well adapted for electric drive, and Mr. Stewart said that they enable the central-station man to be substituted for the iceman. The ice made by these machines is invariably opaque, but its taste is said to be better than that of most clear ice. The smallest machine running but half the time will use about 196 kw-hr. per month; the largest machine will use about 2360 kw-hr. per month, assuming a motor efficiency of 75 per cent. These are typical figures for summer months. In winter, when the load on the central station is, of course, at its heaviest, the demand of the refrigerating machines will be perhaps one-third of that of the summer months. The machines also afford a long hour load, running under ordinary circumstances from six to twenty-four hours a day.

At the same time the refrigerating machine is brought to the attention of the electric-service man as a revenue producer it is offered to the user of refrigeration as effecting an economy as compared with ice. The speaker said that with these machines the energy required to replace 100 lb. of ice varies from 2.6 kw-hr. to 1.6 kw-hr., depending upon the size of the machine. Mr. Stewart pointed out that the ordinary icebox or refrigerator, as used in the home, is very inefficient. Warm-weather tests will usually show that the inside temperature is about 60 deg., whereas it should be 40 deg. to preserve the food in a healthful condition.

The speaker described the use of refrigerated counters in meat markets, restaurants and stores. These counters have glass tops and sides with refrigerated pipes in the rear. The rear space above the pipes is open, giving the butcher or salesman free access. The heavy cold air lies in the space between the refrigerated pipes and the front of the counter, keeping the products displayed in good condition in midsummer weather. A small refrigerating machine operates the refrigerated pipes.

Turning to the domestic field for mechanical refrigeration, the author of the paper mentioned the fact that in a large residence in Philadelphia there was recently removed a 10-ton ammonia machine. This outfit was replaced by three refrigerating machines, the total rating of which was 5 tons. Better temperatures were secured with the new machines than with the old one, in spite of the fact that they were of only half the rating of the older unit. However, the principal objection to the large machine was its noisiness. Mr. Stewart also mentioned the application of the small refrigerating machines to soda-fountain work and the cooling of drinking water. There was a brief discussion, in which the author of the paper said that the gas used in the operation of the machine was sulphur dioxide.

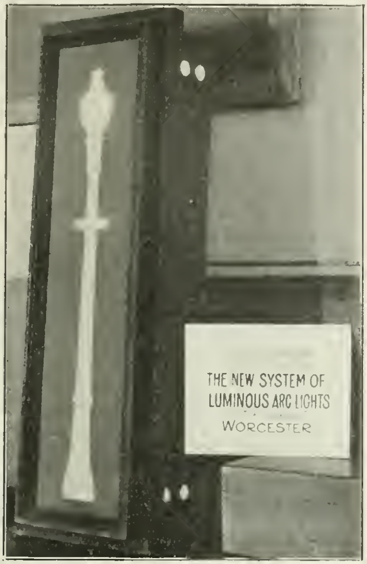
Advertising Irons by Electrically Lighted Billboards

With pictures that endeavor to portray the atmosphere of the average household laundry painted on its electrically lighted billboard spaces, the Union Electric Light & Power Company, St. Louis, Mo., is pointing out the advantages of electric irons in many parts of the city. A large colored woman confiding to her sister laundresses that "Dis beats work" forms the central figure of the picture, while the price of electric irons, the name of the electric-service company and the slogan "Iron by wire" are displayed in large letters elsewhere on the billboard.

ELECTRICALLY LIGHTED SIGNBOARDS IN ST. LOUIS FOR ADVERTISING IRONS

An Effective "White-Way" Window Display

Following the signing of a contract for installing a system of "white-way" lighting, the Worcester (Mass.) Electric Light Company exhibited in the window of its main office the transparency illustrated in the accompanying halftone, giving the public a concrete idea of the type of lamp and pole shortly to be placed in service throughout the business district of the city. The transparency consisted of a box 33 in. high, 10.5 in. wide and 8 in. deep, containing three 25-watt tungsten lamps, the latter being placed behind a translucent drawing of the standard lighting unit and pole as shown. Eight 1¼-in. holes in the sides of the box provided ventilation. A feature of the Worcester installation will be the use of street signs on corner poles illuminated by reflection from the arc-inclosing globe above. The transparency shown was designed by the Lundin Electric & Manufacturing Company, Boston.



TRANSPARENCY TO DEMONSTRATE STREET LIGHTING

Motor Sizes to Drive Refrigerating Machines

The term "ton of refrigeration" relates to the quantity of heat extracted during the freezing of a ton of ice from water at 32 deg. Fahr. One ton of refrigeration per twenty-four hours is equivalent to the absorption of nearly 200 lb.-Fahr. heat units per minute. A 1-ton machine will perform work at this rate; that is to say, it will absorb approximately 200 heat units per minute. A 2-ton machine will absorb heat at the rate of approximately 400 heat units per minute. To drive the smaller machines the motor rating required is about 1.5 hp per ton, and for the larger machines from 1.25 hp down to 1 hp per ton. A caution should be added that a "1-ton machine" will not make a ton of ice in twenty-four hours, for it is usual to reckon a 1-ton machine as capable of making a half ton of ice a day, and a 2-ton machine 1 ton of ice, and so on. The reason is, of course, that the water from which the ice is to be made must be first reduced to the freezng temperature, and the ice itself also has its temperature lowered.

Organization and Methods of a Central-Station Sales Department

Before the Milwaukee Electric Railway & Light Company Section of the National Electric Light Association on April 16 Mr. F. D. Beardslee, sales manager of the Union Electric Light & Power Company, St. Louis, read a carefully prepared paper on "Central-Station Sales Department Organization." Mr. Beardslee gave some of the results of his experience in St. Louis. In the sales department of his company there are seven divisions, industrial, commercial, residential, lamp, application, advertising and clearing-house. Each is in charge of a division head who reports directly to the sales manager. The industrial division handles all business in excess of 50-kw connected load and other cases in which it is advisable to have expert engineering knowledge. The commercial division handles general industrial business like stores, factories, etc., where the connected load is less than 50 kw. The duties of the residential, lamp, application and advertising divisions are indicated by their titles. The clearing-house division is used to expedite the work of all the other divisions, and was referred to by Mr. Beardslee as the keystone of the sales department. This division looks out for the contract routine and the passage of all papers and forms from one division to the other so that the delivery of service will be expedited. It also compiles all figures relating to business handled. Meetings are held by the various divisions and the whole sales department to keep the men closely in touch with all phases of the work.

Compensation, Education, Records

Compensation for salesmen is based on length of service, but in addition monthly bonuses are paid to the men obtaining the greatest amount of business during the month. Further, a certain commission is paid on a point system after deducting allowances for demerit points. Demerits are charged where salesmen report incorrect addresses or where they receive certain instructions and fail to carry them out.

Educational courses form an important feature of the work of the sales department of the St. Louis company. Mr. Beardslee described these courses in some detail. Where it is found necessary to fill a position in the sales department the records of the educational classes are examined and men are promoted according to their class ratings.

Carefully kept records of results are on file. It is known, for instance, that the average number of contracts per man for the year 1913 was 403 as against 327 for the preceding year. The cost of getting the business per contract in 1913 was $6.97 as compared with $6.58 in 1912. These figures include all kinds of contracts. For purely new business the cost per contract was $9.07 in 1913 and $11.24 in 1912.

Public Relations and Advertising

The electrical appliance department is not directly under the sales manager, but has a department head reporting to the general manager. But the sales department and the appliance department work together closely.

The speaker laid emphasis upon the paramount duty of the sales-department representatives to cultivate cordial relations with the public. The sales department must have, also, absolute co-operation from the other departments in the company. The head of any department should be broad-minded enough to receive information which will tend to improve the efficiency of his department.

In relation to the development of sales Mr. Beardslee considered among other things the subject of advertising. He said all advertising copy before being used should be studied thoroughly, especially from the point of view of the reading public. If possible, advertising campaigns should be planned months in advance. When writing copy for an electric-service advertisement it is advisable to lay the copy aside for several days, then take it up again and make a study of it. The manager may be surprised to notice how different the advertisement will appear to him at the second or third reading.

Relations with Contractors

Campaigns for securing connections to "already built" houses are of importance, and Mr. Beardslee described the method adopted in St. Louis. The contracts for wiring are taken by the company and the jobs are then sublet to electrical contractors. A list of contractors is on file in the company's office and each contractor receives approximately $100 worth of work in rotation. By this co-operation the contractors are eager to assist the electric-service company and help to get business. Where a wiring contractor is directly responsible for the receipt of a wiring contract by the electric-service company, the job is immediately sublet to that contractor without affecting the amount of business he will get regularly in his turn.

Selling Water-Power Energy and Electric Signs

Hydroelectric energy was first received in St. Louis, July 1, 1913. It has been found that the most promising market for the sale of this energy is in the steel, ice, electrochemical and cement industries. The difficulties hardest to overcome in securing water-power contracts are cost of change-over, use of steam for other than power purposes, manufacturing by-product used as fuel, minimum-demand charge in case of shut-down, and efficient plant operation for twenty-four hours at a high load-factor.

In relation to electric-sign business, the St. Louis city ordinance is such that all electric signs must necessarily extend up and down the face of the building or be placed on the roof. In some cities electric-service companies employ sign salesmen, but Mr. Beardslee said that this business is usually obtained by close co-operation between the central stations and the sign companies.

Hints in Making Sales

Salesmen for electric-service companies should watch the real-estate transfers closely, as indicated in the newspapers and elsewhere, so that they may follow all leads of this kind for the purpose of securing contracts.

When there is a fire in his district the salesman should get in touch with the customer affected and offer assistance at the old location, or possibly at a new one. The customer should receive special attention at this time, as it will be gratefully remembered in the later dealings between the customer and the company.

Salesmen should be careful about making promises to customers. Salesmen should be very definite and at the same time courteous in handling cases of this kind. Promises made and not kept may cause more harm to a company than going without the business altogether.

Telephone calls should be attended to very carefully and the slips made out at the telephone desk should be in duplicate, one copy going to the salesman and the other being held in the office as a check.

The salesman should be ever on the lookout for new or additional business, but he should never attempt to take advantage of a customer or try to talk him into installing more equipment than he needs. Broad-mindedness and good judgment should be exercised in all cases.

Facts and Factors of Iowa Central Stations

As has been its custom for years, the facts and factors committee of the Iowa State Section of the National Electric Light Association, of which Mr. Austin Burt, of Waterloo, is chairman, presented statistics regarding Iowa central stations at the fourteenth annual convention held at Cedar Rapids, Ia., April 22, 23 and 24. The statistics were compiled by the engineering experiment station of the University of Iowa at Ames, under the direction of Mr. F. A. Fish, and are published on this and the following page.

It was pointed out by Mr. Burt, in explaining the items, that by annual load-factor is meant the kilowatt-hours output for the year divided by the kilowatt-hours output at the station operated at peak load during every hour of the year. The operating load-factor he defined as the ratio of the average load during actual operation to the peak load. The population given comprises the total of all cities, towns and communities served, and the station rating includes in most cases the total rating of all main generators, whether they could all be run at the same time or not. Items 4 and 5 are likely to be high when new generating equipment has recently been added, or in the case of water-power plants with steam auxiliary equipment. The committee said it is probably true that the total connected load given in the tables was derived from estimates rather than from accurate records in more instances than was any other quantity involved in the whole table. The ratio expense to gross income in percentage is naturally variable, and the expense includes operating expenses, taxes and insurance, but no interest or depreciation.

CENTRAL-STATION STATISTICS FOR THE STATE OF IOWA

MUNICIPAL STATIONS

Station Number	Population of District	Number Consumers per 100 Population	Station Rating, Kw	Station Rating per Capita, Watts	Station Rating per Employee, Kw	Ratio Station Rating to Connected Load, per Cent	Average Load During Operation, Kw	Ratio of Average Load to Station Rating, per Cent	Annual Load Factor, per Cent	Operating Load Factor, per Cent	Investment per Kilowatt of Rating	Investment per Capita	Gross Income per Kilowatt of Rating	Gross Income per Consumer	Gross Income per Capita	Gross Income per $100 Invested	Gross Income per Kw-hr. Made, Cents	Ratio Expense to Gross Income, per Cent	Balance, Interest, etc., Not Deducted	Total Hours of Operation per Year
45.	750	16.0	35	47	17	95	10.6	30 3	11 2	34.0	229	10.66	92 60	27 00	1 32	40 50	10 8	85 8	5.75	2900
46.	1,050	11.5	96	91	47	137	10.2	10.6	13 7	33.0	200	18 28	38 15	30.50	3 51	19.20	9 9	51 5	9.33	3650
47	1,100	13.9	50	45	25		. .	. . . .	. .	. .	236	10 72	83 70	27 35	3 80	35.45		69 7	10.75	4000
48	3,200	15.3	175	55	29	50	47.8	27.3	30.2	31.6	183	10.00	87.50	31 30	4 78	47 70	3 8	75.0	11 95	8390
49.	3,900	18.6	350	90	50	88	39 6	11.3	23 3	24.0	100	9.00	51 80	21 95	4 65	51 80	5.4	67 1	17.00	8500
50.	6,500	15.5	500	77	70	96	78 5	15 7	24 5	24 5	180	13.85								8750
Average 1914	2,750	15.1	201	68	40	93	37 3	19 0	20 6	29 4	188	12 09	70 80	28 20	4 21	38 90	7 5	69 8	10 96	6030

CENTRAL-STATION STATISTICS FOR THE STATE OF IOWA

COMMERCIAL STATIONS

Station Number	Population of District	No. Consumers per 100 Population	Station Rating, Kw	Station Rating per Capita, Watts	Station Rating per Employee, Kw	Station Rating to Connected Load, Per Cent	Average Load During Operation, Kw	Average Load to Station Rating, Per Cent	Annual Load Factor, per Cent	Operating Load Factor, per Cent	Investment per Kilowatt of Rating	Investment per Capita	Gross Income per Kilowatt of Rating	Gross Income per Consumer	Gross Income per Capita	Gross Income per $100 Invested	Gross Income per Kw-hr. Made, Cents	Expense to Gross Income, Per Cent	Balance, Interest, etc., Not Deducted	Total Hours of Operation per Year
Item No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	700	12.8	75	107	37	93	10.0	13.3	34.2	50.0	$200	$21.43	$58.70	$48.90	$6 29	$29.30	7.3	127.1	$16.00	6000
2	750	16.0	75	100	25	250	4.4	5.9	10.5	26.0	173	17.33	38.54	24.08	3.85	22.22	18.5	68.5	7.00	3540
3	1,050	7.9	17	16	17	62	....	....	....	....	400	6.67	167.30	34.30	2.71	40.65	....	77.4	9.15	2500
4	1,100	19.4	75	68	25	..	. .	. . .	....	....	160	10.90	80.00	28.00	5.46	50.00	....	66.7	16.67	8760
5	1,200	14.6	50	42	25	91	10.0	20.0	16.5	22.2	240	10.00	112.20	32.05	4.67	46.75	8.6	85.5	6.75	6500
6	1,200	16.6	75	62	25	37	13.8	18.4	17.3	27.6	224	14.00	100.00	37.50	6.25	44.65	9.9	70.0	13.40	5500
7	1,200	14.2	90	75	90	..	3.5	3 9	....	....	164	12.30	35.70	18.88	2.67	21.75	10.5	69.8	6.57	8760
8	1,200	14.6	50	43	25	28	13.0	26.0	15.0	30.0	400	16.67	154 00	44.00	6.42	38.50	13.9	89.6	4.05	4380
9	1,400	21.4	125	89	42	48	15.0	12.0	23.9	25.0	120	10.72	....	.		...	....	...	...	8360
10	1,400	7.0	40	29	40	100	11.0	27.5	8.7	30.0	262	7.50	67.60	27.57	1.93	25.75	9.6	55.5	11.50	2550
11	1,500	13.3	60	40	20	48	25.0	41.7	15.7	50.0	167	6.80	124.20	37.25	4 97	73.05	10.8	84.0	11.66	2750
12	1,500	25.0	125	83	25	..	..		....	....	200	16.67	101.60	34.90	8 72	52.30	....	84.5	8.08	8760
13	1,600	20.3	110	69	29	21	72.9	66.0	66.0	75.0	243	16 25	149.10	49.10	9.97	61.40	2.8	46.6	32.75	7710
14	1,600	16.6	200	125	50	67	14.3	7.1	14.4	17.7	125	15.62	53.70	40.70	6.71	42.95	10.5	74.5	10.92	7120
15	1,600	20.0	100	62	33	42	10.3	10.3	12.1	12.1	370	23.10	80.00	25.00	5.00	21.62	8.9	....	....	8760
16	1,700	12.2	175	103	58	70	22.6	12.9	16.9	39.3	131	13.51	47.50	39.95	4.89	36.10	9.8	76.5	8.48	3760
17	2,000	10.3	90	45	30	60	25.8	28.7	12.2	36.8	178	8.00	99.40	43.40	4.47	55.90	11.9	64 0	20.10	2900
Average 1914	1,337	15.4	90	68	35	73	18.0	21.0	20.2	34.0	221	13.40	92.00	35.35	5.31	41.40	10.2	76.0	10.61	5800
Average 1913	1,416	14.2	88	61	28	56	20.2	26.6	....	30.2	216	10.93	93.28	31.96	5.13	51.51	11.6	66.6	18.51	4871
Average 1911	1,415	11.9	82	62	36	94	19.4	26.3	....	33.8	205	11.03	84.30	48.20	4 33	43.50	10.9	73.4	6.23	4840
Average 1909	1,600	10.0	67	42	27	94	. .	....	..	36.0	236	10 00	94.00	37.00	4.06	38.00	...	70.0	...	....
18	2,200	15.9	140	64	47	42	16.9	12.0	21.9	23.2	171	10.85	92.50	37.00	5.89	54 20	9.2	55.4	24.15	8260
19	2,400	12.1	130	54	26	26	20.0	15.4	20.9	22.2	215	11.66	76.90	34.50	4.17	35.70	6.1	80.0	7.14	8260
20	2,500	22.9	160	64	26	23	56 6	35.3	37.7	37.7	237	15.20	127.90	35.75	8.20	53.90	4.1	72.2	15.00	8760
21	2,900	15.7	190	65	38	26	14.9	7.8	15.0	15.0	225	14.74	62.40	26.00	4.09	27.70	9.1	63.7	10.05	8760
22	3,000	20.0	100	33	25	33	37.0	37.0	34.9	35.0	250	8.33	166.67	27.80	5.55	66.67	5.2	72.0	18.65	8740
23	3,000	16.6	210	70	35	47	26.3	12.5	27.6	27.7	166	11.63	66.40	27.90	4.65	40.00	6.1	89.2	4.30	8740
Average 1914	2,667	17.2	155	58	33	33	28.6	20.0	26.4	26.8	211	12.07	98.80	31.50	5.42	46.40	6.6	72.1	13.21	8600
Average 1913	2,437	16.6	163	67	36	43	27.1	16.7	....	27.4	201	12.88	105.40	41.53	6.76	58.10	8.0	75.6	16.46	8573
Average 1911	2,650	12.7	157	60	29	55	28.4	25.1	....	33.0	190	10.61	83.20	37.40	4.52	41.90	5.7	76.1	8.39	7620
Average 1909	2,470	10.0	122	44	38	48	. . .	....	....	....	221	9.40	95.00	43.00	4.04	41.00	....	63.0	..	. .
24	3,500	12.8	300	86	60	50	53.7	17.9	27.1	29.0	150	12.85	68.60	45.70	5.88	45.70	4.7	67.8	14.71	8200
25	3,850	13.1	400	104	44	..	....	....	....	....	237	24.60	47.90	38.00	4.98	20.20	...	88.8	3.73	8760
26	4,200	17.3	285	68	28	35	....	....	....	...	141	9.60	82.30	32.30	5.58	58.20	....	58.9	23.88	8200
27	5,000	10.8	270	54	30	30	57.0	21.1	19.0	19.0	333	18.00	119.00	59.60	6.43	35.73	6.4	58.9	14.70	8760
28	5,000	13.2	190	38	31	40	28.6	15.0	25.9	25.9	263	10.00	113.40	32.70	4.31	43.10	8.6	74.2	11.10	8760
29	5,200	19.0	1040	200	62	50	152.0	14.6	38.0	38.0	120	24.00	52.40	55.00	10.47	43.60	4.1	68.7	13.60	8760
30	6,000	10.1	380	63	47	50	22.2	5.8	14.8	14.8	158	10.00	50.40	31.50	3.19	31.90	9.9	79.2	6.62	8760
31	7,000	18.9	300	43	33	43	78.0	26.0	20.8	20.8	300	12.85	136.30	31.00	5.84	45.45	6.0	50.9	22.32	8760
32	7,000	14.7	875	125	125	62	30.8	3.5	13.7	13.7	343	42.85	27.45	23.43	3.43	8.00	8.9	41.1	4.71	8760
33	8,000	12.0	590	74	37	39	68.5	11.6	24.8	24.8	495	36.60	112.00	68.80	8.28	22.60	11.0	68.0	7.24	8760
Average 1914	5,475	14.2	463	86	50	44	61.4	14.4	23.0	23.3	254	20 14	80.97	41.80	5.84	35.45	7.5	65.7	12.12	8648
Average 1913	4,550	12.9	277	61	33	66	36.7	21.4	....	33.0	222	12.67	116.16	52.78	7.06	61.76	7.7	63.4	25.81	7379
Average 1911	4,580	11.5	239	53	33	74	42.1	18.0	....	26.7	248	12.30	88.50	38.75	4.46	38.25	6.8	67.1	11.95	7720
Average 1909	5,670	10.0	285	51	37	50	. . .	....	....	....	202	10.00	85.00	42.00	4.40	49.00	. .	56.0	. .	. . .
34	10,000	13.4	725	72	20	51	117.0	16.1	25.0	25 0	388	28.10	75.70	40.85	5.49	19.53	5.4	65.5	6.73	8760
35	10,750	14.3	1100	103	27	77	143,2	13.0	29.0	29 0	454	46.52	55.45	39.60	5.67	12.20	4.9	62.0	4.63	8760
36	11,000	13.6	2000	182	74	133	228.0	11.4	45.6	45.6	342	62.20	35.67	47.50	6.48	10.42	3.6	52.8	4.91	8760
37	12,000	10.4	950	79	47	95	113.0	11.9	26.9	26.9	...	....	....	....	....	....	..		...	8760
38	17,000	11.8	850	50	61	40	202.3	23.8	30.0	30.0	470	23.40	113.70	48.35	5.70	21.30	5.4	49.0	12.40	8760
Average 1914	12,150	12.7	1125	97	46	79	160.7	15.2	31.3	31.3	414	40.10	70.10	44.10	5.84	16.60	4 8	57.3	7.17	8760
Average 1913	17,060	7.2	1080	63	119	56	215.0	20.0	....	29.7	579	27.47	82.55	64.07	4.27	60.55	4.9	50.3	16.13	8760
Average 1911	14,500	8.4	1206	92	128	70	141.0	14.1	....	22.6	277	18.70	65.70	52.95	4.27	24 10	5.5	51.7	10.71	8760
Average 1909	15,500	5.0	775	50	71	67	....	....	....	22.0	139	8 00	60.00	60.00	3.20	54 00	. .	71.0	....	
39	25,000	9.7	1000	40	33	23	323.8	32.4	32.4	32.4	310	12.40	128.60	53.20	5.15	41.50	4.5	44.1	23.20	8760
40	26,000	7.7	3000	115	176	27	582.0	19.4	35.9	35.9	177	20.38	67.95	102.40	7.84	38.45	4.0	55.0	17 30	8760
41	30,000	13.3	2700	90	77	44	380.0	14.1	31.6	31.6	....	.	....	...	.	.	...	...	.	8760
42	38,000	12.2	4225	112	78	47	667.0	15.8	29.0	29.0	286	31.80	56.60	51.50	6.29	19 70	4.1	51 4	9.60	8760
43	45,000	6.6	5000	111	111	90	862.0	17.2	30.0	30.0	195	21 70	42.65	72.30	4.74	21.80	2.8	41.2	12.84	8760
44	117,000	7.6	8850	76	49	51	1675.0	18.9	35.0	35.0	339	25.60	66.55	66.70	5.03	19 62	4.0	. .	...	8760
Average 1914	46,830	9.5	4130	91	87	47	748.3	19.6	32.3	32.3	261	22.40	72.50	69.20	5.80	28.20	3.9	47.9	15.73	8760
Average 1913	44,500	7.5	3120	64	209	56	593.0	24.4	.	24.3	326	19 91	81.35	71 10	4 52	28.22	4 1	50.6	13.03	8760
Average 1911	55,600	6.2	2890	51	81	43	653.0	22.7	...	31 5	541	27.20	80 50	68.90	4.17	15.27	4 1	48 9	8 26	8750
Average 1909	53,000	5 0	2110	46	262	42	....	....	...	24.0	195	9.00	88.00	79.00	3.50	42.00	.	51.0	...	.
Grand Av. 1914	9,890	14.3	852	77	46	57	159.2	18.5	25.2	30.0	251	18.40	85.80	41.35	5.57	36 70	7.6	67.9	14.57	7565
Grand Av. 1913	11,400	12.5	778	61	71	35	155.0	23.2	....	29.3	255	14.23	93.50	49.90	5.74	50.60	8 2	63.6	19.00	6950
Grand Av. 1911	14,920	10.6	576	64	51	72	117.0	22.0	...	30.1	252	13.85	82.10	47.60	4.36	36.80	7.8	67.5	9.82	6710
Grand Av. 1909	9,411	9.0	401	44	63	56	....	....	.	32.0	220	9 60	89.50	46.00	3.93	41.60	...	64.0	....	....

Illumination and Wiring

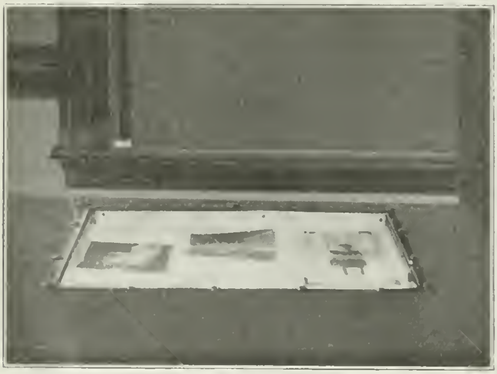
Effective Electric Sign on Dry-Goods Store

The electric sign illustrated herewith, recently installed over the main entrance of a Cambridge (Mass.) dry-goods house, faces an important square and street-railway transfer point and combines fixed and flasher operation in an attractive manner. The sign is 31 ft. long and about 18 in. wide, and its principal feature is a flashing arrow equipped with forty-six 5-watt clear-bulb outline lamps which emphasize the name of the store, the latter being featured as a transparency lighted by fourteen 5-watt lamps on the inside of the sign. The arrow is about 15 ft. long and its band is illuminated from within by twenty 25-watt lamps which emphasize the slogan of the store. The face of the sign is black, opalux letters being used in the wording, with a green background for the band of the arrow. Energy is supplied by the Cambridge Electric Light Company.

DRY-GOODS STORE SIGN, CAMBRIDGE, MASS.

Illuminated Counter for Examining Negatives

An effective home-made arrangement to facilitate the examination of photographic negatives by customers has been developed by Mr. James H. King, a commercial photographer at 309 Washington Street, Boston, Mass. As illustrated herewith, the device consists of a depression 18 in. long by 11 in. wide and about 1 in. deep in the counter of the reception room, the opening being closed by a plate-glass top and a ground-glass bottom. Beneath the latter are installed three 20-watt tungsten lamps controlled by a snap switch at one side. At the rear of the depression are divisions marked one each, two each, etc., up to five, so that time can be saved and accuracy conserved in selecting the number of prints to be made as the customer examines his negatives. The location of the lighting device in the counter enables negatives to be examined with speed and comfort and the cost of operation is nominal.



ILLUMINATED COUNTER FOR EXAMINING NEGATIVES

Lighting the Bill-of-Fare Electrically

A Boston restaurant in the Beacon Hill district has added materially to its patronage by posting its daily menu out of doors on the wall adjoining the entrance to the establishment and equipping the bulletin with a 16-cp tubular incandescent lamp shaded from the eye by a tin reflector with a white-enameled inside surface. The reflector diameter is 3¼ in., and the bulletin measures 8 in. by 12 in. A hinged and padlocked cover with plate-glass window protects the menu from the weather and facilitates changing the card at noon and night. As the street is rather dimly lighted after dusk, the illuminated list of viands set forth to tempt the pilgrim and the stranger stands forth conspicuously and illustrates the drawing power of a well-designed bit of electrical display advertising.

ILLUMINATED MENU OF A BOSTON RESTAURANT

Tungsten-Lamp Renewal Arrangement in Chicago

Following the recent announcement of reduction in the price of tungsten lamps, the Commonwealth Edison Company of Chicago advertises that those customers whose contracts for electricity provide for the free renewal of standard carbon lamps may obtain 60-watt tungsten lamps free of cost under the following conditions: Upon the surrender to the company of burnt-out standard carbon lamps (etched and with bulbs intact) the customer will be entitled to receive in exchange for two such lamps (1) two new standard carbon lamps free, or (2) one standard carbon lamp and one standard tungsten lamp of 60-watt or larger size free, or (3) one standard tungsten lamp of 60-watt or larger size free and one other tungsten lamp at a specified price. Upon the surrender to the company of a burnt-out tungsten lamp of 10-watt or larger size (etched and with the bulb intact) the customer will be entitled to receive in free exchange therefor a standard tungsten lamp of 60-watt or larger size. The reduced exchange prices for standard tungsten lamps are now as follows: 10-watt lamps, 24 cents each; 15-watt, 21 cents; 20-watt, 16 cents; 25-watt, 14 cents; 40-watt, 12 cents; 60-watt, 10 cents. No charge is made for 100, 150 or 250-watt tungsten lamps.

Some Present Street-Lighting Problems

By J. R. Cravath.

The scientific study of the production of satisfactory interior illumination has progressed much more rapidly than that of street lighting, and certain features of the latter are very much in need of investigation on a more scientific basis than has yet been attempted.

One of the principal problems involved is that relating to the question of large versus small units. It is important to know how far it is desirable to go in reducing the size and shortening the distance between lamps. The relative cost of a given quantity of light delivered from large as against small units of course has an important bearing on the ultimate solution of the problem. However, before any such ultimate solution can be reached in any case it is necessary to know the relative practical illumination values to the user of the street of the various possible arrangements of large and small units from a purely illumination standpoint, leaving out of account the cost of production.

For many years exclusive use was made of large and efficient light units such as the arc lamp on the one hand and the much less efficient small incandescent unit on the other. Recently the old limitations have been removed, and their removal opens up an unexplored field in the production of street-lighting effects. Thanks to the tungsten lamp, a large range of sizes of efficient lamps exists, and the methods have been perfected for more economically distributing electrical energy to small units than formerly where underground service is required. There is now an abundance of new tools, but one does not know yet how best to use them. One cannot say with certainty, for the lighting of any given length of street with a given amount of light flux available, what sizes of lamps and spacing will give the best illuminating effect. It is probably safe to state that a majority of the leaders in the field of illumination would have been much more certain of the correct answer to a problem of this kind several years ago than they are at the present time, some of the most important considerations in street lighting usually not having had sufficient weight in years past. In 1910 Mr. Preston S. Millar, in a paper read at the Illuminating Engineering Society convention, called attention to some neglected considerations pertaining to street illumination, and since then one has come to realize adequately how much of one's seeing along streets at night is attributable to the silhouette effect. In other words, pedestrians and vehicles are seen very largely because they are silhouetted as dark objects against a lighter background which reflects the light from the lamps along the street. Even in the best lighted thoroughfares the silhouette effect is very important, while it constitutes about the only method of distinguishing objects along the greater portion of the more dimly lighted streets.

It is easy to determine the probable intensity of illumination on a street or sidewalk surface from given sizes and spacings of lamps, and the probable surface brightness of different portions of the street can be arrived at by calculation after a sufficient number of tests have been made on the diffuse reflecting power of the street surface. From this one might suppose that it is a simple matter to calculate theoretically the street surface brightness resulting from different sizes and spacings of lamps and so to determine their relative value in producing the desired silhouette effect, just as one can calculate theoretically the amount of illumination on vertical objects. For many years the vertical illumination was the only one that received consideration from many engineers. Much of the value of the calculations of street surface brightness, however, is uncertain because of the fact that in viewing any vertical object along the street it is seen silhouetted against a background of street which may cover a considerable distance ahead and probably consists of alternate patches of light and dark pavement.

The question that arises is, Can an object be seen better against a uniformly illuminated background, such as would be obtained with small lamps at frequent intervals, or with a background much less uniform with occasional spots much brighter than in the first case, such as would be obtained by an equal total flux of light from lamps spaced at longer intervals? The effect on the eye of the street user produced by these different sizes and spacings of lamps cannot be calculated theoretically from information now available. The effect is both physiological and psychological. The only way to determine these uncertain factors is by making an actual test on the street in such a way that different arrangements can be compared directly. For this purpose similar converging streets would have to be equipped with lamps for a distance of from 0.25 mile to 0.5 mile from their convergence. The light flux per foot of street should be the same in all cases if results of real value are to be obtained. In such experiments it is necessary that the streets under comparative test converge, so as to admit of quick and easy comparisons, since it is a notorious fact that the eye has no memory so far as illumination values are concerned. After the fundamental requirements are determined in this manner the light flux per foot of street could be so varied as to present for direct comparison different systems of equal annual cost per foot of street illumination.

Certain extreme conditions are not in need of investigation because they have already been used many times and are matters of common casual observation. For example, it is well known that large units such as arc lamps spaced from 600 ft. to 1000 ft., as in hundreds of small towns, do not provide satisfactory street illumination. An equal amount of light flux, small though it may be, scattered along the street from small units is known to be more satisfactory. One does not know, however (for the reasons before explained), how far it is desirable to go in reducing the size of the lamp and shortening the spacing.

For the reasons mentioned before it is believed that street lighting cannot be judged either by the average or by the minimum illumination midway between lamps alone. Perhaps a low minimum illumination may be compensated for partially by the bright background afforded by the greater illumination under each lamp if the interval between lamps is not too great.

Considerable discussion has taken place in England on standard specifications for street lighting proposed by Mr. A. P. Trotter in 1913. These specifications in brief were that the minimum horizontal illumination at any point along the illuminated street should be taken as the basis of contract. Strong exceptions were taken to this proposed specification in the lengthy discussions upon it in the (British) Illuminating Engineering Society, and the defects of the proposed plan were also pointed out editorially in the *Electrical World* on May 10, 1913.

In view of the importance of silhouette effects in street lighting it is very improbable that good street lighting can be judged by minimum values alone. While it is known that brightly lighted areas under large lamps produce light backgrounds which are of decided assistance both in the apparent and in the effective illumination of the street, it is known, on the other hand, that if these lamps are far enough apart a point is reached where the extreme contrast between these brightly lighted areas under the lamps and the dark areas between lamps tends to confusion and interference with vision. The fundamental problem is to determine how far the average illumination along the street can be raised above the minimum illumination at the darker parts before the detrimental effect of too much contrast overbalances the helpful effects of the better illuminated patches of background which the higher average of illumination will give.

Another question which could profitably be investigated in the course of such experiment would be the proper height of lamp with different spacings of lampposts. Usually the height is limited in residence streets by trees, but for streets where there is no such limitation this question needs further study. It is well established that glare from street lamps interferes with or reduces the ability to see with a given illumination of the street surface. The actual effect on the street with different lamp heights can be determined only by actual street experiments where just comparison can be made simultaneously, or nearly so, by a number of observers, technical and non-technical.

A third point for fruitful experiment is that of shades and reflectors for street lamps which will minimize the glare effect of distant lamps without restricting too much the area illuminated from one lamp.

In view of the increasing amount of money spent annually for street lighting the expense of such tests (although considerable if properly carried out) would be amply justified, since an immense amount of money will be wasted during the next few years through the ineffectiveness of street lighting unless some of these fundamental determinations are made.

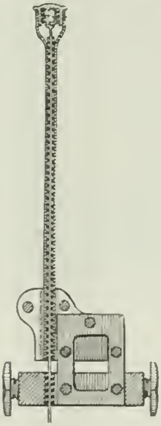
Manufacture and Testing of Insulated Wire and Cable

Mr. H. A. Morss, of Boston, Mass., vice-president of the Simplex Wire & Cable Company, gave an interesting and instructive talk on the insulation and testing of wires and cables before a number of the employees of the Commonwealth Edison Company, Chicago, at the rooms of the Western Society of Engineers on Feb. 17. Taking the bare copper wire from the time of its arrival at the tinning bath, the speaker traced the various steps in the process of insulation to their completion, illustrating his talk with lantern slides showing the machines employed for tinning, tarring, braiding, applying cotton and jute, insulation, stranding copper cores and protective armor, placing rubber insulation, sheathing cable with lead, taping cable and winding steel tape on steel-taped cable. Processes of masticating and drying rubber preparatory to mixing it with other insulating ingredients were also described and illustrated.

In answering questions asked at the close of the lecture Mr. Morss said that he did think wire made fifteen years ago was in some instances better than the products of the factories of to-day, for the reason that competition has forced the manufacturer to bring out wire which is of a lower quality but which is quite good enough for the use to which it is put. He said further that voltage tests on cambric-insulated cables have shown that this type of insulation is really unfit for use where high temperatures are liable to occur. In speaking of testing methods, Mr. Morss emphasized the fact that the manufacturer does not follow the rule of applying a potential two and one-half times the rated voltage for testing all sizes of wires and cables, but uses higher voltages for larger cables in order to bring out possible faults which might come to light later in operation. For instance, the speaker said a No. 14 wire with a 0.047-in. wall, designed for 600-volt operation, is tested at two and one-half normal voltage, or 1500 volts, while a 1,000,000-circ. mil cable with an insulating wall 0.092 in. in thickness, intended for a working pressure of 600 volts, is subjected to a factory test of approximately 5000 volts to search out possible faults.

Recent Telephone Patents

Among the successful selective signaling schemes in use are those based upon the so-called harmonic principle, wherein different frequencies of alternating current are used for different stations, the corresponding ringers being tuned each to respond to its own frequency. One of the peculiarities of these systems lies in the fact that the vibrator changes its normal vibration period whenever the recoil of any stop piece is introduced. For a bell, therefore, the tuning must be slightly off, although it must be sufficiently close for the vibrator to start and to make a first stroke against the stop. Further, the reed must not be out of step when speeded by the recoil. With these conditions in mind Mr. Kempster B. Miller, of Chicago, has devised a system in which the harmonic vibrator has free swing. He uses the vibrator as a relay to control the bell circuit. This relay, which forms the subject of a patent granted to him and assigned to McMeen & Miller, will be understood by reference to the cut, which shows the vibrating part. The chamber at the upper end contains mercury which under the agitation of the vibration closes the relay contact.



HARMONIC RELAY

Mr. A. B. Buckland, of Rochester, N. Y., has inclosed his antiseptic device in a sheet-metal annulus which clamps over the lip of the mouthpiece.

Letters to the Editor

For a Chain of Amateur Wireless Stations

To the Editors of the Electrical World:

Sirs:—The Radio Club of Hartford, Conn., has been at work for some time on plans to organize one or two good amateur wireless stations every 30 to 50 miles throughout as much of the country as seems practicable. The object is to make it possible to relay messages between distant points.

The plan has already reached a point where messages are being relayed from Hartford to Buffalo, N. Y., via Northampton, Mass., and Westfield, N. J. In a short time we expect to get through to Chicago by this relay system. All we need is to get in touch with those amateurs who have stations which will transmit at least 30 miles and who keep their station in continuous working order.

As a means of getting the names and addresses of amateurs who have stations able to transmit messages 30 miles, such amateurs are asked to write to Mr. Clarence D. Tuska, secretary Radio Club of Hartford, 136 Oakland Terrace, Hartford, Conn., who will forward blank forms which when filled out will be used as a basis for appointing official relay stations of the American Amateur Radio League, the name of the organization as already started.

The writer is taking an especial interest in this work and it has his hearty support, especially as it seems to be the only plan by which the amateur can reach distant points without getting into difficulties with the United States government. It may be that we have in this idea a great organization in the making.

Hartford, Conn. Hiram Percy Maxim.

The New Learning

To the Editors of the Electrical World:

Sirs:—Is the attribute of learning properly accorded to the man whose higher education has been entirely along technical and scientific lines? In other words, has the engineering profession made good its right, as the faculties of law and medicine long ago did theirs, to share the laurels of erudition with purely scholastic callings? Here is a question that might be commended to debating societies, for in nothing have the changes in human evolution been more clearly marked than in the slowly shifting standards of a liberal education. In medieval times the learned man of the Western world was he who, steeped in patristic Latin, split hairs upon the minute creedal subdivisions of a fantastic theology. Then the Renaissance dawned, and education gradually came to mean proficiency in Greek and Latin with mathematics, philosophy and the new-born literature as subsidiary branches. The classics long retained their supremacy. It is only necessary to glance at the prose writings and the parliamentary speeches of the eighteenth and the early part of the nineteenth century to perceive how education was bound up with knowledge of ancient literature and mythology. Yet when, some years ago, a scholarly Massachusetts statesman ventured to declaim a few lines from Virgil in the Senate chamber of the United States his colleagues gasped and consternation struck the copy-editing rooms of the morning newspapers. The times had changed, and the qualifications of senators and editors had changed with them.

Much the same thing seems now to have taken place concerning modern literature in its higher branches. Those whose school days are dated back a generation or more can remember the first formidable inroads of physical science on the ground where formerly the humanities were firmly intrenched. That was the period of Darwin and his illustrious coadjutors; but electricity was still in its swaddling-clothes and latter-day engineering was taking its first faltering steps. In those days the erudite man was he who had perchance comprehended Kant's "Critique," edited an encyclopedia, or applied his mind to memorizing historic details all the way from the siege of Troy to the siege of Paris.

That along with specialized acquirements of this nature there existed an extensive knowledge of the magnificent prose and poetry of the English language was taken for granted. It was, indeed, the possession of thousands with no pretence to scholarship, and it served as the foundation stone for every structure erected in the name of learning by men to whom that tongue was native. *Mutatis mutandis*, the same thing was doubtless true of men of other tongues. Scholars might become absorbed eventually in one division or subdivision of knowledge, but the price of mastery was not an early and complete limitation of the scope of effort.

Once again "we have changed all that." Abstract reasoning makes small appeal to the twentieth-century youth. Literature, though happily it will always have in plenty its devotees, is in some danger of being relegated to the status of a cult, one of the fine arts, along with music, painting and sculpture. The day of the engineer has arrived, and in schools and colleges mathematics holds first place in undergraduate favor—not so much by virtue of its inherent merits as because it is the foundation of and supplies the formulas for the score of practical sciences that modern invention has caused to grow up around it. Here is the path along which the ambitious and enterprising youth finds himself drawn. If, in addition, he applies himself to the study of the modern tongues, it is for a cognate reason. His French is acquired not in order to get the fine flavor of Molière's comedy or to examine the epoch-making philosophy of Voltaire, but to enable him to know what light the analytic genius of France has to throw on scientific problems; his German is not for the purpose of grasping the subtleties of "Faust," but to keep pace with Germany's strides in the development of natural forces; his Italian is not that he may explore hell, purgatory and heaven with Dante, but that he may follow the achievements of the native disciples of Pacinotti and Marconi; while his Spanish is not used to savor in their Iberian idiom the racy speeches of Sancho Panza, but in learning of the vast industrial potentialities of South America.

To such a student once master of his subjects, so far as subjects so pulsating and expanding can be mastered, there must no longer be denied the distinction of the learned, even though to him, perhaps, Emerson and Browning be only names and philology and rhetoric incidental pursuits of small import. It is well, of course, to urge him to broaden his mind by excursions into other intellectual realms than those he has made his very own. But versatility is a rare quality and a tireless mind an endowment of the few. The twentieth century is a utilitarian one and one which all men hope is making, however blindly, for the amelioration of the race. From both these points of view, as well as from that of difficulty of performance, surely the mental acquirements of the man who has learned how to throw a bridge across a mile of water, or to harness Niagara to a street car 200 miles away, or to equip a great electric power house to stable the strength of a million horses, do not deserve to be ranked below those of the translator of Homer, the exponent of metaphysics, or the commentator on Shakespeare's sonnets.

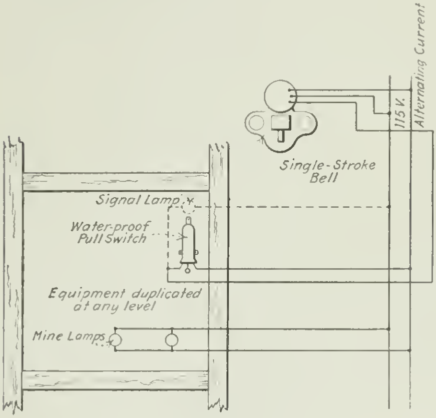
New York, N. Y. Frank C. Wells.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Mine Signals and Lamps on Same Circuit

Shown in the accompanying diagram is an alternating-current mine-signal wiring system for use in single-compartment shafts. Mine lamps can be connected to the same circuit. Single-stroke bells, waterproof pull switches and insulated circuits are employed, so there is little possibility of the bells being accidentally rung or current straying through the earth and causing sparks or explosions. The conductors should be rubber-covered and preferably inclosed in weatherproof or lead-covered cable. This system is employed in the Cripple Creek Mines, Colorado.



SIGNAL SYSTEMS FOR MINES

Blown Compensator Fuse

When a polyphase induction motor is started from a plain triple-pole, single-throw switch (small motors usually are), or from an external resistor and controller, or from an internal-resistor and switch device, the supply lines are fused, so that the fuses are in circuit all the time. This is practicable where the motor is small, or where the starting current is under control, or where the motor is never required to start with a heavy connected load. When an induction motor is operated from a compensator, however, it is customary to fuse only the motor side of the compensator, because fuses of a size that would be of any protection to the motor under ordinary running conditions would blow when subjected to the starting currents incident to compensator control. An inspector was called to locate trouble with a 35-hp, three-phase induction motor that would always start when the compensator was closed on the starting side, but would sometimes stall when the compensator was thrown over to the running side. The trouble proved to be due to a blown fuse, and the explanation of the motor's action is as follows: The motor's connected load was a centrifugal blower. With the blower damper closed the load was very light and the motor would start promptly and operate comparatively free. With the blower damper open, however, the load was heavy and increased rapidly with the speed. In the first case the motor would come up to nearly synchronous speed on the starting side of the compensator so that when the compensator was moved to the running position the speed was so high and the load so light that the motor would continue to operate, but as a single-phase motor; in the second case the connected load would prevent the speed from getting near synchronism on the starting side of the compensator, and on throwing the compensator to the running side the load would become too great and the speed too low for single-phase action to pull the rotor into synchronism, so it would stall and blow more fuses. The operator would then replace the fuses, not knowing, of course, that one of them had been blown perhaps for some time, and everything would then run along all right until the next fuse blew from age or overload, when the same erratic cycle would be irregularly repeated. The motor was installed above the compensator, access to it being by a ladder. Had it been placed where the operator would have had occasion to rest his hand upon it in passing, he would have probably noticed that the motor became a good deal warmer on some days than it did on others, because a three-phase motor operating single-phase takes about a third more current.

Construction of 11,000-Volt Switch Tower

The solution of the 11,000-volt switching problem described herewith is of interest because of the peculiar construction necessary to mount the apparatus in restricted space so that the taps would have maximum clearance while at the same time making the switches as accessible as possible.

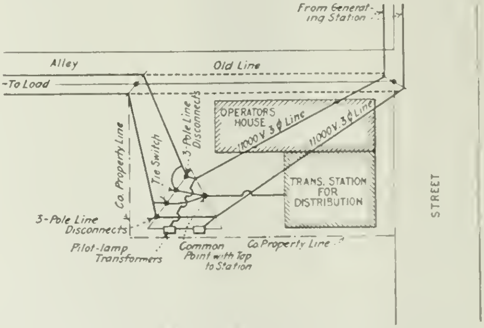


FIG. 1—PLAN OF SUBSTATION PROPERTY, SHOWING SWITCH TOWER

Two loaded 11,000-volt, three-phase lines of the Northern Indiana Gas & Electric Company passed through a town in which there was a transformer substation. This station was equipped with pole-top switches so that it could be fed from either line. Later the company decided to provide switching means, with pilot-lamp transformers on both lines, so that in case one of the lines went bad between his station and the generating plant the substation operator could quickly shift the load to the other line.

The engineer who designed the switch tower was handicapped by the amount of ground space available and by the fact that the three-pole disconnecting switches required flat construction. In the old type of construction the taps for the station were taken off from the main line by buck arms, but it was not considered desirable to repeat this construction as buck arms with their taps had been found to make a poor and dangerous job.

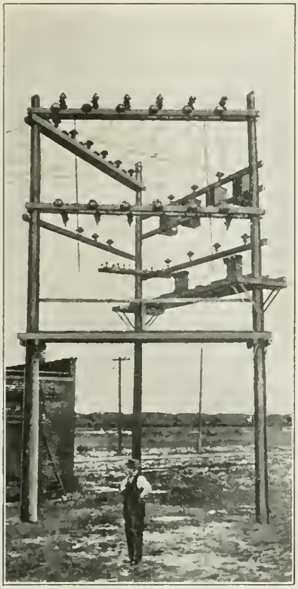


FIG. 2—11,000-VOLT SWITCHING TOWER WITH PLATFORM FOR OPERATOR

For pilot lamps standard 11,000/110-volt, 2.5-kva transformers were used, protected by Matthews fused switches. The tie switches were of the single-pole inverted type. They were so mounted that there remained plenty of clearance above the platform when the switches were open.

The accompanying sketch shows the relative location of the switches and transformers, and the picture presents some idea of the finished tower construction. From the platform shown, the operator can do all necessary switching in minimum time and with the greatest possible degree of personal saftey.

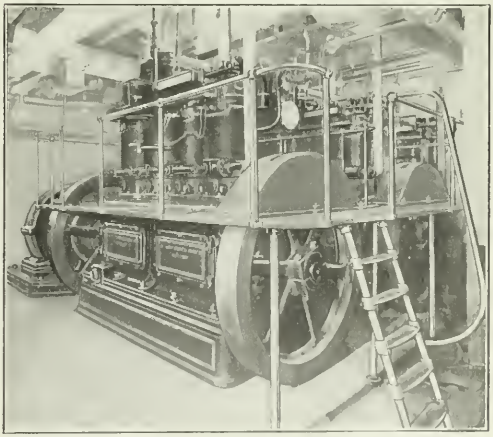
Inertia Effects

A crane hoist of which the motor was electrically braked had given all kinds of trouble. First, the brake wheels would break through their hubs; the operator reinforced them. Then the armature cores started to loosen on their shafts. This apparent weakness was strengthened by pressing the cores onto the shafts and securing them with two keys instead of one. Everything then went smoothly till the pinion end of the armature shaft twisted off at the filleted shoulder. A spare armature suffered the same fate. Then the operator sought help. The inspector ascertained that the crane gearing in the first place had been such that the electric brake had to be used to hold the hook load when the motor circuit was off and also to control the rate of lowering. The gearing was later changed to the worm-and-wheel type, in which the worm would hold the load and all the electric brake had to do was to stop the armature. This it was doing instantaneously, as nearly as the eye could judge. The result was that when the brake stopped one end of the armature shaft the whole core with its copper winding would tend to keep turning, and it was only a matter of the weakest part breaking. The weight by means of which the brake was applied when the main circuit was thrown off was decreased 75 per cent, whereupon all troubles ceased.

Combined Steam and Gas-Engine Plant for Hotel Service

The Fort Pitt Hotel, Pittsburgh, Pa., is equipped with a combination steam and gas-engine plant. The gas engines were installed in the fall of 1912 when an addition was made to the hotel. Prior to that time only steam was used. The mechanical equipment includes three 316-hp Heine boilers and three Roney stokers, two 250-hp Erie-Ball four-valve steam engines, three 100-hp Erie-Ball slide-valve steam engines and three 150-hp Bruce-Macbeth four-cylinder gas engines. All of the above engines are connected directly to Westinghouse 125-volt direct-current generators. There are also a 20-in. by 16-in. by 20-in. and a 16-in. by 10-in. by 20-in. Burnham steam pump, a 15-ton and a 30-ton Frick ice machine, a 48-hp air compressor and a four-sweeper steam vacuum cleaner.

A comparison of the fuel costs for the months of January and June, 1912, when steam was used exclusively, and those for the corresponding periods in 1913, when both steam-driven and gas-engine units were used, is given in the accompanying table. In 1912 there were 540 rooms and in 1913 approximately 700 rooms, representing an increase of 29.5 per cent. The cost of labor for 1913 was practically the same as that for 1912. The data for June and January are taken to give a comparison of both winter and summer operation. The cost of coal was $1.70 per ton delivered and



THREE 150-HP GAS ENGINES DIRECTLY CONNECTED TO 125-VOLT GENERATORS that of the gas approximately 20 cents per 1000 cu. ft.

At all times of the year enough steam equipment is run to heat the water by the exhaust steam and in cold weather to heat the building. In the summer the pumps and ice machines furnish sufficient exhaust steam to heat the water, and the three gas engines are run almost continuously during this time. In the winter sometimes two and sometimes only one gas engine is run. The refrigerating machines run practically continuously. The air compressor runs continuously twenty-four hours and the vacuum cleaner about twelve hours, daily. The kitchen steam consumption in January and June, 1912, averaged about 75 boiler hp and for the same time in 1913 about 100 boiler hp.

FUEL COST AND OUTPUT FOR TWO MONTHS OF 1912 AND 1913

	January, 1912	January, 1913	June, 1912	June, 1913
Kilowatt-hours delivered	133,660	149,380	106,220	125,480
Gallons water pumped	8,139,276	11,176,506	9,366,464	10,420,590
Coal consumed in tons.	1,000	766	850	511
Cost	$1,733.81	$1,474 07	$1,328.01	$885.95
Gas cost	....	157 80	...	315.60
Oil cost.............	84.16	94.06	89 95	103.64
Total cost (coal, gas, oil)...........	$1,817.97	$1,725.93	$1,417 96	$1,305.19

From the figures in the table the total output for January and June, 1912, was 239,880 kw-hr. and for the same months in 1913, when the gas engines were used, 274,860 kw-hr., an increase of 34,980 kw-hr., or 15 per cent. The water pumped in January and June, 1912, was 17,505,740 gal. and for the same months in 1913 21,596,096 gal., an increase of 4,090,356 gal., or 36 per cent. The coal charges for January and June, 1912, were $3,061.82 and those for oil $174.11, making a total of $3,235.95, and for the same months in 1913 the coal charges were $2,360.02, gas $473.40, oil $197.70, making a total of $3,031.12, a decrease of $204.81, or 6.4 per cent. These figures show a reduction in fuel costs in spite of increased output and a greater hotel service.

Repulsion-Induction Motor Trouble

A repulsion-induction motor has, in addition to the main field winding, to which line voltage is applied in the same way as to the stator of any other induction motor, a compensating field winding wound upon the same poles. The rotor, which is a direct-current armature, may have no electrical connection with the main field winding. In its simplest form the motor has two sets of brushes. One set, called the "energy brushes," is short-circuited. It is this so-called "energy" circuit to which rotation is due. The other brushes are connected to the compensating field winding. One function of this compensating winding, energized by the rotor, is to limit the free speed of the motor, for the greater the speed the greater the rotor voltage and the stronger the compensating field. In variable-speed motors both of these circuits are opened, the terminals being brought outside of the motor and the circuits there completed through variable resistances contained in a controller.

An inspector was called in to find the trouble with each of two small motors, one of which ran too fast and the other of which would not run at all. Both installations were new. The motor that would not start had a broken grid in the resistor of the energy circuit, so that that circuit could not be energized until the controller was pushed well around toward the full-on position. On the motor that ran too fast at light load a brush was missing from one of the brush holders of the compensating circuit, so that the compensating circuit was inactive and could not, therefore, strengthen the field and limit the speed. Without the limiting influence of the compensating field, the motor free acts like a series direct-current motor.

Charging Lightning Arrester Causes Transformer Noises

In charging electrolytic lightning arresters a noise, between a hiss and a squeak, is heard on the transformers. What is the cause? C. O. R.

The noise is due to vibration, which is probably caused by the half-wave charging current taken by the lightning arrester. This current sets up a pulsating magnetic flux in the transformer core which tends to cause any loose laminations to vibrate in unison with it.

Radio-Telegraph Antenna

What are the advantages of the umbrella radio-telegraph antenna? D. T.

The umbrella aerial is preferred to the flat-top for some installations because it can be supported from a single mast and (in quenched-gap working) because its radiation damping is as a rule less than that of a flat-top antenna of equivalent capacity and height. The flat-top antenna in general can be erected more conveniently in restricted quarters and for a given maximum height has greater transmitting or receiving ability. The transmitting ability of an aerial is determined largely by its "effective height." This height is equal to the geometric height in the case of a flat-top or, in the instance of an umbrella, to the average height of the middle points of each rib wire.

Resistor for Shunting Series-Field Coils

How can the proper amount of shunt resistance to be connected across the series-field circuit of a compound generator be determined? F. P. S.

If the generator is already constructed and factory test data are not available, perhaps the simplest way to determine the amount of resistance to be shunted across the series-field circuit is by making trial tests with a water rheostat. Connect in series across the terminals of the series-field coils the rheostat and an ammeter, the maximum scale reading of which should not be much smaller than the rated full-load current of the generator unless some precaution is taken to protect the instrument. Operate the generator at no-load and adjust the shunt-field circuit resistance for no-load voltage; then load the generator to its rated current output or to the amount at which a definite voltage is desired and adjust the shunted water rheostat to give that particular voltage across the generator terminals. Record the current through the water rheostat when the right conditions are obtained, and then disconnect the entire temporary shunt circuit from the series-field coils and measure its resistance with the same current value. By employing the data thus obtained and using wire having a temperature coefficient close to that of the series-field conductors it will be possible to design a satisfactory shunt resistor. After the final connections are made between the shunt resistor and the series-field terminals, the resistor can be insulated by wrapping it with heavy cord.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Experimental Investigations of Field Distortion and Commutation in a Modern Dynamo.—A. Mauduit.—An account of a continuation of the author's former researches into the phenomena of commutation. He had formerly studied a comparatively simple Rechniewski dynamo, and later three more complex designs of Oerlikon, Thury-Schneider and Gramme. He now takes up the case of a modern multipolar dynamo with equipotential connections and auxiliary commutation poles. A large number of oscillograms obtained with a Blondel oscillograph of latest design show very clearly the part which saturation plays in the distortion of the field under the brushes, the operation of the interpoles and all phenomena of commutation. Further experiments with alternating currents, combined with oscillographic tests, permit the author to state precisely the criterion of good commutation proposed by him in his former papers, and to apply it to a modern dynamo.—*La Revue Elec.*, April 3, 1914.

Eddy-Current Losses in Sheet Steel.—J. D. Ball and W. E. Ruder.—It has been assumed for some time that the eddy-current losses in various magnetized materials vary inversely with the specific resistance. A number of observations have shown, however, that such is not always the case. For instance, certain silicon steels having five times the resistivity of common iron have been found to give only half as much eddy-current loss as the iron, and also certain heat treatments, which do not materially alter the resistivity, increase the eddy-current losses. It is also shown that the eddy currents increase rapidly with grain size up to a point where the grains can easily be seen with the naked eye. This article gives the results of several tests which have been made in an investigation of the factors influencing eddy-current loss. In addition it points out the unsatisfactory state of knowledge on the subject at the present time.—*Gen. Elec. Rev.*, May, 1914.

Lamps and Lighting

Direct-Current Conversion for Railway Lighting.—P. Amsler.—The author has formerly described a system for use on high-tension direct-current traction lines for transforming the high-tension direct current to low-tension direct current for lighting, heating, driving ventilators, etc. The arrangement is shown in Fig. 1. *A* is the trolley wire with an emf of 1200 volts, *B* is a series resistor, *C* a direct-current motor coupled to a low-tension direct-current generator *D*. *E* is an auxiliary winding, *F* a series winding, *G* a counter-compound winding, *H* excitation winding, *I* is the lighting generator with the auxiliary pole winding *H*, *K* being the compound winding, *L* the shunt winding and *M* the lamps. It will be seen that the high-tension machine in the converter set is separately excited by the low-tension current of the low-tension circuit. The electric road from Biasca to Acquarossa in Tessin is equipped with three such groups for transforming the trolley voltage of 1200 to the lamp voltage of 115. On the Wendelstein road in Bavaria such machine sets have been in operation for two years on a trolley voltage of from 1500 to 1800. The same machines are now being used on all 1200-volt direct-current roads of Brown, Boveri & Company. In the former installations two direct-current machines, each of 1.25 kw, of standard construction were used rigidly coupled together, but this makes the set rather heavy. For this reason a new machine type has been designed which is 30 per cent lighter, though the output rating is 2 kw. These machines have a constant transformation ratio independent of the load on the trolley wire. The voltage drop in the trolley wire, therefore, causes a proportional drop on the secondary side. If this is considered to be a disadvantage, constant voltage may easily be obtained by means of an automatic rapid regulator such as used by Brown, Boveri & Company in general for train lighting. Fig. 2 shows the connections of such a machine set with an automatic regulator. This system is used on the Bern-Oberland roads. The high-tension motor *M* is coupled with a low-tension generator *G* and a ventilator. While the high tension varies between 1300 volts and 1700 volts, the speed of the set and the voltage of the dynamo on the low-tension side are automatically kept constant by means of the voltage regulator. In this way the ventilator always supplies the same amount of air and the voltage at the lamps is independent of the fluctuation of the voltage of the trolley wire. The arrangement of Fig. 2 is simi-

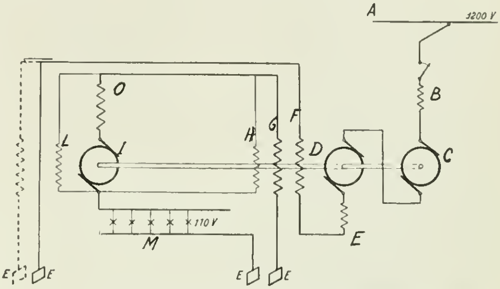


FIG. 1—METHOD OF OBTAINING LOW-TENSION ENERGY FROM HIGH-VOLTAGE TRACTION CIRCUIT

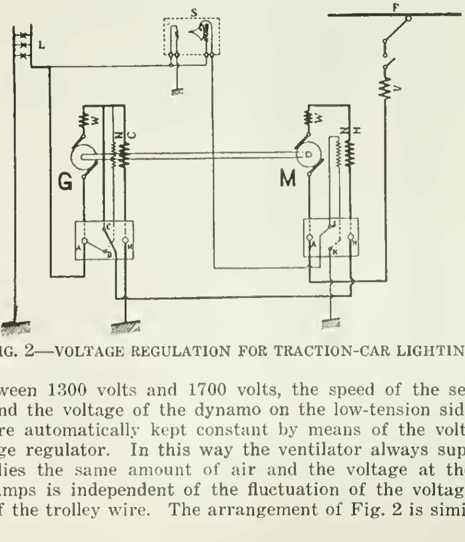


FIG. 2—VOLTAGE REGULATION FOR TRACTION-CAR LIGHTING

lar to that of Fig. 1. The chief advantage is the use of an automatic voltage regulator which regulates the voltage of the generator. Moreover, the counter-compound winding of the motor is omitted since its function is fulfilled by the voltage regulator. There are no magnetic field coils in the high-tension line. Only the armature of the motor is supplied with high-tension current and its winding is, therefore, very strongly insulated with a mica preparation.—*Elek. Zeit.*, April 16, 1914.

Generation, Transmission and Distribution

French Power Plant.—J. de Soucy.—La Société Pyrénéenne d'Energie Electrique is a French power company greatly favored by the availability of large water-powers, but embarrassed by their location in a district of little industrial development. The author gives a concise history of the development of the company and describes especially the methods employed in building up a load which has as far as possible a uniform load curve.—*La Lumière Elec.*, April 11, 1914.

Phase Compensation.—G. H. Eardley-Wilmott.—An illustrated article in which the different kinds of plant available for phase compensation are considered, such plant being classed as (1) that which may improve the power-factor of the system as a whole and (2) that which is applied to individual motors. The over-excited synchronous motor is first considered, the effects being illustrated graphically and by a specific instance. Reference is then made to condensers, and lastly a case is taken where a rotary phase-advancer is used. It is pointed out that the type of plant to be adopted must depend on the circumstances of each case, it being impossible to lay down any general rule.—London *Electrician*, April 17, 1914.

Ship's Steering Gear.—A note on a recent British patent (No. 1505, 1913) of the British Thomson-Houston Company and the General Electric Company of this country. The motor controller consists of two independent drum controllers connected by differential gearing, the intermediate element of which can be worked by the steering wheel to set one drum to drive the motor working the rudder, while this motion rotates the otherdrum so that through the gearing the first drum is brought to its original or "off" position. The motor is fed through a motor-generator whose generator-field current is varied by a rheostat controlled by the motor-generator shaft through a clutch and holding-off magnet.—London *Elec. Eng'ing*, April 16, 1914.

Gold Dredging.—W. H. Gardner and W. M. Shepard. —An illustrated article on the construction, equipment and operation of the latest and largest electrically operated gold dredge, Yuba No. 14.—*Gen. Elec. Rev.*, May, 1914.

Traction

Heating Trolley Cars.—Oskar Stegemann.—A paper read before the Electrical Society of Berlin. The author describes different systems for heating trolley cars. Heating by means of the starting and stopping resistors is cheap but very poor. To get a reliable system special heating resistors must be provided. For this purpose carbon lamps or resistor wires have been used. The author describes in detail a new system in which the resistor consists of a metallic tube made from nickel-steel ribbon bound in helix form so as to form a tube. These resistor tubes are arranged vertically so as to produce a movement of the hot air upward in the tube. With this system it is possible to produce the desired temperature within a few minutes. A heating furnace of this kind of 500 watts weighs 4.5 kg (9.9 lb.), and fifteen such furnaces are used in one car on the Berlin tramway system.—*Elek. Zeit.*, April 9, 1914.

Automobiles.—T. Clarkson.—A paper read before the (British) Institution of Civil Engineers on "some recent developments in commercial motor vehicles," dealing with steam, gasoline and electric automobiles. —London *Electrician*, April 17, 1914.

Installations, Systems and Appliances

Berlin Central Station.—Emil Schiff.—An illustrated article on the development of the Berlin Electricity Works and a discussion of the best policy to be adopted by the city. The question is now before the municipality of Berlin, either to take the plant over for municipal operation or to renew the concession to the Berlin Electricity Works under new conditions. At present the city of Berlin gets about one-half of the total net income of the plant. The technical development of the electricity works has been steady, as has also been the increase in the net income. This is shown by the form of the curves extending over the last twenty years. On the other hand, the dividends paid have fluctuated from 1890 to 1912 between 7.75 per cent as a minimum and 13.5 per cent as a maximum and were 12 per cent in 1911. The stock quotations have been subject to still greater fluctuations. The question of erecting a very large generating station in the Bitterfeld lignite district, with a transmission line to Berlin, is considered. The author thinks that in Germany better economic results have been obtained with municipal stations than with privately owned stations. He is in favor of the project that the city of Berlin should take over the electricity works. If, however, the city should decide in favor of giving a new concession, the prospects are that in the future there would be a combined municipal and privately owned management. But the author thinks that in this case the old management, having an experience of many years, would be practically in control.—*Elek. Zeit.*, April, 16, 1914.

Central-Station Development in Germany.—Thierbach.—The author calls attention to the following results for the 1648 German central stations for which statistical data are available. The aggregate sum of their ratings is 2,100,000 kw. One hundred and three stations have a rating of more than 5000 kw each and the aggregate rating of these 103 stations is 1,560,000 kw. The rating of all stations with a smaller rating than 5000 kw each is, therefore, 540,000 kw. As a matter of fact, in the 103 large stations only 800,000 kw is usefully employed, so that 760,000 kw is useless. This is more than the rating of all the stations with less than 5000-kw rating, and the author concludes that the machines and storage batteries installed in the 103 largest stations would have been entirely sufficient to supply all the energy needed in the whole of Germany. The author shows that the situation has not improved in late years, and that on the contrary during the last ten years the number of very small stations of less than 500 kw each has increased enormously. This he considers to be a very great economic waste. His article is a plea for the creation of a central bureau which should prevent the foolish erection of small central stations and should take into consideration the supply of energy all over Germany in accordance with a uniform systematic plan.—*Elek. Zeit.*, April 16, 1914.

The Compulsory Purchase of British Electric Central Stations.—The first of a series of articles in which the harmful effect of the compulsory purchase of electricity undertakings by municipalities is considered, more particularly in regard to London electricity supply. The present article deals with the relation of private enterprise to progress as shown by the various public utilities. In a second article the reward of private enterprise will be discussed, and it will be pointed out that this reward, as measured by dividends, is by no means as large as is often supposed. In a third article the fallacy of municipal trading is to be discussed, emphasis being laid on the danger of permitting the government or a municipality to have a monopoly, such danger being greater than in private enterprise. This danger is well exemplified in the history of the National Telephone Company. A fourth article is to be a brief history of the London electricity supply companies. In a fifth article the effect of compulsory purchase looming in the near future is to be shown to cause necessarily a less active policy than would otherwise be the case, besides increasing difficulty in expansion. In a sixth article the effect of compulsory purchase in the near future is to be shown to cause a restriction of capital expenditure, illustrated by reference to the last few years of the existence of the National Telephone Company. It is shown that working under municipal control cannot be so efficient as private enterprise. Various alternatives are considered. These are the "mixed" type of undertaking, as found in Germany; the control of dividends, as in the case of gas companies, and the working under control of an independent authority. This last is found to be extremely successful in America, and is suggested as a solution of the present difficulty in London electricity supply.—London *Electrician*, April 17, 1914.

Auto-Transformers.—Lee Hagood.—On account of cheapness the auto-transformer is attractive for energy transmission. Although some are in successful operation, considerable care should be observed before adding an auto-transformer to a system. A contract was made with Company "A" for the purchase of sixty-cycle, 22,000-volt energy by Company "B." Available for supplying this power was a 16,000-volt, sixty-cycle system and a twenty-five-cycle system. A frequency-changer set was installed arranged for 2300 volts on the sixty-cycle side. It was therefore necessary to furnish apparatus to step the voltage from 2300 volts to 22,000 volts and from 16,000 volts to 22,000 volts. To meet the two conditions of voltage transformation a transformer was installed having a delta connection from 2300 volts to 22,000 volts and the high-tension winding was connected as an auto-transformer for 16,000 volts to 22,000 volts. The connections are illustrated in Fig. 3. In view of the fact that both systems are isolated, the auto-transformer neutral was not grounded, since grounding would involve changing all the two-pole relays on the automatic oil switches to three-pole relays. This would also have involved the addition of another series transformer for each automatic switch. The transformer in question was a 3600-kva set made up of three single-phase units. Trouble arose when an attempt was made to supply energy from the 16,000-volt system with the 2300-volt delta connection open. Immediately serious telephone disturbances arose. By closing up the 2300-volt delta winding the disturbance was brought to an end. The next trouble arose some time later when Company "B" experienced a "ground" which raised the dynamic voltage from 16,000 volts to 19,000 volts on the Company "A" side. Simultaneously high frequency was transmitted through the auto-transformer due to the arc at the ground on the Company "B" side. This caused the horn-gaps of the 16,000-volt lightning arresters to arc, and thereupon the lightning arresters were destroyed. If a transformer with two secondary windings had been selected in the first place, it would have been only slightly more expensive than the present auto-transformer combination and would not have been exposed to any of these troubles. While it might appear that grounding an auto-transformer would solve all serious difficulties, yet the author shows that this would have presented several distinct disadvantages.—*Gen. Elec. Rev.*, May, 1914.

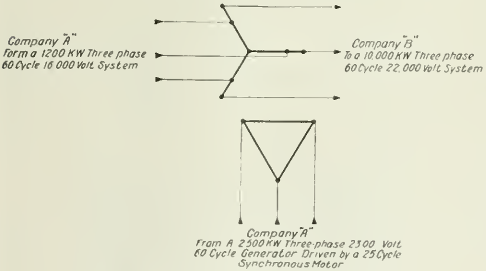

Company "A"
Form a 1200 KW Three phase
60 Cycle 16 000 Volt System
Company "B"
To a 10.000 KW Three phase
60 Cycle 22.000 Volt System
Company "A"
From A 2500 KW Three-phase 2300 Volt
60 Cycle Generator Driven by a 25 Cycle
Synchronous Motor

FIG. 3—TRANSFORMER CONNECTIONS

Wires, Wiring and Conduits

Current Density of Transmission Lines.—Nils Forrsblad.—An article illustrated by diagrams and tables in which the author shows how the most economical current density of an overhead-transmission line can be calculated from the price of the energy or read directly from curves.—*Elek. Zeit.*, April 16, 1914.

Purifying Copper.—A note on a recent British patent (No. 6286, 1913) of the British Thomson-Houston Company and the General Electric Company of this country. Copper of a high degree of purity is obtained by melting the copper above a mixture of inert material and boric anhydride. The temperature is kept at about 1300 deg. C., while the boric anhydride is kept beneath by the inert material and the mass is stirred until the boric anhydride rises to the surface. The process may also be applied to silver, gold, etc.—London *Elec. Eng'ing*, April 16, 1914.

Electrophysics and Magnetism

Lecher Oscillator.—F. C. Blake and Charles Sheard.—A third paper on the vibrations of a Lecher system using a Lecher oscillator. In their last paper they stated that when the Lecher system was in exact tune with the oscillator and receiver circuits Abraham's theory ought to apply, provided the various harmonics were damped out proportionately. The present paper gives the results of experiments in which they tried this. The results are given in diagrams and tables. Decreasing the couplings at both ends of the Lecher wires does not affect appreciably the degree of harmony of the tones. Increasing the coupling at the oscillator end only does decrease the harmony of the tones. An increase in the end capacity decreases the harmony of the several tones. It would seem that three conditions need to be fulfilled if the various tones are to be strictly harmonic, namely, (1) the distance between the Lecher wires must approach zero; (2) the end capacity must approach zero, and (3) the coupling must be loose at both ends of the Lecher system.—*Phys. Review*, March, 1914.

Units, Measurements and Instruments

Multiple Recorders.—A note on a recent British patent (No. 5734, 1913) of the British Thomson-Houston Company and the Allgemeine Elektricitäts Gesellschaft. Different markings are produced by the use of a paper soaked in an electrolyte and different electrodes, or by different current strengths. One or both sides of the record sheet may be used. Suitable electrolytes are potassium ferro-cyanide or iodide; for example, paper soaked in the first will give a red, blue or green line with a positive electrode of copper, iron or steel.—London *Elec. Eng'ing*, April 9, 1914.

Thermal Emf at the Junction of Metals and Metallic Oxides.—S. L. Brown.—An abstract of an American Physical Society paper. Considerable electromotive force is generated when a cold wire is brought in contact with a similar or dissimilar hot wire. If two iron wires are fastened to the terminals of a galvanometer, one wire is heated in a flame, and the heated portion is touched with the cool wire, the emf is many times sufficient to throw the galvanometer deflection off the scale. If two similar wires are left in the flame, the emf will reduce to zero or nearly zero, and if they are dissimilar the emf force will reduce to the value that is characteristic of the two metals at the particular temperature. These large emfs were found to be due to the oxides which formed on the heated metals. The results of experiments with several couples are given. The temperature of the oxide at the point of contact with the cool wire is much lower than the temperature of the oxide at the point of contact with the hot wire, and consequently a metal, metal-oxide thermocouple is formed. These results emphasize the necessity of close contact between the metals of any thermocouple since a very small difference between the temperatures of the wires would produce erroneous results if an oxide separated the wires. There also seems to be sufficient reason for discarding the method that is sometimes used to test thermocouple wires for homogeneity. This method is to bring two wires in contact in a flame, and by moving from point to point along one wire nonhomogeneity would result in a thermo-emf if the wires were of the same material or a change in the emf if the wires were of different materials. A small difference between the temperatures of the wires and an oxide between them would produce emfs much larger and much more variable than the emf force due to nonhomogeneity.—*Phys. Review*, March, 1914.

Telegraphy, Telephony and Signals

Electric Transmission of Pictures.—ARTUR KORN.—The author gives an illustrated review of the present status of picture telegraphy by means of the selenium-cell method and the telautograph method. He then describes a recent improvement in the form of a relay which permits a considerable increase of the weak currents obtained by transmission with the selenium method. There are two types of relays. In one type if i is the amplitude of the current received in the receiver at any moment, then the relay gives an amplitude ai, where a is a constant greater than unity so that the amplitude given by the relay is always proportional to the current received. The microphone relays and the Lieben relay are of this type. The second type of relay is what the author calls a step relay. For instance, if the current received varies between 0 and 1 milliampere, he divides this range into ten steps. The first step is from 0 to 0.05 milliampere, the second from 0.05 to 0.15, and so on, the ninth from 0.75 to 0.85, and the tenth from 0.85 milliampere to 1 milliampere. The author's relay changes any current of the tenth step into current of the intensity of $9a$ milliamperes, any current of the ninth step into $8a$ milliamperes and any current from the second step into a milliamperes, while the currents in the first step are not affected. a is greater than 0.1. The operation of his relay is based on the property of weak high-frequency currents (Tesla currents) to light arcs instantaneously. By means of very sensitive telephone instruments Tesla currents are directed to air-gaps, the terminals of which are shunted by suitable direct-current or alternating-current voltages, so that heavy-current arcs are started by means of the Tesla currents. Some further applications of this new step relay are described.—*Elek. Zeit.*, April 16, 1914.

Propagation of Electromagnetic Waves in Wireless Telegraphy.—GEORGE R. DEAN.—The first part of a theory of propagation of electromagnetic waves in wireless telegraphy. In this part the author discusses the simple Hertz element and the electric doublet, dealing with the magnetic intensity at points near the origin, Hertz's solution of the vibrating electric doublet and the determination of the constants in the solution, the components of electric and magnetic intensity and their values on the origin and at infinity, the components of the field, the lines of electric induction, and the effect of a third harmonic.—London *Electrician*, April 10, 1914.

Book Review

FORMULÆ AND TABLES FOR THE CALCULATION OF ALTERNATING-CURRENT PROBLEMS. By Louis Cohen. New York: McGraw-Hill Book Company, Inc. 281 pages, illus. Price, $3.

In the study of alternating currents, and in the solution of the more complicated problems which the engineer must necessarily encounter the moment he departs from the well-worn ruts of common practice to enter the newer or less familiar fields of investigation, a sound knowledge of mathematics is almost essential. It is, however, not within the scope of the book before us to instruct the reader in the principles of mathematics. The knowledge requisite to apply the formulas and tables intelligently is assumed. The work is, in fact, of the nature of a compilation, all sources of information being drawn from freely in order that the most accurate and useful formulas may easily be found in connection with the particular subject to which they are applicable. Apart from the fact that some of the formulas and methods of working are due to the author, he lays no claim to having produced an original work; yet it must not be supposed that any writer, however great his mathematical knowledge, is capable of collecting and presenting the material in such a manner as to form a really valuable addition to the literature of alternating currents. The author has taken great pains to attain accuracy and completeness, and he is to be congratulated on the result of his labors, which cannot fail to be welcomed by scientists and engineers, who will find here collected and admirably presented such information as they would ordinarily have to seek in various more or less accessible scientific publications. The plan of applying many of the formulas to the working out of numerical examples adds greatly to the usefulness of the book. The matter is arranged systematically and presented in the following order: Resistance and eddy-current losses; inductance; capacity; alternating-current circuits; transient phenomena; distributed inductance and capacity. In the final chapter a number of useful mathematical formulas and tables (including exponential and hyperbolic functions) are collected for easy reference. The long-distance overhead transmission line receives its due share of attention, and several formulas are given both for concentrated and distributed capacities. The engineer engaged on the practical design of transmission lines may, if he desires, use the more accurate formulas applicable to the case of distributed capacity; but he is not likely to do so when simpler formulas are available. He knows that the actual wave-form rarely, if ever, adapts itself to the mathematical conception of what it ought to be, and for that reason he is not inclined to waste time on mathematical niceties based on false premises. The book, however, is not primarily intended for the use of the practical engineer. It deals with exact methods and solutions, and the engineer is at liberty to use discrimination in arriving at the approximations which will generally satisfy his needs.

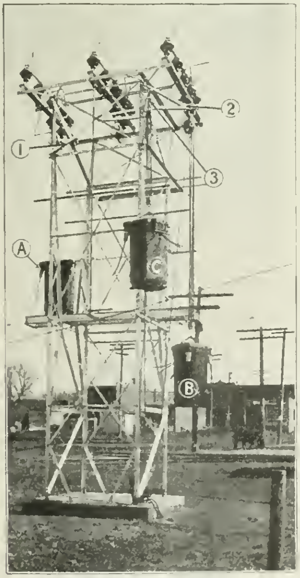
New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Transformers on Steel-Tower Substations

One of the problems confronting the central-station managers using steel-tower outdoor high-tension substations is the economical handling of transformers. However well a station may be designed to control and protect transformers, it falls short of commercial requirements if the method of handling the transformers is difficult. An outdoor substation designed to meet conditions encountered in practice is shown in the accompanying illustration. This station is equipped with a transformer platform provided with a transfer truck, which can travel the full length of the I-beam supports. Near the top of the front corner posts are pivoted single-jib and double-jib cranes, indicated as 1, 2 and 3. These jib cranes, which have a large radius of action, are provided with steel U-bolts to take the tackle hooks.

Assuming that the middle transformer B has failed and must be removed, the end transformer C is first raised by means of the No. 3 jib crane; it is then swung around out of the way and left hanging on the tackle. The transfer truck with the middle transformer B is next rolled to the end of the platform, the transformer being raised with jib No. 2, then swung around and lowered to the ground. To restore service, transformer C is swung around and lowered to the platform, the station now operating in open delta until the defective transformer can be repaired. By this combination of transformer truck and jib cranes, it is said that transformers of any weight up to 4000 lb. can be handled easily.



HIGH-TENSION OUTDOOR SUBSTATION

These steel-tower outdoor substations are manufactured by the Delta-Star Electric Company, Chicago, Ill.

Ventilated Reflectors Designed for Incandescent Lamps

The reflectors and diffusing units shown in the accompanying illustrations have been designed for use with high-efficiency 750-watt and 1000-watt tungsten lamps. The semi-indirect unit shown in Fig. 1 consists of a Druid-glass outer envelope within which is suspended a prismatic glass reflector which directs the light up toward the ceiling. Air passes downward between the reflector and envelope and upward through the center of the reflector between the lamp and the reflector. The diffusing unit shown in Fig. 2 consists of an outer envelope of dense opal glass and a bowl at the bottom of crystal roughed glass. Air enters from below the lower band of the fixture and escapes through the hood above. Shallow-bowled and deep-bowled enameled-steel reflectors have been designed for use on platforms and in shops, yards, etc. The screening angle of the shallow-bowl unit shown in Fig. 3 is 85 deg. These reflectors and diffusing units have been developed at the Holophane Works of the General Electric Company, Cleveland, Ohio.

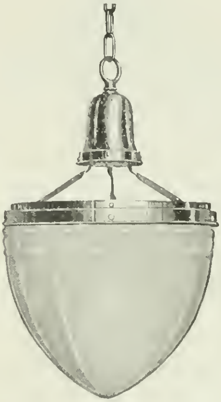


FIG. 1—SEMI-INDIRECT UNIT

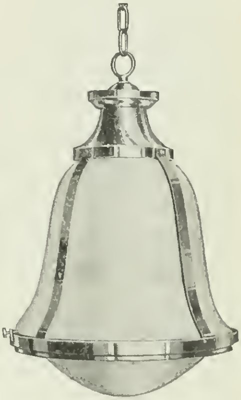


FIG. 2—DIFFUSING UNIT

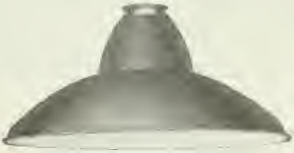


FIG. 3—SHALLOW-BOWL REFLECTOR

Electric Coffee Urn and Teakettle

The electric spray coffee urn and tilting teakettle shown herewith are being placed on the market by the Simplex Electric Heating Company, Cambridge, Mass. The colonial type of silvercraft is used in the design of the urn. Spraying with the latter begins in two minutes when starting with warm water and in from four to five minutes when starting with cold water. The stove is provided with a "lock-on" device which insures good heating contact and conservation of heat. It is equipped with a three-heat switch. The urn can be removed and the stove used for toasting or other light cooking purposes when desired. The urn is equipped with a 6-ft. silk cord, a lamp-socket attachment and a quick-detachable connector. The stove is rated at 500 watts.

ELECTRIC SPRAY URN

ELECTRIC TILTING TEAKETTLE

The tilting teakettle is made of solid copper heavily nickel-plated and double-tin-lined. The stand is so arranged that the kettle may be easily tipped for pouring and at the same time the heat will not be interfered with. The kettle can be removed from the stand. Water can be boiled in a very short time, because the heater is a part of the bottom of the kettle. An automatic safety device is provided to prevent damage to the heater in case the kettle becomes dry. The cord can be disconnected from the kettle quickly by means of a detachable connector. The kettle is either nickel-plated or has a copper finish.

Outdoor Fixtures for Nitrogen-Filled Tungsten Lamps

The fixtures shown in the accompanying illustrations have been designed for outdoor use with high-efficiency tungsten lamps. In Fig. 1 is shown a fixture of the suspension or pendent type, and in Fig. 2 one of the bracket type. The large porcelain casings make an extra insulator for either multiple or series circuits unnecessary. These fixtures are equipped with a one-piece series socket which can be adjusted up and down so that the same fixture and reflector may be used with lamps of different sizes. The provision for moving the socket up and down makes it possible to place the lamp in the proper position in relation to the reflector and allow the use of a one-piece reflector, which is rigidly attached to the casing. The bowl-shaped reflectors used with these fixtures are provided with either a porcelain-enamel reflecting surface or one made of a material called "Ky-Ce Lain." The span type of reflector is equipped with a self-locking cable grip to prevent the fixture from sliding along the rope. These fixtures are being manufactured by the Line Material Company, South Milwaukee, Wis.

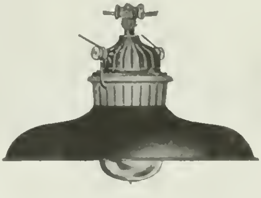


FIG. 1—SUSPENSION-TYPE FIXTURE

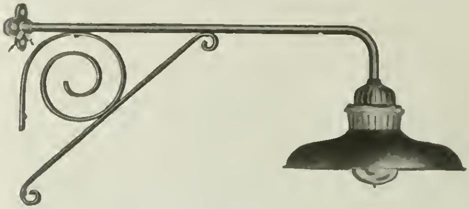


FIG. 2—BRACKET-TYPE FIXTURE

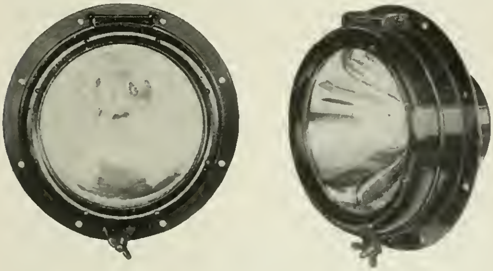
Luminous-Bowl Indirect-Lighting Fixture

The indirect-lighting fixture illustrated herewith has been designed for use with either a 100-watt or a 150-watt tungsten lamp. By means of a one-piece silvered-glass reflector the light from the lamp is directed to the ceiling at the proper angle. The small amount of light which comes through the opening in the bottom of the reflector is redirected by an opal-glass diffuser so as to illuminate the glass bowl evenly and softly for decorative effects. No useful light reaches the working plane directly through the glass bowl. With the exception of a narrow metal band the bowl is made entirely of glass. This fixture is being placed on the market by the National X-Ray Reflector Company, Chicago, Ill.

INDIRECT-LIGHTING FIXTURE

Headlamps for Electric-Railway Service

Two lamps for electric-railway cars are being placed on the market by the Esterline Company, Indianapolis, Ind. One unit is designed to fit in a recess in the dash of the car and the other for mounting on the front of the dash. The lamp bodies and fronts are made entirely of pressed steel. A metal ring which holds the reflector in place also clamps a heavy gasket over which the front or door presses. The hinges and latches are designed so as to have no projecting parts which are likely to catch wires or ropes. Electrically welded joints and fastenings are used instead of screws or rivets. The lamps are ventilated in such a manner as not to admit dust or water. After assembling, the lamp bodies receive several coats of baked enamel inside and out. The front glass is extra heavy and is held in place by spring clips which permit of expansion and contraction without cracking the glass. These lamps are equipped with "Golden Glow" reflectors made by the above company.



ELECTRIC-RAILWAY HEADLAMPS

Two-Circuit Porcelain Pendent Switch

A two-circuit push-button porcelain switch is being made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. This switch is designed to replace a larger switch of the same type equipped with a brass cap put out by the same company. The switch is used to control two circuits. Control is accordingly centralized and, especially in the case of large chandeliers or clusters, provides a convenient means for controlling the lamps in two groups from one switch. A simple mechanism is used and the operation is positive and quick. The three terminal screws are placed at the top of the switch and the casing halves can be separated by the removal of only one screw. This switch has been approved by the Underwriters' Laboratories and is rated at 6 amp for 125 volts and 3 amp for 250 volts.

TWO-CIRCUIT ALL-PORCELAIN PENDENT SWITCH

Tungsten-Lamp Fixtures

The fixtures illustrated herewith are designed for use with tungsten lamps. In Fig. 1 is shown a shallow-bowl reflector with a surmounting hood of enameled steel. The fixture shown in Fig. 2 is equipped with a 12-in. by 8-in. alabaster outer globe. An oxidized-copper holder and a hood finished in black are used for outdoor service and a brushed-brass holder and hood for indoor service. The fixtures described are being placed on the market by the Benjamin Electric Manufacturing Company, Chicago, Ill.

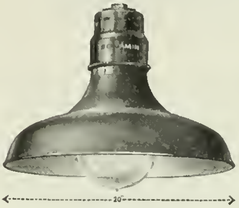


FIG. 1—SHALLOW - BOWL FIXTURE

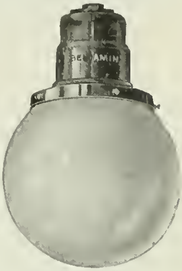
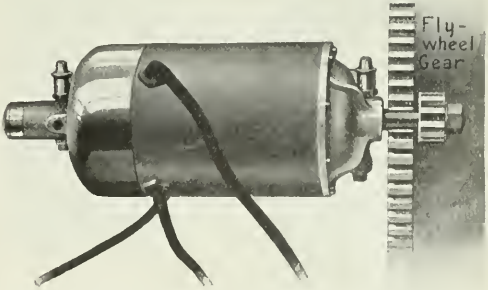


FIG. 2—GLOBE FIXTURE

Electric Starter for Automobiles and Motorboats

A 6-volt starting motor for use with internal-combustion engines employed in the operation of motor vehicles and boats is being placed on the market by the Rushmore Dynamo Works, Plainfield, N. J. The machine weighs about 30 lb. complete. The armature pinion engages directly with a gear upon the engine flywheel. As soon as the engine picks up, the pinion automatically slips out of mesh. The motor is of the ironclad type, series wound, with four poles and four brushes. Under normal conditions this starting motor, it is said, delivers to the flywheel rim nearly 75 per cent of all the energy received from the battery.



6-VOLT STARTING MOTOR FOR AUTOMOBILES AND MOTOR-BOATS

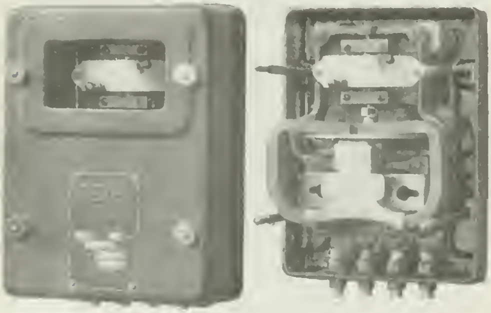
Compression Carbon Rheostat

A compression carbon rheostat for use in calibrating electrical instruments, testing batteries, photometric work, etc., is being placed on the market by James G. Biddle, 1211 Arch Street, Philadelphia, Pa. This rheostat contains ninety carbon plates 1/8 in. thick and 1.5 in. square, which are mounted in a V-shaped trough made of asbestos wood. The end supports are bolted to a heavy asbestos-wood base, 15 in. by 5 in. by 0.5 in. in size, and are also held in place by rods which are insulated from the end supports by mica. A screw, operated by a hand-wheel, serves to vary the amount of pressure on the carbon blocks. Special brass plates with terminals are provided with each rheostat. These plates can be inserted between the carbon blocks, and the rheostat can accordingly be sectionalized to increase its range. The resistance can be varied uniformly between 0.1 ohm and 8 ohms according to the degree of pressure applied. For constant service the rheostat can safely take 200 watts, and momentarily, the manufacturer claims, it can take 500 watts or even 1000 watts without injury. The height of this device over all is 6 in., and the weight is approximately 8 lb.

CARBON RHEOSTAT

Inverse-Time-Element Relays

Alternating-current relays designed for inverse-time-limit service have been developed by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. The relays are of three different types. One relay embodies the overload and reverse-power characteristics combined, another operates only when there is an overload, and the other when the power is reversed. The latter two relays are designed to work either instantaneously or at certain adjustable time limits.



FIGS. 1 AND 2—OVERLOAD RELAY, COVERED AND UNCOVERED

The contacts of the overload-and-reverse-power relay are closed by an induction-type alternating-current instrument in which are combined the functions of ammeter and wattmeter. The relay is operated by means of a transformer with a pressure of 100 volts and a current of 5 amp at the secondary. The contacts close a direct-current tripping circuit. The maximum time-setting of the inverse time element is about ten seconds and that of the minimum about one second. With the minimum setting the tripping action is instantaneous for heavy loads. Three adjustments are provided, one for regulating the ratio of the reverse to the overload tripping current, another for regulating the absolute values of these quantities, and the third as above described for regulating the value of the time element. The relays can be adjusted to operate at from 6 amp to 14 amp in normal direction and from 0 amp to 4 amp with reversed power and normal voltage.

The plain overload relays are similar in principle to the combined overload and reversed-power relays, but the voltage connection is omitted. The instrument therefore acts as an induction ammeter. The minimum current at minimum time-setting for this relay can be adjusted from 3 amp to 5 amp and at a maximum time-setting for from 3 amp to 8 amp. A torque compensator is used as an auxiliary to this overload relay.

The relay for reverse power only is a combination of the overload-and-reverse-power-relay movement with a selective wattmeter element which keeps the trip circuit open for normal power requirements. This characteristic removes the overload feature of the main relay and allows the instrument to close the circuit only on reversed power. The time-element characteristics of the reverse-power relays are the same as those of the plain overload relays, and the same adjustments are provided.

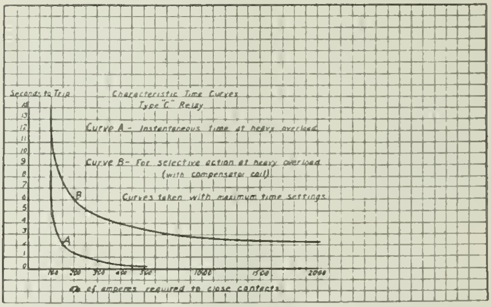


FIG. 3—CURVE SHOWING EFFECT OF TORQUE COMPENSATOR ON THE TIME-ELEMENT CHARACTERISTICS

A torque compensator for modifying the time-element characteristics of an alternating-current overload relay has been developed by the company. This device is said to reduce the torque of the relay at heavy overloads without decreasing it at light loads. The time-element of the relay is thus increased at overloads and the effect is proportional to the overload. An example of the effect of the torque compensator on the time-element characteristic of a relay is shown in the accompanying curves. When used with the torque compensator a definite minimum time element at heavy loads is obtained as shown in curve B.

This torque compensator consists essentially of a small auto-transformer connected between the relay and the series transformer on the line. It is so designed that at a certain value of current the core of the compensator becomes saturated and any further rise in current results in an increasing impedance drop so that the current in the relay circuit does not increase in proportion to the current in the line.

Jobber, Dealer and Contractor

Denver to License Electrical Contractors

An ordinance has been passed by the city commissioners of Denver creating a board of electrical examiners. This board is to consist of three members, the city electrician being, ex officio, chairman. It will also include one electrical contractor and one journeyman electrician. These three men shall have the power and authority to examine every person engaged in the electrical business, whether employer or employee, helpers excepted. After the person passes the examination the board will issue a certificate of qualification upon the payment of 50 cents, and this certificate will be renewed yearly without examination.

New Building of Northwestern Electric Equipment Company

The Northwestern Electric Equipment Company has recently completed and moved into its new home on East Sixth Street, St. Paul, Minn. The building, which is the largest in the Middle West occupied exclusively by an electrical jobbing house, is of reinforced-concrete construction, with 60,000 sq. ft. of floor space. On the first floor are the demonstration rooms, where industrial and residence fixtures, household electrical devices, etc., are shown. The office floor, which is lighted by the indirect system, is equipped with the Hackney electrically operated ventilating system, which changes the air every six minutes. Three electrically driven elevators are installed and a complete intercommunicating telephone system connects every department of the building. Approximately 13,600 ft. of "Greenfieldduct" and 72,000 ft. of "Americore" wire were used in wiring the structure, and 450 tungsten lamps are used to illuminate it. Electricity for all purposes is purchased from a central station. Mr. F. B. Thompson is president and treasurer of the company, Mr. J. M. Whalen is vice-president, Mr. A. J. Anderson is secretary and manager, and Mr. J. M. Hannaford, Jr., is manager of sales.

"Service" Versus "Price" in Electrical Contracting

Reading a paper before the recent convention of the Iowa Electrical Contractors' Association, Mr. Edward Kunkel, Davenport, said: "I consider the substitution of the word 'service' for 'price' an important element of modern business methods. Relegate to the rear the old idea that cheapness is the necessary and is the all-important feature in business getting, and make prominent the various elements that bring about good service.

"Don't let it be said any more that the John Jones Electric Company gets a lot of business because its price is always low. Rather let your patrons get the habit of saying to their friends: 'Get Jones to do your electrical work. He knows how. He keeps posted on everything and is up to date. He will take the time and trouble to tell you about something you need or ought to have and will explain it to you so that you will understand it and thank him for the suggestion. He will get his men on your job when he says he will, and when he is through it will be the job that is done, not you. He will go to considerable trouble to rearrange his workmen so as to get one of them to you in case of an emergency. He is always accommodating and obliging.' "

Merchandising and the New Idea

Industrial organizations are gradually awaking to the fact that business conditions can be bettered only by keeping in touch with cost and efficiency systems, and not by the continued cry for legislative protection. Some of the ideas of the Trumbull Electric Manufacturing Company, Plainville, Conn., on merchandising will probably be of value to those who are seeking to develop their organizations according to the new and progressive notions:

"To possess the fundamentals of merchandising a man must have the ability to comprehend the ideas of others and merge them with his own. If a business man is not an aggressive thinker, his brain will become sluggish, monotony will overpower him and his business, and both will fall into a rut. A man who cannot grasp business-getting ideas is like a person in a darkened room containing desired articles which cannot be obtained by groping about blindly.

"Merchandising is obtaining a higher percentage of net results, not through increased effort and hurry, but by thoughtfully directing every action. There are three marked periods in the growth of an industry: First, the period of inventions; second, the period of development, and third, systematizing the field. Most lines of business have developed quite far into the third period, and it is time that the electrical industry realizes that the inventive period is passing into the stage where it is necessary to develop high-grade merchants to sell the apparatus and obtain the most efficient methods of manufacture and distribution.

"What we all want for the electrical industry is a reputation for low credit, short-term payments, few failures and less readjustment. In addition, we need a crowd of men on a par with the best the country affords, who understand costs, know their field and can develop internal organization, which will enable them to distribute, manufacture, and wire or contract for electrical equipment with the highest economy and with a sure profit. More business acumen is the cry of the hour.

"When a business man knows the production cost, is sure of the efficiency of his organization, has cut out enormous waste, and knows what he can do on the capital available, then he can hold up his head in the face of any competitor and say, 'I'm on a rock; you can't oust me.' When this happy time of waste elimination comes the man who doesn't know his costs, who has no policy, whose only possible selling argument is 5 per cent better than the next man's price, will be promptly forced into the rear, because he cannot stand the pace. He will be like a man without training competing in a Marathon with a practised runner.

"Business is going to be a war between giants, not trust giants, but brain and efficiency giants. Tariff protection is going; the barriers of combinations and monopoly are burned away. Business is being thrown back on itself and its effective inside organization, no longer depending on the outside organization which, by clever manipulation, was employed to make profit where now brains and real efficiency only can show results. The time has come when there should be no more 'pools,' no more excessively high re-sales and no more high tariff that lets a man make 50 per cent without sweating his brow. Now is the period of individualism in business, greater freedom, but much greater responsibility. The solution for the keener competition that is coming is the development of the internal organization. This can be accomplished through better directed efforts, more initiative, more thought, more brains, all of which means more merchants engaged in the business.

"It is not so necessary for the distributer to have a highly protected re-sale price as it is to have a renewed efficiency of methods which will eliminate waste. We make so bold as to suggest that it would be the rarest good thing if the jobbers would get together, discuss methods of reducing the cost of doing business, thereby eliminating unnecessary expense and getting better results. It will be useless to worry about questions of protection, government investigation of associations, or established re-sales, important as they may be.

"Why shouldn't jobbers employ an efficiency engineer on a yearly basis just as lawyers are now employed by some firms to look into cost methods, stock handling, credit stability, latest accounting and office methods? Such an engineer could investigate each jobber's business, with a view toward helping him reduce the cost of doing business, then, as a benefit to all, submit reports on the conditions found so that all will be warned by the mistakes of others and helped by the improvements that are made. This is done in associations and other lines of business; nothing could be better for any branch of our trade. By sharing experiences and eliminating jealousy, other industries have greatly improved, to the advantage of every member.

"Mr. Gilbreth, the noted efficiency engineer, said he would like to see in our government a 'bureau of business,' which would take up these questions of business management and efficiency, and which would not only have literature and figures at the disposal of business men but would actually study the conditions of any line of trade and make harmony where chaos exists.

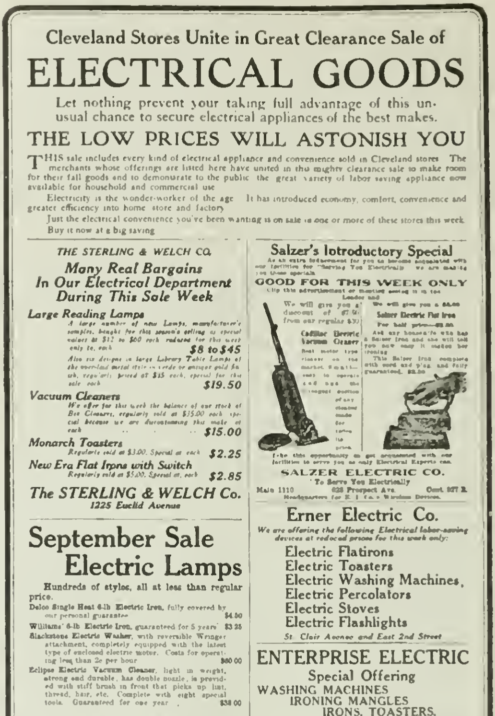
"There is not a manufacturer who knows on which side his bread is buttered but who is in intimate touch with cost and efficiency experts. The better ones have their own cost and accounting department. The best accounting system should be established, thus saving thousands of dollars and keeping a firm in touch with itself. Many business men are in touch with the trade but don't know much about their own business. Reverse this condition of affairs and be surest of yourself, and the trade will be all right.

"The man to be feared and the one who will be suppressed is the man who does not know his costs but mechanically cuts under. He is like a crazy man running through the streets, and, being crazy, he has no fear for his own life or respect for that of others. Efficiency engineers could convert such men into better citizens. Why can't the Society for Electrical Development, which has now raised the needed money to start, devote a certain part of its time to the development of better merchandising methods in the electrical trade? How can the industry be better 'boosted' than in boosting the standards of business methods? Are not such measures nearly as necessary as the sale of more 'juice'? Competition based on civilized warfare is all right, but the bushwhacking method is the wrong sort."

Conducting a Clearance Sale of Electrical Appliances

Special sales to dispose of electrical merchandise have been tried in a number of ways. Here is an example of a co-operative sale which was held in Cleveland. The work was started by the central-station representative laying the idea before the local merchants selling electrical appliances and obtaining their approval and promise of support. This settled, the local newspapers were approached to see if they would lend their aid toward making the sales a success by mentioning it in their shopping directories and news columns. This they promised to do. So much assured, the central-station company put out with its monthly bills some 50,000 leaflets reading as follows:

"The second week in September Cleveland stores selling electrical goods will hold the greatest special sale in the history of the business. A large selection of electrical appliances, including irons, toasters, washing machines, art lamps, fans, reflectors, etc., will be sold at sacrifice prices to make room for the fall goods.



Cleveland Stores Unite in Great Clearance Sale of

ELECTRICAL GOODS

Let nothing prevent your taking full advantage of this unusual chance to secure electrical appliances of the best makes.

THE LOW PRICES WILL ASTONISH YOU

THIS sale includes every kind of electrical appliance and convenience sold in Cleveland stores. The merchants whose offerings are listed here have united in this mighty clearance sale to make room for their fall goods and to demonstrate to the public the great variety of labor saving appliance now available for household and commercial use.

Electricity is the wonder-worker of the age. It has introduced economy, comfort, convenience and greater efficiency into home, store and factory.

Just the electrical convenience you've been wanting is on sale in one or more of these stores this week. Buy it now at a big saving.

THE STERLING & WELCH CO.

Many Real Bargains In Our Electrical Department During This Sale Week

Large Reading Lamps
A large number of new Lamps, manufacturer's samples, bought for this season's selling as special values at $12 to $60 each, reduced for this week only to, each **$8 to $45**
Also six designs in large Library Table Lamps of the over-laid metal style in verde or antique gold finish, regularly priced at $25 each, special for the sale, each **$19.50**

Vacuum Cleaners
We offer for this week the balance of our stock of Bee Cleaners, regularly sold at $35.00 each, special because we are discontinuing this make, at each **$15.00**

Monarch Toasters
Regularly sold at $3.00. Special at each **$2.25**

New Era Flat Irons with Switch
Regularly sold at $5.00. Special at, each **$2.85**

The STERLING & WELCH Co.
1225 Euclid Avenue

September Sale
Electric Lamps

Hundreds of styles, all at less than regular price.

Delco Single Heat 6-lb Electric Iron, fully covered by our personal guarantee $4.50
Williams' 6-lb Electric Iron, guaranteed for 5 years $3.25
Blackstone Electric Washer, with reversible Wringer attachment, completely equipped with the latest type of enclosed electric motor. Costs for operating less than 2c per hour $60.00
Eclipse Electric Vacuum Cleaner, light in weight, strong and durable, has double nozzle, is provided with stiff brush in front that picks up lint, thread, hair, etc. Complete with eight special tools. Guaranteed for one year $38.00

The Geo. H. Bowman Co.
224-226-228 Euclid Ave.

Electric Sad Irons
Electric Vacuum Cleaners
Electric Diamond Water Heaters
Electric Curling Irons
Electric Fancy Art Reading Lamps
Electric Fans

The Geo. Worthington Co.
802 to 832 St. Clair Ave. N. W.

Three Glower Radiators
Water Heaters
Residence Type Fan Motors
Guaranteed Toasters
Family Washing Machines

THE REPUBLIC ELEC. CO.
2067-2069 E. 9th Opp. Scott Griggs

WE HAVE on hand a few Electric Ranges which have been used for demonstrating purposes. Except for a few slight mars in handling these ranges are perfect in every detail. We offer them at the exceedingly low prices of $25 to $30 each. The advantages of Electric cooking at an initial expense of no higher than you would pay for an old fashioned range.

THE ILLUMINATING CO.
Sales Department 232 Superior Ave. N. E.

Salzer's Introductory Special

GOOD FOR THIS WEEK ONLY

Cadillac Electric Vacuum Cleaner

Salzer Electric Flat Iron

SALZER ELECTRIC CO.
"To Serve You Electrically"
Main 1110 628 Prospect Ave.

Erner Electric Co.

We are offering the following Electrical labor-saving devices at reduced prices for this week only:

Electric Flatirons
Electric Toasters
Electric Washing Machines,
Electric Percolators
Electric Stoves
Electric Flashlights

St. Clair Avenue and East 2nd Street

ENTERPRISE ELECTRIC
Special Offering
WASHING MACHINES
IRONING MANGLES
IRONS, TOASTERS,
PORTABLE LAMPS
FIFTY BARGAINS
It will pay you to call

The Enterprise Electric Company
6509-11 Euclid Ave., Vickers Bldg.

Annunciators	Bells
Flashlights	Fans
Heating Pads	Irons
Fixtures and	Shades
Percolators	Radiators
Interphones	
Reading Lamps	
Vacuum Cleaners	

The Western Electric Company
7?? Prospect Ave. S. E.

Standard Make
High Grade
Electric Fans
SPECIALLY PRICED

End Of The Season Prices have been placed upon our remaining stock of Electric Fans to insure their quick disposal.

In many cases the prices are so low that the large saving makes these offers very good purchases even though you buy for next year's use.

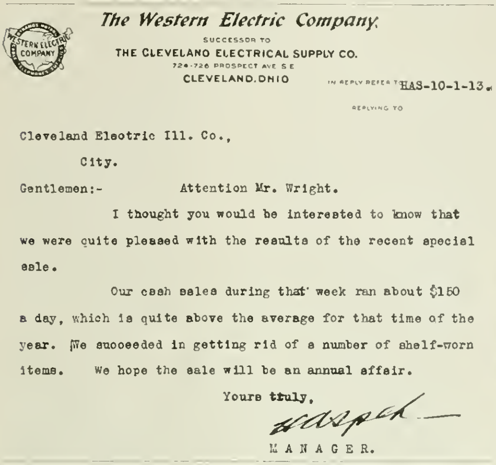
The Kinney & Levan Co.
1375-1385 Euclid Ave.

FIG. 1—ADVERTISEMENT IN CLEVELAND PAPER

"This will be the greatest opportunity ever offered to purchase standard electrical appliances at reduced prices. That iron, washing machine or vacuum cleaner you have always wanted will be on sale somewhere at an astonishingly low price.

"Watch your newspaper for the announcement of the sale. Remember, one week only, beginning Sept. 8."

About 800 cards announcing the sale were also placed in the street cars. Meanwhile the jobbers had been pushing the proposition among the small dealers and contractors with the idea of getting them to display appliances and cards announcing the sale in their windows. To boost the small contractors' business further and make them feel that the efforts of the jobbers were made in their behalf, a display was made to go in the window of the central station. This display consisted of a large outline map of the city of Cleveland 14 ft. long and 6 ft. high. The location of each merchant was shown by placing his name and address in good-sized letters on the map. The articles each particular store had for sale were listed on a card, together with the address of the store selling them. These cards were placed on the floor of the window, and a ribbon connected the card to the dealer's name shown on the map. To give life to this display small round holes were cut in the map close to the dealer's name and tungsten lamps on thermostatic plugs were placed back of these holes.



The Western Electric Company
SUCCESSOR TO
THE CLEVELAND ELECTRICAL SUPPLY CO.
724-726 PROSPECT AVE S E
CLEVELAND, OHIO

IN REPLY REFER TO HAS-10-1-13.
REPLYING TO

Cleveland Electric Ill. Co.,
City.

Gentlemen:- Attention Mr. Wright.

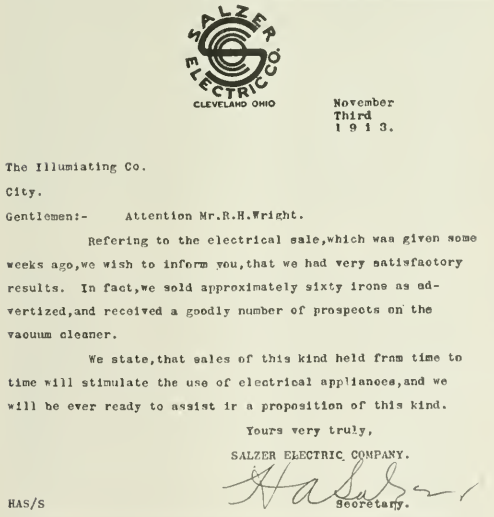
I thought you would be interested to know that we were quite pleased with the results of the recent special sale.

Our cash sales during that week ran about $150 a day, which is quite above the average for that time of the year. We succeeded in getting rid of a number of shelf-worn items. We hope the sale will be an annual affair.

Yours truly,

MANAGER.

FIG. 2—REPORT OF PROMINENT JOBBER



SALZER ELECTRIC CO.
CLEVELAND OHIO

November
Third
1 9 1 3.

The Illumiating Co.
City.

Gentlemen:- Attention Mr.R.H.Wright.

Refering to the electrical sale,which was given some weeks ago,we wish to inform you,that we had very satisfactory results. In fact,we sold approximately sixty irons as advertized,and received a goodly number of prospects on the vacuum cleaner.

We state,that sales of this kind held from time to time will stimulate the use of electrical appliances,and we will be ever ready to assist in a proposition of this kind.

Yours very truly,

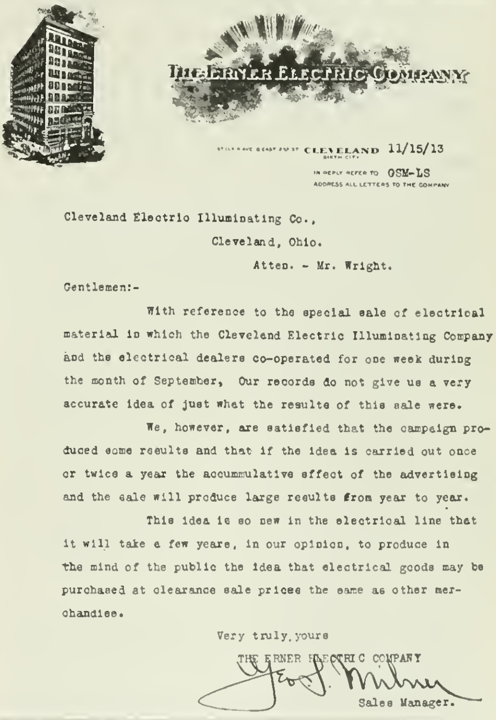
SALZER ELECTRIC COMPANY.

Secretary.

HAS/S

FIG. 3—RESULTS FROM SALES OF IRONS AND VACUUM CLEANERS

The show window was made attractive by draping a few American flags in the corners. The cost of this display was borne by the jobbers. During the week of the sale display advertisements were published in two morning papers and one evening paper. In this advertising the central-station company bore the expense of the heading of the advertisement, and each dealer paid for the space used by his copy as shown. Copies of these advertisements were put in the display room of the central station and dealers' stores and windows. The newspapers made good their promise of boosting the sale both in reading notices and in their shoppers' guides. This is extremely valuable publicity and should not be overlooked. Displays of the articles on sale in the dealers' windows are also a feature not to be overlooked.



THE ERNER ELECTRIC COMPANY

CLEVELAND 11/15/13
SIXTH CITY
IN REPLY REFER TO OSM-LS
ADDRESS ALL LETTERS TO THE COMPANY

Cleveland Electric Illuminating Co.,
Cleveland, Ohio.
Atten. - Mr. Wright.

Gentlemen:-

With reference to the special sale of electrical material in which the Cleveland Electric Illuminating Company and the electrical dealers co-operated for one week during the month of September, Our records do not give us a very accurate idea of just what the results of this sale were.

We, however, are satisfied that the campaign produced some results and that if the idea is carried out once or twice a year the accummulative effect of the advertising and the sale will produce large results from year to year.

This idea is so new in the electrical line that it will take a few years, in our opinion, to produce in the mind of the public the idea that electrical goods may be purchased at clearance sale prices the same as other merchandise.

Very truly, yours
THE ERNER ELECTRIC COMPANY
Geo. J. Milner
Sales Manager.

FIG. 4—JOBBING HOUSE'S OPINION OF SPECIAL SALE

The particular articles each merchant should list and what discount he should give was left to his individual judgment. Some put up for sale only shopworn articles and dead stock, while others gave a straight 10 per cent discount on any article in their store. The results of the sale are probably best shown by statements made by the managers of some of the firms participating, as shown in the three letters from prominent jobbers and dealers of Cleveland reproduced.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

New Name for Research Laboratory.—The director of the physical laboratory of the National Electric Lamp Association announces that hereafter the laboratory will be known as the Nela research laboratory of the National Lamp Works of the General Electric Company.

Increasing Space in New York Office.—The Electric Controller & Manufacturing Company (Cleveland, Ohio) is doubling its office space at 50 Church Street, New York, to meet the requirements of increased business in the East. Business conditions for this company are reported to be very good.

Steel Transmission Towers for Southern Utility.—The Riter-Conley Company, Pittsburgh, has received an order for 2000 steel towers for use on the high-tension transmission system of the Southern Power Company, of Charlotte, N. C. The towers will be made at the company's Leetsdale plant.

New High-Pressure Expansion Joint.—A new expansion joint for high-pressure service has been developed by the Alberger Pump & Condenser Company. A nest of circular disks, stamped from steel plates, is provided. These disks are welded together, forming a flexible bellows which absorbs the movement of the pipe line.

Conduit Business Good.—Mr. G. M. Gest, conduit engineer, finds business very good. Numerous installations are being made both in the United States and Canada. On account of the late spring, conduit work in the North has been held up considerably, and the amount of work completed on this account is smaller than that at the same time last year.

Westinghouse Office in Des Moines.—The Westinghouse Electric & Manufacturing Company has established a sub-office in Des Moines in charge of W. E. Gant. The office is located at 310 Citizens' National Bank Building. This makes the third office of the Westinghouse Electric & Manufacturing Company in Iowa, the others being at Burlington and Waterloo, in charge, respectively, of A. M. Miller and H. H. Caughlin. These sub-offices report to the district office in Chicago.

Brass Industry Healthy.—A representative of the American Brass Company states that, although business is only about 60 per cent of what it should be and the outlook for an increase in the near future is not promising, the industry is managing to hold its own very well. It is noteworthy, he adds, that none of the larger companies dealing in copper supplies are overstocked. The cheapness of copper at the present time is also a factor in putting the brass and other copper-alloy products on a firm basis.

Wide Field for Induction Motors.—Both direct-current and alternating-current motors are being placed on the market by Fairbanks, Morse & Company, the sales of the latter amounting to about double the former. The internal-starter motor recently developed by this company is meeting with considerable favor, and it is being used quite extensively for elevator service and irrigation pumping. This machine has an interesting starting device the action of which depends upon the varying resistance of carbon contacts under pressure.

Contract Awarded for Construction of Steel Plant.—Westinghouse, Church, Kerr & Company, New York City, have been engaged by the Taylor-Wharton Iron & Steel Company for the design and construction of a plant for William Wharton, Jr., & Company, Inc., to be erected at Easton, Pa. The plant will cover 25 acres and will include machine and grinding shop, blacksmith shop, foundry, pattern shop, storage buildings, office buildings and power plant. Construction work is to begin at once. The plant will be completed and in operation within one year.

Electric Motors Supplied for Operating Ore-Dock Chutes.—The Ideal Electric & Manufacturing Company, of Mansfield, Ohio, has recently shipped to the Duluth, Mesaba & Northern Railway Company, of Duluth, Minn., thirty-two 25-hp, three-phase, twenty-five-cycle, squirrel-cage induction motors, to operate at 750 r.p.m. on 440-volt circuit. This railroad is a subsidiary of the United States Steel Corporation, and the motors are part of the equipment of the new No. 5 iron-ore dock which it is building at the above location and which is said to be the largest in the world. Each of the above motors will, when installed, operate a bank of twenty-four chutes.

Orders for Splicing Sleeves and Insulator Clamps.—The Clark Electric & Manufacturing Company, 149 Broadway, New York, has recently made a shipment of seamless copper splicing sleeves for use on the United States government transmission lines in the Panama Canal zone. Another order for sleeves and also a large number of insulator clamps has been received from the Otter Tail Power Company, Fergus Falls, Minn. This material will be used on a 75-mile transmission line which the company will build this year. Overhead clamping sets for use on the right-of-way of the Rochester Railway & Light Company are being furnished by the above company.

Refrigerating Equipment Installed in New York.—A contract was recently awarded to the Carbondale Machine Company for two 50-ton refrigerating machines and a 20-ton Parsons quick-freezing plant to be installed in the new Equitable Building. A high-pressure and low-pressure brine system is employed, and the brine pumps are driven both by steam and electricity. In the Hudson Terminal Building, at 50 Church Street, a 15-ton Parsons quick-freezing plant is being installed as an addition to the equipment already in use. Two 100-ton refrigerating machines were supplied recently to the National Cold Storage Company, Brooklyn, N. Y. A large number of alterations and improvements are also being made to installations already in operation. The sales in refrigerating apparatus are found to be greatest in the spring.

Motors for Iron and Steel Industry.—Included in the electrical machines ordered by various iron and steel companies have been a large number of motors. The American Iron & Steel Manufacturing Company, Lebanon, Pa., will add to the electrical equipment in its mill a 150-hp induction mill-type motor with sectional-control equipment. The Bethlehem Steel Company, South Bethlehem, Pa., has ordered two 150-hp motors, two 125-hp motors and nine motors rated at from 10 hp to 50 hp. The Riter-Conley Company, Pittsburgh, Pa., has ordered two motors rated at 10 hp and 25 hp. The Hubbard Steel Foundry Company, East Chicago, Ind., will add to the electrical equipment of its plant two 100-kva synchronous motors with 5-kw exciters and accessories. The orders for these machines have been placed with the General Electric Company.

Montreal Utility Orders Switchboard and Transmission Line Equipment.—The Cedars Rapids Manufacturing & Power Company has let the contract for a 66,000-volt transmission line, which will run from the plant to the step-down station at Côte St. Paul, a suburb of Montreal, a distance of about 30 miles. The Canadian Allis-Chalmers Company, Ltd., will supply the steel poles, which will be lattice type, 40 ft. high, and the aluminum, steel-reinforced wire will be manufactured by the Northern Aluminum Company, of Shawinigan Falls, Quebec. The General Electric Company has obtained the contract for the switchboard equipment of the 100,000-hp hydroelectric development now being built at Cedars, Quebec. Mr. R. M. Wilson, of the Montreal Light, Heat & Power Company, is the electrical and Mr. Julian C. Smith, of the Shawinigan Water & Power Company, the hydraulic engineer of the company.

Friendly Relations with Latin-American Republics.—Addressing the Peoria (Ill.) Transportation Club on April 30, Mr. E. N. Hurley, vice-president of the Illinois Manufacturers' Association and president of the Hurley Machine Company of Chicago, made a plea for high-class salesmanship in dealing with the business conditions in Central and South America. Salesmen sent down there from the United States must speak the language of the country to which they are sent, must understand the people with whom they deal, and must have a real and sympathetic comprehension of the needs of the country. If American manufacturers will devote the same keen attention to developing their business in Latin America that they do to the field at home, there is no reason why they should not win a large measure of success.

Lighting-Pole Business from Two Standpoints.—The Electric Railway Equipment Company, of Cincinnati, Ohio, has experienced a slump in most of its lines, but its lighting-pole business has been encouraging and a further increase is expected. The reason advanced for this is that in the spring the installation of the poles is easier and more seasonable, as a part of the general construction activity at that time of year. Another manufacturer of the same product states that his business has fallen off largely, in accordance with his expectations, in view of the approach of summer, when the demand for street lighting is not so urgent and when general business activity is usually not so great as in the winter months. Since both are active concerns and are doing business over a wide territory, it is interesting to observe that the reasons given for differences in present business are exactly opposed.

Electrical Apparatus for Western Power Stations.—A number of power companies in the West have recently ordered electrical equipment for their power stations. Four 10,000-kva waterwheel-driven generators, two 500-kw generators, nine 6000-kva water-cooled transformers, nine 360-kva reactances, a switchboard and accessories will be installed in the station of the Great Falls Power Company, and the Thompson Falls Power Company, of Butte, Mont., will install two 6250-kva waterwheel-driven generators, two 500-kw generators, four 3750-kva water-cooled transformers and a switchboard with accessories. The Eastern Michigan Power Company, Jackson, Mich., will add to the equipment of its plant at Flint, Mich., a 690-kva Tirrill regulator. The Great Western Power Company, San Francisco, Cal., will add to the equipment of the Big Bend power house two 150-kw, three-unit motor-generator sets and a switchboard with accessories. All of this equipment will be supplied by the General Electric Company.

NEW YORK METAL MARKET PRICES

Copper	April 28 Bid	April 28 Asked	May 5 Bid	May 5 Asked
Standard spot*	13.37½	14.00	13.40	14.00
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	63 15 0		63 7 6	
Prime Lake	14.37½	to 14.62½	14.37½	to 14.62½
Electrolytic	14.10	to 14.20	14.10	to 14.20
Casting	14.00	to 14.10	14.05	to 14.15
Copper wire base	15.25		15.25	to 15.50
Lead	3.90		3.90	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.00	to 5.10	5.05	to 5.15
Tin, spot	34.37½	to 34.62½	33.05	to 33.15
Aluminum:				
Prompt delivery	17.75	to 18.00	17.75	to 18.00
Future	17.75	to 18.00	17.75	to 18.00

*OLD METALS

Heavy copper and wire	12.87½	12.87½
Brass, heavy	8.62½	8.62½
Brass, light	7.50	7.50
Lead, heavy	3.90	3.90
Zinc, scrap	4.15	4.15

*COPPER EXPORTS

Total tons to May 5..........4,650

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*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Directors of United Railways Investment Company.—A. J. Hemphill, U. S. Chesbrough and H. I. Miller have been elected directors of the United Railways Investment Company to succeed Patrick Calhoun, George E. Shaw and Sidney March, resigned.

American Gas & Electric Company Earnings.—Gross earnings of the American Gas & Electric Company for the calendar year 1913 were $3,811,292, an increase of $472,522 over 1912. Net earnings were $1,024,715, a gain of $109,276. The surplus remaining after provision for fixed charges was $680,303, or an increase of $64,034.

Fixture Manufacturer in Difficulty.—Mr. James E. Hegan, president of the Hegan Manufacturing Company, of Louisville, which dealt extensively in electric-lighting fixtures and against which involuntary proceedings in bankruptcy were begun some time ago, has filed a voluntary petition in the federal court. He lists his liabilities at $26,389.12 and his assets at $56,694.33.

Earnings of Northern States Power Company.—President H. M. Byllesby reports for the year ended March 31, 1914, that gross earnings of the Northern States Power Company were $3,962,033; net earnings were $2,043,398; fixed charges $1,232,109, leaving a surplus of $811,288, from which $580,263 was paid out in preferred-stock dividends.

Valuation of Washington (D. C.) Utility.—The J. G. White Engineering Corporation has been retained by the Capital Traction Company, of Washington, D. C., to make a complete inventory and valuation of its property. This valuation is to be made simultaneously with a valuation of all public utilities in the District by the Public Utilities Commission of the District of Columbia, in accordance with the provisions of the act of Congress passed March 4, 1913, creating that commission.

Central-Station Output and Earnings for Month of March.—Central-station statistics for March received from companies operating in practically all of the larger cities in the country serve to bring out clearly how great a percentage of the energy output of the entire United States is furnished by a few large companies. In many of the largest metropolitan areas the local central-station company actually furnishes service to a far greater number of people than is indicated by the population figures of the city in which its headquarters are located. In New Jersey, California, Washington and many other states the major portion of the needs of the whole state is supplied by a single system directed from the largest city in the territory. There are several such organizations in the country whose earnings in a single month run above the million-dollar mark. For the month of March the gross earnings of all the companies in the country may be placed at a little over $31,000,000, and returns which the *Electrical World* has received from the companies operating in practically every one of the twenty-five largest cities show that these companies between them earned something in excess of $13,000,000 in the month. The gross was $12,440,100 for March, 1913, and $13,426,100 for March, 1914, the increase being $986,000, or practically 8 per cent. It can be seen that this figure is more than 43 per cent of the earnings of the entire industry. In the month of March the energy output of the whole country may be placed at 1,240,000,000 kw-hr., and returns from the twenty-five largest cities show that their share of this output was 511,000,000 kw-hr., or about 41 per cent of the whole. The gross yield per kilowatt-hour for these companies was therefore 2.63 cents, which agrees very closely with the average derived from the 1912 census of the entire industry. It should be noted that, while the foregoing statement of the industry's earnings for March rests practically upon a bedrock of official data, the figures relating to kilowatt-hours involve supposition. Official data on the matter of station output, however, are sufficiently numerous and representative to make possible a close estimate that the energy produced in the twenty-five largest cities in the country increased from 475,000,000 kw-hr. in March, 1913, to 511,000,000 kw-hr. in March, 1914.

Business Notes

C. O. Mailloux, consulting engineer, has removed his office from 90 West Street, New York, to 20 Nassau Street, New York.

Lotz & Scheible, patent lawyers and patent advisers of Chicago, have moved to larger quarters at 1063 McCormick Building, 332 South Michigan Avenue. Albert Scheible, an electrical man of wide acquaintance, is a member of this firm.

The Walpole Tire & Rubber Company, of Walpole, Mass., has abandoned its sales office at Boston, Mass. The general offices are at Walpole, Mass., and all communications should be addressed to the receivers of the company at the latter place.

Sargent & Lundy Remove Their Offices.—Sargent & Lundy, mechanical and electrical engineers, who for many years have had their offices in the Railway Exchange, Chicago, have removed to 1412 Edison Building, 72 West Adams Street, Chicago. This new Edison Building is the former Commercial Bank Building, recently acquired as the headquarters building of the Commonwealth Edison Company.

McMeen & Miller Open Cleveland Office.—McMeen & Miller, engineers, of Chicago, have opened a branch office at 407 Electric Building, Cleveland, Ohio. Mr. Allen C. Morse, who has been engaged in engineering work for several years, has been chosen as resident engineer and manager of the new office. McMeen & Miller do general engineering work, devoting particular attention to the rehabilitation of plants, the making of appraisals and the establishment of proper systems of records.

New Industrial Companies

The Stites Automatic Signal Light Company, of Plainfield, N. J., has been incorporated with a capital stock of $50,000, to manufacture automatic signal lamps, etc., by A. B. Stites, H. L. Stites and E. Seeley, of Plainfield, N. J.

The American Products Company, of Canton, Ohio, has been incorporated by P. D. Miller, R. L. Miller, J. V. Stahl and I. A. Arnold. The company is capitalized at $15,000 and proposes to manufacture and deal in electrical appliances.

The Chelsea Manufacturing Company, of Newark, N. J., has been granted a charter with a capital stock of $100,000 to manufacture motors, engines, machinery, etc. The incorporators are E. R. Mills, L. E. Hall and O. F. Root, of East Orange, N. J.

The R. K. Mickey Company, of Bloomfield, N. J., has been incorporated by R. McNeill, of New York, N. Y.; M. L. Mickey and R. K. Mickey, of Bloomfield, N. J. The company is capitalized at $50,000 and proposes to manufacture incandescent electric lamps, etc.

The J. N. Johns Manufacturing Company, of New York, N. Y., has been incorporated with a capital stock of $25,000 by A. A. Ewald, A. Ackerson, of New York, and J. Rubin, of Brooklyn. The company proposes to manufacture and deal in steam and electric supplies, car trucks and wheels, etc.

The Sun Electrical Manufacturing Company, of Burrage, Mass., has been chartered with a capital stock of $25,000 to manufacture electrical supplies. The incorporators are G. B. Levy, of Brookline; Julius Nelson, of Boston; Samuel O. Reinstein, of Brookline, and Frank Sanford, of Bryantville.

The Crescent Engineering Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000, to do a general mechanical and electrical engineering business. The incorporators are F. R. Hansell, of Philadelphia, Pa.; G. H. B. Martin and S. C. Seymour, of Camden, N. J.

The Interstate Hydrostat Company, of Buffalo, N. Y., has been incorporated with a capital stock of $200,000 by Charles B. Sherwood, of Buffalo, N. Y.; Michael Owen, Anthony J. Eckel, William Eckel and Dr. S. A. Lenhard, of Detroit, Mich. The company proposes to manufacture electrical machinery, engines, boilers, etc.

Trade Publications

Flashers.—The Reynolds Electric Flasher Manufacturing Company, 422 South Talman Avenue, Chicago, Ill., is mailing a large card containing Suggestion No. 5, which refers to flashing signs for drug stores.

Used Scientific Apparatus and Instruments.—The Leeds & Northrup Company, of Philadelphia, Pa., has issued a descriptive price list on odd stock and used electrical apparatus and instruments for laboratory use.

Switches.—Bulletin No. 27 of the Detroit Fuse & Manufacturing Company, Detroit, Mich., is devoted to its ironclad entrance switch. This switch is made for two-wire and for three-wire circuits at 30 amp and 125 volts.

Storage-Battery Operation.—A small four-page folder just issued by the Electric Storage Battery Company, of Philadelphia, Pa., gives instructions for the receiving of a new battery of its make and for the operation of the same.

Electrical Specialties.—Harvey Hubbell, Inc., of Bridgeport, Conn., has recently put out a large catalog on its various manufactures of lighting supplies and fixtures. The book is well illustrated and gives complete information concerning the extensive line of this apparatus which the Hubbell company markets.

Rope.—Manila rope for transmission and hoisting is the subject of Catalog No. 12-8 recently issued by the C. W. Hunt Company, West New Brighton, New York. It was written by Mr. C. W. Hunt and is an interesting, well-prepared and instructive pamphlet on ropes used for the transmission of torque. It contains formulas, tables and data useful in mill engineering. The illustrations are excellent and well selected.

Sterilization of Water.—In a pamphlet of thirty-two pages the R. U. V. Company, Inc., 50 Broad Street, New York, illustrates the R. U. V. system of water sterilization in hospitals, hotels, factories, railway stations and apartment houses. Reports are given of tests of the system in various laboratories. It is claimed for this system that any amount of water varying from 20 gal. to 200,000 gal. an hour can be successfully treated.

Governors.—"Lombardata" II, a card, size 7¼ in. by 5⅜ in., shows a map of New York State. On it are indicated in red dots the installations of Lombard governors on the New York Barge Canal. A miniature illustration is shown of one of the Barge Canal governors, of which fifty-eight are installed on the waterwheels in the plants of the system from end to end. This card is issued by the Lombard Governor Company, Ashland, Mass.

Lamps.—The engineering department of the National Lamp Works of the General Electric Company, Cleveland, Ohio, has recently issued a number of new bulletins. Bulletin 8E refers to miniature tungsten lamps. Bulletin 13D contains technical data concerning 750-watt and 1000-watt multiple tungsten lamps, their accessories and their uses. In Bulletin 11B tungsten street series lamps are discussed and the more essential operating considerations are set forth.

Guards for Machinery.—The increasing interest in accident prevention makes timely the booklet issued by the Consolidated Expanded Metal Company, Architects' Building, New York. This publication contains information regarding its "Steelcrete" guards for machinery. There are many excellent illustrations which serve to demonstrate the adaptability of "Steelcrete" mesh to the construction of machine-tool guards and other protecting devices. This material is also used for racks, window guards and small partitions in shelves.

Electric-Lighting Sets for Private Service.—Catalog A of the Petschel Storage Battery Company, 3051 West Lake Street, Chicago, describes complete electric-lighting sets, for country or other service, designed for 32 volts, 60 volts or 110 volts. Battery cells are furnished in glass jars or rubber jars, the latter costing a little more. One of the 60-volt plants is designed especially to give electric service for moving-picture theaters. Each set includes the battery, switchboard, small dynamo and gasoline engine. Illustrations showing the new factory of the company are given in this catalog.

Personal Mention

Mr. Percy Warner has resigned as president of the Nashville (Tenn.) Railway & Light Company.

Mr. B. O. Brown has been appointed assistant superintendent of the Electric Light Company at San Domingo, Hayti.

Mr. B. F. Eyer has been appointed general manager of the Marshall County Power & Light Company, of Blue Rapids, Kan.

Mr. H. Merrifield, formerly of Springfield, Ill., has been appointed superintendent of the Mankato (Minn.) division of the Consumers' Power Company.

Mr. Curtis C. Curry has been made branch manager at Minneapolis for the Westinghouse Electric & Manufacturing Company, succeeding Mr. Walter D. McDonald.

Mr. Douglas I. McKay, until recently police commissioner of the city of New York, has been appointed first assistant to Mr. Gano Dunn, president of the J. G. White Engineering Corporation.

Mr. William O'Hallaren, chief engineer and chief electrician of the Newmarket (Ont.) Municipal Electric Light & Water Works, has tendered his resignation after seventeen years of service.

Mr. Corliss Kemery, assistant manager of the Shenango Valley Electric Light Company, has been appointed superintendent of the local office at Sharon, Pa., as successor to Mr. J. C. Chestnut.

Mr. M. D. Leslie has resigned as superintendent of the light and water department of the city of Mulberry, Kan., and has accepted a similar position with the municipal light and water works at Russell, Kan.

Mr. Eugene H. Bell, formerly of Youngstown (Ohio), has been appointed manager of the Youngstown (Ohio) Consolidated Gas & Electric Company, including the branches at New Castle, Sharon and Ellwood City.

Mr. C. G. Johnson, formerly manager of the Chickasha (Okla.) Light, Heat & Power Company, has been appointed general manager of the Vicksburg (Miss.) Light & Traction Company, succeeding Mr. A. J. Bemis.

Mr. F. N. Kollock, Jr., until recently district manager for the Westinghouse Electric & Manufacturing Company at Seattle, Wash., has been made treasurer of the Westinghouse Lamp Company, with office in New York City.

Mr. Walter D. McDonald, formerly branch manager at Minneapolis for the Westinghouse Electric & Manufacturing Company, has been appointed district manager for that company at Seattle, succeeding Mr. F. N. Kollock, Jr.

Mr. Percy M. Ayer has been elected president of the Plymouth (N. H.) Electric Light Company. Mr. Ayer, who is just twenty-one years of age, is probably the youngest manager of an electric-light plant in the State of New Hampshire.

Mr. J. C. Chestnut, formerly superintendent of the Shenango Valley Electric Light Company at Sharon, Pa., has been appointed manager of the New Castle (Pa.) Electric Company, a subsidiary of the Mahoning & Shenango Valley Electric Company.

Mr. E. T. Munger, general manager of the Cumberland County Power & Light Company, of Portland, Maine, has been relieved of his duties owing to illness, and Mr. Alfred Sweeney, who has been assistant to the general manager, will act in his stead for the time being.

Mr. Thomas J. Duncan has resigned as superintendent of the Ocean City (N. J.) Electric Light Company. Mr. Duncan was in charge of that property for the last thirteen years, during eleven of which he was also superintendent of the Ocean City Electric Railroad Company.

Mr. George F. Atwater has been appointed superintendent of the United Electric Light & Water Company at New Britain as successor to the late L. S. Risley. Mr. Atwater is at present superintendent of the Greenwich office of the company. He is a graduate of Yale and was formerly connected with the company at South Norwalk and at Naugatuck.

Mr. Elmer Lingard, formerly connected with the United Electric Light & Water Company, has been appointed superintendent of the new East Norwalk municipal electric plant. The district recently voted $25,500 for a new plant and site, and Mr. Lingard will assist the commissioners in the plans and in the selection of the equipment.

Mr. L. W. Hess, general superintendent of the Northern Illinois Light & Traction Company of Ottawa, Ill., one of the McKinley properties and closely allied with the Illinois Traction System, has been put in charge of the Citizens' Lighting Company of LaSalle, Ill., which is also a McKinley property. Mr. Hess will retain his headquarters in Ottawa.

Mr. J. T. Shannon, commercial agent of the United Electric Light & Water Company at Waterbury, Conn., has been appointed superintendent of the Greenwich office as successor to Mr. G. F. Atwater, who has been transferred to New Britain. Mr. Shannon joined the staff of the United Electric Light & Water Company in June, 1912, having come from Cincinnati, Ohio, where he was then working with the Central Electric Company.

Mr. Patrick Calhoun, who resigned last year as president of the United Railroads of San Francisco, has tendered his resignation as a director of the United Railways Investment Company, which owns or controls most of the stock of the California Railway & Power Company. The latter company in turn controls the United Railroads, the Sierra & San Francisco Power Company, the Coast Valleys Gas & Electric Company and the San Francisco Electric Railways.

Mr. P. S. Young, who has been comptroller of the Public Service Corporation of New Jersey, Newark, N. J., has been elected treasurer of the company to succeed Mr. James P. Dusenberry, who has retired, having reached the age limit fixed by the company. The offices of comptroller and treasurer have been consolidated, and Mr. W. S. Barker, formerly assistant comptroller, has been appointed an additional assistant treasurer to serve with the present assistant treasurers, Mr. R. D. Miller and Mr. T. W. Van Middlesworth.

Mr. J. S. Pevear, second vice-president of the New Orleans (La.) Railway & Light Company since last fall, has been elected president of the company, which position has been vacant since the election of Mr. Hugh McCloskey as chairman of the board of directors and president of the American Cities Company. Mr. Pevear was formerly vice-president of the International Railway and vice-president of the Buffalo & Lake Erie Traction Company, of Buffalo, N. Y. He became general superintendent of the latter company in 1911, having been previously connected with the Twin City Rapid Transit Company of Minneapolis and with the General Electric Company.

Mr. W. G. Murrin has recently been appointed general superintendent of the British Columbia Electric Railway, Ltd., with headquarters at Vancouver, B. C. His work will cover duties of mechanical superintendent with control of equipment over the company's entire system as well as the supervision of the Vancouver & Suburban division of the company's railway system. Mr. Murrin went to British Columbia from England last year to take the position of mechanical superintendent. His early technical training was obtained in the Finsbury Technical College, after which he served as apprentice in the shops of the City of London Lighting Company. He subsequently served as superintendent of power on the London United Tramways and later was appointed manager of rolling stock and electrical equipment and works manager of the London company.

Obituary

Frederick W. Burdick, for the past ten years manager of the contracting department of the H. W. Johns-Manville Company, died at his home in New York on April 28.

George H. Potter, president of the Bradford (Pa.) Light, Heat & Power Company, died April 27. Mr. Potter was born at Rockford (Ill.) July 12, 1847, served during the Civil War, and later went to the oil regions and located at Petroleum Center. He is survived by a widow and a daughter.

Construction

New England

PRESQUE ISLE, MAINE.—The Maine & New Brunswick Electrical Co., of Presque Isle, expects to erect 8 miles of three-phase, 11,000-volt transmission line, extending from Presque Isle to Mapleton. C. O. Austin is superintendent.

NEWTON, N. H.—The Exeter & Hampton El. Lt. Co. has decided to extend its transmission line to Newton to furnish electrical service here.

BOSTON, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 10 for furnishing and installing lighting fixtures in the United States custom house in Boston, Mass. For details see proposal columns.

BROCKTON, MASS.—Within the next two months the Edison El. Illg. Co. of Brockton expects to erect a 13,200-volt transmission line from its East Bridgewater plant to a substation in the town of Bridgewater. The company is now extending its lines into the towns of North Hanson, South Hanson, Bryantville and Pembroke for the purpose of furnishing the residents with electrical service. A. F. Nelson is manager.

CHICOPEE, MASS.—The Water Department is contemplating equipping the waterworks pumping station with two electric motors of 100 hp each to replace steam power.

FALL RIVER, MASS.—The aldermanic committee has approved plans for the installation of ornamental lamps on Morgan Street.

GREENFIELD, MASS.—The Greenfield El. Lt. & Pwr. Co. is negotiating with the residents of Ashfield with a view of furnishing electrical service in that town. If the deal is carried through, the service will be extended to cover Ashfield Plains and South Ashfield before fall.

LUNENBURG, MASS.—The town of Lunenburg has voted to establish a municipal electric distributing system and to appropriate an amount not exceeding $10,000 for same. It is proposed to purchase electricity to operate the system.

MALDEN, MASS.—The Malden El. Co. is expecting to purchase one 600-hp Babcock & Wilcox water-tube boiler equipped with Murphy stokers. J. T. Day is superintendent.

WORCESTER, MASS.—The Worcester El. Lt. Co. has entered into a contract with the Crompton & Knowles Loom Works, whereby it will furnish electricity to operate the plant of the latter. The connected load at the works will be about 1600 hp in 550-volt, three-phase induction motors and about 200 kw in lighting apparatus. The electric company will also furnish about 400 hp for the new industrial building being erected by John E. Bradley, at Grafton and Franklin Streets.

PROVIDENCE, R. I.—Bids will be received at the office of the Board of Contract and Supply until May 11 for electrical work at the Courtland Street School. Plans and specifications may be obtained at the office of Hoppin & Field, architects, 32 Westminster Street, Providence.

BRISTOL, CONN.—The directors of the Bristol & Plainville Tramway Co. have recommended an increase in capital stock from $375,000 to $562,000, the proceeds to be used for extensions and betterments.

BRISTOL, CONN.—The New Departure Mfg. Co., of Bristol, has signed a contract with the Bristol & Plainville Tramway Co. to furnish electricity to operate its manufacturing establishment. It is understood that the contract calls for 3000 hp, which will be furnished from the power plant of the Stone & Webster Corpn., of Boston, Mass., at Falls Village, on the Housatonic River.

EAST NORWALK, CONN.—Bonds to the amount of $20,000 have been voted for the installation of an electric generating plant. Electricity for operating the municipal electric-light system is purchased from the municipal electric plant at South Norwalk

Middle Atlantic

BINGHAMTON, N. Y.—The City Council has decided to call an election on May 19 to submit the proposal to issue $148,000 in bonds for the installation of a municipal electric-light plant in Binghamton.

FULTON, N. Y.—The Fulton Lt., Ht. & Pwr. Co. expects to purchase the following material for street-lighting system: 25 miles of No. 6 wire, 210 30-ft. poles, 500 cross-arms, 500 12-in. bolts, 1000 square washers, 500 lags, 500 pair cross-arm braces, 400 No. 222 Pierce brackets, 400 Lock No. 44 insulators, 2000 high-voltage insulators, three 25-kw constant-current transformers, complete with panels, etc., 424 reflectors and 268 fixtures. The company would like to receive prices direct from manufacturers on the above J. J. Jordan is general manager.

HUDSON, N. Y.—Bids will be received until May 25 by Miss Mary Hinckley, president of the board of managers, New York State Training School for Girls, Hudson, for electric work in cottages Nos. 1, 2, 3 and 4 at the New York State Training School for Girls at Hudson. Drawings and specifications may be seen and blank forms of proposal obtained at the training school at Hudson and at the office of Lewis F. Pilcher, state architect, Capitol, Albany. Plans and specifications may be obtained on application to the state architect.

ITHACA, N. Y.—Bids will be received by E. L. Williams, treasurer of Cornell University, Ithaca, N. Y., until May 15 for the electric-service connections for the forestry building, animal husbandry headquarters building, stock-judging pavilion and agronomy building at the New York State College of Agriculture, Cornell University, Ithaca. Specifications and blank forms of proposal may be obtained at the office of Green & Wicks, 110 Franklin Street, Buffalo, N. Y., for which a deposit of $10 will be required. Specifications are on file in the office of Lewis F. Pilcher, state architect, Capitol, Albany, and at the office of the treasurer at Cornell University, Ithaca.

NEW YORK, N. Y.—Bids will be received by Douglas Mathewson, president of the borough of the Bronx, Municipal Building, Crotona Park, 177th Street and Third Avenue, until May 15 for furnishing and installing electric and gas fixtures in the Bronx Borough court house. Blank forms can be obtained and plans and specifications may be seen at the above office.

SYRACUSE, N. Y.—The Public Service Commission has granted the application of the Syracuse Ltg. Co. for permission to erect a transmission line to Minoa to supply electricity for lamps and motors in that town.

CONNELLSVILLE, PA.—The garage owned by the Wells-Mills El. Co., of Connellsville, was recently destroyed by fire, causing a loss of about $8,000.

EASTON, PA.—The City Council has authorized the superintendent of the Department of Highways to advertise for proposals for the extension of the street-lighting system. It is proposed to erect 117 ornamental standards on Northampton and Third Streets to supplant the 22 arc lamps now in use. Tungsten lamps of the new nitrogen type will be used.

HERSHEY, PA.—The power plant of the Hershey Chocolate Co., it is reported, was badly damaged by fire recently, destroying an engine and six generators.

PHILADELPHIA, PA.—Plans, it is reported, have been submitted for estimating on the construction of power houses along the main line of the Pennsylvania Railroad. Philadelphia contractors have already been asked for bids on a power house to be erected at Broad Street and Glenwood Avenue.

PHILADELPHIA, PA.—The United El. Construction Co., 1727 Sansom Street, Philadelphia, has been awarded the contract for the installation of engines, generators, switchboard, telephones, program clocks, elevators, etc., to be installed in the Germantown High School, to be erected at Germantown, Philadelphia. The cost of the work is estimated at about $50,000.

LONACONING, MD.—The Home El. Lt. Co., of Lonaconing, is expecting to purchase within the next three months one 200-kw to 250-kw single-phase, 2300 volt alternating-current generator and one 300-hp to 400-hp engine to drive same. The company has taken over the plant of the Lonaconing Lt. & Pwr. Co. and will operate it in connection with its own system. J. Somerville is manager.

MOUNT RANIER, MD.—The town of Mount Ranier has engaged Harry Stevens, civil engineer, of Washington, D. C., to prepare plans for the installation of a municipal electric-light plant, for which bonds to the amount of $25,000 have been voted.

SALISBURY, MD.—Within the next 30 days the Salisbury Lt., Ht. & Pwr. Co. expects to purchase one 3000-hp water-tube boiler. John W. Downing is assistant manager.

WHEELING, W. VA.—Preparations are being made for extensive improvements and additions to the Wheeling Trac. Co.'s system. It is understood that a large part of the $6,500,000 secured on a bond issue will be used for expanding the railway system.

WASHINGTON, D. C.—A concession has been granted by a foreign government for the construction of an electric-light and tramway system for a certain city. The concession carries with it the privilege of utilizing falls which it is estimated will furnish 12,000 hp all the year, the current to be transmitted about 60 miles. Further information may be obtained by addressing No. 13,008, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and at the branch office, 315 Custom House, New York, N. Y.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 26 for furnishing at the various navy yards and naval stations the following supplies: Newport, R. I., Schedule 6722—two electrically heated baths. Washington, D. C., Schedule 6731—810 ft. four-way vitreous conduit, 800 ft. 500,000-circ. mil electric cable. Schedule 6748—4000 ft. plow-steel wire rope (¾ in. in diameter). Brooklyn, N. Y., Schedule 6725—one 24-in. motor-driven variable-speed upright drill, one motor-driven variable-speed screw-cutting tool-room lathe, one motor-driven variable-speed milling machine with overhanging arm, one motor-driven grindstone (30 in. in diameter, 4 in. face); Schedule 6740—six hot-wire, unshunted direct-reading 0-40-amp ammeters, 2600 ft. four-conductor, leaded or armored galvanized soft-steel interior-communication cable; Schedule 6739—miscellaneous seamless-drawn copper tubing; Schedule 6737—4000 ft. 150,000-circ. mil plain, single-conductor armoring and leading cable. Norfolk, Va., Schedule 6746—five electrically operated potato peelers. Portsmouth, N. H., Schedule 6743—one electric range. Bids will also be received until June 2 as follows: Mare Island, Cal., Schedule 6762—4100 lb. seamless-drawn copper pipe (12-in. lengths). Boston, Mass., Schedule 6764—two 10-in. suction, motor-driven, directly connected centrifugal fuel-oil pumping units. Applications for proposals should designate the schedule desired by number.

North Central

DRYDEN, MICH.—An electrical distributing system is being erected in Dryden. Electricity for operating the system will be furnished by the Schlegel Lt. & Pwr. Co., of Lapeer, 12 miles distant.

GRAND RAPIDS, MICH.—The contract for wiring the new Young Men's Christian Association building has been awarded to the Grand Rapids El. Co.

LAPEER, MICH.—At an election held April 6 the proposal to install a municipal electric-light plant to light the streets and public places in Lapeer was defeated. J. H. Brilwell is city clerk.

MONROE, MICH.—New bids will be received by the Board of Education until May 14 for electric wiring of old high-school building, which is to be remodeled throughout. Thomas R. Waters is secretary.

MOUNT CLEMENS, MICH.—The Eastern Michigan Edison Co. is negotiating for a new contract for lighting the city, the former contract having expired April 30. The company proposes to install in the business district steel posts equipped with flaming-arc lamps.

CLEVELAND, OHIO.—The Brooklyn municipal electric-light plant, it is understood, will be abandoned soon after the new municipal plant is completed and part of the machinery removed to the large plant. Connections will be made to give the West Side service from the new plant. The Collinwood plant will be continued to be operated until extensions are made to that section of the city.

DELPHOS, OHIO.—The Delphos El. Lt & Pwr. Co. is extending its transmission lines to furnish electrical service to nearby towns. The company, it is understood, contemplates enlarging its power plant and to make further extensions to its service, including Van Wert, Grover Hill, Ottoville, Ohio City, Convoy and Middle Point.

EAST LIVERPOOL, OHIO.—The Council has directed J. J. Grafton, director of public service, to advertise for bids for electric and gas street-lighting service for a period of from two to five years. The question of establishing a municipal plant, for which $60,000 in bonds have been voted, is still held in abeyance on account of an injunction suit instituted by W. C. Conner.

MARION, OHIO.—Plans are being considered for the installation of cluster lamps in the business district.

MARYSVILLE, OHIO.—The Marysville Lt. & Wtr. Co. is contemplating the erection of 18 miles of transmission lines within the next 90 days. Wayne Mackan is superintendent.

MOUNT VERNON, OHIO.—The contract for the installation of an electric-light plant at the Knox County Infirmary has been

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Responsibility of Commissions In its first annual report the Missouri Public Service Commission raises the question of its obligation to investors who are influenced in their purchases by the fact that securities have been approved by the commission and therefore supposedly represent value. The commission rightly recognizes this as a "serious and important question." The guide to the policy which the Missouri commission announces it will follow is found in a decision of the New York Public Service Commission, Second District. This case arose from an application of the Hudson Electric Power Company. In approving the New York rule the Missouri commission declares that it is both wise and sound. The New York decision held that to a reasonable extent the interests of the investing public should be considered. "The commission should satisfy itself that, in a general way, the venture will be likely to prove commercially feasible, but it should not undertake to reach and announce a definite conclusion that the new construction or improvement actually constitutes a safe or attractive basis for investment. Commercial enterprises depend for their success upon so many conditions which cannot be foreseen or reckoned with in advance that the duty of the commission is discharged as to applications of this character when it has satisfied itself that the contemplated purpose is a fair business proposition." This problem is a very trying one for the commissions. It is not clear how a state can escape a moral obligation in the matter. Certainly the state cannot fairly approve securities which it knows will not be good in order to help a corporation to get funds to provide needed or wanted service. The burden is clearly upon a commission to do everything that it properly can to make securities issued under reasonably justifiable conditions good.

Protective Resistors for Oil Switches It is now a well-established phenomenon that when an oil switch is used to connect a considerable length of cable with high-tension alternating-current busbars there is apt to be an overvoltage or an overflow of current during the first few cycles unless the switch happens to close at precisely the right moment in the cycle. A similar phenomenon in regard to overflow of current may occur when the switch is used to connect transformers if the cores of these transformers happen to have been left with a considerable amount of remanent magnetism; that is, if the current happened to be shut off the transformers near a peak in a current wave. Similarly, at the opening of high-tension oil switches under a heavy inductive overload, there is apt to be a severe overvoltage on the switch which may endanger it. Some experiments with oil switches under such circuit conditions are described by Herr von Bruno Bauer in a recent number of *Elektrische Kraftbetriebe und Bahnen*. These experiments indicate that the use of a protective resistor intercalated into the circuit at the opening and at the closing, during half a dozen cycles, has a beneficial influence in wire-drawing these overvoltages and currents, so as to reduce their magnitudes. An approximate theory of the actions occurring in such a switch is outlined, but it is pointed out that no such theory can be completed until the characteristics of arcs occurring under oil have been properly investigated.

Cultivating Long-Hour Appliances Elsewhere in this issue are given the estimated annual earnings of a considerable number of electric appliances as approximated by the Narragansett Electric Lighting Company, of Providence, R. I., in connection with an analysis of the business of the Electric Shop of this large central station. Close accuracy is, of course, impossible in figures of this kind without the use of separate meters for different devices, and, again, local customs and habits are decidedly influential in controlling the use of such equipment on the purchaser's premises, to say nothing of the stimulation of service produced by rates of from 10 cents downward per kilowatt-hour. But if the values for each appliance expressed in terms of yearly or monthly income are at best estimates, it should not be overlooked that in the absence of more complete data the figures given are highly suggestive on their comparative side and furnish a starting point for further investigations of much interest. A study of the table of incomes shows that a large connected load per appliance by no means always indicates the maximum annual revenue, the conditions being very different from those obtaining in the motor field. It is interesting to note that a 25-watt sewing-machine motor yields a much larger income than a 300-watt soldering iron used only occasionally, that electric irons are among the best customers of central-station service on account of the regularity of their use and the duration of their work, and that a 60-watt heating pad equals a 250-watt foot-warmer or a 350-watt shaving mug in its integrated demand upon the distribution system. None of these devices is to be scoffed at from the standpoint of community electrification, but it is worth studying how much different apparatus is utilized where the central station is trying to develop its business along systematic lines and with the minimum yearly outlay for new plant equipment. The point should also not be overlooked that often devices of almost zero energy consumption are very effective advertisers of electric service. Load-factor is not everything in the marketing of energy for use in devices for convenience in domestic or business fields, but there is no escaping the fact that long-hour use of connected load is a decidedly profitable thing to encourage, even where the wattage of the equipment units is individually low. If it has not already been done, it is time some central-station man with favorable conditions and a family of fair size put an independent meter on each kind of energy-consuming device in his home for a year and gave the results to the industry. Until a study of this kind is made public, there will be room for much discussion as to the earning power of appliances at stated rates.

Standardization Rules

Certain proposed new standardization rules of the Verband Deutscher Elektrotechniker in regard to electric conducting wires have recently been published in the *Elektrotechnische Zeitschrift*. They relate, in particular, to the conductivity of industrial copper and to insulated wires and cables, their dimensions, loads and tests. The standards for industrial copper are precisely those which were internationally adopted by the International Electrotechnical Commission at the Berlin meeting last September, and which have been subscribed to by the Bureau of Standards, the American Institute of Electrical Engineers and the American Society for Testing Materials in this country. It is thus a world-wide blessing to see copper-wire tables coming into general use which are based on internationally adopted constants. Hereafter "annealed copper wire of 100 per cent conductivity" may be expected to be a phrase possessing the same quantitative meaning all over the civilized world to within a tenth of 1 per cent. This good understanding paves the way for international agreement as to the measurement and determination of temperature changes in coils or windings of copper, with respect to their corresponding changes of electrical resistance.

The standards committee of the American Institute of Electrical Engineers has recently been actively engaged in preparing a new edition of the Standardization Rules. This is a large undertaking, involving many difficulties, owing to the numerous interests concerned, as well as to the many and intricate matters to be dealt with. A draft of the proposed rules is now being prepared by the committee for its final adoption early in June, prior to transmitting them to the American Institute of Electrical Engineers board of directors at the Detroit convention. The new edition will doubtless be distributed among the members as heretofore, after it has been approved, but in the meantime the committee has asked for suggestions from all sides, with a view to making the new edition as nearly satisfactory and complete as possible. The rate of development in electrical industries is such that the several past editions of the American Institute of Electrical Engineers Standardization Rules have become obsolete in a few years, and each new edition has been nearly double the size of its predecessor.

The Flicker Photometer

The flicker photometer is generally regarded by those familiar with its use as decidedly the most reliable means for comparing lights of different colors. It has been shown, to be sure, that under certain circumstances and at high intensities the results obtained by the direct-comparison method do not differ widely from those found by the flicker instrument. This fact, however, is not of great importance when one considers the wide discrepancies found under ordinary circumstances. That the discrepancies are attributable chiefly to the phenomena of simultaneous contrast interfering with direct comparisons has been pretty clearly shown, the more effectively since it is well known that in using Bunsen screens carefully prepared to ameliorate conditions of contrast as much as possible fairly satisfactory direct comparisons can be made. Nevertheless, there are those who hold that while the flicker photometer makes easy a comparison between lights of different colors, it does not necessarily measure their true brightness, but rather some unknown function of the brightness which may not be a more satisfactory criterion than the ordinary equality-of-brightness test. The broad fact which lies at the bottom of flicker photometry is that the color flicker blends and disappears before the brightness flicker, and the fundamental question is whether the disappearance of the brightness flicker really measures equality of brightness.

In an article in this issue Mr. M. Luckiesh deals directly with the validity of the flicker method as a correct measure of brightness. One series of tests seems to clear up the matter more than anything that has yet appeared. According to the first of these, a pure yellow obtained by a suitable light filter was compared with a synthetic yellow composed of green and red light alone. Obviously these could be compared as regards brightness with the utmost ease using the ordinary equality-of-brightness photometer, there being no residual color difference. Now, unless the flicker photometer correctly sums up the red and green components in a synthetic yellow, it will give for that yellow a different brightness value from that obtained in the ordinary way. In point of fact, the results by the two methods agreed within experimental errors of less than 1 per cent. The same degree of equality was found when the lights concerned were nearly white, one from a continuous spectrum and the other a synthetic match of red and blue-green. Under these circumstances the luminosity values of the red and green are added by both methods without involving the phenomena of simultaneous contrast, and the two methods lead to the same result. It is conceivable, as Mr. Luckiesh says, that other combinations of colored lights might give different results, but it is extremely unlikely in our opinion that such would be the case to an extent sufficient to indicate any uncertainty about the brightness values found by the flicker method. Mr. Luckiesh's results must be regarded as very strong evidence in favor of the flicker instrument for heterochromatic photometry. It does not follow that the flicker photometer is the one always to be used as a matter of practice. As Mr. Luckiesh hints, it may be desirable in ordinary work to use an equality-of-brightness instrument and make corrections for color by means of suitable screens, calibrating these perhaps by the flicker method. Most observers prefer a Lummer-Brodhun screen to any other for rapid and easy work, while generally finding that the flicker instrument is rather slow and causes too considerable a strain on the attention to make it convenient for regular work.

A Real Case of Conservation

In this issue is concluded a description of a plant peculiarly instructive as being a first-class example of a type which has for years been talked about enthusiastically and is now being realized in our own country. It is curious that, obvious as are the advantages of utilizing unmarketable coal at the mouth of the mine for the transmission of electric energy, very little has yet been done toward carrying this important economy into effect. Every ton of coal burned to this good end represents a genuine saving, a reduction in the drain on the world's supply of coal, to say nothing of abolition of an economic waste in carrying fuel when such transportation is really unnecessary. Yet, until the inauguration of the project here considered little had been accomplished in this country and comparatively little abroad, one large South African plant being perhaps the most conspicuous foreign example of the class. It has frequently been demonstrated that where a cheap supply of otherwise unmarketable coal is available a large electric station can produce energy at an extraordinarily low figure and transmit it to great advantage. Such conditions of fuel supply have existed in Pennsylvania and other coal-producing states for a good many years. It was not without appreciation of this fact that twenty-five years ago an electric-light station in Scranton was planted at the foot of a culm pile, from which the firemen could almost shovel fuel directly into the boiler room.

In the present instance the project of electric-energy supply from waste fuel has been carried out intelligently and on a scale large enough to reap the substantial advantages of the plan. The plant is situated in the anthracite territory of the Lehigh Coal & Navigation Company, to which the Lehigh Navigation Electric Company is allied. The plant at Hauto is skilfully laid out for the production of energy at a low cost. The essential feature of the problem in such cases is to provide means for handling the waste coal with the utmost economy. It is necessary not only to transport the fuel to the boiler house as cheaply as possible, but to provide boilers in which it can be burned with the maximum efficiency. Ordinary furnaces are not well adapted for the use of low-grade coal. They lack both grate area and furnace area. In the Hauto plant steam is furnished by eight water-tube boilers, each of which is provided with four grates, half of the grate area being fired from each side. The steam pressure is 225 lb., and there is superheating besides. The fact that the bank of boilers aggregates nearly 2 acres of heating surface will convey to the untechnical mind some notion of the provision made for supplying steam. Six of the eight boilers are hand-fired, the other two being operated by automatic stokers. Comparative results with hand and automatic firing in this work will be watched with a good deal of interest. Generally speaking, automatic stokers are preferred for low-grade fuel, but in this case the situation is different, for the waste product is not similar to the low-grade bituminous coal of the more western fields, and it probably requires more intelligent attention to compensate for variations in its quality than can be secured without hand-firing. The coal is conveyed to the furnaces in the simplest possible manner, for a trestle carries a track of standard-gage equipment directly over the bunkers in the upper part of the boiler house, so that the fuel can be run in on cars and dumped directly into the bunkers, whence it is fed by gravity to the fireroom. There is no need for any considerable coal storage inasmuch as the mine is very near and can be reached at any time.

Water for condensation has been a serious consideration and requires an artificial pond which has a storage capacity of a billion gallons. The condensing water is taken from near one end of the pond and discharged near the other, so that there is ample cooling area to meet all requirements. To give greater facility in dealing with the immense bulk of coal of varying character, the boiler room is equipped with forced draft capable of meeting any requirements in the way of air supply. The generating outfit consists at present of three 12,500-kw turbo-generators, with provision for five more, so that the ultimate equipment rating of the station will rise to 100,000 kw. These generators are wound for 11,000 volts, which well provides for the mines, cement mills and other industries in the immediate vicinity, while the transmission voltage for longer work is 110,000. When one realizes that New York City is less than a hundred miles from this plant, and Philadelphia considerably nearer, the possibilities of disposing of the output are obvious. The turbo-generators are stated to be able to produce a kilowatt-hour for 12.3 lb. of steam, which ought to mean, with the fuel employed, a production cost kept down to a very low figure. The Hauto plant represents a serious and well-planned effort to realize a dream of conservation which has troubled the sleep of engineers for at least twenty years past, and it certainly deserves a degree of success which will make it the forerunner of a new era in the development of energy generation and distribution.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Los Angeles for Municipal Ownership

By a vote of 56,199 to 23,179 the electors of Los Angeles on May 8 authorized the issuance of $6,500,000 of bonds for the completion of a hydroelectric generating station and the construction or acquisition of an electric distribution system. The campaign was energetically contested by the three electric companies operating in Los Angeles. The City Council refused to accede to a request to permit the question to go upon the ballot in a segregated form, namely, $1,250,000 for the completion of the generating station, upon which $3,500,000 has already been expended, and $5,250,000 for a distribution system. The electric companies offered to buy the energy produced at the aqueduct plant at a price to be fixed by the state railroad commission, the city to fix the price at which the energy would be resold to consumers, but the offer was rejected. It is reported that the intention of the city's administration is to acquire a distributing system by eminent-domain proceedings. There is little doubt that these proceedings will be contested to the limit.

Contest Over Municipal Plant at Springfield, Ill.

The Sangamon Circuit Court at Springfield, Ill., is expected to hand down early in June a decision of importance to public service corporations. The decision will be in the case of Mr. E. W. Payne, a citizen, against the city, brought to secure an injunction to prevent Springfield from combining its light and power plants at the river pumping station and thus producing energy for commercial use and competing with the Springfield Light, Heat & Power Company. Mr. Payne contends that the section of the State public utilities act which exempts from the jurisdiction of the State commission municipally owned utilities is unconstitutional.

The Springfield Light, Heat & Power Company has a franchise from the city, and for many years it has been supplying all private consumers. Some years ago a municipal plant was organized to provide energy to light the streets. The Commissioner of Public Works, Mr. Willis D. Spaulding, about a year ago conceived the idea of combining the city light plant and city waterworks plant and selling energy. Many people opposed the plan, so the city officials began to install an electric plant at the water-works by piecemeal. It was proposed to buy a 750-kva generator, and then to add other units, and in the meantime to keep the city's electric plant in operation independently. A referendum election was held and the people voted in favor of the plan.

It was after the Council had passed the ordinance providing for the purchase of the generator that Mr. Payne brought his injunction proceedings. He contends that the city must get permission from the Public Utilities Commission before installing the generator. The city points out the section in the act which gives cities the right to proceed independently of the commission, and Mr. Payne in turn contends that the section is not valid because it gives the city an advantage over the private company to the detriment of the company, thus violating the federal constitution.

Pittsfield A. I. E. E. Meeting

As noted on page 968 of our issue dated May 2, a meeting of the American Institute of Electrical Engineers will be held in Pittsfield, Mass., on Thursday and Friday, May 28 and 29, to discuss the general subject of "Relative Advantages of Star and Delta Connections." Sessions will be held on Thursday morning and afternoon and on Friday morning, afternoon and evening. In addition to the papers by Messrs. D. W. Roper, J. P. Jollyman, P. M. Downing, F. G. Baum, Louis F. Blume and Charles Fortesque, referred to in the earlier notice, the following papers will be read: "Inherent Voltage Relations in Star and Delta Connections," by Messrs. R. W. Sorensen and W. L. Newton; "Harmonic Voltages and Currents in Star and Delta Connected Transformers," by Mr. R. C. Clinker; "Relative Merits of Star and Delta Connections for Alternators," by Mr. T. S. Eden. Written discussions by Mr. Guido Semenza, of Milan, Italy; Mr. Ferdinand Koscherak, of Paris, France, and Messrs. Cassius M. Davis and C. P. Steinmetz, of Schenectady, N. Y., will also be read.

Prof. Dugald C. Jackson, of the Massachusetts Institute of Technology, will preside at the meeting in place of Mr. John J. Frank, chairman of the Pittsfield Section, who finds he is unable to be in Pittsfield during the meeting. The entire program will be summarized and discussed at the close of the meeting by Mr. Percy H. Thomas.

The local arrangements committee in charge of the meeting is composed of Mr. Paul R. Smith, chairman, and Messrs. M. O. Troy, H. W. Tobey, H. P. Ball, V. E. Goodwin and Neal Currie.

On Thursday evening members of the Institute will meet the members of the Berkshire County University Club at a dinner to be served at the Maplewood Hotel. Mr. William Stanley will be the chief speaker on this occasion.

Cleveland Meeting of I. E. S.

The regular monthly meeting of the Pittsburgh Section of the Illuminating Engineering Society, which embraces Cleveland in its territory, will be held in the latter city on Friday, May 22. It had been originally intended to hold this meeting on Friday, May 15, but at the suggestion of the Cleveland members it was decided to postpone the meeting until the later date so that the members could visit the Cleveland Electrical Show, which will be in progress at that time. The Pittsburgh delegation will go to Cleveland in a special car. The meeting will be held in the early part of the evening, after which the society will be guests at the Nela Park Laboratory. A paper will be presented at the meeting by Mr. Ward Harrison on the illumination of building exteriors and one by Mr. C. L. Dows on the latest development in incandescent lamps. The reading of the papers will be followed by discussion.

Niagara Development Bill

At a conference which was held in Washington on May 13 between Secretary of War Garrison and representatives Harrison, Cline and Cooper, for the House foreign affairs committee, a compromise bill to regulate the water diversion rights at Niagara Falls was agreed upon. The bill gives the Secretary of War the right to issue revocable permits for a daily diversion averaging 15,600 cu. ft. per second on the American side and for the importation of 250,000 hp from the Canadian side. The control over the rates, tolls and service would be left to the State of New York.

Electrical Supply Jobbers' Convention

The regular quarterly meeting of the Electrical Supply Jobbers' Association was held at the Hotel Chalfonte, Atlantic City, N. J., on May 12 and 13. The attendance was excellent, the sessions being given over entirely to routine matters pertaining to the jobbing business.

Definite action was taken on the report of the special committee of the Chamber of Commerce of the United States of America on trust legislation in regard to the proposal to create an interstate trade commission. The association voted favorably on all sections of Referendum No. 7 except the third. This ballot, which was taken for the guidance and instruction of the board of directors of the Chamber of Commerce, provides for the creation of an interstate trade commission of at least five members, whose jurisdiction in conducting investigations shall extend to all corporations engaged in interstate or foreign commerce. The committee recommends that the commission should not now be given authority to advise applicants concerning the legality of proposed contracts, combinations, etc., under the Sherman act. In annual reports corporations ought not to be required to disclose trade processes, shop costs, classification of sales and profits among particular articles, names of customers, or other like private information. Publication of facts obtained by the commission should be confined to such as are of public concern. Congress should direct the commission to investigate and report at the earliest practicable date on the advisability of amending the Sherman act to allow a greater degree of co-operation in the conduct and the protection of the foreign trade.

A general discussion was also had on House Bill No. 13,305, known as the Stevens bill, the purport of which is to give the owner of a patent or trade-mark the right to fix the resale price of the article to which the patent or trade-mark applies.

During the year the Electrical Supply Jobbers' Association has been gathering data on rubber-covered wire, and the trade statistics thus secured were presented in closed session on Wednesday morning. Other routine matters brought up for consideration were the subjects of cash discounts and the return of goods.

On Wednesday night a rejuvenation of the Jovian Order was held at the Hotel Rudolph, followed by a banquet and entertainment in the same hotel. The next meeting of the association will be held in September, the date and place to be decided later. The November meeting will be held at Birmingham, Ala., as announced at the February Washington meeting.

Electric Vehicle Association

Owing to the increased interest generally evident in electric vehicles and the volume of work to be disposed of, three days, rather than the usual two days, will be allotted to the fifth annual convention of the Electric Vehicle Association of America, which will be held in Philadelphia Monday, Tuesday and Wednesday, Oct. 19, 20 and 21, during the week of the Philadelphia Electric Show, at which there will be a comprehensive exhibit of both passenger and commercial vehicles.

In addition to the sections in New England, Chicago, Philadelphia and Washington, the Electric Vehicle Association of America has recently added Cincinnati and San Francisco, and additional sections are to be announced shortly. The officers of the Cincinnati Section are: Mr. George Behlen, the Charles Behlen Sons Company, chairman; Mr. James W. Schrantz, Westinghouse Electric & Manufacturing Company, vice-chairman; Mr. Parker H. Kemble, Union Gas & Electric Company, secretary. The San Francisco officers are: Mr. Stanley Walter, Pacific Gas & Electric Company, chairman; Mr. C. W. Hutton, General Vehicle Company, vice-chairman; Mr. J. W. Redpath, *Journal of Electricity, Power and Gas*, secretary.

Speaking in Chicago on May 5, Mr. Frank W. Smith, president of the Electric Vehicle Association of America, related some facts of interest at the annual meeting of the local section. When Mr. Smith took office, about Nov. 1 last, there were 434 members of the association. The number at present is about 675. Local sections are in existence in Boston, Chicago, New York, Philadelphia, Washington, Cincinnati and San Francisco, while there are good prospects for the organization of sections in Pittsburgh, New Orleans, Detroit, Los Angeles, Cleveland and other cities. Mr. Smith mentioned the fact that the association may become international in its scope. He devoted considerable time to the work of committees and said of the pamphlet entitled "The Electric Vehicle in Parcel Post Service for Economy and Reliability" that 10,000 copies had been distributed. One of the most recent efforts in which the activities of the association are expressed is the endeavor to induce steam-railroad men to give consideration to the merits of the electric truck as a medium for relieving freight terminal congestion in large cities.

Electric Vehicle Course at Armour Institute

An announcement of considerable interest was made at the recent annual dinner of the Chicago Section of the Electric Vehicle Association on May 5. Among the speakers was Dean H. M. Raymond of the Armour Institute of Technology, Chicago. President Frank W. Smith of the national organization had previously referred to the work of the education committee, which the association deems of much importance. Dean Raymond announced that the Armour Institute is about to establish a course of instruction in the practical care and operation of electric vehicles. As outlined by Prof. D. P. Moreton, who will be in charge of the new course, the students will be instructed in the history and development of the electric automobile and the fundamental principles underlying the design and operation of the electric motor, the controller and the storage battery. Methods for charging will be explained as well as the use of measuring and recording instruments. One of the lectures will contain hints on good driving, while others will relate to cost data, records, etc. The course as planned will relate to fundamentals rather than to technical refinements and is designed, apparently, for young men employed, or who expect to be employed, in the operation of electric vehicles. Instruction will be given during the evening so that those employed during the day may attend.

Activities of the Society for Electrical Development

As noted in our issue of April 25, the annual meeting of the Society for Electrical Development will be held at the Bellevue-Stratford Hotel, Philadelphia, Pa., on June 1. This plan will enable those going to Philadelphia for the convention of the National Electric Light Association to attend also the meeting of the Society for Electrical Development, which will be held at 10 a. m. At the Friday morning session of the National Electric Light Association Mr. J. M. Wakeman, general manager of the society, will outline the plans for electrical development. These plans have been carefully worked out by a special committee and have been approved by the executive committee of the society. The staff for putting them into execution has been engaged, and the society is now actively at work along the lines indicated below:

Field Co-operation

Local Co-operation.—The plan is to organize the allied interests into local leagues, to secure the personal support and co-operation of the members of the society in each district, so that they will all work together for the intensive cultivation of the electrical business in the territory in which the local organization is formed.

Part of this local work is to be done through co-operative advertising, through aiding in local legislation, local inspection of wiring, local wiring codes, etc.; also through being able to present to the local governing body ordinances regulating electric signs, street lighting, etc., in other cities.

This department also will be prepared to co-operate with the local interests in the preparation of electrical pages and to furnish information regarding electric shows.

It is intended that the society should take an active part in conventions, not only of electrical interest, but in all conventions where users of electricity get together. Arrangements will be made for papers to be presented by representatives of the society on some application of electricity of interest to that particular convention.

General Co-operation.—The field representatives of the society will devote a portion of their time to co-operation with architects, builders and engineers, so that these may be informed as to the proper method of writing specifications for installations for electric light, heat and power; thus the specifications will embody the use of everything electrical that is available on the American market.

As the textbooks used in public schools on electrical subjects are very apt to be behind the times, the department will co-operate with the publishers of textbooks with the view of bringing them up to date.

It is also the intention of the society to co-operate with school boards by furnishing moving-picture films, lectures and stereopticon exhibitions showing the progress in the world of electric service. In this work the local central-station company is expected actively to co-operate. Visits to large manufacturing plants where electric drive and other uses of electricity could be pointed out will also be arranged for high schools.

There are numerous business men's associations throughout the country, and by putting jobbers, contractors, manufacturers and central stations in closer touch with these boards of trade, chambers of commerce and other business men's associations, great good can be accomplished.

The section will continue the campaign for membership and in a general way keep the allied interests fully posted on the work of the society.

New Development

The society has engaged as a traveling investigating engineer a man whose experience in the electrical field has particularly fitted him for the work of compiling up-to-date information as to the various uses of electricity in the different industries and suggesting every possible use of electricity for light, heat and power in factories, mills, etc., as well as in the home and on the farm.

It is very difficult at the present time to secure such information. Some of it has been published in different periodicals, but it has not been brought together in a comprehensive way. Information as to the requirements of various industries, together with the price per unit of output that the consumer could afford to pay for energy, would be invaluable to central-station companies. Analyzing the application of electricity to the industries will undoubtedly show that none of them has been equipped to the limit of possibility, and the society purposes to make practical suggestions as to the further uses of electricity in all industries.

There is a great work to be done for central stations throughout the country in developing an increased demand for electric service in the home. This can be done to a large extent by securing and disseminating information among the central-station members as to how such a demand has already been developed elsewhere and outlining new-business campaigns.

There are innumerable examples of heating throughout the country, but the number of them in use in proportion to the prospective list is absurdly small. There is no place where one can obtain information covering what has been done in this connection, much less what might be done. The Society for Electrical Development will help central-station companies to get this kind of business and to bring the manufacturer, central station and dealer together in the production and sale of such apparatus.

Commercial Exchange Bureau

The Commercial Exchange Bureau will work in very close co-operation with the section for field co-operation, and the society has engaged as manager of this bureau an electrical engineer who is thoroughly capable of collating, indexing and filing the information gathered by the latter section and from all other available sources.

This bureau will prepare bulletins or pamphlets explaining the various uses of electricity, prepare data for articles of similar character for the trade journals and for convention papers, and carry on the necessary correspondence upon such subjects with the members of the society and the public.

Editorial and Advertising

News items and electrical stories for local papers, describing electrical inventions, improvements or applications, compiled in news form so that electrical stories will be accepted by the press on their merit as news, will be prepared by the society.

The society plans to provide an advertising copy service for members to assist them in conducting their advertising in the best possible manner; also to carry on discussions in regard to newspaper advertising before meetings of the Electrical Contractors' Association, the Electrical Supply Jobbers' Association, the National

Electric Light Association, etc., so that the greatest number of concerns engaged in the electrical business will be informed upon the value of newspaper advertising and how through this means to bring about increased interest in and demand for everything electrical.

General Publicity Special Writers.—This part of the society's plans provides for well-written stories by magazine writers of good reputation, suggesting the use of things electrical by the householder, by the merchant and by the factory owner, the stories to be prepared by men of ability so that they will either be accepted on their merits or be sufficiently interesting to be paid for by the publishers and in this way cut down the cost to the society of having this work performed.

Moving Pictures.—The society has arranged for the preparation of moving pictures suggesting the use of things electrical, illustrating their uses in the home and the factory and on the farm. This is one of the most effective methods of interesting and educating the public to "Do It Electrically."

Window Trimming.—The society has arranged to have a number of windows trimmed with electrical supplies, the displays to be made in a novel and effective manner, two photographs to be taken, one showing the fixture setting and the other showing the completed window. These photographs to be reproduced in halftone and sent to the members of the society who have show windows, together with printed instructions as to how to dress the windows to obtain the effects shown in the photographs. Such photographs and instructions will be sent out at regular intervals during the year, and it is felt that this work will give the smallest and the largest member a concrete exhibit of the definite help that the society is in a position to furnish its members. From the experience of large manufacturers specializing in this form of advertising, it is felt that this is one of the most important activities that the sociey can participate in for the development of the electrical industry.

Progress on Pennsylvania Railroad Electrification

Preliminary and to some extent experimental construction work is already well under way on the electrification of the Pennsylvania Railroad's main line from the Broad Street Station, Philadelphia, to Paoli, Pa., 20 miles distant. Following the completion of this work the Chestnut Hill branch will also be electrified, the single-phase system to be used in both instances. This will provide for a movement of forty-nine inbound and forty-seven outbound suburban trains a day. Through passenger and all freight trains for some time to come will continue to be handled by steam locomotives.

Reasons for Adoption of Single-Phase

As explained by Mr. George Gibbs, consulting engineer on the Pennsylvania's electrification work, the single-phase system of operation was adopted not so much as a result of calculations based upon the conditions existing on the suburban line being equipped but, rather, as a logical step toward the accomplishment of the Pennsylvania's electrification plans as a whole. The general reasons for the decision to use single-phase have been that the type of overhead construction for this system and the method of transmission make possible the use of any type of tractor which has so far been suggested in the history of steam-railroad trunk-line electrification. In addition, the apparatus as installed especially for the single-phase system is available for the split-phase locomotive, for any of the various types of single-phase motors, or for the use of the rectifier in case that becomes a practical commercial development. There exist also the advantages of high transmission voltage and ease of transformation from three-phase, twenty-five-cycle lines. The proposed installation includes consideration only of the multiple-unit car service for the suburban traffic. For the present no electric locomotives are to be operated over the line. Each of the cars will be equipped with two 225-hp single-phase, commutator-type motors, both mounted on one truck.

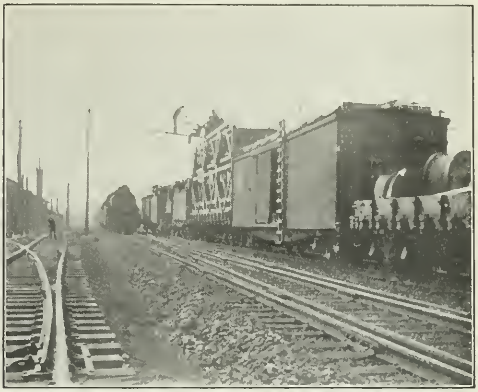


FIG. 1—CONSTRUCTION GANG AT WORK ON OVERHEAD ABOVE PASSING STEAM TRAINS

Overhead Construction

Electricity will be furnished from an overhead catenary system carried on supports of the cross-catenary type. In this arrangement no structural steel bridges are used except the anchor bridges at half-mile intervals, but instead a span wire of heavy cable is carried across the tracks between two tubular steel poles at 300-ft. intervals. From this is suspended a single longitudinal catenary with a secondary messenger wire of copper and a trolley or contact wire of bronze. This cross-catenary type of overhead construction over a four-track main line has never been used heretofore in this country.

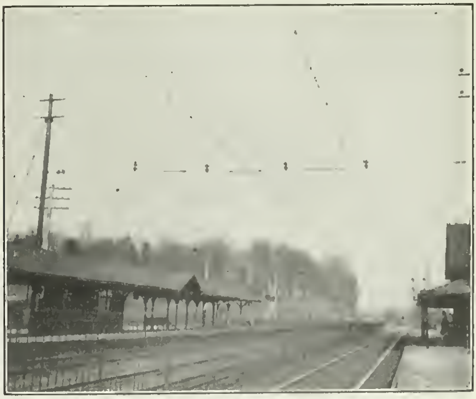


FIG. 2—OVERHEAD CATENARY CONSTRUCTION AT ST. DAVID'S, 14 MILES FROM PHILADELPHIA

The longitudinal catenary consists of a messenger cable supported from the cross-catenary cable, and from this in turn is suspended the secondary messenger and trolley wires, both of the latter being practically horizontal. The secondary messenger wire acts as a conductor as well as a means for producing flexibility in the trolley wire, against which run the pantographs of the cars. In general the use of two lower wires is well known abroad and also in this country through the installation of the New York, New Haven & Hartford Railroad and the New York, Westchester & Boston Railway, but on the Pennsylvania installation the method of supporting the contact wire from the secondary messenger differs materially from that heretofore used. Small two-piece clips fasten the wires together at intervals of about 15 ft., and between every second pair of clips, or at intervals of about 30 ft., a hanger from the catenary is attached to the upper wire. In the previously mentioned installations a hanger is installed between every pair of clips instead of between every second pair, so that the new form of construction obviously reduces the number of hangers from the catenary cable without necessarily reducing the number of clips.

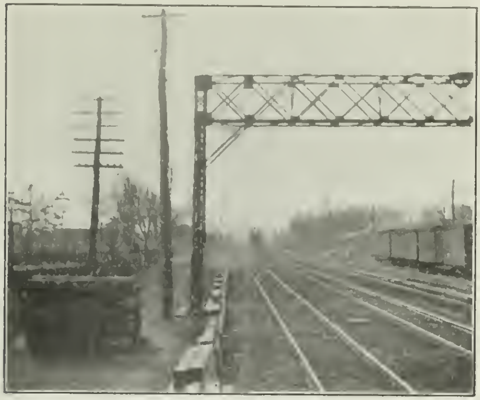


FIG. 3—ANCHOR BRIDGES OF THE TYPE TO BE ERECTED AT HALF-MILE DISTANCES

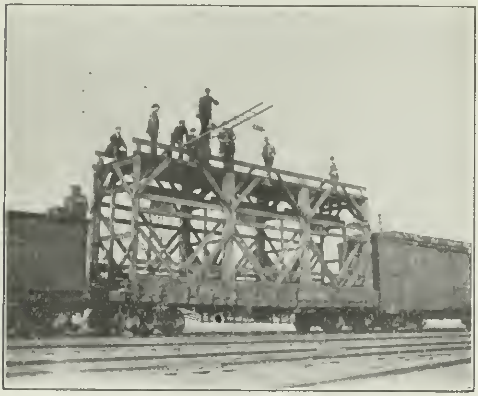


FIG. 4—CONSTRUCTION GANG WORKING FROM PLATFORM ON FLAT CAR

Arrangements for Central-Station Energy

Under the terms of the contract with the Philadelphia Electric Company which will supply the energy to operate the Pennsylvania's electric trains, the initial minimum of 3750 kw is to be ready in September of this year. The railroad will erect its own substation at a point opposite the Christian Street plant of the electric company and will purchase twenty-five-cycle energy at 13,200 volts. A minimum load-factor of 25 per cent is specified.

The rate for this railroad service will be made up of a stand-by charge for kilowatts of demand and an energy charge per kilowatt-hour consumed. The rates will be increased proportionately if the power-factor is less than 70 per cent. When the railroad company can guarantee a maximum demand of 15,000 kw and 35 per cent load-factor the rate will be proportionately reduced.

Chicago Fire Protection Convention

Sustained interest in the important subject of fire prevention was shown by the members and visitors who, to the number of about 250, attended the annual convention of the National Fire Protection Association in Chicago on May 5, 6 and 7. President Robert D. Kohn, of New York, occupied the chair, and Mr. Franklin H. Wentworth, of Boston, the secretary and treasurer, also occupied a seat on the platform. In his annual address Mr. Kohn laid stress on matters of education and legislation to the end of safeguarding life and property from fire hazard.

Mr. F. J. T. Stewart, of New York, as chairman, presented the report of the executive committee. One interesting recommendation, which was adopted, was that the association take no action in the matter of changing rules or standards without consulting the manufacturers or others interested. Resolutions were adopted calling upon all citizens to aid in the campaign against fire waste. To this end certain measures are advocated. These consist of such recommendations as the use of fire-resistive building material, the installation of automatic sprinklers and the like.

The secretary's report showed a total membership of 2635. Active members consist of institutes and societies to the number of 121. A committee recommended certain amendments to the articles of association. One of these proposes to change the name to the American Fire Protection Association. This amendment was referred back to the committee for further consideration.

Municipal Fire Prevention

Mr. Robert Adamson, Fire Commissioner of New York City, delivered an address on "Municipal Fire Prevention." He emphasized the need of interesting business men of the country in the subject of fire protection. The great problem is that of education. The Fire Prevention Bureau in New York City is only two years old. Uniformed men of the fire department inspect all buildings except private residences. In the first three months of 1914 325,000 inspections of this character were made. A picked man from each of the 300 fire companies in the city is detailed for this purpose. These firemen-inspectors make recommendations to the owners or managers and, in addition, report dangerous conditions to the Fire Protection Bureau. The value of the inspection is shown by the fact that the records show that those businesses classed as most hazardous have few fires. Most fires are due to the carelessness of the people.

Features in the Work of Underwriters' Laboratories

Mr. William H. Merrill, Chicago, manager of the Underwriters' Laboratories, spoke of the new features of the work. In addition to the large Chicago plant a station has been in service in New York for about a year. The New York equipment is devoted almost exclusively to electrical testing. It is now quite immaterial whether an electrical device is tested in the Underwriters' Laboratories at Chicago or at New York. Although the volume of electrical testing at Chicago has not decreased, the New York plant is doing as much electrical work as the Chicago plant. The Underwriters have established laboratories in London to inspect goods to be admitted to Canada and the United States. There is some prospect of this work being extended to Germany and Italy. Mr. Merrill said that he realized the importance of field work in inspecting materials, and he explained how this work is done. He described the label service and the follow-up system as exemplified in field inspection.

Electric Fire Pumps

The report of the committee on fire pumps was presented by Mr. H. O. Lacount, of Boston. The committee offered some amendments to the specifications for steam pumps, but devoted the greater part of its report to rules and requirements for electrically driven fire pumps. The new rules provide that the drop in potential for circuits supplying energy to electric fire pumps shall not be over 5 per cent for direct-current motors or 8 per cent for alternating-current motors. Transformers must be placed in a separate room or outdoors. Direct-current motors must be of the shunt-wound type; alternating-current motors must be of the wound-rotor or squirrel-cage induction type. The squirrel-cage motor may be used only when the conditions are such that it will surely start and attain full speed. It is required that motor windings be thoroughly impregnated with waterproofing compound. The report of the committee was approved for reference to the executive committee. Mr. Forster, of Philadelphia, Mr. Fitzhugh Taylor, of Chicago, and others took part in a brief discussion.

Controlling Equipments for Electric Fire Pumps

In the absence of Mr. Dana Pierce, of New York, chairman of the committee, Mr. William S. Boyd, of Chicago, read the report on controlling equipments for electric fire pumps. Specifications were presented covering controlling equipments for both the manual and the combined manual and automatic types for electric motors driving fire pumps. In the manual type it is provided that the operation shall be such that the motor is directly started by a single lever which, except in auto-starters or compensators, shall be arranged to move in one direction from the initial to the final position. Electrical actuating devices will not be approved with this type. In the combined manual and automatic type the automatic operation shall be initially actuated by an approved pressure governor acting directly on the winding of a solenoid or other device or devices which, in turn, shall close the main contact and a series of rheostatic switches admitting energy to and cutting out starting resistance from the motor circuits.

There was some discussion on this report, in which Messrs. H. O. Lacount of Boston, Fitzhugh Taylor of Chicago, F. J. T. Stewart of New York, J. H. Brumbaugh of Chicago and others took part. In relation to automatic starters it was said the manufacturers are ready to provide these devices. For electric fire pumps something better is required in the way of starters than for commercial pumping equipments. One provision of the report was to the effect that where direct current is used an auxiliary field rheostat must be provided. The word "must" here was taken out and the word "may" substituted. There was some discussion also on the use of fuses in motor circuits, the provision of space on motor-control panels for watt-hour meters, and the temperature inside the cabinet at the end of the test period. Some sections of the report were referred back to the committee, but, with these exceptions, the report was adopted and referred to the executive committee for promulgation.

Signaling Systems

In the absence of Mr. Ralph Sweetland, of Boston, chairman of the committee, Mr. W. S. Boyd, of Chicago, presented a brief report on signaling systems. Some changes were suggested in the provisions relating to municipal fire alarms. The committee was continued.

Electrical Committee Takes No Action on Refillable Fuses

Mr. Boyd also presented the report of the electrical committee, of which Mr. F. E. Cabot, of Boston, is chairman, and Mr. Ralph Sweetland, of the same city, secretary. The report of this committee was short. No changes in the National Electrical Code have been made during the year. A sub-committee on high-potential lines is in conference with other organizations to endeavor to bring about a national standard for this kind of construction. In relation to the interesting subject of fuses the committee said:

"At the meeting held April 1 the subject of refillable fuses was brought up, and after careful consideration it was voted that the committee did not consider it desirable or proper to recommend at this time any action, either favorable or unfavorable, as to changes in code rules regarding the construction of inclosed-type fuses. Other fuse questions also were considered, and the committee decided to recommend a change which will allow inclosed fuses in multiple where the capacity of the circuit is greater than the largest standard inclosed fuse now made."

The question of appeals between inspectors and contractors, which has now become a matter of considerable importance, was considered by the committee, and a standard set of rules for handling such matters was adopted. Consideration was given to the case of the city of Providence, R. I., where 250-500-volt systems are used for both alternating-current and direct-current distribution. It is believed that satisfactory changes in the code can be made to meet the Providence situation.

The committee's report was accepted and referred to the executive committee, and the committee was continued. The members of the committee, in addition to the gentlemen named, are Messrs. W. H. Blood, Jr., Boston; George E. Bruen, New York; J. E. Cole, Boston; Washington Devereux, Philadelphia; J. C. Forsyth, New York; C. M. Goddard, Boston; C. H. Hill, Philadelphia; H. O. Lacount, Boston; C. H. Lum, New York; E. McCleary, Detroit; Farley Osgood, Newark; F. Overbagh, Chicago; A. M. Paddon, Syracuse; Dana Pierce, New York; A. M. Schoen, Atlanta; Martin Schreiber, Newark; R. P. Strong, New Orleans; C. M. Tait, Montreal; V. H. Tousley, Chicago; H. S. Wynkoop, New York.

Election of Officers

Officers were elected as follows: President, Mr. Robert D. Kohn (re-elected), New York; first vice-president, Mr. Charles E. Meek, New York; second vice-president, Mr. Louis Wiederhold, Jr., Philadelphia; secretary and treasurer, Mr. Franklin H. Wentworth (re-elected), Boston; chairman of executive committee, Mr. F. J. T. Stewart (re-elected), New York; new members of executive committee, Dr. S. W. Stratton, Washington, D. C., and Messrs. James White, Ottawa, Ont.; R. P. Miller, New York; C. H. Patton, Cleveland; C. L. Scofield, Montreal; F. M. Drake, Louisville, and C. M. Goddard, Boston.

The nominating committee for next year consists of Messrs. W. E. Mallalieu, New York; D. Everett Waid, New York; C. H. Phinney, Boston; W. H. Merrill, Chicago, and H. L. Phillips, Hartford, Conn.

Testimony on Regulation of Public Utility Holding Companies

A hearing on the holding-company feature of the Newlands interstate trade commission bill was held before the interstate commerce committee of the United States Senate at Washington, D. C., on May 12. Testimony was presented by Messrs. Bernard Flexner, representing the Middle West Utilities Company, of Chicago; Charles K. Beekman, of Beekman, Menken & Griscom, representing the United Gas & Electric Corporation and the American Cities Company, and Stuart G. Gibboney, of Barber, Watson & Gibboney, New York, representing Bertron, Griscom & Company and William P. Bonbright & Company, Inc. The testimony was entirely on the public utility holding company.

Testimony of Mr. Flexner

Mr. Flexner, the first witness, described the position of the Middle West Utilities Company, a Delaware holding company. An office is maintained in Wilmington in order to comply with the law, but the main office of the company is in Chicago. Two aspects of the bill were taken up. One is the prohibition of the holding of stock by another corporation and the other is the provision that all stock issued shall be sold at par. Mr. Flexner cited as an example of a subsidiary company engaged in interstate business the Twin State Gas & Electric Company, which transmits electrical energy across state borders.

In the operations of the holding company various instances have arisen where the communities served desired to permit the consolidation of competing companies. In such cases competition would be destroyed. The absolute purpose in such a consolidation is to rid the community of competitive conditions. In some cases actual consolidation might not be possible owing to the existence of an outstanding stock interest, so that instead of a conveyance there might be substituted the holding-company feature.

Discussing the general subject of state regulation, Mr. Flexner said that it has been recognized uniformly by the commissions that the way to regulate is to avoid competition between utilities of one class in each community. Of the thirty existing state commissions, nineteen or twenty in express terms permit the acquisition of stock of operating companies and the transfer of franchises with the approval of the commissions. Gas and electric lighting companies in the same district are generally recognized as competitive forms of business.

Senator Cummins asked whether the witness thought that the gas and electric business should be controlled by one company.

Mr. Flexner said that there are certain economies in the administration of two properties as one. Where the entire situation is subject to regulation by the state commission there is ample protection for the public interest. Congress might very easily legislate on this subject in such a way that a particular state might feel that it had acted in the interest of a particular community. So far no court of last resort has held that a holding company owning securities is engaged in interstate commerce.

The history of the industry, Mr. Flexner added, shows that the development of the holding company has made it possible to give service to many small communities which would otherwise be without any service. It has been a factor in the social development of the community. It has brought twenty-four-hour service to communities that formerly had service only at night.

Referring to Section 12 of the bill, Mr. Flexner said that, while he was in entire sympathy with what the committee has in mind, it appeared to him that the committee might consider the ways in which the various states have handled the question. These states, instead of tying the hands of their commissions, have provided that securities should be issued on terms subject to their approval. The section in the bill gives no leeway to a commission. It is not always possible to sell stock at par. Although not urging the issue of stock for no consideration, Mr. Flexner urged that power be lodged with the commission to say what price should be required. Generally stock is sold at a discount of 10 to 15 per cent.

Commenting on instances cited by Senators Pomerene and Newlands showing the issue of securities without specific value in the promotion of properties or enlargement for improvements, Mr. Flexner said that undoubtedly there had been serious abuses. In California one company which wanted to issue securities to reimburse its treasury for $1,800,000 spent on additions and betterments was denied permission so to do by the Railroad Commission, which took this method of taking part of the water out of the capitalization. The addition of water to capitalization cannot take place to-day where state commissions have regulatory power.

Argument of Mr. Gibboney

Mr. Gibboney referred to the brief filed with the committee and also to a brief filed with the judiciary committee of the House of Representatives in regard to the bill on the same subject pending before that committee. These briefs are supported by appendices quoting from the utterances of prominent authorities, including Mr. Wilson before his election as President. The briefs are signed by Mr. Gibboney and Barber, Watson & Gibboney, of New York; Mr. Flexner and Mr. Ralph D. Stevenson, of Chicago, and Messrs. H. Alexander Smith, Daniel W. Knowlton and George B. Hatch, of Colorado Springs, Col.

Supporting the argument in the briefs, Mr. Gibboney asked for the insertion of a clause definitely excepting public-utility-holding companies from the operation of the bill. He argued that regulation by state commissions has been effective and has been largely the answer to the demand by the public for municipal ownership and operation. Through the law enacted by New York State in 1907 under the direction of Governor Hughes the entire cry for municipal ownership was allayed.

Under the New York statute competitive lighting companies may be brought together by permission of the commission through a holding company. Texas does not permit such a form of combination. The states are not uniform in their ruling as to whether gas and electric companies are competitive. It would work great harm for the federal government to interfere in this situation.

Over $8,000,000,000 of capital is employed in public utilities, of which $5,500,000,000 is held through holding companies. As an instance of the possible effect of legislation, Mr. Gibboney cited the Appalachian Power Company. This company operates in two states. It reaches the town in which the witness was born and where the lighting company went through financial difficulties from time to time before the property was acquired by the large power corporation. Previously the streets had not been lighted. Now improvements have been made and rates reduced. If Congress enacts legislation on this subject, it will be taking powers from the states that they have developed. The states are in a better position to regulate within their borders than Congress.

Mr. Gibboney declared that a great advantage of holding companies is that they are able to take broken-down plants and develop them with money raised in larger cities or abroad. Over $300,000,000 of holding-company securities were sold in Europe last year. With such capital the holding companies improve service and reduce rates of operating companies. They average the risk of the small investor. It is found that investors will not buy securities of plants situated in small towns, while they will buy securities of holding companies controlling many small plants.

Continuing, Mr. Gibboney declared that in his judgment the United States Supreme Court would hold that practically all public-utility-holding companies are engaged in interstate commerce. He has figured that about 20 per cent of the holding companies have properties that are actually engaged in commerce between the states. An Idaho company is conducting operations in three states. Mr. Gibboney suggested that the following exception be added at the conclusion of Section 13 of the bill:

"These sections shall not apply to corporations acquiring or holding the stock of, or engaged in the business of conducting, a public utility which is subject to state regulation, other than common carriers as defined in the act to regulate commerce, approved Feb. 4, 1887, and the amendments thereto."

Mr. Beekman on Two Holding Companies

Mr. Beekman explained the scope of operation of the American Cities Company and the United Gas & Electric Corporation and said that these two companies are typical of all others. They are essentially investing companies. They are not controlled by a large moneyed interest, but their ownership is scattered through the holding of their securities in small lots throughout the country and in Europe. Such companies are not controlled by cliques of bankers but banking houses advise and assist in their operations.

In the last few years the United Gas & Electric Corporation has acquired various properties in the West that had not been able to set aside replacement funds. They were living on their capital and were getting in worse condition. The holding company puts the operating plant in good physical and financial condition and introduces proper accounting so that it stops living on principal. Mr. Beekman explained the financing of holding companies and their subsidiaries. The object is to get the money as cheaply as possible. Various methods are adopted to raise capital either through direct sale of securities of the subsidiary or their deposit as collateral security for the securities of the holding company. For instance, the New Orleans Railway & Light Company, a subsidiary, had to spend a large amount of money for improvements required by the city. The holding company guaranteed the notes, and these obligations were sold partly in this country but largely abroad. In 1913, in order to meet absolute capital requirements, the subsidiary companies of the American Cities Company and of the United Gas & Electric Corporation had to issue $14,000,000 of securities. These were to provide for the actual necessities of enlargement due to the development of the business. The financiers made scarcely anything out of the transaction. It will be found, said Mr. Beekman, that small profits, if any, have been made by public-utility-holding companies in the financing of the concerns subsidiary to them.

Mr. Beekman, continuing, said that the price of gas and of electrical energy has gone down steadily. Street-railway rates have not gone down, but the service has been extended. The rate of fare is so low on street railways now that it cannot be reduced further. Replying to a question as to the low-fare cities in Ohio, Mr. Beekman said that the operating officials in his organization feel that a day of reckoning for those properties is coming. Some of the combined operating companies furnishing different classes of utility service are losing on the street-railway business but gaining in the electric and gas departments. The street railways have to meet the labor problem and are unable to raise fares in order to overcome the effect of higher wages. Reliance has to be placed on the combination of the different classes of service.

In referring to different experiences with plants in small cities, Mr. Beekman said that local people start properties with the idea that they can make money. After disappointment they refuse to invest more capital. The additional capital then has to be secured outside. The holding company can guarantee the securities of the subsidiary company which has not good credit and raise capital in that way. The holding company makes its profit from the increase in the value of the equities represented by the stock.

So far as the actual operating companies are concerned, they are controlled by state statutes and commissions. The holding company has to go to the public in order to finance itself. The public has to pay a return on the securities of the local company, and it is the function of the holding company to find means of providing the necessary large amounts of capital. It is not so important that the holding company should be held to accountability. Companies have been accustomed for years to sell bonds at a discount without criticism, but it is held to be a crime to sell stock at a discount.

Securities of holding companies are sold to European investors who do not speculate but buy with the prospect of an enhancement in value. That process draws great amounts of capital to this country without placing any burden on the public. The cost of financing would be greater without the holding company. The local companies have poor credit and are unable to discount bills. Holding companies buy in enormous quantities at prices from 10 per cent to 15 per cent less than small local companies secure. They get the benefit of trade discounts. In addition, they are able to borrow money at lower rates. There is a serious danger in the bill as it stands.

Cost of Money for California Utilities

Some interesting testimony on the cost of money to California public utilities is found in the affidavit made by A. F. Hockenbeamer on March 2, 1914, in the case of the Pacific Gas & Electric Company vs. the City and County of San Francisco in the United States District Court for the Northern District of California, Second Division. Mr. Hockenbeamer has been connected with the Pacific Gas & Electric Company since Feb. 1, 1908, as comptroller, treasurer and vice-president, and previous to that time for three years was connected with N. W. Halsey & Company, bankers, New York.

Mr. Hockenbeamer says that the company is compelled under the law of the State to render satisfactory and adequate service and to extend its facilities to all residents within its territory who may be within 100 ft. of its main or distribution lines. The penalty for neglecting to do this within ten days after an application for service is $50, and $5 per day thereafter. The possible aggregate of such damages can be understood from the fact that during the calendar year 1913 the company connected 15,350 new customers to its distribution system within the city and county of San Francisco, and 28,452 to its entire distribution system. The capital expenditures required for such connections were, of course, not limited to the cost of connections and meters, but the company from time to time was obliged to enlarge its entire plant. Other capital expenditures become necessary when the company is required by law to change the location of its street lines and various supply systems or to make other improvements. For various purposes the company has been obliged to spend during the past eight years more than $54,000,000 for capital purposes, and as a matter of self-preservation it must keep its system modern and efficient. For some years to come it will probably have to find between $5,000,000 and $10,000,000 new capital. It must also, according to the terms of its mortgages, secure money for its sinking fund payments to the extent at present of approximately $800,000 a year and later of $1,813,000 a year.

Mr. Hockenbeamer summarizes the statements in his affidavit as follows:

"1. That the law compels constant expansion of plaintiff's facilities and corresponding increase in its investment.

"2. That plaintiff must raise from $5,000,000 to $10,000,000 of new capital per annum for new construction, and additional large sums for the payment of maturing obligations and other purposes.

"3. That market quotations on bonds do not measure the cost to utilities of borrowed capital.

"4. That plaintiff's stockholders are entitled to a greater return on the value of their property than the mere cost to them of borrowed capital.

"5. That it has cost plaintiff from 6.1 per cent to 10.75 per cent per annum to borrow money on secured obligations, exclusive of necessary expenses.

"6. That in twenty-one months the Railroad Commission of California authorized the issuance and sale of more than $37,000,000 of secured obligations of California gas and electric corporations at prices making the cost to these utilities of the money so borrowed from 6 per cent to 10.75 per cent per annum.

"7. That plaintiff must obtain a large proportion of its new capital from stockholders.

"8. That the best price at which plaintiff was able to sell $3,000,000 of its stock was on an 8.6 per cent basis of a yield.

"9. That the Railroad Commission of California has authorized various gas and electric utilities to sell an aggregate of $3,327,500 par value of preferred stock on a basis of yield of 7.5 per cent, and $3,000,000 of common stock on a basis of yield of 7.74 per cent.

"10. That there must be a substantial margin of earnings in excess of interest and dividend requirements to make stocks and bonds salable and to provide for other necessary charges against net earnings.

"11. That the utilities of California must offer their stocks and bonds in competition with thousands of other investment securities and must make them to conform to the standards of safety demanded by investors.

"12. That California utilities cannot raise the required new capital in the home market owing to other demands and to the many other profitable avenues of investment open to such home capital.

"13. That capital in large amounts is safely employed in the business of banking under the national bank act at an average annual profit in excess of 9 per cent.

"14. That, owing to severe competition, capital employed in the electric light and power business in San Francisco is exposed to unusual hazard and uncertainty of return."

In his conclusions Mr. Hockenbeamer expresses the opinion that unless his company is able, and is permitted, to derive net profits from the operation of its business equivalent to at least 8½ per cent per annum upon the money invested or to be invested in its enterprise, it will be unable to obtain the additional capital necessary to carry on its business.

He is also of opinion that the capital employed by the company could not be persuaded to embark in its enterprise without the reasonable assurance of a return of at least 10 per cent per annum.

Arguments Against Municipalization of Washington Street Railways

Mr. Clarence P. King, president of the Washington Railway & Electric Company, and Mr. Thomas N. McCarter, president of the Public Service Corporation of New Jersey, testified before the District committee of the House of Representatives at Washington, D. C., on May 13, in regard to a bill introduced by Congressman Crosser, of Cleveland, providing for municipal ownership of the street railways in the District of Columbia.

Mr. King declared that the companies in the district operate directly under an act of Congress and that they have been developed under the authority of that body. Congress directed that horse-cars be abolished. The company experimented with cable, compressed-air and storage batteries before it finally introduced the underground-conduit system by which it is now operated. The present Washington Railway & Electric Company succeeded a former company which was unable to operate the street railways profitably and underwent reorganization.

Mr. King contended that in ordering the change in method of construction Congress gave practically a contract and franchise without limit. In any valuation of the property the history of the company from horsecar days would have to be taken into consideration.

Mr. McCarter, in introducing his discussion of the subject, said that he did not own a share of stock or any financial interest in either of the companies in the District. Although a lawyer by profession, he has been exclusively occupied for the last eleven years as president of the Public Service Corporation of New Jersey. He appeared before the committee because he conceived it to be his duty to give his views and utter a word of warning in regard to what he considered the dangerous experiment the members of the committee were considering.

Mr. McCarter said he would frankly state that his expert knowledge came from his connection with the company for the last eleven years and his practice at the bar for ten years previous, when his time was given largely to the representation of companies of the same character. Over and above that, however, Mr. McCarter declared that he was an American, that he thought he was a good citizen and that he has the welfare of his country at heart. Of course, the views of men are likely to be biased by their life activities, but he resented the idea that a public utility official could not be interested in the public welfare of his country.

Mr. McCarter's first thought regarding the situation is that the whole scheme of municipal ownership is un-American. It is not suited to the form of government devised by our forefathers and handed down for generations. It would mean bureaucracy galore. It would mean that the government would take on an enormous army of men and ultimate operation of the country by the government through this enormous army. The subsidiary companies of the Public Service Corporation of New Jersey have 12,000 employees and serve 2,000,000 of the 2,500,000 people in New Jersey. If the same proportion held good throughout the country, there would have to be added to existing government and municipal employees from 600,000 to 750,000 men.

A member of the committee said that the federal government now employs 471,000 people.

The law is, Mr. McCarter said, that there is a limitation on the power of the Legislature to alter or repeal a franchise even though the franchise contains a reservation of the right to alter, amend or repeal. The right to revoke the charter of a company might exist, but the franchise could be sold by the company or a receiver. If the legislating body failed to fix a definite time for duration of the contract it created, in the opinion of Mr. McCarter, a perpetual franchise. The public can protect itself through the rate-making power or by condemnation of the property. In the latter case, if the capitalization is not taken into account in the determination of the value, the only test is the fair value of the property devoted to the public use.

New Oldfield Bill on Patents

A bill designed to take the place of the original Oldfield patent bill has been introduced in the House of Representatives by Congressman William A. Oldfield, of Arkansas. It is a material change from the original bill and represents the result of the careful study which has been given to the subject since the introduction of the earlier measure. The bill, which was referred to the committee on patents, of which Representative Oldfield is chairman, is entitled "A bill to revise and amend the laws relating to patents." It provides that Section 4884 of the Revised Statutes shall be amended to read as follows:

"Every patent shall contain a short title or description of the invention or discovery correctly indicating its nature and design, and shall have annexed thereto and made a part thereof a copy of the specifications, claims and drawings of the application therefor, to which it shall refer for the particulars of the invention or discovery, and contain a grant to the patentee, his heirs or assigns, of the exclusive right to make, use and vend the invention or discovery throughout the United States and all territories and possessions under the jurisdiction thereof for the term of seventeen years. But every patent granted for an invention shall be so limited as to expire nineteen years from the date of the filing in this country of the application upon which the patent was granted, exclusive of the time actually consumed by the Patent Office or the courts in considering the application and, where the application has been involved in interference, of the actual time in which it has been so involved; and in no case shall the patent be in force more than seventeen years."

Section 4899 of the Revised Statutes would be amended to read as follows:

"Every person who purchases of the inventor or discoverer or, with his knowledge and consent, constructs any newly invented or discovered machine or other patented article prior to the application by the inventor or discoverer for a patent, or who sells or uses one so constructed, shall have the right to use, and vend to others to be used, the specific thing so made or purchased, without liability therefor. No person selling or otherwise disposing of any article manufactured under a patent shall have any greater right to prescribe, either by contract or otherwise, conditions limiting its subsequent disposition or use than if the article were not manufactured under a patent. No purchaser, lessee or licensee of a patented article shall be liable to an action for infringement of the patent because of any breach of the contract of sale, lease or license, or of any provision thereof. No person who obtains a license to use any patented art or process, or to make, use and sell any patented article, shall be liable to an action for infringement of the patent because of a breach of such license or of any provision thereof."

To the court of the district where the owner of a patent or of any interest therein is an inhabitant or may be found jurisdiction is given to compel the granting of a license under such patent under the circumstances hereinafter set forth.

The person applying for the license shall file a bill in equity setting forth briefly the facts and circumstances, and the court shall thereupon hear the person applying for the license and the owner of the patent. If the applicant shall prove to the satisfaction of the court that the patented invention is being withheld or suppressed by the owner of the patent, or those claiming under him, for the purpose or with the result of preventing any other person from using the patented process, or making, using and selling the patented article in the United States in competition with another article or process, patented or unpatented, used, or made, used and sold, in the United States by the owner of the patent or those claiming under him or authorized by him, and also prove that the application for the patent was filed in this country more than three years prior to the filing of the bill in equity, the court shall order the owner of the patent to grant a license to the applicant in such form and upon such terms as to duration of license, amount of royalty, security for payment thereof and otherwise as the court, having regard to the nature of the invention and the circumstances of the case deems just. It is provided, however, that nothing shall be construed to authorize the court to compel the granting of a license by the original inventor who has not obligated himself or empowered another person to suppress or withhold the invention.

From the order of the district court granting or refusing such license appeal may be taken by the party aggrieved to the circuit court of appeals in the same manner and form as in other cases arising under the patent laws. The provisions of this section, however, shall not apply to any patent granted prior to the passage of this act.

The bill provides further that every applicant for a patent or for the reissue of a patent, and every owner of a patent or of any interest therein, who is not domiciled within the United States shall within three months next after the filing of his application or of the acquirement of his interest in the patent, or after the passage of this act, designate by a notice in writing filed in the Patent Office some person residing in the United States upon whom process or notice of proceedings brought under the provisions of this act or other laws of the United States may be served with the same force and effect as served upon the person of applicant or of the owner of the patent. No such owner of a patent or of any interest therein shall be entitled to institute an action of infringement until after compliance with this section or to recover damages for infringing acts prior to compliance therewith.

In the act, unless the context otherwise requires, "person" shall include firms, corporations or association existing under the laws of the United States, any territory or possession, any state or any foreign country. "Patent" means patent granted by the United States, whether for an art or process or article, machine, manufacture or composition of matter. "Patented article" includes patented machine, manufacture or composition of matter.

The bill says the act shall take effect Jan. 1, 1915.

A preliminary meeting of the committee on patents was called for May 13, when it was proposed to arrange for a series of hearings on the bill. On account of the absence of several members of the committee, however, the meeting was postponed.

Legal Aspects of Regulation

Mr. Charles F. Mathewson, of New York, made an address on "Some Legal Aspects of the Regulation of Public Service Corporations" before the Finance Forum of the West Side Branch of the Young Men's Christian Association, New York, on May 11. In introducing his subject Mr. Mathewson spoke of the importance of regulation to corporations and consumers. He added that the most essential consideration to customers is efficiency of service, and any mistaken theory or imposition which compels a public service corporation to sacrifice efficiency to lower rates is, and will sooner or later be recognized to be, a greater misfortune to the public than to the corporation.

Rate-making is, of all manifestations, Mr. Mathewson declared, the most serious and common aspect to public service corporations of the special regulatory power of the state. If a legislative act fixing rates is passed in the usual manner, it is possible that it does justice, but if it does so, it is usually due to Providence only; and such legislation, where a commission is in existence, is vicious to the last degree in principle and usually in result.

On the other hand, a commission, said Mr. Mathewson, may proceed at leisure. It has opportunity for complete examination of all essential facts. Its members are in office for a term of substantial length, so that they should be more independent of popular disfavor or popular acclaim than are legislatures.

The first matter to be considered is the value of the property employed. It has taken many years and multitudes of decisions to determine what elements of property shall be included in the total valuation, the basis upon which they shall be valued, and the amount (if any) which shall be deducted therefrom for depreciation to reach the ultimate base upon which the return is computed. So, too, what constitutes a fair rate of return has been the subject of innumerable decisions, and even now no uniform rate has been or can be settled upon as applicable to every case. It is necessary further to distinguish between a rate of return which may be barely non-confiscatory and therefore constitutional and a rate of return which is commercially just and fair.

Ascertainment of the reproductive value of the physical property involves elements of information and judgment which require engineering skill of high degree. It is said that the physical valuation of the railways of the United States recently authorized by Congress will cover five years and cost $10,000,000. Mr. Mathewson expressed the view that it will cover twice that period and cost more than twice that sum to the national government alone, to say nothing of the incidental cost to the railways, and that after the valuation is completed it will then be so far behind the times that it will in hardly any case represent the full value or present value of the property, and in the case of most railways it will never be of any value at all except statistically.

Mr. Mathewson then outlined the different items and allowances included in a physical valuation. The intangible property may be, and often is, divided into two classes—cost of "organization and development" and cost of "going" or "going concern" value. It is not surprising that the development and organization work may represent a cost equal to 20 per cent or more of the entire cost of the physical property itself.

In commenting on the recent decision of the Court of Appeals of New York in the Kings County Lighting Company case the speaker disagreed with the expressions of the justice who wrote the opinion. The opinion defined "going value" for "rate purposes" as "the amount equal to the deficiency of net earnings below a fair return on the actual investment" due to the expenditures reasonably incurred in the development of the business and property of the company, in addition to the value of the physical property. Mr. Mathewson believed it to be the sound doctrine that such expenditure represents the value of the "going-concern" development whether there is a deficiency in net earnings by reason of such expenditure or not. The language of the justice, literally read, would indicate that there could be no "going concern" value in the case of a corporation which earned a fair return on the investment from the beginning; and while the discussion may be academic because there is rarely found such a corporation, yet his proposition as quoted is believed to be unsound.

Mr. Mathewson also touched on franchise value. Quoting various rates of return, the speaker declared his belief that it follows that even in the city of New York 8 per cent is not more than a fair return for public service corporations; and in Connecticut, New Jersey, Wisconsin and other states similar views have been expressed respecting corporations there operating.

Whether "accrued depreciation," so called, should be deducted from the cost of reproduction of the company's property, and a return allowed only on the balance of the investment, was discussed by the speaker. "Accrued depreciation" as used does not mean deterioration, which should already have been made good by repairs or replacements; it means or represents expired life of apparatus still operating as efficiently as when new. Thus a gas retort half of whose estimated period of life has expired is producing just as much gas at just as low a cost as when it was installed; but it is claimed by some authorities, including the New York Public Service Commission, First District, that such retort should nevertheless be included in the valuation of the company's property in a rate case at only 50 per cent of its cost value.

This theory was recently accepted by the Appellate Division of the Supreme Court in New York State in the Kings County Lighting case. It has never been passed upon by the Court of Appeals; it is in direct conflict with what Mr. Mathewson understood to be the holdings of commissions in other states, such as Connecticut, New Jersey and Wisconsin, and he believed that it is thoroughly unsound and will ultimately be so held in all courts. It has not been adopted by the Public Service Commission of the Second District, but is wholly contrary to the views of the engineer of the Public Service Commission of that district as expressed by him in the Westchester Lighting Company case, and also to the views of the engineer of the Public Service Commission of the First District, who acted for it in the Kings County Lighting case, as expressed by him to Mr. Mathewson.

It is true that the Supreme Court of the United States, and some other courts following it, have expressed in general terms the view that some depreciation is deductible in a rate case; but it is fair to say that the subject never has been fully or adequately presented in the Supreme Court, and that that court has never declared that "theoretical depreciation" should be deducted, representing merely expired life of still efficient apparatus, where it is a question merely of rates for service between a company and consumers. The motto should be "100 per cent of efficiency and 100 per cent of return." Nothing else is or ought to be satisfactory either to the company or to consumers.

In conclusion, the speaker said that if allowances for doubt are to be made, it is far better for the community (to say nothing of the corporation) to err on the side of liberality than in the other direction.

Public Service Commission News

California Commission

The Railroad Commission of California and representatives of large gas and electric companies have joined in an application to the State Supreme Court for a rehearing of the case in which the commission denied permission to the Oro Electric Corporation to compete in Stockton with the Western States Gas & Electric Company. The petition for a rehearing says in part: "We take the position that if rates are to be cut down by the commission and regulation carried to the point of fixing a certain rate of revenue, then the regulated companies must be protected in their fields from competition. Competition and regulation do not go together. Either competition must be allowed to take its course in determining rates or, if rates are to be fixed by regulation, then the power that regulates must protect from competition. If competition is allowed, there should be no regulation, and if regulation is enforced then competition should be restricted. This is an important economic principle.

"It has been said that the California Railroad Commission has taken advanced ground in seeking to protect regulated companies from unnecessary competition, but as a matter of fact the older commissions in New York, New Jersey and other states have taken much more pronounced positions in this regard, and they have been followed by the newer commissions of Idaho, Montana and Arizona."

New York Commissions

The Department of Efficiency and Economy of New York State has started an investigation of the Public Service Commission, Second District. It is stated that the investigation arises from the fact that the commission has not reopened hearings in the case of the Canadian-American Power Corporation, which was authorized to place a capital value on a contract for power with one of the Niagara Falls companies. Complaints against the commission were lodged with the Department of Efficiency and Economy. Chairman Van Santvoord made a statement saying that the failure of the commission to act on the complaint is due to the fact that three of the members, including himself, took office after the approval of the application of the company and that time had not been allowed for the new members to become familiar with the case.

"If I could seriously believe," Mr. Van Santvoord said, "that the statement intends to convey the idea that an investigation of the commission had been undertaken and would be pressed because the commission declined to comply with the demands of the Department of Efficiency and Economy to investigate certain complaints or to decide a pending application, I would quite as seriously suggest that such action or threat might properly be taken before a grand jury."

Indiana Commission

Governor Ralston of Indiana seems determined that the Public Service Commission or some part of it—probably three members—shall continue to serve as an arbitration board to mediate between the Indianapolis Traction & Terminal Company and its employees. The commission struggled through three months of hearings on the original strike situation and handed down an award in which an arbitration board, to be appointed by judges of certain courts in Indianapolis, was to mediate during the three years of the strike settlement agreement.

The judges of the courts declined to serve as the appointive power for the arbitration board, because appeals from that board might reach their courts. Since that declination labor troubles have been threatening again. Throughout practically every step of the mediation attempts since the decision was handed down, one side or the other has suggested that the commission serve as the new arbitration board. Many of the employees are opposed to such service by the commission, and already several questions under the award of the commission have directly conflicted with duties of the commission under the act of the Legislature creating the body. Regardless of this fact, the latest move toward a settlement of the labor difficulty—entered into by the Governor and Mr. A. L. Faulkner, of the United States Bureau of Labor—provides that three members of the commission, Messrs. Thomas Duncan, Charles A. Edwards and John F. McClure, shall serve as the special arbitration board.

Missouri Commission

The first annual report of the Missouri Public Service Commission has been issued. It covers the period of eight and one-half months ended Dec. 31, 1913. The report says that an appraisal of the property of the Kirksville Light, Power & Ice Company has been completed. Preparations are being made for the appraisal of the properties of four steam railroads, one electric railway, two electric utilities and two telephone utilities.

In reference to the department of statistics and accounts, the report said in part: "Appreciation of capital cannot be recognized as an offset for depreciation. Appreciation should not be considered under any circumstances unless actual sale has been made and there is a real profit, in which case it can rightly be classed only as a profit on sale of capital. If, however, there has been a transfer for a more expensive property, the appreciated value of the new property may be taken into account as a capital surplus item."

The gas, electric, heat and water department has been engaged for some time in forming a tentative set of rules and regulations applicable to gas, electric and water service within the State. These rules will involve ultimately considerable addition to the working force of the department as well as the establishment of a laboratory equipped with suitable facilities and standards for the various tests which will be conducted. It is probable that the public service commission law will be changed so that meters will be tested by the commission only on request of the consumer for a reasonable fee or on its own volition where that is deemed desirable. It is probable that arrangements may be made with the State University at Columbia to do all of the testing for the commission in connection with standards of service until the commission is able to establish a suitable laboratory of its own at Jefferson City.

The report refers to the clause in the law stating that no electric meters shall be put into service the type of which has not been approved by the commission. Commenting on this clause, the report says that it is questionable whether the advantage gained by the consumer of electric energy will compensate for the extra expense devolving on the commission through the enforcement of this regulation. At any rate all meters will be tested before installation and will be subjected to periodic tests thereafter. Individual meters or a number of a certain type of meters whose test record shows a marked tendency to vary in accuracy of measurement, regardless of the ordinary adjustment or repairs, will subject that particular meter or type to permanent rejection. A systematic inspection will be made of all the gas, electric, heating and water plants at as early a date as possible, together with the transmission and distribution systems in connection therewith.

Current News Notes

Forest Products Exposition.—At the Forest Products Exposition to be held at the Grand Central Palace, New York, from May 21 to 30 there will be exhibited by the Northern White Cedar Association some telephone poles of Northern white cedar that have been in actual service for fifty years, ties used for twenty-nine years and some fine quality posts. The Northern White Cedar Association was formerly the Northwestern Cedarmen's Association. The name was recently changed in order to correspond with the name given by the United States Forest Service to the cedar timber growing in the States of Michigan, Wisconsin and Minnesota, from which the products of the members of the association are manufactured. Mr. N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn., is secretary of the association.

* * *

Outside Engineer to Report on Affairs of Sanitary District of Chicago.—Following the dispute among the trustees of the Sanitary District of Chicago and some of the aldermen of the city in relation to the cost of producing the hydroelectric energy supplied by the Sanitary District for Chicago street lighting, the Board of Trustees of the Sanitary District, after a recent stormy debate, adopted a resolution recommending the employment of Mr. Gardner S. Williams, a consulting engineer, of Ann Arbor, Mich., to investigate all facts and questions arising in connection with the cost and operation of the Sanitary District's hydroelectric plant and electrical development, together with recommendations relating to the sale to the best advantage of the energy generated. The total cost of the investigation is not to exceed $100 a day.

* * *

St. Joseph Electric-Service Company Gives City a "Slogan" Sign.—On April 17 the St. Joseph (Mo.) Railway, Light, Heat & Power Company, one of the Doherty properties, presented to the city a large and handsome "slogan" electric sign. This sign is placed on the twelve-story Corby-Forsee Building and bears the legend "St. Joseph, the City Worth While." Before the exercises marking the presentation of the sign to the city there was a night parade. The streets were illuminated by festoons of red, white and blue lamps, and a temporary trolley wire stretched over the line of march was utilized to supply electricity to the floats. Every float entered was decorated with electric lamps, some being embellished with as many as 300 or 400. In addition to the floats nearly every electric pleasure automobile in St. Joseph was in the parade. These cars were decorated with miniature lamps and flowers.

* * *

Examination for Expert Radio Aid.—An examination for expert radio aid is announced by the United States Civil Service Commission for June 17, 1914. From the register of eligibles certification will be made to fill a vacancy in the Navy Yard, New York, at $6 per day. The duties of the appointee to this position will be to direct and assist in the laboratory standardization tests of all circuits, instruments and apparatus relating to radio-signaling and in the development of special apparatus and methods of radio-signaling suited to special conditions and of new forms of sending and receiving circuits, to inspect the various radio stations, and to carry out such work as may be necessary for the development of radio apparatus. Those interested in taking this examination should write to the United States Civil Service Commission, Washington, D. C., and ask for Form 1312, stating the name of this examination.

SOCIETY MEETINGS

Governor Cox Now a Jovian.—At the rejuvenation of the Jovian Order in Dayton, Ohio, on May 9, a class of thirty-eight candidates was initiated under the direction of Statesman Thomas F. Kelly. Among the newly made Jovians were Governor James M. Cox of Ohio and City Manager H. M. Waite of Dayton.

* * *

Cleveland Rejuvenation.—Elaborate preparations are under way for the rejuvenation and joviation of the Jovian Order to be held in Cleveland on May 26 during the Cleveland Electrical Exposition. The Cleveland Electrical League, Jovian Chapter, has invited the Jovian leagues of a number of other cities to be represented, and a large gathering is anticipated.

* * *

Detroit-Ann Arbor Section, A. I. E. E.—At a meeting of the Detroit-Ann Arbor Section of the A. I. E. E. on May 8 at Ann Arbor, Mich., Mr. H. L. Wallau, electrical engineer of the Cleveland Electric Illuminating Company, Cleveland, Ohio, read a paper on "Factors Entering Into the Cost of a Kilowatt-Hour." The general discussion was led by Mr. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, Chicago. Prof. H. H. Higbee, of the electrical engineering department of the University of Michigan, was in charge of the arrangements for this meeting.

* * *

Chicago Rejuvenation.—A successful rejuvenation and joviation of the Jovian Order was held in Chicago on May 11 under the direction of Statesman Homer E. Niesz. Seventy candidates were initiated, the total attendance being about 250. Brief speeches were made by Mr. W. W. Winship, of Philadelphia, statesman-at-large; Mr. Leonard Fitzgerald, of Gary, Ind., statesman, and others. The initiation is said to have been the most impressive ever held in Chicago, the work of the degree team and the scenery and lighting effects being especially good. The degree team was made up as follows: Jupiter, Roy E. Schaulin; Neptune, W. E. Finlay; Pluto, George C. Richards; Vulcan, O. J. Kaberna; Mars, John Foster; Hercules, O. H. Johnson; Mercury, Walter Bischoff; Apollo, R. M. Prior; Avrenim, A. J. Selzer.

* * *

Dallas Electric Club.—At some of the recent weekly luncheons of the Dallas (Tex.) Electric Club, which meets each Friday noon at the Oriental Hotel, Dallas, the attendance has been seventy-five and more. A number of prominent laymen have addressed the club, a recent speaker being Mr. Royal A. Harris, president of the American Exchange National Bank, who talked on the federal reserve act as it applies to the establishment of a reserve center at Dallas. The Dallas Electric Club is a comparatively new organization and has as its officers Mr. W. J. Drury, Western Electric Company, president; Mr. F. R. Slater, Texas Power & Light Company, vice-president; Mr. Charles W. Davis, Westinghouse Electric & Manufacturing Company, vice-president; Mr. E. S. Marshall, Dallas Electric Light & Power Company, vice-president, and Mr. H. S. Cooper, Southwestern Gas & Electrical Association, secretary and treasurer. Mr. R. D. Cummings, Western Electric Company, is chairman of the entertainment committee; Mr. L. V. Nogueira, Electric Appliance Company, heads the entertainment committee; Mr. Hartwell Jalonick, Texas Power & Light Company, is chairman of the educational committee, and Mr. F. L. Booth, Texas Power & Light Company, is chairman of the commercial committee. The club has 150 members.

Unmarketable Coal Used for Generating Electricity—II

Switch and bus layout of the Lehigh Navigation Electric Company's station at Hauto, Pa.—Use of 110,000-volt reactance-type switches—Features of the transmission-line construction

THE equipment of the Hauto station is arranged on the unit system; that is, one generator, one set of transformers and one outgoing feeder line are normally to be operated as a unit. Power is generated at 11,000 volts, twenty-five cycles, by three 12,500-kw General Electric turbo-generators. Three sets of General Electric transformers, one for each generator, step the voltage up from 11,000 volts to 110,000 volts. The energy from each machine is fed through reactors in the basement to generator buses from which two circuits tap off—one feeding its individual transformer set and the other energizing an 11,000-volt loop bus. From the 110,000-volt side of the transformers circuits lead to transformer buses feeding outgoing lines and the main 110,000-volt bus, which will be connected in a loop the same as the lower-voltage bus when more units are added. The 11,000-volt bus also feeds two auxiliary buses supplying energy to 11,000-volt transmission circuits in the station and adjacent territory. The ultimate plan contemplates one 110,000-volt outgoing feeder for each set of transformers, but in the present installation there are only two. A 110,000-volt transfer bus is arranged so that any outgoing feeder may be connected to any set of transformers, or two or more feeders may be connected in multiple to one or more sets of transformers.

The generators are connected in multiple by means of the 11,000-volt ring bus equipped with sectionalizing switches. Two auxiliary 11,000-volt buses are provided for supplying energy to auxiliary motor circuits in the power house and in the mines, breakers and washeries of the Lehigh Coal & Navigation Company.

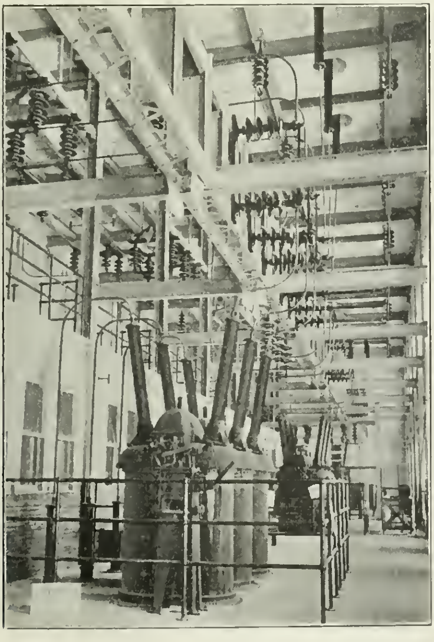


FIG. 11—HIGH-TENSION-EQUIPMENT OIL SWITCHES

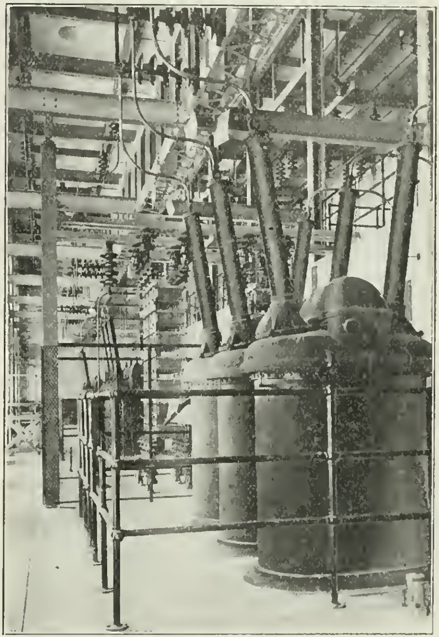


FIG. 12—110,000-VOLT REACTANCE-TYPE OIL SWITCHES AND NEUTRAL RESISTANCE TO GROUND

Along the north side of the engine room are three galleries containing the transformer and switching outfit. On the first floor, which is divided into two compartments by a fireproof partition, are the generator field rheostats, the low-tension buses and the transformers. On the floor above are the 11,000-volt buses and switches, the 110,000-volt oil-switches and the neutral ground resistor. The 11,000-volt outgoing circuits leave the building at the second-gallery floor level. Above the space containing the 11,000-volt switches is a compartment which will be devoted to high-tension bus-sectionalizing switches when the generating equipment is increased. On the same floor above the high-tension oil switches is the 110,000-volt bus structure. The outgoing high-tension circuits pass through roof bushings to choke coils suspended from insulators on a structural-steel framework on the roof.

All high-tension conductors are made of brass tubing, which is supported on porcelain insulators at least 3 ft. away from every part of the building except at points where it passes through the floors and roof. At

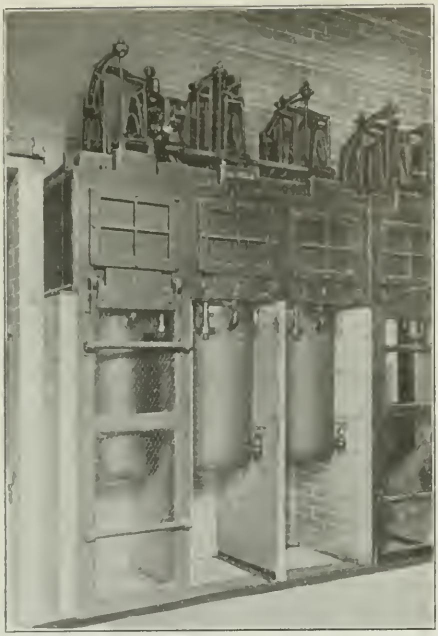


FIG. 13—22,000-VOLT REACTANCE-TYPE SWITCHES

these points the conductors are inclosed in special bushings.

The generators have 6 per cent internal reactance, which together with that in the leads limits the short-circuit current to ten times the normal value. No bus-tie or feeder reactors are employed in the station. One of the features of the installation is the use of 110,000-volt oil switches containing reactance to limit the current surges due to switching. Similarly equipped switches are also employed in the 11,000-volt circuits. All of the oil switches, with the exception of those connecting the generators with the main 11,000-volt bus, are of the automatic type. The reactor-type switches are used in the generator leads, on both sides of the transformers and between the 11,000-volt bus and the auxiliary buses.

The 110,000-volt reactor-type oil switches have an outward appearance similar to an ordinary single-phase high-tension switch, but their internal construction and operating mechanism are different. Each casing contains a main and an auxiliary switch, the latter being connected in series with a reactor across the main switch. The auxiliary switch closes before the main switch does, allowing the current to rise gradually through the reactor. On opening the switch the main contacts separate first and the reactor reduces the current enough to leave little possibility of a line surge when auxiliary contact opens. The contact rods are mechanically connected by an ingenious arrangement of levers and gears which allows a definite interval of time to elapse between the operation of the two switches. The three units composing one of the three-phase switching outfits are operated by one motor, which is geared to a shaft extending along the back of the oil switches. All of the contact rods, therefore, move simultaneously, and there is no possibility of one unit operating and not the other. The reactor is supported in the top of the case. The 11,000-volt switches operate on the same principle, but the reactor coil is immersed in oil.

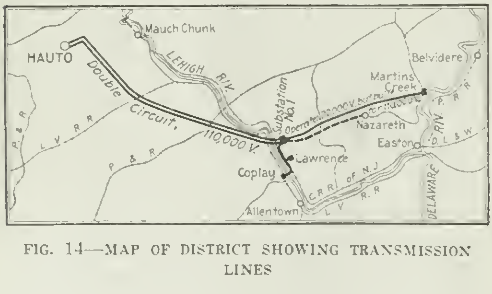


FIG. 14—MAP OF DISTRICT SHOWING TRANSMISSION LINES

The main 110,000-volt bus, which is a loop, is provided with sectionalizing switches which permit of operating all of the generators in parallel or separately, as each machine has its own bank of transformers and feeders.

Transformers

A bank of three 3350-kva oil-insulated water-cooled transformers is provided for each of the generators, to step the voltage up to 110,000 volts. An extra unit is installed to serve as a spare. The primary windings are connected in delta and the secondaries in star, while the high-tension neutral of each bank is connected through an electrically operated switch to a common neutral bus which is grounded through a resistor of 127 ohms resistance. The neutral of one of the banks of transformers being grounded, all except one of the transformer neutral switches are kept open by interlocking the neutral switches. The transformers are installed in fireproof compartments and are separated by walls of similar material from the low-tension busbars on the same floor.

Along the outside wall of the transformer compartment is a transfer-table track on which cars can be

FIG. 15—SUBSTATION LINES AND LIGHTNING ARRESTERS

operated to facilitate the removal and installation of transformers.

Other Equipment in the Station

Three exciters are installed in the station. Two of them are 300-kw turbo-generator units developing 250 volts each, while the third is a 250-kw motor-generator set driven from 550-volt transformers. All the exciters are equipped with slip rings, which permit of connecting a neutral for three-wire emergency lighting. Energy for testing, lighting and driving the boiler-blower motors and the motor-generator exciter is supplied from two auxiliary buses which are energized by transformers connected to the 11,000-volt bus through automatic oil switches. A special motor-generator set is also installed to charge the 125-volt storage battery operating the switching apparatus.

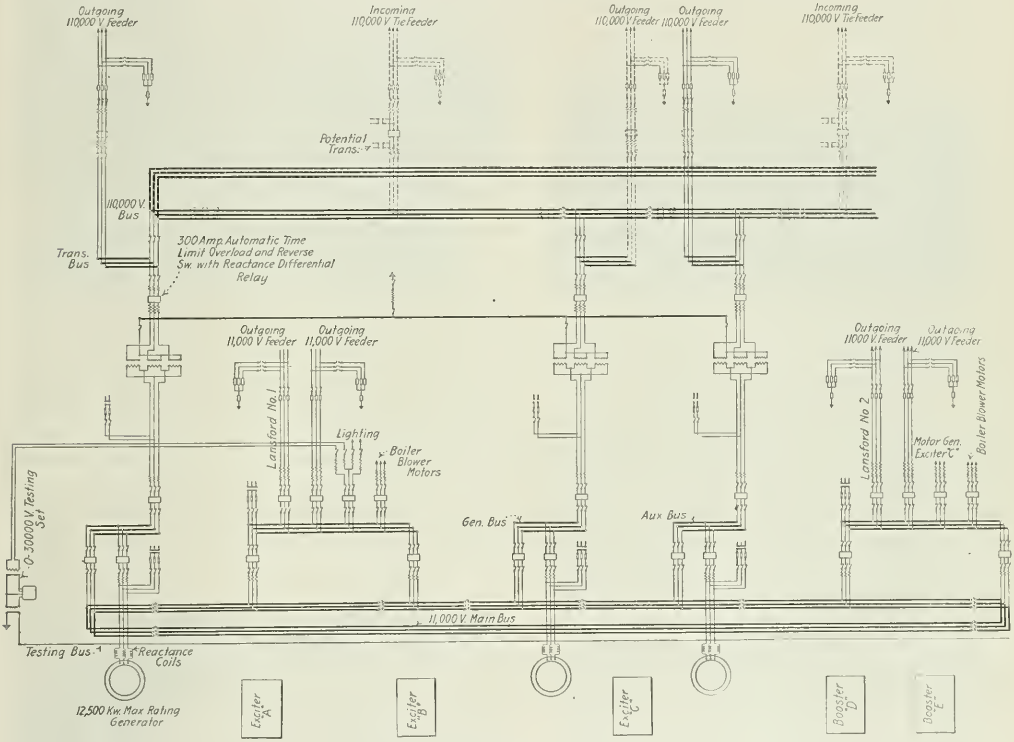


FIG. 16—GENERAL BUS LAYOUT

A Nicholson arc suppressor will soon be installed in the station, which will, in case there is a short-circuit on any one of the lines, automatically ground that line through a fuse long enough to reduce the voltage and thereby extinguish the arc. If the short-circuit persists in recurring, new fuses are successively brought into service until eight have been blown, and then the overload relays will open.

Outdoor Apparatus

Installed outside the station are the electrolytic and horn-gap lightning arresters and the towers supporting the outgoing lines. Separate dead-end towers are erected for the 11,000-volt and 110,000-volt transmission circuits, the lightning-arrester equipment being installed at the base of each. The low-tension tower is situated nearest the station and is designed to support twelve conductors, six being arranged in a vertical plane on each side of the center line. The 110,000-volt circuits which leave the building at the roof pass over the low-tension tower and join the bridges supported by the high-tension towers. From this point two 110,000-volt circuits now extend to a substation at Siegfried, Pa., about 26 miles away. Two 11,000-volt lines also extend to Lansford, Pa.

Substation Equipment

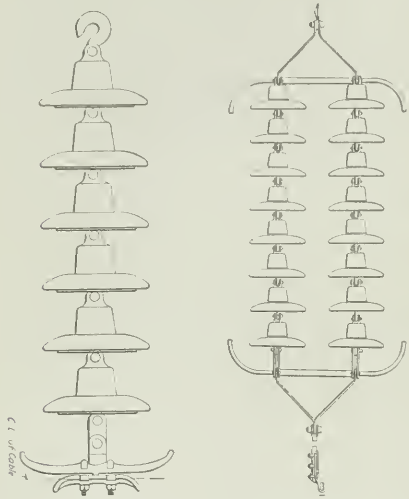
The substation at Siegfried contains four 3350-kva, 110,000/22,000-volt transformers, one of which is held as a spare. They are connected in delta on both sides, and their primary coils are provided with five taps which may be used in compensating for line drop when the voltage falls below 110,000 volts. Reactor-type oil switches are also employed.

Energy Transmission

Energy is transmitted at twenty-five cycles from the Hauto station over a double-circuit 110,000-volt transmission line to a substation at Siegfried, Pa., from which two double-circuit lines extend to Martin's Creek and Coplay, Pa. Both of the latter operate at 22,000 volts, but the one going to Martin's Creek is designed for 110,000-volt operation and will transmit that voltage as soon as the line is extended sufficiently to warrant it. Two 11,000-volt lines run to Lansford, Pa., where 3200 kw in direct-current coal-mine equipment will be installed to supplement the 1800 kw in motors already used.

The Lawrence Portland Cement Company is situated just south of the substation at Siegfried and is supplied with energy at 22,000 volts. About 1200 kw in equipment is installed now, but 3500 kw is contracted for, and that load will be supplied when the remainder of the equipment is installed. The voltage is stepped down to 2200 volts to operate the motors.

About 1000 kw is required at Coplay to supply the Coplay Cement Company, which operates with direct current. Rotary converters are installed there to deliver this form of energy.



FIGS. 17 AND 18—SUSPENSION AND DEAD-END INSULATORS EQUIPPED WITH ARCING HORNS

At Martin's Creek is the Alpha Portland Cement Company, which will eventually have 3500 kw in direct-current motors fed from a rotary-converter installation. Equipment totaling 1200 kw is already installed.

Along the line leading to Martin's Creek are rich coal fields which offer extensive opportunities for electrification. For this reason the electric-service company contemplates tapping the Siegfried-Martin's Creek line near Nazareth to supply service in that vicinity.

Line Construction

Double-circuit transmission lines are employed over the entire Lehigh Navigation Electric Company's system to insure uninterrupted service. Each circuit is designed to carry the entire load on the line in case one circuit has to be repaired or is temporarily disabled.

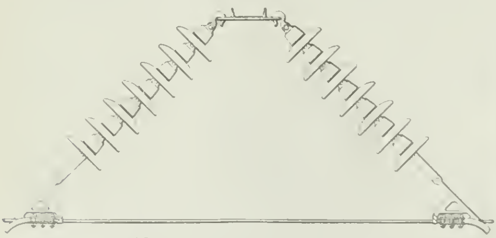


FIG. 19—SEMI-DEAD-END INSULATORS

The 110,000-volt circuits consisting of three stranded-copper conductors 0.625 in. in diameter are supported by six 10-in. disk porcelain suspension-type insulators on steel towers. Three conductors are arranged 10 ft. apart in a vertical plane about 9 ft. on each side of the center line of the tower, the lower conductor never being less than 22 ft. above the ground. The towers are 78 ft. 6 in. high and are spaced about 600 ft. apart. Two 0.375-in. galvanized-steel cables are run along the tops of the towers to protect the line conductors from lightning disturbances.

Special precautions have been taken to make the transmission lines as rugged as possible. Anchor towers of exceptional strength are placed at every turn in the line, and where the line is straight at intervals of about one-half mile. The footings are provided with concrete foundations to give a substantial base and prevent uplift, and the steel work is galvanized and painted with asphalt where it enters the ground.

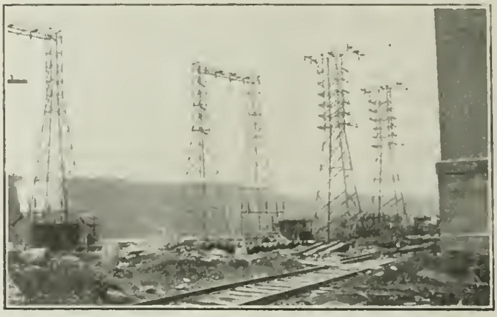


FIG. 20—110,000-VOLT AND 22,000-VOLT OUTGOING LINES

At the anchor towers each conductor is fastened to two sets of eight-disk dead-end insulators joined in multiple to reduce the mechanical strain on the porcelain. From the observation of other lines operating where lightning is prevalent it was noticed that a line surge caused by lightning has a tendency to flash over at dead-end insulators in its effort to go to ground. In doing so the insulators are sometimes punctured or wrecked, so to prevent such trouble on this line arcing horns have been installed to take the brunt of the discharge.

The end units of the dead-end insulators are attached to a metal rod electrically connected to the line conductor and bent in an arc at each end to form a discharge point for flash-overs. The vertical-type suspension insulators are also equipped with similar arcing horns.

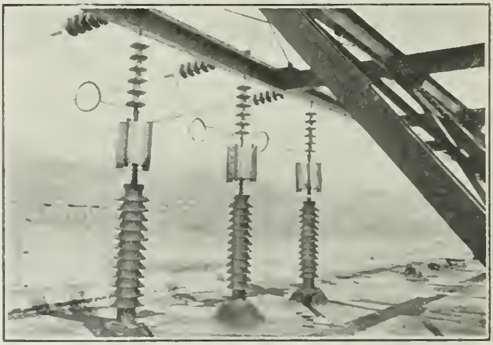


FIG. 21—ROOF BUSHINGS AND CHOKE COILS

To minimize the sag of conductors when they become loaded with ice or sleet, specially arranged insulators are employed on every third tower to support all except

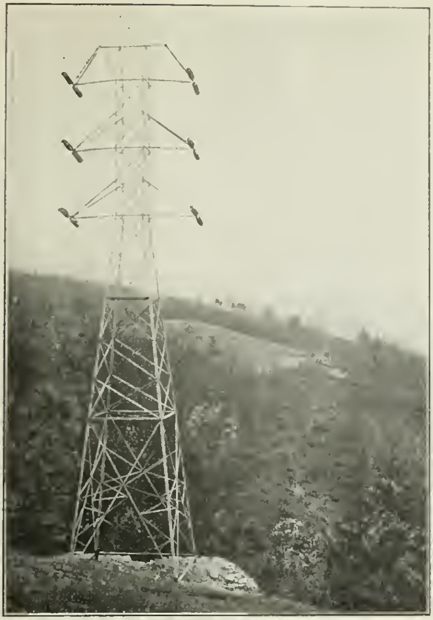


FIG. 22—ANCHOR TOWER

the lowest conductors. Two sets of suspension insulators are hung at the end of each cross-arm with their lower ends separated to form an isosceles triangle having the conductor as the base. The center lines of the insulators are at right angles to each other so that more than the normal tension in the conductors will deflect the insulators through only a small angle. The advantage in using this arrangement is that the conductor continues in its general direction in passing by the insulators and does not have to be connected with the adjoining span by a jumper, as is done when a dead-end insulator is employed on an anchor tower.

A 100-ft. right-of-way has been provided for the 110,000-volt and 22,000-volt transmission lines, the towers being installed at one side of the center line in order that another pole line may be erected on the same right-of-way when the service becomes so extensive as to warrant this being done.

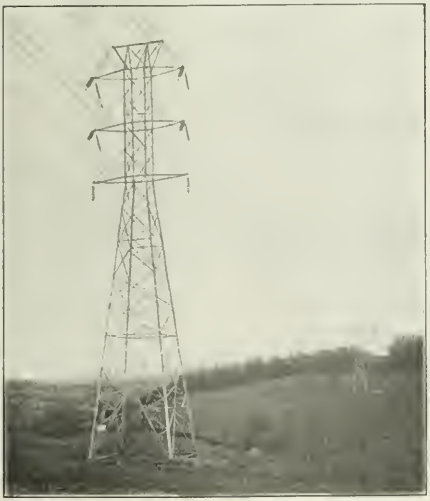


FIG. 23—SEMI-ANCHOR TOWER

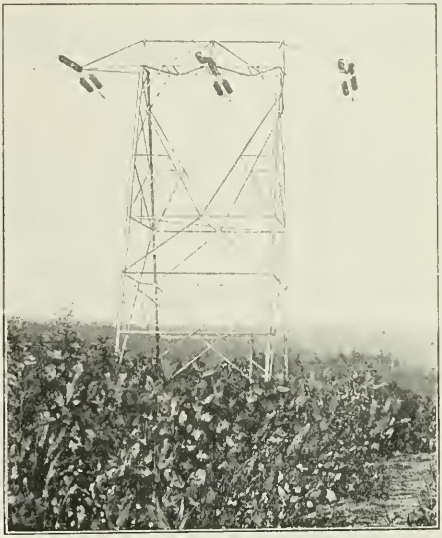


FIG. 24—SPECIAL TOWER OVER COAL OUTCROP

Telephone System

A private-telephone circuit parallels both the high-tension and the low-tension lines. No. 6 copper wires are used and are supported on tower cross-braces. As

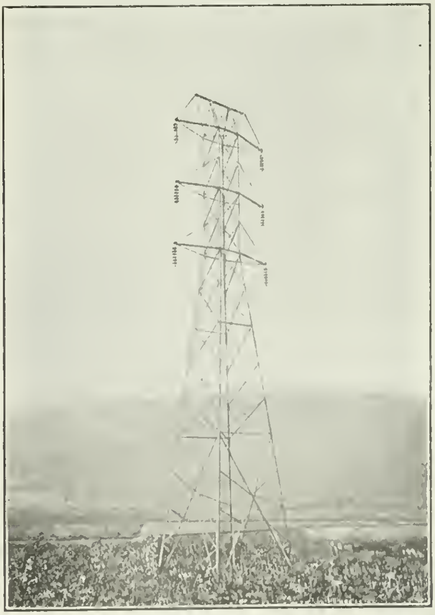


FIG. 25—TOWER WITH VERTICAL SUSPENSION INSULATORS

the spans are exceedingly long for this size of wire, wooden poles are installed at mid-spans to support the conductors. On the 110,000-volt tower lines the mid-span poles are 25 ft. high.

To prevent inductive and static disturbances in the telephone circuits transpositions and grounding transformers are employed. Transpositions are made at each tower support and at each mid-span pole. Telephone booths are situated about every four miles along the transmission lines. Grounding transformers are placed at all terminals and at intermediate points about 6 miles apart. The middle point of the primary winding is grounded so that static charges may escape to ground. An insulated platform is provided on which a person may stand while using the telephone.

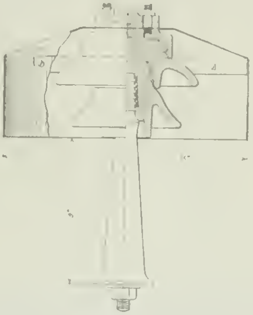


FIG. 26—HOOD TO PROTECT INSULATORS FROM DUST DEPOSIT

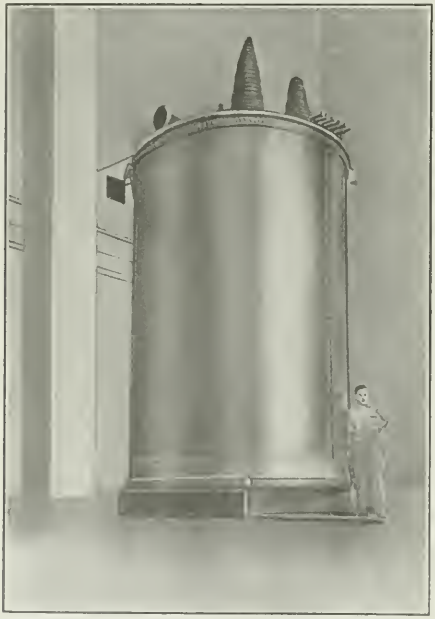


FIG. 27—110,000-VOLT TRANSFORMER

The Lehigh Navigation Electric Company's station at Hauto was designed by the firm of L. B. Stillwell, consulting engineers, New York. All generators and transformers were furnished by the General Electric Company, and the switching apparatus and lightning arresters by the Westinghouse company.

Ballast Characteristics of Boron When Used in Voltage Control

The principal commercial uses of boron are based upon its peculiar properties of high specific electric resistance and its negative temperature coefficient, as pointed out by Dr. E. Weintraub, director of the General Electric Company's research laboratory at Lynn, Mass., recently. Dr. Weintraub gave an interesting account of his researches before a meeting of the American Electrochemical Society.

The specific conductivity of boron at 0 deg. C. is about 6×10^{-7} mhos per cm cube. This high resistance is also accompanied by a large negative temperature coefficient, quite unprecedented among the elements. At ordinary room temperatures the conductivity of boron doubles for every 17 deg. C. of change. Addition of even one-tenth of 1 per cent of carbon to pure boron will increase the latter's conductivity many times. Boron containing 7 per cent to 8 per cent carbon has a conductivity comparable to that of silicon or even carbon.

If the current passing through a piece of pure boron is increased, the voltage at the terminals of the boron rises until it reaches a sharp maximum, after which with further increases of current the voltage across the terminals decreases. This property at once suggests the use of boron as a cut-out, and Dr. Weintraub expressed the belief that in such cut-outs boron will find a large field of usefulness especially in connection with series lighting. Whenever the voltage rises beyond a certain value the boron cut-out, which before had a very high resistance, will break down and open a path for the current.

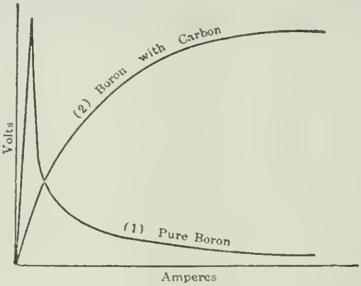


DIAGRAM SHOWING THE VOLTAGE-AMPERE CURVES OF BORON BALLAST CELLS

If a little carbon is added to the boron the nature of the volt-ampere curve changes, and by adding more and more carbon a form of the curve may be obtained which reaches a maximum and then remains practically constant, becoming parallel to the ampere axis. Such boron-carbon resistors are practically applicable for voltage regulators. The principle is that if such a boron-carbon resistor is in shunt with a conductor to be regulated, and if the current fluctuates, the boron-carbon conductor will absorb more or less current while the conductor in parallel maintains its amperes constant so that the voltage at the terminals remains constant. This property is made use of in car-lighting regulators.

Another type of boron-carbon resistors in an atmosphere of nitrogen (containing a little less carbon than the type just discussed) is employed for automobile-lighting regulators to take care of the variations of speed. These regulators are placed in the field of the generator.

Electric Cooking on the Battleship "Texas"

Coal-fired ranges superseded by ranges of the electric type on the newest United States warship—All culinary operations for nearly 1000 men carried on by electricity—Menu

THE U. S. S. *Texas*, the most recently constructed battleship of the United States Navy, which left the Brooklyn Navy Yard on May 13 bound for Vera Cruz, is the first battleship on which coal-fired ranges have been entirely replaced by the electric type. The equipment consists of ten ranges in the general-mess galley, five in the officers' galley, and two bakers' ovens.

The immense extent of the cooking operations on board this ship is only realized after considering the quantity of food prepared and the number of people served. The crew consists of 900 men and the officers number about 70. The accompanying menu is typical of the meals served to the crew. The officers' meals are a little more elaborate, but the quantity of food served is about in proportion to the numbers given. Coffee, tea, boiled meats and vegetables for the general mess are prepared in steam-jacketed caldrons and therefore do not require the operation of the electric ranges. In the officers' galley, where less food is prepared, electricity is used exclusively for cooking and even boiling.

As shown by the menu, about 6300 lb. of bread is required per week, not including that consumed in the officers' quarters. The other cooking operations, named in the order of the quantities of food prepared by that method, are frying, roasting and broiling. More than half of the food, by weight, is boiled, while that baked and roasted about equals the amount fried.

FIG. 1—U. S. S. BATTLESHIP "TEXAS"

As is customary on board a ship, the officers' and crew's galleys are separate. The former is on the main deck about midship, while the general mess galley is situated farther aft. The bakery is also separate from the galleys.

Installed in the crew's galley are ten General Electric eight-plate ranges, equipped with broilers and ovens. Each hot-plate is heated by leaf elements similar to those used in flatirons, while the broilers and ovens are equipped with the exposed-type heating element. The hot-plate units consist of ribbon resistors arranged in a wave-shape between two sheets of mica. Four of these units are clamped beneath each grid and are connected in two series groups. One set is ordinarily sufficient to maintain the proper temperature of the plate, but the second set is employed in parallel with the first for rapid cooking or for hastening the temperature rise of the plates.

The broiler and oven-heater units consist of spirally wound resistor wire which is exposed to the air and direct radiation. The broiler elements which are stretched across the top of the compartment are supported at short intervals by passing them through insu-

GENERAL MESS MENU ON U. S. S. "TEXAS" FOR WEEK ENDED APRIL 11, 1914

SUNDAY

Breakfast—Baked pork (60 lb.) and beans (66 gal.), cornbread (thirty 24-in. by 12-in. pans), and coffee (175 gal.).

Dinner—Roast pork (600 lb.), apple sauce (60 gal.), sweet potatoes (600 lb.), creamed peas (25 gal.), bread (300 lb.), oranges, and coffee (100 gal.).

Supper—Cold bologna, cold baked beans, tapioca pudding (60 gal.), bread (300 lb.), and tea (100 gal.).

MONDAY

Breakfast—Fried eggs (180 doz.), hot grits and milk (80 gal.), bread (300 lb.), and coffee (175 gal.).

Dinner—Vegetable soup (80 gal.), boiled beef (350 lb.), potatoes (450 lb.), lima beans (25 gal.), bread (300 lb.), and coffee (100 gal.)

Supper—Beef stew (140 gal.), with dumplings (30 lb.), celery, bread (300 lb.), and tea (100 gal.).

TUESDAY

Breakfast—Fried hash (600 lb.), oranges, bread (300 lb.), and coffee (175 gal.).

Dinner—Bean soup (80 gal.), ham (450 lb.), cabbage (600 lb.), potatoes (450 lb.), turnips (350 lb.), bread (300 lb.), and coffee (100 gal.).

Supper—Hamburger steak (275 lb.), fried mashed potatoes (600 lb.), bread (300 lb.), and tea (100 gal.).

WEDNESDAY

Breakfast—Baked pork (60 lb.), beans (66 gal.), catsup, hot rolls and bread (300 lb.), and coffee (175 gal.).

Dinner—Beefsteak (550 lb.) and onions (100 lb.), gravy, potatoes (200 lb.), spinach (400 lb.) and eggs (120 lb.), bread, and coffee (100 gal.).

Supper—Headcheese, cold beans, pickled beets, bread, and tea (100 gal.).

THURSDAY

Breakfast—Pork sausage (375 lb.), baked potatoes (500 lb.), bread (300 lb.), and coffee (175 gal.).

Dinner—Rice soup (80 gal.), roast beef (450 lb.), sweet potatoes (600 lb.), chocolate pudding (70 gal.), bread (300 lb.), and coffee (100 gal.).

Supper—Cold roast beef and fried potatoes (200 lb.), macaroni (100 lb.) and cheese (35 lb.), bread (300 lb.), and tea (100 gal.).

FRIDAY

Breakfast—Fried eggs (180 doz.), fried bacon (150 lb.), bread (300 lb.), and coffee (175 gal.).

Dinner—Fried fish (500 lb.), tomato sauce, mashed potatoes, mince pies (225 lb.), bread (300 lb.), and coffee (100 gal.).

Supper—Clam chowder (140 gal.), cheese, cold slaw, fruit, bread (300 lb.), and tea (100 gal.).

SATURDAY

Breakfast—Corned-beef hash (600 lb.), rolled oats (80 gal.), milk, bread, and coffee (125 gal.).

Dinner—Braised beef (450 lb.), tomato soup (80 gal.), gravy, sweet potatoes (600 lb.), kale (300 lb.), bread (300 lb.), and coffee (100 gal.).

Supper—Kidney stew (140 gal.), tinned fruit, bread (300 lb.), and tea (100 gal.).

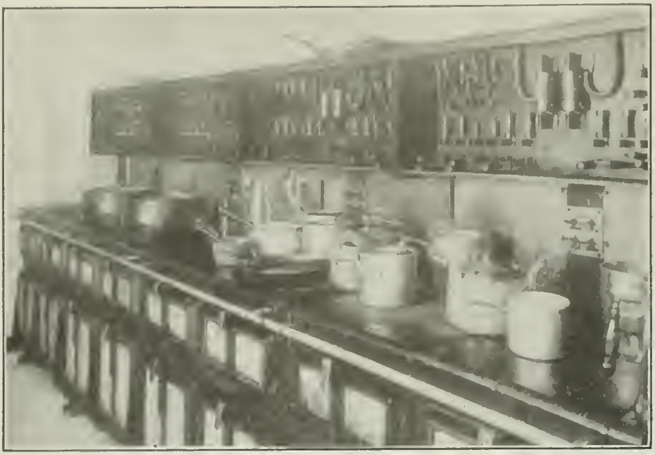


FIG. 2—ELECTRIC RANGES IN OFFICERS' GALLEY

lated bushings set in sheet-metal barriers running crosswise of the broiling compartment. The oven units are similarly supported at both the top and bottom of their respective compartments. Extra heater elements are also installed to raise the temperature of the ovens rapidly.

Energy for cooking, as for all other electrical operations on the ship, can be supplied from either one of two generating rooms, which are situated forward and aft of the boiler room. From the main feeder circuits in each galley individual circuits are tapped off and run along the ceiling to each range.

The switches controlling the different parts of each range are placed in a compartment above the hot-plates. A main switch and fuses are installed in the middle of this panel, and on each side are five knife switches controlling the ten heater units installed in the range. The switches connected to the hot-plate and oven circuits are each equipped with an auxiliary blade which when closed allows energy to flow through the extra heater unit to produce a "high heat." The ranges in the officers' galley are of the same type, but there are only five of them.

In the bakery are two ovens each having six baking levels. The circuits are led into a compartment at one side of each oven where the control switches are installed. From these switches horizontal conducting rods lead to the heater elements at the top and bottom of each pair of baking levels. The heater elements are similar to those employed in the range ovens.

Sufficient cooking apparatus has been installed so that under ordinary conditions it is necessary to operate only four-fifths of the ovens at a time. By leaving one-fifth of the ovens idle each week it is believed that the heating units will last a longer time.

The time required to prepare each meal depends on the food to be served. The temperature of the hot-plates can be raised from normal to a working value in about twenty minutes by connecting the "high-heat" unit for five minutes at the start and using only the main element thereafter. By operating the "high-heat" units in the ovens in a similar manner the temperature can be brought up to the proper value in from twenty-five to thirty minutes. Only about six minutes is required to start the broiler.

Particular care is exercised to secure economic operation of the ranges by concentrating the cooking on a few ranges so that the inefficiency of intermittent operation is avoided. The head cook supervises the operation to see that switches are not left closed when a range is not in use.

Mr. G. L. King, first-class cook on the *Texas*, declares that he considers the electric range far superior to the coal-fired type. First of all, the use of the electric type eliminates the necessity of handling coal and ashes, consequently there is less dirt present in the room where the food is prepared. The electric range is much cooler to work around, the heat being hardly noticeable even on hot days. Furthermore, he declares it is much easier to cook with the electric equipment, as the temperature is uniform.

The ranges have been in constant use on board the *Texas* since March 12, and since that time three meals a day for a crew of 900 have been prepared without an interruption or delay. In the general-mess galley five cooks and a head cook are required each watch. In the officers' galley there are four cooks, one for each officers' mess.

Previous to the regular operation of the electric ranges some trial tests were conducted to ascertain the energy consumption in terms of the amount of food prepared, and results of value were thus obtained.

Mr. M. A. Libbey is the electrical officer stationed on the *Texas*.

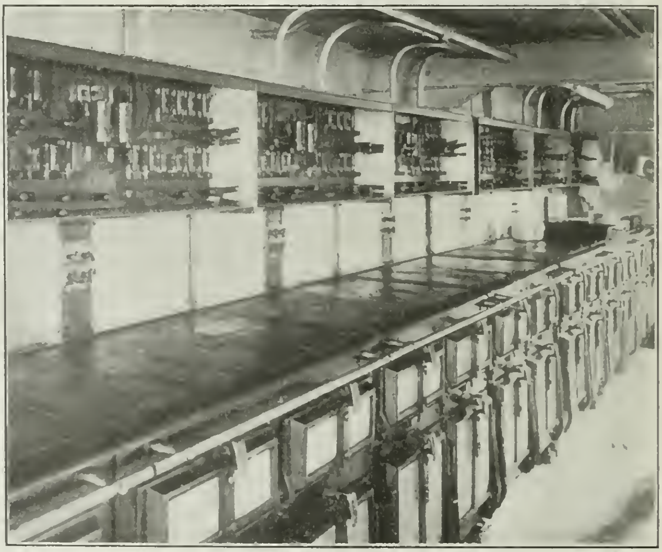


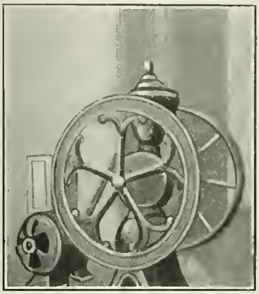
FIG. 3—HALF OF ELECTRIC RANGES IN GENERAL MESS GALLEY

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

Saving the Customer's Time

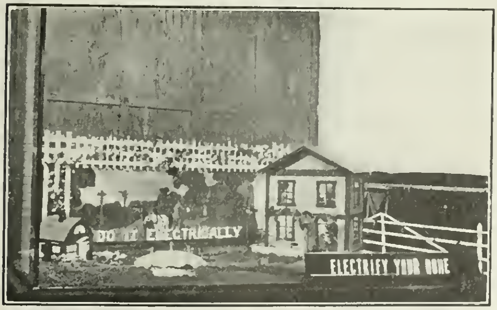
A retail grocery merchant at Mattoon, Ill., has mounted a motor-driven coffee mill in the show window at the front of his store to convince his customers that they will not be obliged to wait for a pound of coffee while a listless clerk grinds it with a hand machine revolving at about 3 r.p.m. The motor which is belted to the coffee mill is a 0.25-hp, 110-volt, 1350-r.p.m. direct-current machine manufactured by the Emerson Electric Company, St. Louis, Mo. When asked how much time was required to grind a pound of coffee with the electrically driven machine the dealer said he had never timed it but that it took "considerably less than a minute."



MOTOR-DRIVEN COFFEE MILL

Window Display to Illustrate Electrical Comfort

During a recent house-wiring campaign in Fort Madison, Ia., the Fort Madison Electric Light Company fitted up one of its office show windows to represent a suburban estate fully equipped with electric service. The display consisted of a miniature house and barn lighted by electricity. In the background was a sign reading "Do It Electrically," while nearer the window was another sign worded "Electrify Your Home." To appeal to the human interest of the observer and make the scene more attractive and lifelike, miniature dummy models placed around the estate were represented as engaged in some occupation commonly indulged in around the home. Sitting on the front porch of the house was a miniature representation of an elderly lady reading, while behind her peering through the window was a child seated in a high chair. Represented pictorially in the background was a stage-coach drawn up at the roadside with some new arrivals just stepping out of the vehicle. The front porch lighted by a small incandescent lamp and the interior of the house, which was made visible by the bright illumination within, gave an especially homelike appearance to the scene.



WINDOW DISPLAY AT FORT MADISON, IA.

Electric Cooking in Southern Households

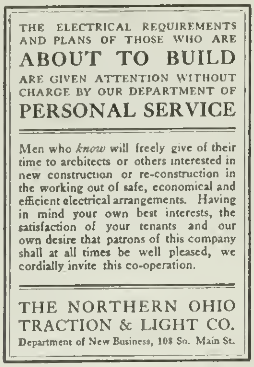
The South has in general been a difficult section in which to introduce electric cooking devices on account of the prevalence and cheapness of negro "help" and the difficulty of educating this class of servants in the economical use of electric-heating apparatus. Most of the colored cooks live at home and "go out for the day." In certain sections it is even difficult to get these independent servants to prepare any other meal than the midday "dinner," leaving to the mistress of the house the task of getting ready both breakfast and supper. The condition described has opened up a demand for electric cooking devices, and one Southern plant manager has already acquired a considerable connected cooking load in households which are servantless night and morning. A special rate of 4.5 cents net per kw-hr. is offered for this cooking business.

Teaching the Salesmen to Sell

Twelve scholarships in a Chicago school of salesmanship were recently purchased by the Columbus Railway & Light Company and offered to solicitors in its new-business department. The terms of acceptance in each case specified that the company was to bear one-half the expense, the other half being taken from the solicitor's salary in small monthly payments. Each of the twelve solicitors in the new-business department accepted the offer and these men are now holding bi-weekly meetings with the resident instructor. These sessions are held on Thursday evenings, and on the alternate weeks Mr. W. A. Wolls, sales manager, himself meets with the salesmen, helping them, through a series of talks, to understand the fundamentals in the production of electrical energy. In commenting upon the success of the school and the value of the weekly meetings Mr. Wolls says that the results obtained have made the work well worth while. To the fact that the men accepted the offer voluntarily and are themselves helping to bear the financial burden of their education is attributed no little part of the success of the plan.

A Department of Personal Service

In the electric-service division of the Northern Ohio Traction & Light Company, at Akron, Ohio, a department of "personal service," in charge of Mr. H. B. Bixler, has been instituted. As stated in the accompanying advertisement, the men of this department freely give their time to architects or others interested in new construction or reconstruction, in order that safe, economical and efficient electrical arrangements may be worked out. By inviting the co-operation of those who are about to build, the company hopes to bring about a condition wherein its patrons will at all times be well pleased. Publicity is given to the company's offer through *The Traction Bulletin,* which is distributed on the company's cars.


THE ELECTRICAL REQUIREMENTS AND PLANS OF THOSE WHO ARE

ABOUT TO BUILD

ARE GIVEN ATTENTION WITHOUT CHARGE BY OUR DEPARTMENT OF

PERSONAL SERVICE

Men who *know* will freely give of their time to architects or others interested in new construction or re-construction in the working out of safe, economical and efficient electrical arrangements. Having in mind your own best interests, the satisfaction of your tenants and our own desire that patrons of this company shall at all times be well pleased, we cordially invite this co-operation.

THE NORTHERN OHIO TRACTION & LIGHT CO.

Department of New Business, 108 So. Main St.

ADVERTISEMENT DESCRIBING PERSONAL-SERVICE DEPARTMENT

The Annual Cycle of an Engineering Department

The work of the engineering department of a great electric-service organization like that of the Commonwealth Edison Company of Chicago is both interesting and important. In a recent N. E. L. A. company-section meeting Mr. Herbert A. Fife outlined in part the work of the engineering department of the Chicago company. He said that the principal work can probably be best described by following it through an annual cycle. This naturally begins with the estimate for the next year's load to determine the additional generating and converting apparatus which will be required. Then comes the preparation of the budget, which is based on the rating required in the operating system and also on other items of information received from various departments. This budget is submitted to the budget committee, which, if it approves, recommends it to the president. Upon approval of the budget by the board of directors, formal orders are sent to the firm of Sargent & Lundy for professional services in connection with plans and contracts for steam and mechanical installations, and to the architects in connection with buildings. The general plans of the year's work being based on the budget, the details are further worked out, working order requisitions are issued based on costs and contracts, and all work coordinated with that to be done under the immediate supervision of the department. Plans and instructions for the electrical equipment in generating plants and the complete equipment for converting, transforming and storage-battery substations are prepared; also for transmission and distribution lines.

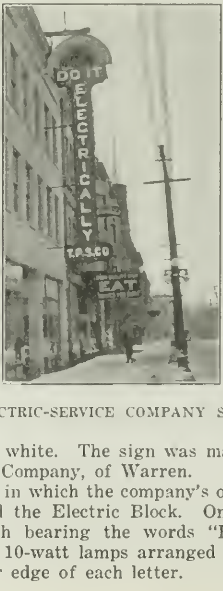
Very close co-operation is required with the architects and steam engineers, for the reason that buildings must be adapted for the proposed apparatus. Special foundations and an intricate system of ducts for cables or air, and compartments for isolation of "live" apparatus, are an essential portion of the system of the company.

Coincident with the planning of the work, the kinds of material required, quantities and specifications must be given, and as manufactories are often working at full capacity, the time element is always a very material factor in the year's work. When the construction of the building is under way the engineers on building construction must see that its completion will not delay the installation of the apparatus soon to be received, and the engineers on electrical construction must see that the construction department has the necessary plans and instructions so that all the work will go steadily on. The apparatus is put into service by deputy starting engineers of the testing, construction or street departments.

Generally this cycle is completed in October and November, and then begins anew the comparing of the actual loads with those previously estimated and the beginning of a new cycle.

A "Do It Electrically" Sign at Warren, Ohio

A sign two stories high and containing 1228 10-watt lamps has recently been erected in front of the office of the Trumbull Public Service Company at Warren, Ohio, admonishing the passing public to "Do It Electrically." The ninety-six circuits of the sign are controlled from a flasher on the roof and light successively groups of the lamps forming the border. This operation gives the effect of streams of light running toward the top, and when the last of each border group has been lighted, the fan-shaped group of lamps at the top of the sign is illuminated in three sections, respectively red, green and white. The sign was manufactured by the Kerr Sign Company, of Warren.



ELECTRIC-SERVICE COMPANY SIGN

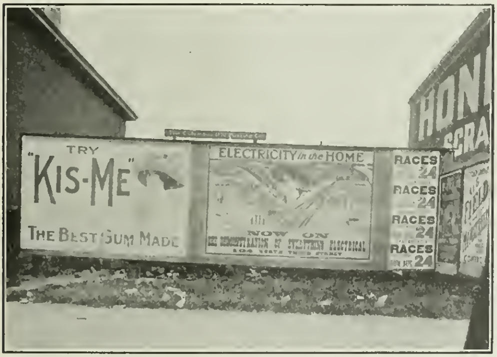
The building in which the company's office is situated has been called the Electric Block. On the roof is a sign 4 ft. high bearing the words "Electric Block" lighted by 375 10-watt lamps arranged in double rows along the outer edge of each letter.

Two Months of a Year's Housewiring Campaign at Louisville

Louisville, Ky., has about 40,000 dwellings, of which number 15,000 are connected to the Louisville Gas & Electric Company's lines. The remaining 25,000 are now being secured at the rate of 150 a week, of which number at least half are "old" houses. The average cost of the wiring and fixtures, complete with 40-watt lamps, has been about $36.40 per house. For the purposes of the campaign the city has been divided into five districts, each in charge of a salesman who devotes all his time to securing contracts from owners of existing or "old" houses. The present campaign was started in February, and the intention is to keep it in force a year at least. Up to April 25 the number of "old-house" contracts secured was 626.

Billboard Advertising for the Central Station

Prior to the opening of the Columbus Light & Railway Company's new co-operative store and offices on North Third Street, Columbus, Ohio, eighty-seven billboards throughout the city carried advertisements such as the one shown in the accompanying illustration.



BILLBOARD ADVERTISING IN COLUMBUS

These highly colored posters, placed among advertisements of coming races and theatrical performances, were before the public for days and created much interest and comment. The posters also served to notify the public that the company was moving its new-business department from its former office on High Street to new quarters on North Third Street.

"Ice-Making Ideal Adjunct to Small Electric Plant"

An operator who for several years has had charge of a combination ice-electric plant in a Middle West town of 4000 makes the statement: "Properly operated, the ice manufacturing business is an ideal adjunct to a small electric-light plant, for reasons which have been presented so often that it is hardly necessary to repeat them. My own advice to a small company contemplating starting in the ice business would be to get first a successful and experienced ice-plant man to go over the local conditions and prepare plans and specifications. In building a new plant as an adjunct to an existing electric plant using condensing prime movers, I would employ a motor-driven compressor and install a system to manufacture ice from raw water."

Commercial Progress at Providence, R. I., During 1913

The Narrangansett Electric Lighting Company, of Providence, R. I., operates the second largest central-station system in New England and is one of the most vigorous organizations of its kind in the country. The results of the company's development of business in 1913 are outlined below through the courtesy of Mr. E. R. Davenport, who is the sales manager of the company.

A new lighting schedule, known as the "C" rate, went into effect Oct. 8, and this is considered one of the most important forward steps of the year. The rate is for customers signing a one-year contract for a demand of 0.25 kw or over, and under it energy may be used for all purposes. For a demand of 0.25 kw to 10 kw there are both a service charge of $120 per year per kilowatt of maximum demand and an energy charge of 1 cent per kw-hr. As the demand increases the service charge decreases until, with a demand of 200 kw and over, the service charge is $24 per kw of maximum demand per year, with an energy charge of 0.8 cent per kw-hr. Lamps are not supplied or renewed free under this contract, and the rates are net. Under this new rate ninety-seven contracts were signed between Nov. 5 and Dec. 31, involving 152.6 kw of additional connected load and an estimated additional yearly income of $21,147. The estimated yearly income per kilowatt of demand is $138.58, or 6.38 cents per kw-hr.

The net gain in connections for the year was 21,476 50-watt equivalents, or 47 per cent. The company sold 102,596 tungsten and Hylo lamps, compared with 79,510 in 1912, a gain of 29 per cent. The gain in Hylo lamp sales was from 253 in 1912 to 439 in 1913, due almost entirely to the opening of the "Electric Shop" in the new Turk's Head Building, to which the company's offices were moved during the year. The company's profit on the sales of tungsten lamps in the year was $3,967. In the commercial arc-lamp field there was a decrease of 107, or 25 per cent, from the total number in use on Jan. 1, 1913.

Display Lighting

In 1913 3013 kw of new lighting business was contracted for. Among the larger installations were the Turk's Head Building, 100 kw; Kinsley Building, 34 kw; Jackson Building, 30 kw, and others. Gas-lamp replacements were of frequent occurrence, notably since the introduction of the "C" rate already mentioned. Electricity superseded gas in seventy-three installations. Sign development received a notable impetus during the year. More than twenty-four installations were made of sign lighting exceeding 100 5-watt lamps each, and the installation of outline and sign lighting on the Jackson Building called for 1960 lamps of this description.

The bill-posting concerns of the city have equipped twenty of their display boards with electric lighting, there being thirty-seven electrically illuminated boards on Dec. 31, an increase of 119 per cent over the preceding year.

During the year the company renewed 186,038 carbon and miniature lamps, a gain of 1 per cent over 1912. The success of the lamp contract basis on lamp purchases during the year has continued, there being forty-one such contracts in force. Twice during the year graphitized-filament lamps were tried out on the company's 250-volt service but were discontinued on account of unsatisfactory life. All previous troubles on 5-watt lamps used in sign work have been eliminated since the adoption of the 55-volt lamp as the standard for this service.

Industrial Motor Service

The year was one of the most successful in the history of the company's "power division," the net connections having been 2456 hp, a gain of 43 per cent over 1912. This showing is largely due to the inauguration of new rate scales in effect in Providence July 1 last.

One of these, "Rate D," has a base rate ranging from 8 cents to 2.5 cents per kw-hr., with minimum charges ranging from $1 to $5 per month, and the other, "Rate F," for customers signing an annual contract with a demand of 5 hp or over, has a monthly service charge varying from $1.50 to $1.15 per hp and an energy charge ranging from 1.5 cents per kw-hr. for motors of 5 hp to 10 hp to 0.9 cent for 75-hp or larger motors. Eighteen steam engine plants were shut down, with a total rating of 1147 hp and an individual range of 5 hp to 160 hp.

Among the new contracts secured were the Terminal Warehouse Company of Rhode Island, 200 hp; the Warren Worsted Mills, 100 hp, and the Standard Machinery Company, 300 hp. The company also secured a contract for the entire power supply of the Providence & Fall River Street Railway, amounting to 400 hp and yielding an estimated annual income of $12,000. The total sales of motors during the year were $29,308, the profit from these sales amounting to $9,475. During the year no private generating plants of any description were installed in the company's territory, which includes the greater part of eastern Rhode Island.

Electric Vehicles

Twenty-nine electric pleasure vehicles are in service in Providence, a gain of 31 per cent over 1912, and there are now eighteen electric trucks in operation. The company's income from charging has increased about 300 per cent. The electric-vehicle situation was never brighter in the city, and great care is exercised in the selection and recommendation of such equipment. In the past the idea was widely held that electric vehicles were unadapted to service in a hilly city like Providence, but this point of view has undergone a change. At the Shepard Company's department store a Detroit electric delivery wagon makes four trips and delivers an average of 300 packages daily over a route on which horses formerly used could make only three trips. Four times a day this vehicle climbs a grade of about 18 per cent maximum, and it makes a run of about 40 miles every day. The entire cost of operation is only slightly more than the former horse cost, and about 33½ per cent more work is done by the electric vehicle. The cost per ton of transporting freight to the store from the freight houses and docks is considerably less than when horses were used.

"ELECTRIC SHOP," NARRAGANSETT ELECTRIC LIGHTING COMPANY, PROVIDENCE, R. I.

Appliance Sales

During the year the company sold 3996 electric appliances, compared with 2511 in 1912, an increase of 59 per cent. Among these were 1053 flatirons, 667 toasters, 213 portable lamps, 129 stoves, 120 percolators, 58 chafing dishes, 201 egg boilers, 58 radiators, 175 grills and 95 heating pads. On April 1 the company opened a new branch office at Arctic Center and as a result more than doubled its appliance business in the district, the sales rising from 106 to 270.

TABLE OF ESTIMATED INCOME FROM ELECTRIC APPLIANCES

Article	Watts	Yearly Income
3-lb. flatiron	330	$4.50
5 lb. flatiron	575	6.00
Small size water boiler	350	0.75
Chafing dish	450	1.00
Toaster	600	3.00
Egg boiler	450	1.00
Grill	600	1.80
Heating pad	60	1.00
Small vibrator	50	2.00
Percolator, pot style	450	3.00
Radiator	450	8.00
Electric oven	600	2.50
Foot warmer	250	1.00
Curling iron	50	1.00
Shaving mug	350	1.00
Hair drier	800	2.00
Tea-ball	450	1.00
Utility flatiron	330	8.00
Bell-ringing transformers	50	Intermittent service
10-lb. flatiron	800	12.00
Electric cooker	600	2.50
Sealing-wax melter	350	2.00
Sewing-machine motor	25	3.00
Drill, ⅜-in	300	1.00
Soldering iron	300	2.00
No. 50 range	3200	120.00
Sterilizer	500	1.00
Air heater	1500	8.00
Water heater	450	1.12

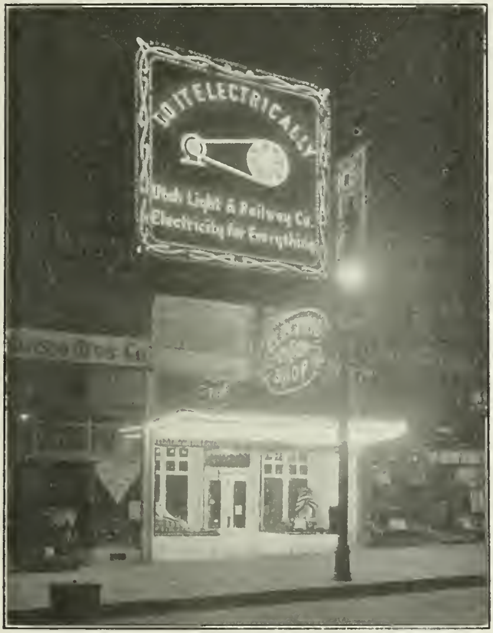
The Electric Shop, illustrated in the accompanying photograph, was opened Aug. 18, and the appliance sales from that date to Dec. 31 totaled $8,345 gross, of which 29.6 per cent was profit in handling. The total connected load of these appliances was 527 kw, there being 3571 sold. Among these were 229 6-lb. flatirons, with 131.6-kw combined rating; ninety electric grills, total rating 54 kw; fifty-four radiators, 40.5 kw; 117 toasters, 70.2 kw; 2150 10-watt miniature lamps, 21.5 kw, and twenty 5-lb. flatirons, 11.5 kw. The maximum domestic rate is 10 cents per kw-hr.

Illumination and Wiring

Exterior Lighting of Salt Lake City's Electric Shop

The electrical illumination of the front of the Utah Light & Railway Company's new commercial office, 154 Main Street, Salt Lake City, has made that building at night easily the most conspicuous point along the city's principal business street. As shown in the accompanying illustration, nearly 40,000 cp in tungsten lamps is used on the front of the little building, the effectiveness of this lighting being further enhanced by the finish of glistening white tile which is employed on the building front.

The "Do It Electrically" sign measures 20 ft. by 20 ft. and contains 1200 15-watt tungsten lamps. Bordering the sign is a triple row of lamps in colors, while a motor driving a pulley is shown in operation in the middle of the display. The sidewalk sign contains 500 15-watt lamps with the words "The Electric Shop" interwoven with a kaleidoscope in five colors, showing ten changes. The marquise contains 325 25-watt units in frosted round bulbs. The trolley post directly in front of the building bears four 1000-cp flaming arc lamps besides the regular city street lamp.



NEW COMMERCIAL OFFICE, UTAH LIGHT & RAILWAY COMPANY, SALT LAKE CITY

The main street office shown is devoted entirely to the Salt Lake company's commercial business, the general offices remaining in the company's building at 133 South West Temple Street. The staff at this commercial office, headed by Mr. Bayard W. Mendenhall, commercial agent of the company, handles orders, collections, complaints and other details of customer's business. The showroom contains, for display and demonstration purposes only, a complete assortment of energy-consuming appliances.

Heterochromatic Photometry

By M. Luckiesh

That the results obtained by the direct-comparison and flicker photometers disagree in most cases has been well established. Under favorable conditions this disagreement is only a few per cent, but where there is a large color difference, such as obtains when red or green lights are compared with white light or with each other, the results by the two methods differ by many per cent.[1] Another well-established difference is found in the fact that in flicker photometry a reversed Purkinje effect is encountered. That is, at low illumination red light is weighted relatively more than blue light, a phenomena directly opposite to that obtaining in ordinary direct-comparison photometry. These facts are sufficient to encourage inquiry into the phenomena underlying the flicker photometer.

The flicker photometer has won many adherents owing to the ease with which lights of different color can be compared. Even inexperienced observers find little difficulty in making consistent observations. Many adherents have assumed that the flicker photometer yields true measurements of brightness in spite of the fact that no extensive comparison of the flicker and direct-comparison photometers has been made until recently. Ives[2] concludes that the flicker photometer used under certain conditions is best suited to the comparison of lights of different color, but realizes that it is inevitable that correction factors must be applied. The latter is evident from an inspection of the data obtained by eighteen observers as presented by Ives. It is found that extreme observers would measure red or blue light, for instance, againt "white" light with a difference of more than 100 per cent. Even when comparing yellow light with "white" light, the results of extreme observers differed by as much as 20 per cent. These differences, of course, emphasize the need of a standard eye. Ives further shows that the flicker method fulfils certain axioms which must be demanded of a true method of photometry, namely, brightnesses measuring equal to the same brightness measure equal to each other, and the sum of the measurements of the parts is equal to the measurement of the whole. The writer finds these two axioms practically fulfilled (at least within a few per cent) by the flicker photometer under the special conditions of the experiment; however, a method can completely satisfy these requirements and yet measure something not true brightness.

It is not the intention to discuss the relative merits of the flicker and direct-comparison photometers, but the foregoing suggests that it will be interesting to search for possible reasons for the differences in the results obtained by the two methods. The phenomenon of simultaneous contrast may be effective in comparing colored lights by the direct-comparison method, but the experiments up to the present time have been confined to the phenomena which are probably involved in flicker photometry. Where flickering lights are observed it is at once obvious that the rates of growth and decay of the color sensations are very likely to be involved. H. Morris Airey[3] has already suggested that the results obtained with a flicker photometer might be influenced by the different rates of growth of color sensations. Broca and Sulzer[4] have studied the growth of sensation with colored lights and white light. They find that in general there is an overshooting of luminous sensation before the final steady value is reached. This overshooting becomes greater as the intensity of the stimulus is increased. The writer's experiments, which are to be described in detail in the *Physical Review*, were designed to ascertain, if possible, whether this time element in the growth of sensations is accountable for the differences in the results obtained by the two methods of photometry. In previous work two colored lights—red and blue-green, practically complementary to each other—were selected because of certain advantages. The present work was done chiefly with these two colored lights, which were first balanced against a standard white light many times on different days, thus establishing values which were used throughout the work. When one of these lights was flickered by means of a 50 per cent sector disk and compared with a steady light of the same color, it was found possible to measure the maximum value attained throughout a wide range of flicker frequencies. At all speeds of flicker the maximum sensation of the red flickering light was considerably greater than that of the blue-green light, when these two illuminations resulted from balancing each against a standard white light by the direct-comparison method. Results obtained at an illumination of 5 meter-candles are shown in Fig. 1. The results thus obtained were in general of the same character at various illuminations and show that the maximum values of sensation at a given frequency and the critical frequencies of these two lights after being equated to a standard white light by a direct-comparison photometer are not the same. While in the flicker photometer the two lights are flickered against each other instead of being flickered against darkness, this experiment suggests a possible reason for weighting red light more than a blue-green light by the flicker method than by the direct-comparison method, a fact already established for the writer's eye. If this effect is operative in the flicker photometer, it is obvious that the red light must be diminished in intensity in order that its flicker shall just disappear at the lowest speed at which the flicker of a blue-green light disappears. At any lower frequency of flicker the red light must also be diminished in intensity in order that it may be made to appear to be agitated to just the same degree as the flickering blue-green light. When the intensities of these two colored lights were those obtained by balancing each against white by the flicker method, the curves shown in Fig. 1 appear to coincide.

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[1] *Electrical World*, March 22, 1913, and April 19, 1913.
[2] *Phil. Mag.*, 1912.
[3] London *Electrician*, Aug. 20, 1909, page 758.
[4] *Comptes Rendus*, 1903, pages 944, 977, 1046.

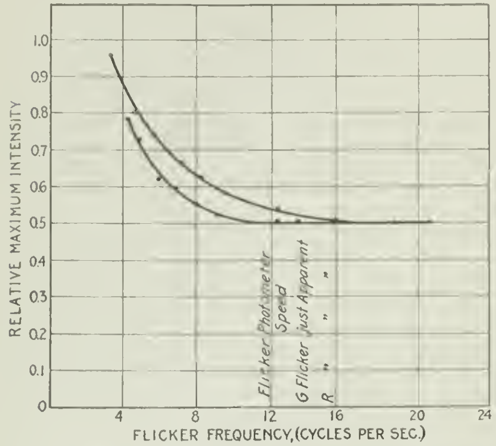

FIG. 1—COMPARISON OF INTENSITIES WITH RED AND GREEN LIGHTS

Another striking experiment is found in flickering the red light upon a steady blue-green field and vice versa. The red and blue-green lights of the same intensities, as determined by balancing each against white by means of the direct-comparison method, were arranged on opposite sides of an ordinary direct-comparison photometer with identical 50 per cent sector disks intervening. On one side of the photometer field the red light could be flickered, while on the other side the blue-green light could be flickered at the same time. Another pair of lights, one red, the other blue-green, were placed one on each side of the direct-comparison photometer between the sector disks and the photometer. Each of these was of the intensity of maximum value of the first pair of lights as measured by the direct-comparison method. Thus on one side of the photometer field a red light flickered upon a steady blue-green field, while on the other side a blue-green light flickered upon a steady red field. At a high speed of the sector disks (which were identical and fastened to the same shaft) the two fields balanced accurately in brightness and color. As the speed was lowered the field upon which red light flickered upon a steady blue-green field became agitated before the other field showed any signs of flicker. In fact, the former field became violently agitated before the latter field flickered noticeably. This again points strongly to the reason for weighting the red light more than the blue-green light in the flicker method than in the direct-comparison method. Next the maximum brightness of each field was determined separately throughout a wide range of flicker frequencies by comparing with a steady white field. In this case there was only a slight color difference. The results of this experiment are shown in Fig. 2. It is seen that there is a distinct overshooting of luminous sensation in both cases, but more marked in the case of the red light flickering upon a steady blue-green field. The overshooting in the case of flickering the light against darkness is not so apparent.

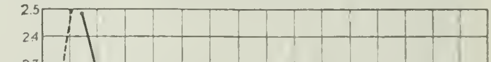

FIG. 2—COMPARISON OF INTENSITIES WITH RED AND GREEN LIGHTS

Experiments were performed in adding these colored lights by pure superposition and by means of flickering one against the other, the flicker speed being above that at which flicker is apparent. No difference in brightness of these two fields was observed.

An interesting experiment, the results of which point with favor to the flicker photometer, is found in comparing lights of the same color but differing in spectral character. By means of dyes two yellow lights identical in color were produced. One was a pure yellow while the other was a subjective yellow composed of green and red light. These were balanced by the direct-comparison method very readily, because there was no color difference. When balanced by the flicker method it was found that the results were the same as obtained by the direct comparison balance within at least 1 per cent. The same experiment was performed with "white" lights, one being the continuous spectrum light from a tungsten lamp, the other being made by mixing red and blue-green lights. Here, again, the results were practically the same by the two methods. These experiments indicate quite strongly that the flicker photometer is not affected by the difference in the rates of growth and decay of color sensations. Of course, other combinations of colored lights to produce two lights of the same color but differing in spectral character might give different results by the two methods. If no differences are found, it might be fair to assume that the flicker photometer measures true brightness and that the differences in the results by two methods are entirely attributable to the effect of simultaneous contrast and other phenomena involved in the direct-comparison method. The latter method does not satisfy the fundamental axioms already mentioned, which is a serious cause for looking upon this method with disfavor when seeking a reliable method of photometry for the standardization laboratory. In summing up the evidence it appears that for a laboratory method the balance is in favor of the flicker photometer.

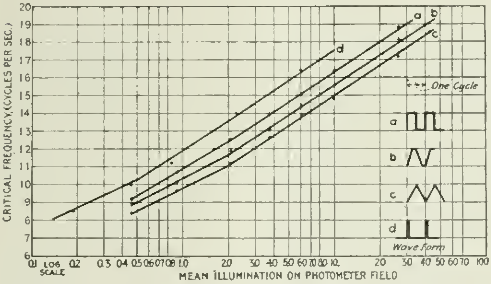

FIG. 3—EFFECT OF CONTOUR ON FLICKER FREQUENCY

The effect of the contour of flicker was also studied to ascertain the possibility of the character of the flicker in influencing results obtained by means of a flicker photometer. Four contours of flicker, as shown in Fig. 3, were studied, in each case the minimum brightness being zero and the maximum values equal. In these cases the critical or vanishing-flicker frequencies were found to be quite different throughout a wide range of illumination. The results are shown in Fig. 3, the illumination being plotted on a logarithmic scale. Porter[5] has found that for white light $f = A \log I + b$ represents the relation between critical frequency and illumination, A and b being constants. At low illuminations A has a value differing from that at high illuminations. The data show that the character of the contour of flicker is possibly of importance in flicker photometry and also serve to condemn the critical-frequency method as a means of photometry unless the character of flicker is standardized. It might be stated that the method of critical frequency has already failed as a practical method of photometry owing to its insensibility. Flicker photometers differ in principle. In some the operation is such that one stimulus ceases abruptly and is replaced by another stimulus with equal abruptness. In other photometers this change is less abrupt. In a flicker photometer devised by the writer the operation is such that the two lights are mixed together in all proportions throughout one cycle. Whether the differences in construction will cause a difference in the results obtained is unknown, yet it is quite possible.

The results shown in Figs. 1 and 2 were obtained from conditions approximately at the extremes of a cycle of operation in flicker photometry. They seem to account at least for a large part of the difference between the results obtained by the direct-comparison and flicker methods of photometry. They throw little light, however, upon the question as to which method measures true brightness. In fact, it is impossible for any method to measure true brightness in one sense, for brightnesses as the eye sees them are influenced greatly by their environment. In fact, the photometer field is always a special condition. Of course, it is highly desirable to obtain a method which is sensitive and reliable even under the special conditions. The flicker photometer is satisfactory from several standpoints, yet corrections are inevitable even with this method. For practical photometry of ordinary illuminants the use of standardized colored screens appears to be the most desirable method of avoiding color differences at the present time. This, however, involves the choice of a method of standardization. The use of colored light is becoming more extensive. The visibility or "carrying power" of signal lamps, colored lamps in signs, etc., depends directly upon the candle-power in the given direction. In prescribing colored light in illumination effects it would be desirable to know relative candle-power values. Yet without an accepted method of color photometry such data become meaningless. The writer has found it convenient to prescribe colored light in terms of watts when dealing with incandescent lamps. This method has the disadvantage of not being applicable to all illuminants and also of being dependent upon the operating efficiency of the filament. Nevertheless, the method has been found practicable for illuminating purposes. However, this is not a solution of the problem of color photometry for standardization laboratories, and it is to be hoped that some movement will be inaugurated which might result in the choice of a method to be universally adopted.

Recent Telephone Patent

Loud-speaking telephones should increase the volume of a transmitted message without sacrificing its clearness. To obtain satisfactory results it is therefore necessary to magnify the energy of the original sound waves by intensifying the transmitted energy or by increasing the efficiency of reproduction. A patent granted to Mr. J. J. Corner, Chicago, and assigned to the Automatic Enunciator Company describes a system using the first method. A differential transmitter is employed, consisting of one movable electrode placed midway between two stationary ones with the intervening spaces filled with granular carbon. The two stationary electrodes are connected through resistances to the energizing circuit, while the movable electrode is joined by a wire to one terminal of the loud-speaking enunciator. The other terminal of the latter is connected to the mid-point of a high resistance or capacity shunting the energizing circuit.

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[5] *Proc. Royal Soc.*, 1902, page 313.

Letters to the Editors

Low-Priced Electric Cars

To the Editors of the Electrical World:

Sirs:—The writer has been very much interested in the discussion regarding a low-priced electric vehicle, and he agrees with both Mr. H. G. Overbeck and Mr. H. H. Skinner, whose letters appeared in your issue dated April 18, 1914. These gentlemen are from widely different territories, while the writer occupies the middle ground.

I have heard a number of users of gasoline cars say that they are ready to purchase a Ford electric car as soon as it is ready for the market, and I am satisfied that every central station and every supply house at present using a wagon or an automobile will welcome a popular-priced electric vehicle.

The fact that the cheap electric vehicle will be a source of increased revenue for the central station at just the time when needed should make every central station manager enthusiastic. The abundant supply of energy now furnished by the hydroelectric plants of the South at prices within the reach of all should make everybody connected with the electrical business in this territory particularly enthusiastic.

Frank Steffner,
President Chattanooga Armature Works.
Chattanooga, Tenn.

Discriminations in Prices

To the Editors of the Electrical World:

Sirs:—The revised Clayton bill, just reported to Congress and now slated for immediate passage by the House of Representatives, provides that any concern which shall discriminate in price between different persons or different localities in the United States (except on account of difference in grade, quality or quantity of goods sold or differences in cost of transportation) "with the purpose or intent thereby to destroy or wrongfully injure the business of a competitor" shall be liable to a fine of $5,000 and to imprisonment of one year.

The clause in quotation marks, apparently, is relied upon as limiting this prohibition of price discriminations that transgress the ethics of business competition. Two facts, however, make this view doubtful.

First—This section presumably adds something to the Sherman law; and since the Sherman law, as already interpreted in many decisions, now plainly forbids all price discriminations that injure the business of a competitor in such degree as to restrain or monopolize trade, it must be assumed that this section forbids all price discriminations that injure the business of a competitor even though they fall short of restraining trade.

Second—With "intent to injure" substituted as the standard in place of "restraint of trade" and with the inexorable presumption of law that a man always "intends" the natural and reasonable consequences of his acts, it follows that "intent to injure" must be imputed to every act by which one man obtains business in competition with another; so that price discriminations between different purchasers or different localities, adopted simply to avert business disaster, or to move unsalable goods, or to get a foothold in new territory, but which necessarily get trade away from a competitor and thus "injure" his business, may fall within the prohibition of this section.

A manufacturer or jobber having branches in widely separated parts of the country might find himself greatly overstocked at one of his branches. Overstocked with unsalable goods, his credit becomes curtailed and he must extricate himself immediately or go to the wall. The only course open to him is to sacrifice the goods accumulated at that branch for whatever they will bring. To require him to make corresponding reductions at all his other branches and to cut under prices at which all his other branches are making easy sales would immediately and needlessly hasten his ruin. To forbid him to make special price reductions at his overstocked branch would mean curtailment of his credit and no less certain ruin. Yet both of these results are compelled by the section above quoted.

Instances like this are normal occurrences in business. How frequent and pervasive are the conditions producing such instances may be realized by reflecting that seasonal changes, weather conditions and fashion effect local changes in the demand for almost every commodity that is sold. Until legislation attains the perfection of controlling the fundamental laws of nature, both animate and inanimate, it should refrain from prohibiting business men from conforming to their inevitable and unforeseen operation.

New concerns, trying to get a foothold against long-established rivals, would be even more cruelly affected. Independent tobacco manufacturers, trying for the first time to get into New York City territory, have to offer special price inducements. Following the customs of the retail tobacco trade, they offer the attraction of low "introductory prices," "free deals," "premiums," special allowances for "sampling," for window display and for advertising, and other substantial price inducements. To forbid such an independent tobacco manufacturer, struggling against odds to gain a foothold in territory already occupied by competitors, to deviate from the prices which he maintains in territory where no such conditions prevail is practically to prevent him from ever getting into competitive territory and to award a substantial monopoly to his competitors.

A flour milling concern at Oswego, N. Y.—to cite another instance—meets competition outside of Oswego throughout New York State from the Minneapolis mills. Freight rates from Minneapolis to various New York points are about the same, but freight rates from Oswego to these points differ considerably. In order to sell its flour, the Oswego concern must meet the price of its Minneapolis competitors, freight included. This it cannot do by selling to every customer at the same price, freight added. Instead, it must sell in each locality at a different price, fixing the price at such a figure that with freight added the price of flour delivered will be as low as that of its Minneapolis competitors.

To forbid the Oswego concern to fix its price in such a manner would give its Minneapolis competitors a monopoly throughout the rest of the State. The monopoly thus legalized would be as complete and oppressive as any punishable under the Sherman act. Yet if the Oswego concern endeavored to break this monopoly, to meet the prices of its Minneapolis competitors in the manner above described, it would be a crime, and its officers, directors and employees would be criminals and each subject to a fine of $5,000 and a year's imprisonment.

Differences in grade, quality and quantity of goods sold and differences in cost of transportation are allowed for in this bill. Differences in the conditions and the cost of distribution, however, which are equally real and even more important are very unjustly ignored.

New York, N. Y. Gilbert H. Montague.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Economy in Flat Arches for Fire-Box Service

As it becomes necessary to renew the arches under the boilers of the Springfield (Ill.) Light, Heat & Power Company's plant flat arches are being substituted for the sprung arches which have hitherto been erected in that station. Mr. R. E. Hagenah, superintendent and chief engineer for the company, states that a saving of approximately 62.5 per cent is effected by this change in design, as the flat arches can be constructed for three-fourths the cost of sprung arches and the life of the former has proved to be fully twice as long as the latter. The boilers in the station are all of the water-tube type and fuel is fed to the grates by means of chain-grate stokers. The boilers are of three makes, namely, Stirling, Babcock & Wilcox, and Springfield.

Fuel Losses Due to Excessive Draft

The penalty of operating boilers under too great draft was well exemplified in an instance cited by Mr. Charles M. Rogers, efficiency engineer for the Meridian (Miss.) Light & Railway Company, before the recent Mississippi Electric Association convention.

The plant mentioned by Mr. Rogers was situated in an important bituminous coal field where the best grade of fuel was obtainable without freight charges. Its furnaces were arranged for burning about 7 lb. of coal per sq. ft. of grate area, but owing to careless fire-room regulations a draft of 0.55 in. to 0.60 in. of water column was maintained on these boilers, or sufficient to burn 50 lb. to 60 lb. of fuel per sq. ft. of area. The result was that an excess quantity of air was passed through the fire, cooling it and diluting the CO_2 content to about 2.3 per cent. Under these conditions the fuel bill was about $1,000 a month.

Later the draft was reduced to 0.08 in., improving the efficiency and output of the boilers to such an extent that it was possible to cut one unit out of service altogether. Meanwhile the fuel consumption fell to $650 a month, showing a saving of about one-third of the former bill under conditions of poor draft regulation.

Open-Circuited Rotor Connection

Ordinarily on a three-phase slip-ring induction-motor rotor each of the three ends of the rotor winding is connected to one of the slip-rings. To this end there pass through the collector three studs, each being connected to one of the slip-rings and insulated from the other two rings. Where clear wires are run from each rotor lead to its ring, all of the studs are used. On some rotors, however, one rotor lead is connected to the spider and the corresponding slip-ring (the middle one) is grounded to the shaft, which thereby takes the place of a connecting wire. In such cases only two of the collector-ring studs are used, the third one being insulated from all rings. A machinery company sent such a rotor out to be repaired, and after it had been reinstalled it failed to start loads that it formerly had started promptly. An ammeter cut into the rotor circuits one at a time showed that only two legs of the rotor were active. Further test with the magneto showed that one of the collector rings was not connected to anything. Disassembly and inspection showed that the repairman in reconnecting the leads of the rotor had connected one of them to the dead stud, with the result that the rotor was operating with only two of its coils active on all notches of the controller. The effect was a decrease of probably 40 per cent in the motor's torque. This device is often purposely used as a means of decreasing a motor's starting torque on the first controller notch, but in such a case the open-circuiting is done by a special arrangement of the contacts on the controller cylinder.

Device to Minimize Wear of Machine Tools

The cutting tools employed on large machine-shop planers are generally so heavy that their cutting edge is rapidly dulled by dragging on the work during the return stroke of the planer bed. To eliminate this unnecessary wear, the scheme illustrated herewith can be employed. Attached to the cutting head of the planing machine is a solenoid, the plunger of which is connected to the cutting tool in such a manner that it is raised from the work during the return stroke and dropped to its normal position again at the beginning of the cutting stroke. The switch completing the circuit through the solenoid is of the sliding-contact type and may be operated by the dogs which reverse the motion of the planer bed. By using this device much time lost in replacing dulled tools is eliminated.

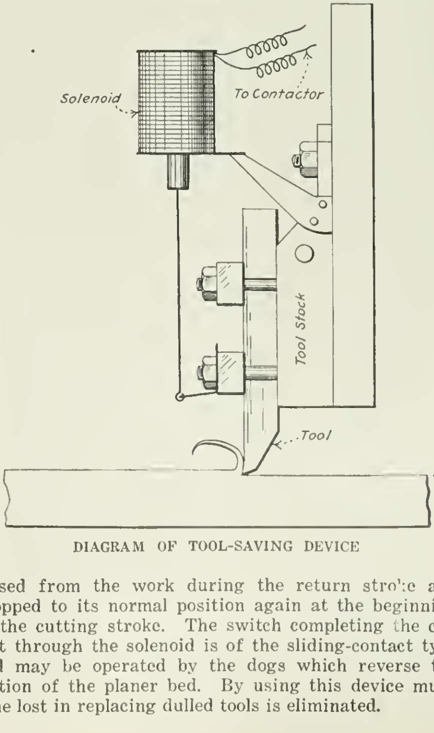


DIAGRAM OF TOOL-SAVING DEVICE

Grease in Condensers

By R. T. Strohm

The usual form of surface condenser consists of a cylindrical shell with hollow heads, between which are inserted a large number of small tubes. Water is circulated through the tubes, and the steam to be condensed is led into the shell so that it surrounds the tubes. The heat of the steam passes through the tubes into the cool circulating water inside and is carried away by the water, and the steam is thus condensed.

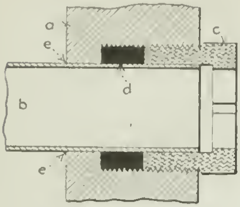


FIG. 1—DETAIL OF CONDENSER-TUBE PLATE

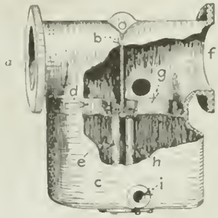


FIG. 2—GREASE EXTRACTOR

The steam that comes over from the engine or engines brings oil with it. This oil is entrained with the steam current and exists as finely divided particles that are easily picked up and carried along. The steam in passing into and out of the cylinder travels at a high velocity, and the heat and the cutting or scouring action due to its rapid flow cause it to sweep the particles of cylinder oil from the walls of the cylinder and carry them out at the exhaust. Thus every time that the exhaust valve opens a part of the lubricant is lost in the outrush of steam. It is this continual escape of oil that necessitates the regular supply of lubricant by some form of automatic feeder attached to the steam pipe above the throttle valve.

The fact that oil is lost beyond recovery is of sufficient moment, but there is a still more important matter to be considered in this connection. The steam comes in contact with the inner surface of the condenser shell and the outer surfaces of the tubes, and as it condenses against these cooler metal surfaces, the particles of oil that have been held in suspension in it are deposited on these surfaces, where they stick. Eventually they collect in such a quantity that the tubes are thickly covered with a layer of sticky, gummy stuff having the consistency of tar.

Now, the purpose of the condenser is to remove the heat from the exhaust steam, so that the resulting decrease of volume shall create a partial vacuum. Anything that interferes with the transfer of heat from the steam to the circulating water reduces the efficiency of the condenser. The deposit of oil on the tubes serves to retard the passage of heat from the steam to the water, because it is a non-conductor of heat. The result is that the heat transfer is rendered less rapid and the vacuum is impaired, or a much greater quantity of water must be circulated through the tubes in order to maintain the desired pressure inside the condenser.

When this state of affairs is reached the condenser must be cleaned. The cleaning is a most unpleasant task, for the reason that the grease adhering to the tubes is very hard to remove from them; also, it is equally hard to remove from the hands and clothes of the workmen.

The method of cleaning a surface condenser is to remove the tubes, which is done by loosening the fastenings of the tubes and drawing the tubes out of the tube plates. A common method of connecting tubes and tube plates is shown in Fig. 1. The holes drilled in the tube plate *a* are made very slightly larger than the tubes, one of which is shown at *b*. On the water side the hole is counterbored and tapped to receive a gland *c*. Packing, *d*, is inserted at the bottom of the counterbored hole and the gland is screwed in tightly, compressing the packing and preventing leakage around the tube, yet allowing the latter to slide endwise in order to compensate for expansion and contraction.

To clean the tubes, the glands are unscrewed and the packing is taken out. Then the tubes are pulled out through the tube plate. As the hole in the plate is only slightly larger than the tube, the grease that adheres to the tube will be scraped off by the plate and will collect at *e* or fall to the bottom of the shell. After the tubes have been drawn, the workman must enter the shell and remove the grease from the tube plate and the shell.

The grease is tenacious and adheres closely to the metal surfaces, but it may be softened by the use of kerosene or gasoline, either of which will cut it. If either of these oils is used to facilitate the cleaning, care must be taken not to bring a naked flame into or near the shell, as the inflammable gases rising from the oil may ignite and cause an explosion.

In view of the loss of efficiency caused by grease in a condenser and the time and labor required to clean it out, some method should be used whereby the exhaust steam may be freed of the entrained oil before it is permitted to enter the condenser. This end may be accomplished by putting a grease extractor in the exhaust pipe between the engines and the condenser.

One form of grease extractor designed to be placed in a horizontal pipe line is illustrated in Fig. 2, one side being broken away to show the construction. The exhaust steam enters at *a* and, meeting the partition *b*, is deflected downward into the body *c* of the extractor. The abrupt change of direction causes the oil to be thrown against the partition; also, the lip *d* around the inlet serves to catch and retain the oil particles. The grease thus collected is led into the bottom of the extractor by the pipe *e*.

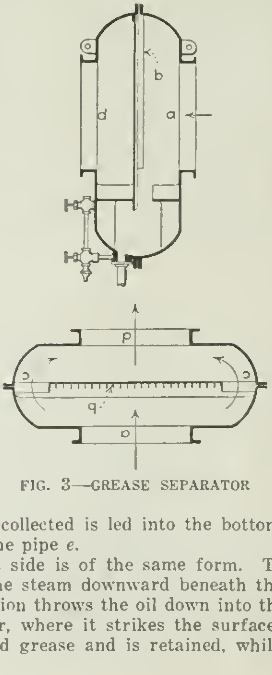


FIG. 3—GREASE SEPARATOR

The outlet side is of the same form. The whirling motion of the steam downward beneath the lower end of the partition throws the oil down into the bottom of the extractor, where it strikes the surface of the collected oil and grease and is retained, while the steam passes up and out at *f*. Any oil that is carried up with the steam is caught by the lip *g* and carried off by the pipe *h*. The water and oil separated from the steam are led away through the opening *i* to a receiver or trap.

Another form of extractor or separator is shown in Fig. 3, in which the upper view is a vertical section and the lower view a horizontal section. The exhaust steam enters at *a* and strikes a ribbed baffle plate *b* that is set squarely across the middle of the separator. There are at the sides of the baffle plate passages *c*, through which the steam may pass to the opposite side, and there is a similar passage at the lower edge of the baffle plate. But the steam is compelled to change its direction of flow sharply in order to get past the baffle plate, and, as the oil is a great deal denser than the steam, it cannot change its direction of motion so easily. So it strikes against the baffle plate and drains to the bottom of the separator, while the steam passes through and escapes at *d*.

Starting-Box Troubles

A starting box for a direct-current motor is a simple device in itself and, with ordinary care, is not liable to many defects excepting those incident to abuse or to misapplication. The most common abuses are using the box to start a motor that is too large for it or using a box as a speed regulator; the most common misapplication is due to carelessly changing boxes from one motor to another, regardless of rated voltage or current-carrying capacity. The more common starting-box troubles are as follows: If a motor fails to start until the starting-box handle is pushed away around, it may mean that the motor is too large, or that it is overloaded, or that the service voltage is too low, or that the starting-box main resistance *R* is too high, or that it is open-circuited so that armature *a* cannot get any current until the handle has passed the open circuit. Where the brushes spit and a bad flash is drawn when the handle is thrown to the "off" position, but the motor shows no tendency to start, it generally means that the motor field circuit is open, so that the motor has no torque; but it may be due to wrong connection of the motor field coils or to two grounds that cut out a part or all of the field coils. On a ground-return circuit only one machine ground fault is needed to produce a short-circuit. If the motor starts and runs all right, but the starting-box handle fails to remain over in the operating position, it is generally due to an open circuit in the no-voltage-release coil or in the resistance that is connected in series with it, but may be due to a roasted or metallicly short-circuited no-voltage-release coil. If a starting box is used on voltage that is too high for the normal rating, the no-voltage-release coil will indicate that fact by excessive heating; if unnoticed, the coil will eventually burn out. The accompanying figure indicates diagrammatically the three circuits through a no-voltage-release starting box intended for a shunt-wound motor. The current entering at *A* divides among three paths as soon as the starting-box handle touches *B'*. In the diagram each current is indicated by one arrow head, so that the number of arrow heads indicates in each case the number of currents in any given conductor. An open-circuit in any of the three paths will cause symptoms that will suggest the location of the fault. It should be noted that when the handle bar is in the "off" position, the field, the starting resistance *R* and the armature *a* form a local closed circuit through which the field discharges when the handle bar is for any reason returned to the "off" position while the motor is operating. This device minimizes the chances of insulation being punctured by the high voltage induced when a field circuit is suddenly interrupted.

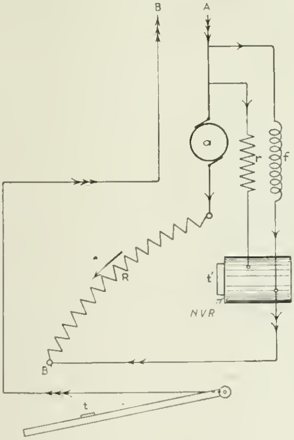


DIAGRAM OF CONNECTIONS

Constant-Current Transformers on Three-Phase Circuits

The writer would like your opinion on the matter of two oil-cooled, constant-current transformers of somewhat obsolete type that are constructed with four coils per transformer—two primary and two secondary, the primaries being arranged for 1100-volt and 2200-volt connections. These transformers are working at approximately three-quarters load upon two phases of a three-phase, 2300-volt system. This plan gives such a low power-factor and such badly unbalanced phase conditions that it much overloads our generators and results in considerable heating. In looking over the situation to see if there were not some way of balancing the load and improving the power-factor, the idea has been advanced that inasmuch as these transformers are working at only three-quarters load, it might be possible to use all the coils in one transformer and one-half the coils in the other—that is, one primary and one secondary—thereby improving the power-factor and possibly balancing the load. Two methods of doing this have occurred to the writer. One is the construction of a three-phase, two-to-one auto transformer and connecting one 1100-volt primary coil across each phase of this transformer, thereby working three sets of coils, two in one transformer and one in the other, to their full load and leaving one set without load. This seems to be perfectly practicable, but another suggested method that might be better is to connect these three primary coils in star, the secondary also being star-connected. Inasmuch, however, as the impressed voltage from any line to the neutral of a star connection is equivalent to 58 per cent of the primary voltage, it is quite evident that more than 1100 volts would be impressed upon these 1100-volt coils, and that a three-phase auto-transformer would have to be constructed to reduce the line voltage to the proper amount so as not to impress over 1100 volts upon these coils. There also seems to be some question as to whether the constant-current secondary would regulate satisfactorily if connected in star, assuming that there might be slight variation of load upon these. Which method is the preferable one? R. C.

Satisfactory results can be obtained by using two transformers or auto-transformers in "T-connection." With a 2300-volt, three-phase system one of these transformers would be subjected to a primary emf of 2300 volts. One terminal of the second transformer would be connected to the center tap of the first-mentioned transformer and would be subjected to an emf of approximately 2000 volts. The secondary voltages of these transformers or auto-transformers could be adjusted separately to such values as would be needed to supply energy to the constant-current transformers. With these voltages properly adjusted for the constant-current transformer circuits no trouble whatsoever should be experienced in the operation of this apparatus.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

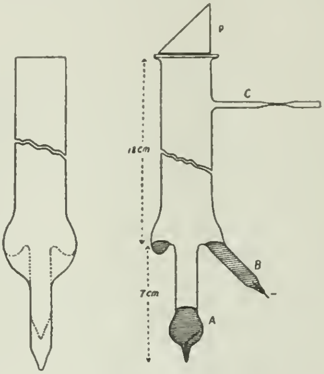
Generators, Motors and Transformers

Voltage Regulation of Alternators.—A. E. Clayton.—An article illustrated by diagrams on a method for determining the total equivalent reactance of an alternator winding and the calculation of the voltage regulation. The author deals with a method for estimating the equivalent coefficient of self-induction of an alternator and shows how the effect of armature reaction depends upon the saturation constant (that is, the ratio of the slope of the characteristic to the initial slope of the same) at the working point. For the total equivalent reactance the author obtains the value $\omega(L_k + SL_a)$, where ωL_k is the total equivalent reactance with no saturation, $\omega L'_a$ the equivalent reactance with no saturation corresponding to armature reaction, and S the saturation constant.—London *Electrician*, April 24, 1914.

Aluminum Rectifier.—Clarence W. Greene.—An illustrated account of an investigation of the potential differences between the electrodes of the aluminum rectifier at extremely short intervals after breaking the charging circuit. After checking some of the results obtained by former investigators by the ballistic galvanometer-condenser method, a potentiometer method for measuring the counter emf was devised and the results thereby obtained were compared with those obtained by the former method. The potentiometer method invariably gave larger values for the counter emf of the rectifier than did the condenser method, the differences being far beyond the range of experimental error. The condenser method of measuring the counter emf introduces an error due to the taking of a charge from the rectifier. The rectifier does not behave as an ordinary condenser. When aluminum is used as the anode, the counter emf alone accounts for the reduction of the current to its exceedingly small value. The results obtained in this investigation are apparently in accord with the gas-film theory and the theory of ionic diffusion.—*Phys. Review*, April, 1914.

Lamps and Lighting

Laboratory Mercury Vapor Lamp.—A. H. Pfund.—An abstract of an American Physical Society paper in which the author describes a re-design of his mercury-vapor lamp for experimental work in the laboratory. He makes the lamp as follows: A glass tube 2.5 cm in diameter is drawn down at one end to a diameter of 1 cm and is closed; a bulb is then blown, and while the glass is still soft the lower end of the tube is pushed up, thus creating the annular trough shown in the dotted lines of Fig. 1. Next a side tube *B* (Fig. 2) is attached, a small bulb is blown in the tube *A*, and the platinum electrodes are sealed in. The inner end of the wire in *A* is preferably bent as indicated to avoid any possible arcing between this wire and the mercury when the lamp is started subsequently by tilting. The lamp as such is finished after the side tube *C* has been introduced and a lip (ground flat with carborundum powder) has been turned on the upper end of the tube. After the lamp has been cleaned and dried thoroughly, distilled mercury is introduced to the indicated amount and a quartz plate is attached to the open end of the tube by means of sealing-wax. After having drawn down the tube *C*, the lamp is attached to a mercury pump and the usual process of exhaustion and boiling of mercury is carried out. The lamp is then connected to a source of direct current (110 volts) through an auxiliary resistance of five or six incandescent lamps in parallel, thus reducing the current to about 2 amp.



FIGS. 1 AND 2—MERCURY-VAPOR LAMP

The discharge is started either by a high-potential discharge or by boiling the mercury in tube *A* so violently that it rushes up to short-circuit the lamp for an instant. While the lamp is still on the pump, the discharge is continued for an hour or more to drive off gases and vapors. After sealing off from the pump the lamp is ready for use. Whenever it is desired to start the lamp subsequently the tubes *A* and *B* are heated cautiously by means of a Bunsen burner and the lamp is tilted so that the mercury from *A* flows directly into the top of the tube *B*. Upon returning the lamp to its vertical position a brilliant discharge sets in. By connecting the lower electrode *A* to the positive end of the source of current, the discharge in the tube *A* becomes very steady, while a brilliant spot dances about on the surface of the mercury in the annular trough. This annoying feature is eliminated by covering the outside of the trough with black paint. The mercury which condenses in the upper part of the lamp gradually runs down into the trough, which overflows periodically into the tube *A*. By constricting suitably the larger tube above the trough it is possible to cause a portion of the falling mercury droplets to reach *A* directly—thus eliminating the sudden overflow previously mentioned. In order to avoid the condensation of mercury on the quartz window the lamp is sealed off from the pump at a pressure of about 1 mm—thus avoiding the luminous flame which shoots up the tube at high vacuums. If in spite of these precautions drops persist in forming on the window, this difficulty is overcome by wrapping strips of wet cloth about the upper part of the lamp. If it be desired to utilize the ultra-violet radiations, a totally reflecting quartz prism is introduced at *P*.—*Phys. Review*, April, 1914.

Generation, Transmission and Distribution

Winding Machines.—W. Phillippi.—The first part of an illustrated article on the present status of electric winding machines in Europe, with special reference to the Ward Leonard system. A new safety device of the Siemens-Schuckert company for use in connection with this system is described, as is also a water resistance with motor relay. The paper is to be concluded.—*Elek. Zeit.*, April 23, 1914.

Traction

Swedish State Railway.—F. Zolland.—A long and profusely illustrated description of the electrification of the Swedish State Railway from Kiruna to Riksgränsen, which has a length of 130 km (78 miles) and is part of the most northern railroad in the world. It is largely used for transportation of ore. Single-phase current is used, the transmission emf being 80,000 volts and the emf on the trolley wire 15,000 volts. The frequency is fifteen cycles. The power plant has been erected at the Porgus Falls in Stora Lule Älf, where when fully developed 250,000 kw will be available. The present plant contains three single-phase, 10,000-kva generators supplying energy for the railway and the 11,000-kva three-phase generator supplying energy for the mines.—*Elek. Kraft. u. Bahnen*, March 24 and April 4, 1914.

Electric Traction in Italy.—G. Huldschiner.—An article on the development of electric traction in Italy in 1913. The Italian trunk railways, which are mainly owned and run by the State, are operated by three-phase currents as far as they have been electrified. The long and heavy grades, the very heavy freight traffic, the relatively low maximum speeds, etc., represent conditions so advantageous to this system that the results obtained on the three-phase lines so far in existence have been very satisfactory and the government will adhere to this system. A review is given of several new three-phase lines. The conditions are different for those roads which are in the hands of private companies, and in this case either single-phase current or high-tension direct-current has been used. Notes are given on three new single-phase lines, and it is pointed out that the chief obstacle to a more extended use of single-phase system is the very strict regulations as to the prevention of induction troubles on the telephone and telegraph lines. For this reason the high-tension direct-current system has found quite extended use, probably more than anywhere else in Europe. Eight new lines of this kind are mentioned, using an emf of 1000, 1200, 1350 and in one case 1650 volts. The latter voltage is used on the line from Rome to Frosinone, which has a length of 135 km (81 miles). Originally a system using single-phase current at 11,000 volts and twenty-five cycles had been projected. But the protection of more than 100 telegraph and telephone lines in the neighborhood would have been so expensive that it was decided to adopt the direct-current system. The voltage is 1650 at no load, and with 10 per cent drop in the line an average of 1500 volts on the trolley wire is obtained. The numerous new direct-current roads with emfs below 1000 volts are chiefly trolley lines in cities. In Naples a subway is in course of erection and subways are also planned for Genoa and Milan.—*Elek. Kraft. u. Bahnen*, April 4, 1914.

High-Tension Direct-Current Line in Italy.—An illustrated article on the suburban line from Verona to San Bonifacio, on which the direct-current system at 1350 volts is employed. The motors are wound for 675 volts and are arranged in groups of two in series.—*Elek. Kraft. u. Bahnen*, March 24, 1914.

Direct-Current Traction.—M. Legouez.—An illustrated description of a new system of direct-current traction with automatic starting and recuperation of energy. This system was worked out by Ward Leonard and has been successfully used on the trial trains of the Paris subway. The characteristic feature is the omission of the starting resistors. In their stead there is a converter in three parts consisting of a regulating machine, a driving machine and an additional machine which is set in operation only when energy is recuperated. All three machines have a common axle.—*Bulletin Soc. Intern. des Electriciens*, Vol. 3, 1913, page 979; *La Génie Civil*, Vol. 64, 1914, page 275; *Elek. Zeit.*, April 16, 1914.

Electric Railways.—H. W. Firth.—The first part of a paper read before the (British) Institution of Electrical Engineers on the electrification of railways as affected by traffic considerations.—London *Electrician*, April 24, 1914.

Storage Battery Locomotive.—H. Schmeusser.—An illustrated description of a three-axle storage-battery locomotive with three motors for switching purposes.—*Elek. Zeit.*, April 23, 1914.

Installations, Systems and Appliances

Electric Driving of Capstans.—Aug. Rasmussen.—The author describes a new system of electric driving of capstans in which series motors for constant current and variable voltage are employed. These are arranged in groups of two in series, with two generators designed for constant current like that by Rosenberg (Fig. 6). The control of the drive is made by one of the following three methods: In Fig. 3 different points of the magnet winding are connected to the segments of a sliding contact bar along which two contacts move in opposite directions so that by a simple motion of the lever the motor may be adjusted to zero position (position *a*), or for winding up (position *b*), or for letting loose (position *c*). Since the current passing through the motor is approximately constant and independent of the load, the motor has a constant torque for a given position of the regulating device. If the motor should be overloaded, it simply stops and starts again automatically when the obstacle has been removed without a fuse burning out or something of the kind. The motor is started by removing the contacts from each other so far that a sufficient torque is obtained (diagram *b*). Thereupon the contacts are brought nearer together again so as to get the desired speed. If the motor has to be started for lowering the load (diagram *c*) the contacts are moved past each other a little so that a torque in opposite direction is produced which overcomes the friction. If the load is heavy enough to drive the capstan itself, the contacts will come back to the position *b* and the motor will operate as a generator and return energy into the network. The regulation requires only a single motion of a lever and is otherwise automatic. The second method of regulation is shown in Fig. 4. It is in principle

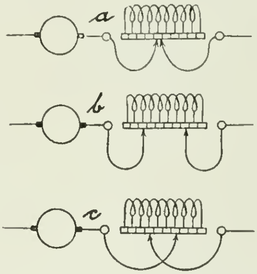
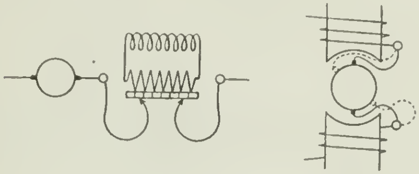


FIG. 3—METHOD OF REGULATION

the same as the former one, but a resistor is provided in parallel with the magnet winding and this resistor is connected to the contact segments. The third method of regulation is shown in Fig. 5. This is the simplest method of regulation and can be used if it is not too difficult to design a direct-current motor which fulfils the requirements as to commutation. The regulation is carried out here simply by displacement of the brushes. The zero position is shown in the illustration in drawn-out lines, while the position for winding the load up is shown in dotted lines. The whole arrangement of the capstans and the generators is shown in Fig. 6. There are two generators of 100 kw and 225 amp constant current. Each of the two constant-current generators can be switched to one of the following three positions: (1) for all capstans in series, (2) for groups of capstans on the front half of the deck, (3) for groups of capstans on the back half of the deck. The emf of each 100-kw, 225-amp generator varies between zero and 440 volts. The latter might seem a high voltage on shipboard, but it must be taken into consideration that this is not the voltage of each motor but the sum of the voltages of all motors, and it is thought that the system is free from danger. The motors are to be designed for 225 amp and an emf of from 100 volts to 150 volts.—*Elek. Zeit.*, April 23, 1914.



FIGS. 4 AND 5—METHODS OF REGULATION

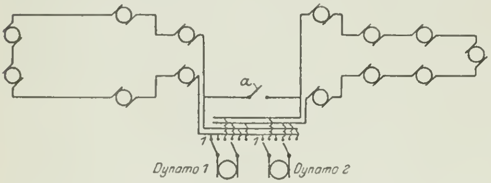


FIG. 6—ARRANGEMENT OF CAPSTANS AND GENERATORS

Wires, Wiring and Conduits

Protective Resistors for High-Tension Oil Switches.—Bruno Bauer.—An article illustrated by diagrams on the use of protective resistors in connection with high-tension oil switches. Their use is based on the consideration that the transient phenomena connected with any switching operation can be rendered free from danger by inserting a damping resistor. The author discusses in detail the following three cases: First, the dangerous rises of voltage and current when a switch is closed or opened on an overhead line or cable with very high tension; second, the current rush which is produced when unloaded large transformers or induction motors of modern design are switched to the line; third, the stresses produced in the switches themselves when large inductive loads or capacity loads are disconnected. The author sums up the literature which exists concerning the first two problems and gives the theory which permits a qualitative calculation of the third problem.—*Elek. Kraft. u. Bahnen*, March 14, 1914.

Electrophysics and Magnetism

High-Frequency Spectra of the Elements.—H. G. J. Moseley.—A second paper on the subject. The author reaches the following conclusions: Every element from aluminum to gold is characterized by an integer N which determines its X-ray spectrum. Every detail in the spectrum of an element can, therefore, be predicted from the spectra of its neighbors. This integer N, the atomic number of the elements, is identified with the number of positive units of electricity contained in the atomic nucleus. The atomic numbers for all elements from Al to Au are tabulated on the assumption that N for Al is 13. The order of the atomic numbers is the same as that of the atomic weights, except where the latter disagrees with the order of the chemical properties. Known elements correspond with all the numbers between 13 and 79 except three. There are thus three possible elements still undiscovered. The frequency of any line in the X-ray spectrum is approximately proportional to $A(N - b)^2$, where A and b are constants.—*Philos. Mag.*, April, 1914.

Radium Emanation.—Horace H. Poole.—A brief note on the activity of freshly formed radium emanation. The general result obtained is that the activity of radium emanation is the same within a few seconds of its formation as some minutes later.—*Philos. Mag.*, April, 1914.

Transformation of Emanations.—P. B. Perkins.—An account of an experimental determination of the periods of transformation of thorium and actinium emanation. By successively inserting suitable capacities in parallel with the leaf of a Wilson-Kaye electroscope as decay progressed, the half-value periods of thorium and actinium emanation were found to be 54.53 + 0.041 and 3.92 + 0.004 seconds respectively.—*Philos. Mag.*, April, 1914.

Effect of Magnetic Field on the Resistance of Metallic Resistors.—Walter A. Jenkins.—An account of an experimental investigation on the effect of a magnetic field on the resistance of nickel. Both longitudinal and transverse effects were studied. The conclusions of the author are as follows: Hysteresis curves for both longitudinal and transverse fields at different temperatures have been obtained. The effect in a transverse field is shown to consist of two parts, one which gives an increase and reaches a maximum and a second which gives a decrease and does not reach a maximum. The longitudinal effect and the first part of the transverse effect possess similar characteristics. There is some relation between the dimensional change in a magnetic field and the resistance effect, but one is not the cause of the other. Both are probably resultant from structural alteration. The ordinary theory for the effect in a transverse field does not explain the results obtained. The effect is possibly due to further structural change.—*Philos. Mag.*, April, 1914.

Magnetic Susceptibility of Water.—H. C. Hayes.—An account of an experimental investigation in which the value of the magnetic susceptibility of water at a temperature of 24 deg. Fahr. was determined by Faraday's method, the difficulties of the method having been sufficiently overcome to make it capable of giving accurate absolute results. The value of the specific susceptibility as found by this method is in excellent agreement with the results recently obtained by Quincke's method and seems to prove that this value is now known to within 1 per cent. The value is -7.26×10^{-7}. Moreover, this value is shown to be independent of the field, for the strength of the field used in this work was only 1180 gausses, while Sève, de Haas and Draper, and Weiss and Picard used fields varying from 15,700 gausses to over 21,500 gausses.—*Phys. Review*, April, 1914.

Units, Measurements and Instruments

Measuring Transformers.—H. GEWECKE.—A long article illustrated by numerous diagrams dealing with the principle of operation of measuring transformers with special reference to the variation of the transformation ratio and the phase angle between the primary and the secondary emfs or currents. The discussion is based on the use of the general transformer diagram and vector diagrams derived from it. Various zero methods are discussed which permit a very exact test of the transformer.—*Elek. Kraft. u. Bahnen*, March 14, 1914.

Telegraphy, Telephony and Signals

Wireless Telegraphy.—CHARLES A. CULVER.—The second paper on his experimental researches on the propagation and interception of energy in wireless telegraphy. The experiments of the author confirm and extend the tests made by Kiebitz and others, and would appear to indicate that horizontal antennas placed very near the earth's surface exhibit efficiencies both as receiving and radiating systems which are comparable with a simple vertical aerial. The data also appear to indicate that when utilizing such low horizontal antennas either as absorbing or radiating systems the free end of the aerial should point in the direction of the second station. This appears not to conform to Marconi's law of horizontal antennas and may be due to local topographical conditions. The fact that energy was intercepted and radiated when both ends of the horizontal systems were grounded would appear to indicate that we are dealing in such cases with what Sommerfeld calls a surface wave, as more or less distinct from a space wave.—*Phys. Review*, April, 1914.

Wireless Telegraphy Waves.—H. BARKHAUSEN.—An article on the propagation of electromagnetic waves in wireless telegraphy. The comparison of the results of experiments and theory shows complete agreement as long as the distance between transmitting and receiving stations is short so that the curvature of the earth need not be taken into consideration. For long distances the propagation of the waves seems to take place by two entirely different methods. First, normally the refraction of the waves which can be calculated from theory brings only a weak wave to the receiver and the amount transmitted is smaller the shorter the wave-length. Wave transmission during the day occurs in this way. Secondly, irregularities in the atmosphere may produce reflections in the air so that a much larger amount of wave energy comes to the receiver, and this amount is independent of the wave-length. This would explain the results obtained with transmission during night.—*Elek. Zeit.*, April 16, 1914.

Miscellaneous

German Electrical Industries in 1913.—A continuation of the long series of reviews of the present status of the different branches of electrical engineering in Germany in 1913. Adolf Schnee discusses the applications of electricity in medicine and therapeutics, while Wehland discusses electric signaling.—*Elek. Zeit.*, April 9, 1914.

German Electrical Industries.—The conclusion of the long illustrated serial on the status of the various branches of German electrical industries in 1913. W. Schneider deals with telegraphy and telephony over wires. H. Thurn with wireless telegraphy and telephony.—*Elek. Zeit.*, April 16, 1914.

Electrical Terms.—A list of the electrical terms about which an international agreement was reached at the Berlin convention of the International Electrotechnical Commission in September, 1913. All the terms are given in German, French and English.—*Elek. Zeit.*, April 16, 1914.

Book Reviews

GRAPHS IN A CABLE-SHIP DRUM ROOM. By Edward Raymond-Barker. London, England: H. Alabaster, Gatehouse & Company. 43 pages, 10 illus. Price, 2s. 6d.

In this little publication are collected and collated a series of articles published by the author in the London *Electrical Review* in the early part of 1913. Mr. Raymond-Barker is an advocate of graphical engineering methods, as his publications well attest. This latest publication is in the same direction. We think that most engineers will agree with him. Graph methods are capable of being made wonderfully swift and reliable. There are few situations where time may be more precious in forming a judgment than in a cable steamer. The pamphlet indicates a number of graphs relating to drum constants, slack and other quantitative details of a cable engineer's work. A few excellent photographs of scenes on cable ships illustrate the text in an interesting manner.

THE PRICE OF INEFFICIENCY. By Frank Koester. New York: Sturgis & Walton Company. 440 pages. Price, $2.

This interesting and instructive book brings home with forcibly illustrative argument the fearful waste going on all around, in the abolition of which lies the chief hope of abatement of continuously rising prices and increasing cost of living. The author calls attention to administrative waste, to the waste of human life, and to the by-products of inefficiency. He shows that a government, like that of Germany, which is of a somewhat military character is certainly more economical than one based on shifting conditions and not infrequently headed by shiftless men. How important a work of this character is at this period anyone may judge for himself. Consider the cost of conducting a business office. The waste of materials would often take care of a business of twice the size, and the time wasted in doing work twice, both in shops and offices, would allow for a volume of business of double the magnitude. Thus the difference between success and failure lies in the ability to reduce waste. Mr. Koester's book will be of value to all who read it.

SWITCHBOARD, SWITCHING, PROTECTIVE APPARATUS. By C. C. Adams. Chicago: American School of Correspondence. 120 pages, 72 illus. Price, $1.

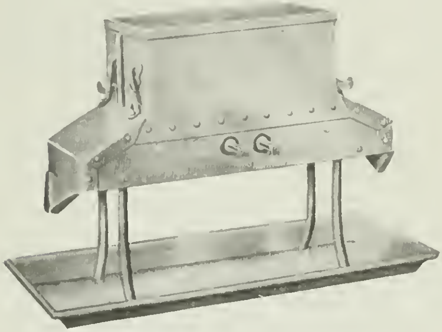
This book contains brief descriptions of the more or less standard types of switchboard. Prominence is naturally given to the latest American practice, although some European types of switchgear are referred to. The "ironclad" type has, indeed, not made very much headway in Europe, and it is doubtful if its few advocates will ever convince the average engineer that the advantage gained by the complete inclosure of all high-tension metalwork may reasonably be set against the fairly obvious disadvantages of this system. Had the author wished to give his readers an insight into the methods of those countries whose practice differs from that of our own leading manufacturers, he would have referred to the European practice of using enameled slate panels, the appearance of which is undoubtedly attractive. It should, however, be borne in mind that the book is probably not intended for the use of designers or experienced engineers. For the student and the operating engineer in charge of electrical machinery it will probably prove to be a very instructive and useful little volume.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Electric Heating Device for Sealing Wax

To satisfy the demand of certain manufacturers for an apparatus which will give a continuous and reliable supply of hot sealing wax of uniform amount and consistency, the firm Simplex Conduits, Ltd., Birmingham, Eng., has developed the sealing-wax heater shown herewith. The size of the wax container is 6 in. long by 3 in. wide by 2.25 in. deep, while the size of the tray is 12 in. by 5 in. The heating unit for the wax takes 200 watts. The sealing wax is placed in the inner receptacle and is allowed to run over two slopes provided at either end, which are also heated to prevent the wax from cooling. As a result the wax can be picked up by the flaps of the parcels to be sealed. Where it is necessary to use an ordinary seal impress, the wax can be run down the slopes, which are so shaped at the bottom as to allow the wax to drop off. The amount flowing out of the central chamber can be regulated by opening or closing the two apertures with the small shutters provided. Any excess wax is caught in the tray upon which the heater stands and is used again. The device is of black-enameled iron and is double-ended, thus enabling two persons to work with it simultaneously.

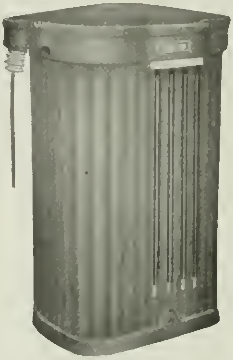


APPARATUS FOR HEATING SEALING WAX

Distributing Transformers

Distributing transformers rated at from 1 kw to 75 kw are being placed on the market by the Moloney Electric Company, St. Louis, Mo. In the illustration is shown one of these transformers built in ratings of from 20 kw to 75 kw. The tank of this transformer is of corrugated cast iron and is provided with a large radiating surface, thus insuring a low temperature rise. All of these distributing transformers are equipped with terminal boards. The lead wires pass through a heavy porcelain block before entering the terminal board. Compensating taps are furnished in 1.25 per cent steps from 1.25 per cent to 10 per cent. With each transformer ranging in rating from 1 kw to 50 kw there is provided a brass name-plate which serves to show how the different taps can be connected.

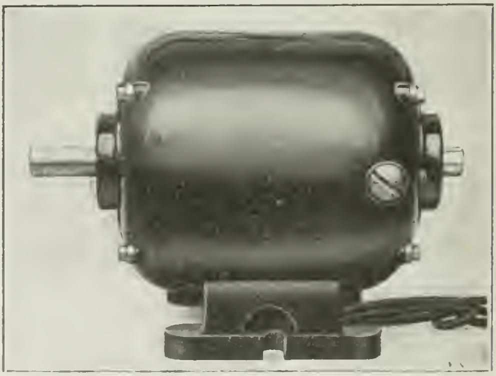
Transformers for outdoor service designed for pressures of from 22,000 volts to 66,000 volts are also being made by the above company. These transformers are of the self-cooling type and are built in ratings of from 10 kw to 2000 kw. The smaller transformers are inclosed in straight steel cases, while the larger have corrugated steel cases.



TRANSFORMER WITH CORRUGATED CAST-IRON CASE

Cycle-Car Lighting Outfit

Apparatus for lighting small cars which have a lamp load of not more than 5 amp is being placed on the market by the Ward Leonard Electric Company, Bronxville, N. Y. This outfit is identical in construction with that for the larger cars with a lighting load approximating 9.5 amp, and the same method of operation is employed. The generator delivers 6 amp at 1800 r.p.m., and it weighs less than 9 lb. As can be seen by com-



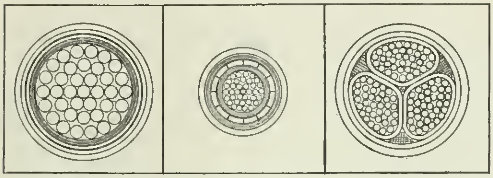
DYNAMO FOR CYCLE-CAR LIGHTING OUTFIT

paring with the scale in the illustration, the machine is very small. A separate constant-current control system is used. This controller also embodies an automatic battery switch.

Insulated Cables of Aluminum

BY E. V. PANNELL

For several years the street-railway system of Paris has been operating with low-tension feeder cables of aluminum. This use of this material has been attended with such very successful results that when considerable extensions were made to the system in 1913 aluminum was again utilized as the conductor, realizing a net economy of about 8 per cent on the cost of copper cables. The cables in question are mainly of the paper-insulated, lead-covered and armored type laid in channels under the sidewalk. Developments in this direction in Europe have not, however, been confined to Paris, for in a paper read by Mr. d'Hoop, of the Brussels (Belgium) street-railway system, about the end of 1912, the author reported that eight different street-railway companies in France, Germany, Switzerland, Belgium and Denmark were using insulated cables of aluminum. In addition to these, several English traction and utility corporations have installed underground aluminum cables for almost every type of service.



SINGLE-CORE CABLE
Area. . .1,650,000 circ. mils
Thickness insulation.0.118 in.
Thickness lead. . . .2x0.06 in.
Resin oil between lead sheaths, jute and compound. . . . . . . 0.09 in.

CONCENTRIC CABLE
Area . . .2x320,000 circ. mils
Thickness insulation. 0.10 in.
Thickness lead. . . 0.09 in.

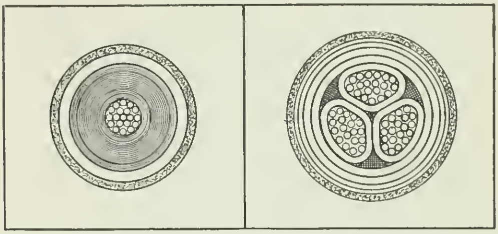
THREE-CORE CABLE
Area. . . .3x610.000 circ. mils
Thickness insulation.0.125 in.
Thickness lead ..... 0.125 in.

FIG. 1—LOW-TENSION INSULATED CABLES WITH ALUMINUM CORES

Not only has the simple single-core cable been manufactured in aluminum but also double and triple concentric cables and the interesting clover-leaf form of three-core conductor for pressures from 600 volts up to 6600 volts have also been used. Quite recently a quantity of the latter was sold at a price which showed a saving over copper, with the heavier metal at a base price of about 17 cents per lb. A few typical aluminum cables for low-voltage high-voltage work are shown in Figs. 1 and 2 respectively. These are reproduced merely to show that practically every form of cable has been manufactured in aluminum and that the metal is by no means restricted to heavy low-tension cables, although these form by far the larger proportion of the aluminum cables in use. The test of economy is, however, the true one wherever a new departure is entered upon, and it is obvious that aluminum cables can compete with copper only where the relative prices of the two metals make aluminum worth while. Before October, 1913, the price of aluminum in the United States was not such as to make it advantageous for insulated cables, except when the copper market was abnormally high. Under present circumstances, however, the light metal is quoted at prices which show about 25 per cent economy over copper, considering the wire base to be about the average figure for the latter metal. During the year 1913 the average monthly price of electrolytic-copper wire billets, f.o.b. New York, was 15½ cents per lb. Allowing a fair differential for rolling and drawing, this represents a wire base of 17 cents per lb. Aluminum wire can be bought at from 24 to 25 cents per lb. Taking the mean of 24 cents, the relation between the costs of the bare wire will be:

	Cents
Aluminum, 1 lb. at 24½ cents	24½
Copper, 2 lb. at 17 cents	34
Difference.	9½

The above computation makes allowance for the physical properties of the metals. Copper has three and a third times the weight of aluminum, but the latter has only 60 per cent of the conductivity of copper; hence the ratio of weight for a wire of given resistance per foot is slightly more than two to one in favor of aluminum.



SINGLE-CORE CABLE
Area . . . . .198,000 circ. mils
Thickness paper dielectric. . . . . .0.512 in.
Thickness lead covering . . . . .0.138 in.
Thickness jute serving. . . . . 0.118 in.
Voltage. 30,000

THREE-CORE CABLE
Area . . . . .3x248,000 circ. mils
Thickness paper dielectric. . . . . .0.197 in.
Thickness lead covering. . . . . .0.118 in.
Thickness steel-tape armoring. . . . .0.120 in.
Thickness jute serving. . . . . . .0.090 in.
Voltage. 6600

FIG. 2—HIGH-TENSION PAPER-INSULATED CABLES WITH ALUMINUM CORES

COMPARATIVE DATA ON COPPER AND ALUMINUM CABLES

	Copper	Aluminum
Size, circ. mil. . .	600,000	1,000,000
Number of strands. .	61	91
Diameter each wire, inches.	0.099	0.105
Diameter core, inches.	0.893	1.150
Thickness dielectric, inches	0.100	0.120
Thickness lead, inches.	0.100	0.120
Outside diameter, inches .	1.293	1.630
Weight core per foot, pounds	1.850	0.925
Base price.	$0.170	$0.215
Cost core per foot	0.314	0.227
Cost insulation and manufacture.	0.160	0.230
Total cost of cable	0.474	0.457

Under the above conditions it remains to be seen to what exent the saving of 9.5 cents per lb. will be taken up by the cost of insulating and covering with lead the larger diameters of aluminum cables. In Fig. 3 is shown the cost of stranding, insulating and lead-covering cables for pressures of up to 660 volts. Allowance has been made for material (taking lead at 4 cents per lb.), labor and a reasonable profit. Figuring out a concrete instance—that of a 600,000-circ. mil copper cable —the results shown in the accompanying table are arrived at. On the aluminum cable in this instance a saving of about $90 per mile is effected. This is, however, considerably less than the economy which frequently results from using aluminum. Larger sizes of cables such as are employed for railway feeders are cheaper to manufacture and show a relatively larger profit when made of aluminum. The price of copper, too, is by no means always as low as the figure assumed in the preceding calculation, so that according to the market aluminum cables will show a greater or less saving than that indicated above. As a writer in the *American Metal Market* (March 2, 1914, page 4) has pointed out, the growth of the electrical industries is calling for increased quantities of copper far out of proportion to the production of the metal, and unless a substitute is forthcoming there is reason to expect sooner or later considerable advance in the present market quotations for electrolytic metal.

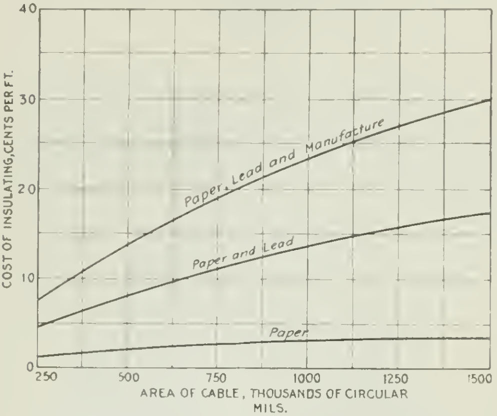


FIG. 3—APPROXIMATE COSTS FOR INSULATING AND COVERING LOW-TENSION CABLES

The subject of aluminum and copper cables was admirably dealt with by Mr. B. Welbourn in a paper read before the London Institute of Mining Engineers in June, 1913. His conclusions were based upon extensive experience in the manufacture and sale of aluminum and copper cables, and the diagram Fig. 5 has been reproduced from figures given by Mr. Welbourn. This shows that for a particular size of cable (equivalent to 380,000 circ. mil copper) aluminum begins to be cheaper when the market price is 24½ cents per lb., and at the average figure aluminum cables show 8 per cent economy.

The foregoing has perhaps sufficed to show that for ordinary low-tension paper-lead cables aluminum is a conductor deserving of consideration from the economic standpoint. In the field of extra high-tension work, however, the case is different; here aluminum possessses technical advantages. Experience with overhead high-tension lines goes to show that there is a ratio of voltage to conductor diameter which cannot be exceeded without giving rise to corona loss. A similar phenomenon takes place with underground cables, and aluminum was chosen for the core of the 30,000-volt cable shown in Fig. 2 for this reason. In any high-tension cable of this kind the steepness of the potential gradient in the dielectric is given by the formula

$$\frac{V}{r \log \frac{r+d}{r}}$$

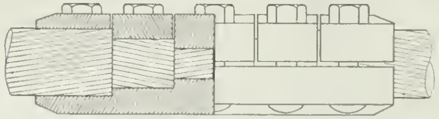


FIG. 4—STEPPED CLAMP EMPLOYED FOR THROUGH JOINTS

where V = effective voltage,
r = radius of core,
d = thickness of dielectric

Naturally, if r is increased d may be diminished and the same potential gradient maintained. Aluminum is effective in that it has a value of r which is always 30 per cent in excess of copper, so that it necessitates less insulation and a correspondingly cheaper cable.

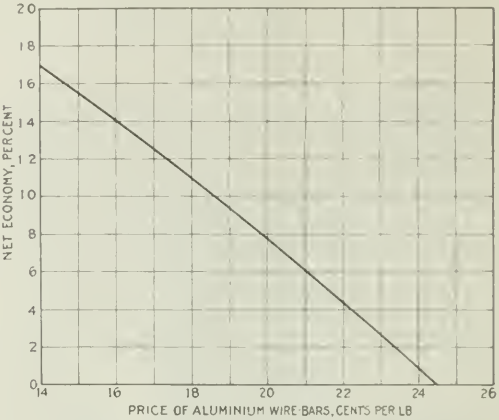


FIG. 5—WELBOURNE'S VALUES FOR NET SAVING EFFECTED BE ALUMINUM CABLES

The practical problems in connection with aluminum are mainly those of making joints. No really satisfactory solder being available, it becomes necessary to employ clamp-joints. The facility with which surfaces of aluminum bite into one another renders these particularly effective, however, and tests made after several years' service demonstrate that this type of connection is no more liable to deterioration than a soldered one. The energy supply for some of the most important suburban railroads in the vicinity of Paris is fed through clamp-joints of the simplest form with perfect satisfaction.

The British Aluminium Company has recently developed an improved type of stepped clamp. A typical pattern is shown in Fig. 4 and represents one of the most satisfactory forms at present in use. The contact resistance is reduced to the minimum, and the size and disposition of the bolts render the joint particularly quick and easy to apply.

Controller for Automobile-Lighting Generator

An automatic controller for low-voltage automobile-lighting generators is being manufactured by the Ward Leonard Electric Company, Bronxville, N. Y. This controller, the manufacturers claim, gives a constant ampere control without arcing at any of its parts. The device is small and embodies an automatic voltage cut-out. This cut-out connects to and disconnects from the battery. This controller, which is illustrated herewith, permits the use of a plain shunt-wound generator.

Internal-Starter Motor

An alternating-current motor with a starting device mounted in a ring, as shown in Fig. 1, has been developed by Fairbanks, Morse & Company, Chicago, Ill. This ring is keyed to the rotor shaft and is inclosed in the motor frame. Within this ring are mounted three insulated iron tubes, each tube containing a pile of carbon disks at the outer end of which is a contact terminal connected to one of the phase windings of the rotor. The inner ends of the three piles are connected together. The three carbon piles, therefore, form a Y connection, and the secondary or rotor circuit is closed through a resistor the resistance of which can be varied by the application of pressure to the inner ends of the piles.

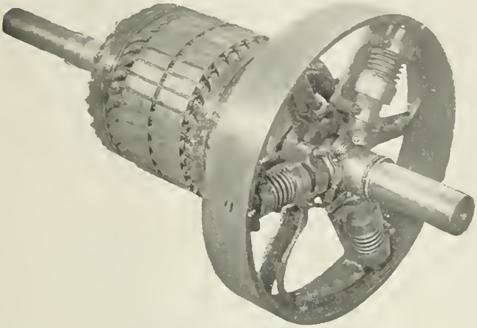


FIG. 1—ROTOR FOR INTERNAL-STARTER MOTOR

The insulated tubes which inclose the disks are free to move radially in their guides, and their motion is opposed by a spiral spring, which surrounds them on the outside. The total motion of the tube does not exceed 1/16 in., but affords a wide range of resistance, which, when the disks are fully compressed, is reduced practically to zero. When the primary circuit is closed by the main switch the motor starts with a comparatively high resistance in the rotor winding, due to lack of pressure on the disks; but as it speeds up the weight of the inclosing tubes compresses the disks and gradually reduces the resistance, thus giving a gradual increase in speed and increase in power as the motor accelerates.

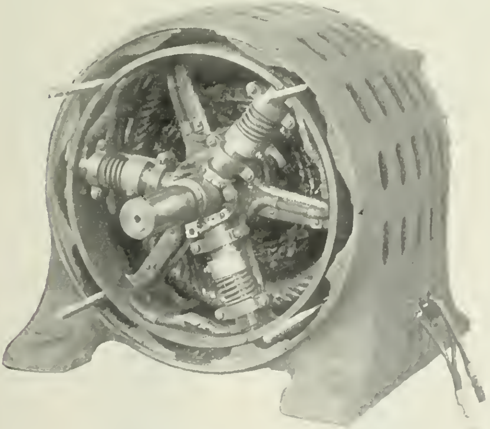


FIG. 2—INTERNAL-STARTER MOTOR WITH ONE BEARING BRACKET REMOVED

This internal-starter motor is designed for use on two-phase and three-phase circuits, and it is built in two types, one being adapted to operate on electric-lighting circuits where the starting will not impair the lighting service and the other for intermittent work. The latter design is especially suited for service in connection with elevators.

Electric Power Table

In every modern home there are many household appliances that are or could be driven by an electric motor. Sewing machines, washing machines, ice-cream freezers and many other devices can now be operated economically by electricity. A simple portable apparatus that makes a separate motor for each appliance unnecessary has been designed particularly for use in the home by the Federal Sign System (Electric), Chicago, Ill. The power table, as it is called, occupies an area 18 in. by 26 in. in dimensions, and it is 30 in. in height.

Energy is supplied through a 10-ft. connecting cord securely fastened to the table and fitted with a detachable plug for connection with the nearest lamp socket. All gears are inclosed. A snap switch is conveniently placed on the right-hand side of the front of the table. A $\frac{1}{4}$-hp motor is suspended from a hinged platform so that it and the power shaft can be lowered and made to disappear below the table top when not in use in a manner similar to the disappearing head on sewing machines. When closed the opening is covered by a sliding panel, leaving a smooth top of polished oak which can be used as an ordinary table. When the motor is in use the panel slips down into the table.

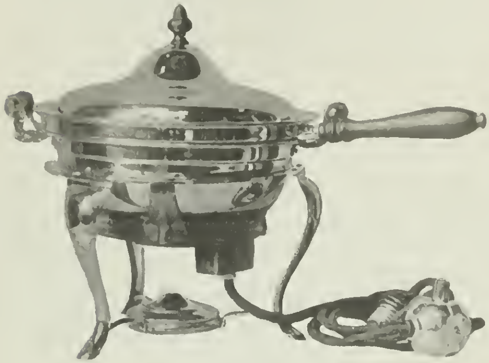
ELECTRIC POWER TABLE

Various devices have been designed for use in connection with this table. These include a bread mixer, a cake mixer, a coffee grinder, a food chopper, an ice-cream freezer, an egg beater, a vegetable slicer, a food grater, a knife sharpener and a knife polisher.

Disk-Stove Chafing-Dish Set

A combination disk stove and chafing dish similar to the ordinary alcohol type of chafing dish except that it has an electric disk stove in direct contact with the water pan, instead of an alcohol heater, is shown herewith. The complete set consists of a stand, a disk stove, a three-heat switch, an attachment plug, a water pan, a food pan, and a cover. The water pan, the food pan and the cover are the same as those used with alcohol-heated chafing dishes.

The heater consists of a steel disk inside of which the heating element is sealed and protected from oxidation. A dead-air space between the heater and the bottom of the stove casing acts as a heat insulator, preventing the loss of heat downward, so that practically all of the heat is thrown upward, where it is wanted. An indicating switch controls the temperature. The high heat is ordinarily used to bring the chafing dish quickly to the desired temperature. The low heat will keep water boiling after the boiling point is once reached; it is also useful for keeping the food warm. The medium heat is the highest that is usually needed for general cooking purposes.


ELECTRIC CHAFING DISH

With the feet of the disk stove reversed as shown the outfit is a chafing dish capable of cooking anything in it that can be cooked in an alcohol chafing dish. The disk stove can be used separately for any purpose for which a single-burner gas stove can be used, such as frying, grilling, making coffee, and various similar operations.

This disk-stove chafing-dish set is being made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Small Direct-Current and Alternating-Current Motors

Fractional-horse-power motors of the clutch and clutchless types rated at from 1/40 hp to 1/4 hp for alternating-current and direct-current circuits are being placed on the market by the Menominee Electric Manufacturing Company, Menominee, Mich. The frames of these motors are of cast iron and are finished with two coats of glossy-black baking enamel.

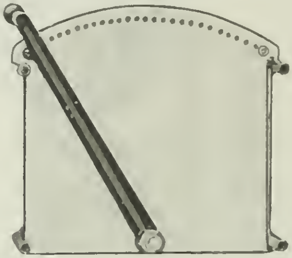
FRACTIONAL-HORSE-POWER MOTORS

The stator of the alternating-current motors is built up of sheet-steel punchings and the rotor of thin Norway iron sheets. There are no windings on the rotor. Lubrication is by oil cup and wick oiler, return grooves being provided to prevent oil throwing. Motors designed for operating pianos are equipped with a special tube oiler in addition to the wick oiler. Motors of less than 1/6 hp are of the clutchless type and those of more than 1/6 hp are provided with a clutch.

The frame of the direct-current motors and the poles are cast in one piece. These motors are tested under 50 per cent overload and they will carry 100 per cent overload, the manufacturers claim, for short periods without injury.

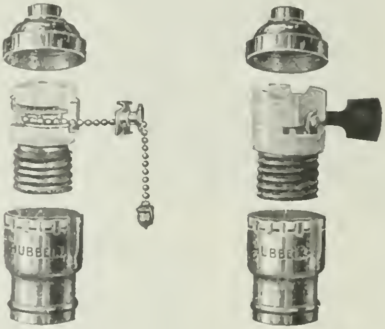
Automobile Battery-Charging Rheostat

An inexpensive battery-charging rheostat for gasoline automobiles is being placed on the market by the Ward Leonard Electric Company, Bronxville, N. Y. The device, which is illustrated herewith, is 11 in. square and 3.5 in. high. It will take care of from one to four cells at a charging rate of 8 amp.


RHEOSTAT FOR GASOLINE AUTOMOBILES

Snap-Shell Sockets

The pull socket and key socket illustrated herewith are equipped with a shell and cap which not only can be fitted together easily but can be as readily detached. The top of the shell is fluted and between the flutes are small cut-outs. There are nineteen different projections in the cap which fit into a corresponding number of slots in the shell, thus insuring absolute security. By means of this arrangement the sockets can be so placed on the fixture that the chain eyelet or key can be at any desired position. These sockets are manufactured by Harvey Hubbell, Inc., Bridgeport, Conn.



FIGS. 1 AND 2—PULL AND KEY SOCKETS

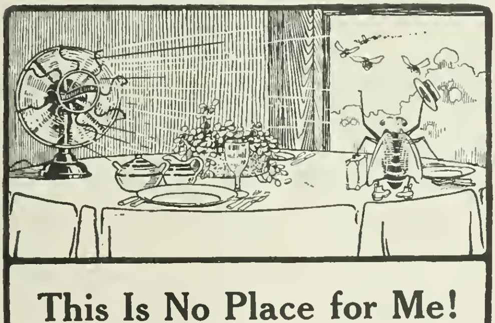
Jobber, Dealer and Contractor

Co-operative Electric Show in Tulsa

In conjunction with electrical dealers and contractors, the Public Service Company of Oklahoma gave an electric show in the Hotel Tulsa, Tulsa, Okla., during the week ended May 16. Domestic appliances in variety were exhibited and demonstrated in the grill room of the hotel. Printed invitations were sent to all of the electric-service company's customers and prospective customers. The dealers and contractors co-operating were the Deshon-Davison Company, Dodge Electric Company, Electric Supply Company and Tulsa Electric & Construction Company.

Jobber's Fan-Selling Campaign

Realizing that the obligation to its customers goes beyond the mere supplying of goods and stereotyped catalogs describing its products, the Western Electric Company has inaugurated a selling campaign which includes the education of the dealers in methods of selling and window decorating, extensive advertising in various newspapers and periodicals, and supplying the dealer with advertising helps of his own. In other words, the company undertakes everything in the process of selling a fan except consummating the actual sale of the article itself. An elaborate collection of circulars, posters and booklets has been prepared, which are being sent out broadcast to the trade.



This Is No Place for Me!

These people have bought a

Western Electric

Fan

Wherever there's a Western Electric fan flies are conspicuous by their absence.

In the dining room, kitchen, restaurant or store a Western Electric fan effectively rids you of these little pests.

For the store—a ceiling fan outside the entrance is better than a screen door. It affords an unobstructed view of the interior and at the same time effectively keeps out the flies.

An 8-inch desk fan on the table will give you a meal in comfort.

This type costs only ¼ of a cent an hour to run.

Every fan has a felt covered base. Can be used on the table, mantel, book case, without scratching.

Come in to-day and let us show you the new fans we've just received.

(This space for your name and address)

FIG. 1—SAMPLE FAN-SELLING ADVERTISEMENT

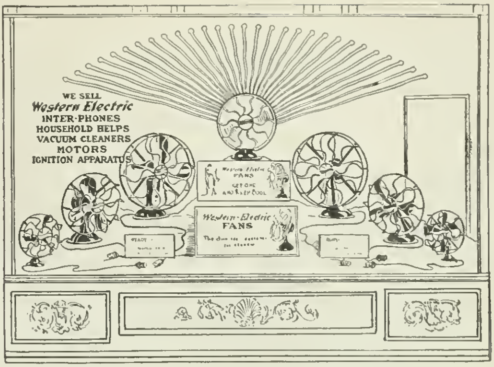


FIG. 2—TYPICAL WINDOW DISPLAY

Instead of the usual expensive catalog, a forty-eight-page booklet has been printed giving price lists and detailed descriptions of each type of fan. This is for the dealer. An attractively illustrated folder, describing briefly several fans, is provided for the buyer. This, however, contains no prices, as these are fixed by the dealer. Another folder, describing the various advertising helps provided, has been prepared for the dealer. Among these are newspaper advertisements, lantern slides for moving-picture shows, display cards, mailing folders and material for decorating windows.

Electrotypes of all the advertisements, one of which is shown in Fig. 1, are provided. One of the stock window displays is illustrated in Fig. 2. The material for this display consists of ribbon to attach to the fan shown in the center of the group, stickers to fasten the ribbons to the window glass, display cards and signs, artificial snow, and a decalcomania window sign shown on the window glass at the left. A circular giving complete instructions for arranging the fans and the decorations is also supplied.

Electrical Contractors Preparing for Big National Convention

It is believed that the forthcoming annual convention of the National Electrical Contractors' Association of the United States, to be held at the Hotel Cadillac, Detroit, on July 14-18, will be the most successful in the history of the organization. Meetings of the board of directors and executive committee will be held on Tuesday, July 14. The morning session of Wednesday, July 15, will be open and talks will be made by a number of men of prominence in the electrical industry. The afternoon session of Wednesday and all sessions of Thursday will be closed sessions, for members only. Friday, July 17, is reserved for outing day. If any business remains to be wound up, it will be taken up on Saturday. Otherwise this day will be used for the meetings of the board of directors and executive committee. The banquet will be held on Thursday night, and one evening will be set aside for the rejuvenation and joviation of the Jovian Order. Exhibits will be made by electrical manufacturers, and it is already certain that there will be displays from fifteen or more concerns. Mr. Ernest Freeman, 538 South Dearborn Street, Chicago, is president of the association.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Electric Truck Business Booms.—Since the beginning of the year 1914 twenty electric trucks have been sold by the General Vehicle Company, Inc., to Chicago breweries. Practically all of these vehicles are heavy units.

Canadian Factory for Lighting Standards.—The Union Metal Manufacturing Company's business in Canada has grown to such an extent that it has undertaken to build a new plant at Galt, Ont., thus saving a 30 per cent duty which is imposed on standards imported from the United States.

Insulated-Cable Business Fair.—The Okonite Company, 253 Broadway, New York, is finding business not so good as it was at this time last year. Conditions, however, are not alarming, and the company is evincing a spirit of optimism. The springtime is said to be usually the busiest time in the cable and wire industry. The Okonite Company gets most of its orders from the North and the West, relatively few coming from below the Mason and Dixon line.

Waterwheels for South America.—The Pelton Water Wheel Company of San Francisco, Cal., is receiving a number of orders for small-sized units from South American republics, and the amount of business done in this locality during the past year is said to be greater than that for the year before. The business in the United States at the present time is very slack. This is due, it is declared, to the unrest resulting from pending legislation on hydraulic developments.

Fire in Transformer Factory.—On May 2 part of the plant of the Pittsburgh Transformer Company was destroyed by fire. The shipping department, one of the storerooms, the carpenter shop and the tank factory were damaged most. The loss is estimated at about $50,000. Fortunately few of the records and none of the drawings or designs were destroyed, and accordingly little delay or inconvenience to customers resulted. A temporary shipping room was put in operation two days after the fire, and shipments have been made regularly since then.

Electric Washing Machines for the Chinaman.—The Public Service Company of New Jersey is endeavoring to convince the Chinese laundrymen that electrically operated machines should be in every laundry, and it is the intention of the company to employ a Chinese salesman to solicit business. A circular has been prepared by the Western Electric Company for the Public Service Company which is printed in both English and Chinese. Should this selling project meet with the success that is expected of it the Western Electric Company intends to develop this business in other localities, carrying on an educational campaign especially for the Chinaman's benefit.

Sales of Recording Instruments.—The Bristol Company, Waterbury, Conn., has recently sold forty-eight recording voltmeters to the Public Service Company of New Jersey, 100 instruments of the same type to a Canada buyer, and thirty-eight recording thermometers to a New York City concern. These sales are in addition to the routine business, which is reported to be very good. This company has developed a new hub for holding the dial plate of its recording instruments. The hole of this hub is eccentrically drilled, and in screwing on the cap a quarter turn is sufficient to bring it home. Fumbling and shifting of the cap to find the thread is, therefore, unnecessary.

Plant of General Insulate Company Damaged by Fire.—On April 25 a fire almost destroyed the power plant, the finishing rooms and part of the press rooms and machine shops of the General Insulate Company, 1008 Atlantic Avenue, Brooklyn, N. Y. Continual rainfall for three days following the fire made it almost impossible to do any work on the unroofed main building. However, within four days after the fire an inventory of the plant, covering 2700 different classifications, had been made, and on the succeeding Monday temporary die shops and finishing rooms were put in working order. Ten days after the fire the company was making shipments and the presses were working again. Reconstruction work has been started on the old plant.

Railway Motors for Baltimore.—The United Railways & Electric Company, Baltimore, Md., has ordered from the General Electric Company eighty-five four-motor equipments, which will be installed on the new cars being built by the J. G. Brill Company. The cars are of the double-end type and are equipped with improved cylinder-type controllers. The motors are of the split-frame, commutating-pole, positive-ventilated type and have a nominal rating of 33 hp on 500 volts and 40 hp on 600 volts. It is interesting to note that this additional traction equipment has been purchased primarily to provide adequate service during the centennial celebration of the writing of "The Star-Spangled Banner," which takes place in Baltimore during the week beginning Sept. 7. The contract with the General Electric Company also includes additional substation apparatus, comprising a 2000-kw, twenty-five-cycle, six-phase, compound-wound rotary converter, three 750-kva transformers, and switchboard panels.

Vacuum-Cleaner Engineer.—The Eureka Sales Company, 131 West Forty-second Street, New York, dealer in vacuum cleaners, employs an expert who acts in an advisory capacity to prospective buyers. This man studies the needs of each customer and advises what kind of cleaner is best suited for his particular purposes. He is also prepared to work with the architect where large vacuum-cleaning installations are to be made. This company finds business very good. It has been found that the largest number of sales are made in October and May of each year. The number of sales of the Eureka vacuum cleaner for April of this year is ahead of that of May last year, and it is safe to conclude, therefore, that the number of sales for May will be greater than that for the same month in 1913. The number of sales of an improved cleaner, known as the Eureka, type C machine, placed on the market March 1, 1914, was greater during April than that of all the Eureka machines sold in May of last year.

Prominent Electrical Men Entertained in Cleveland.—On Wednesday noon, May 6, Mr. George H. Kelly, secretary of the Baker Motor Vehicle Company, of Cleveland, Ohio, was host at the Union Club to a gathering of twelve men well known throughout the country for their connections in the electrical business. The guest of honor was Mr. Frank W. Smith, president of the Electric Vehicle Association of America, who was visiting the Baker factory. After inspecting the Baker plant Mr. Smith visited the leading garages of the city. Other guests at Mr. Kelly's lunch were Mr. S. E. Doane, of the National Electric Light Association; Mr. L. P. Sawyer, manager Buckeye Lamp Company; Mr. C. L. F. Wieber, president Rauch & Lang Carriage Company; Mr. George S. Milner, general manager Erner Electric Company; Mr. Mathias Turner, commercial agent Illuminating Company; Mr. T. P. Cagwin, commercial manager Cleveland Telephone Company; Mr. H. B. Gay, manager Cleveland office of the Electric Storage Battery Company; Mr. George D. Smith, district sales agent of the General Vehicle Company, New York; Mr. Ayers, manager truck department of the General Motors Company, and Mr. Hayden Eames, president Standard Electric Car Manufacturing Company.

Increasing Home Comfort by Means of Electricity.—On May 2 Mr. Arthur W. Hartigan, of the Western Electric Company, read a paper entitled "How to Increase Your Convenience and Comfort in the Home" at the home builders' exposition in the Craftsman Building, New York. Mr. Hartigan pleaded for the development of a higher percentage of efficiency in the home and declared that the adoption of electric appliances would aid materially in its attainment. The speaker gave data showing that vacuum cleaners, washing machines and electric heating and cooking devices were real and necessary factors in elevating the standard of living.

Electrical Equipment for Industrial Concerns.—The increasing popularity and usefulness of electrical equipment among the various industrial concerns is shown by the numerous orders made recently for new installations or for additions to electrical apparatus already in operation. Among these concerns is John P. Squire & Company, Boston, Mass., who will add to the electrical equipment in their plant at Cambridge, Mass., a 300-kw alternating-current generator, three 40-kw transformers, a Tirrill regulator and a six-panel switchboard. The Michigan Limestone & Chemical Company, Calcite, Mich., will also place in operation in its plant at Rogers City, Mich., a 1250-kva Curtis turbo-generator with a 7-kw motor-generator exciter set, a 200-hp induction motor, ten motors ranging from 20 hp to 75 hp, transformers and a switchboard. The Edward Ford Plate Glass Company, Toledo, Ohio, will add to the equipment of its plant a 13-ton, 42-in.-gage electric industrial locomotive and transfer-car equipment. The Braender Rubber & Tire Company, Rutherford, N. J., will add to its equipment five 100-hp induction motors. The Hebron Fire & Pressed Brick Company, Hebron, N. D., has arranged to install electric equipment consisting of a 300-kw Curtis turbo-generator and a 5-kw exciter, a 10-kva transformer, a switchboard and nineteen motors ranging from 7.5 hp to 50 hp in rating. The J. C. Hubinger Brothers Company, Keokuk, Ia., will add to its plant a 1270-hp synchronous motor with an 18-kw exciter and a switchboard. The Grand Rapids Plaster Company, Grand Rapids, Mich., will add a 35-hp and five 25-hp induction motors to its equipment. The Quaker Oats Company, Chicago, Ill., will add to its plant three 75-hp and two 100-hp motors. The Oneida Community, Ltd., Oneida, N. Y., is installing considerable electric equipment in its plant at Sherrill, N. Y., which includes 104 motors ranging from 3 hp to 20 hp in rating. The Robert Gair Company, Brooklyn, N. Y., is equipping its printing plant for electric drive, and has arranged to install fifty-seven additional motors ranging from 0.5 hp to 3.5 hp in rating, with controllers and accessories. The equipment for the above companies is to be supplied by the General Electric Company.

NEW YORK METAL MARKET PRICES

Copper	May 5 Bid	May 5 Asked	May 12 Bid	May 12 Asked
Standard spot*	13.40	14.00	13.50	14.00
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	63 7 6		63 3 9	
Prime Lake	14.37½	to 14.62½	14.37½	to 14.50
Electrolytic	14.10	to 14.20	14.00	to 14.10
Casting	14.05	to 14.15	13.90	to 14.00
Copper wire base	15.25	to 15.50	15.25	to ....
Lead	3.90		3.90	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.05	to 5.15	5.15	to 5.25
Tin, spot	33.05	to 33.15	34.37½	to 34.62½
Aluminum:				
Prompt delivery	17.75	to 18.00	17.87½	to 18.12½
Future	17.75	to 18.00	17.75	to 18.00

*OLD METALS

	May 5	May 12
Heavy copper and wire	12.87½	12.87½
Brass, heavy	8.62½	8.62½
Brass, light	7.50	7.50
Lead, heavy	3.90	3.90
Zinc, scrap	4.15	4.15

*COPPER EXPORTS

Total tons to May 5	14,141

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*From daily transactions on the New York Metal Exchange

Corporate and Financial

General Electric Directors.—At the annual meeting of the stockholders of the General Electric Company, held at Schenectady, N. Y., on May 12, the retiring directors were re-elected and Mr. Benjamin Strong, Jr., was added to the board.

Electric Bond & Share Company Results.—The financial statement of the Electric Bond & Share Company as of Dec. 31, 1913, shows investments of $9,313,478, of which $6,689,350 represents stock and $2,624,128 represents bonds and coupon notes. Syndicate holdings, underwritings and advances amount to $4,187,704. The surplus was $3,187,714 and reserves were $101,000.

Officers Elected for American Water Works & Electric Company.—At a recent meeting of the directors of the American Water Works & Electric Company the following were elected permanent officers: President, H. Hobart Porter; vice-president and treasurer, Stuart H. Patterson; secretary, Harry E. Towle; assistant to the president, J. H. Purdy. The following were chosen as members of the executive committee: H. Hobart Porter, Samuel Insull, Guy E. Tripp, T. H. Wiggin, James D. Mortimer and H. H. Pierce. The company's executive offices will be in New York City.

American Light & Traction Company Earnings.—The statement of the American Light & Traction Company for the twelve months ended March 31, 1914, shows earnings on stocks of subsidiary companies owned by that company of $3,712,368, as compared with $3,748,841 in the preceding fiscal year. Miscellaneous earnings were $710,398 as compared with $571,529. Gross earnings, therefore, were $4,422,766 as compared with $4,320,370. Expenses amounted to $130,882 in the 1914 fiscal year and to $117,489 in the 1913 fiscal year. Net earnings were $4,291,884 as compared with $4,202,881. The surplus and reserve of the previous year amounted to $8,888,790 last year and to $8,032,211 in the preceding year. Total surplus earnings therefore were $13,180,674 as compared with $12,235,092. Cash dividends on the preferred stock were $854,172 in each year. Cash dividends on the common stock were $1,374,497 last year as compared with $1,246,065 in the previous year, and these respective amounts were also paid during the years named as stock dividends on the common stock. The surplus at the close of the year was $9,577,508 for last year and $8,888,790 in the preceding year. The surplus at the close of the last year is divided between $5,500,939 reconstruction reserve and $4,076,569 undivided earnings.

Southern Indiana Power Company Control Sold.—Announcement has been made of the formal transfer of the Southern Indiana Power Company from its former owners, headed by Mr. Horace C. Stillwell, of Anderson, Ind., to a group of capitalists, headed by Mr. Chester P. Wilson, of Indianapolis, president of the Interstate Public Service Company. The Interstate Public Service Company is controlled by the Middle West Utilities Company, of which Mr. Samuel Insull is president. The Southern Indiana company supplies energy to stone quarries and mills of the Monroe and Lawrence County limestone district in Indiana. The company's new officials, it is said, are planning to construct another power dam at Shoals, Ind., in the White River, to supply power to French Lick, West Baden and other southern Indiana cities from a new station projected there. Already a power dam exists at Williams, Ind., from which the company supplies the stone districts with power. The capital stock of the Southern Indiana Power Company is $800,000. It was organized four years ago by Mr. H. C. Stillwell. The transmission lines of the company were extended to Monroe County last fall. A city franchise was granted by the city council of Bloomington at that time, and the offices of the company, formerly in Indianapolis, were moved to Bloomington. The newly elected officers of the company are: Chester P. Wilson, Indianapolis, president; Frank P. Smith, Whiteland, vice-president; Ira E. Guthrie, Indianapolis, secretary and treasurer; directors, the officers and Stanley E. Russell and Thomas A. Elger, Indianapolis. The Southern Equipment & Supply Company, of Bedford, also was purchased by the new owners of the power company. This company handles electrical and quarrying supplies.

Illinois Traction System Operations.—Earnings of the Illinois Traction Company for the calendar year 1913 amounted to $7,948,097 as compared with $7,415,647 in 1912, or a gain of 7.18 per cent. Of the total earnings $1,977,349 was received from the sale of electric energy. During the year there was expended on maintenance, renewals and betterments of all the properties $1,343,489, or 16.9 per cent of the gross revenue, as compared with 15.7 per cent in the previous year. In the annual report it is stated that the usual rate of increase in consumers prevailed on the city electric and gas properties and that exceptionally large industrial contracts were secured at Bloomington and Decatur.

Electrical Gains of United Gas Improvement Properties.—The annual report issued to stockholders of the United Gas Improvement Company shows that for the properties outside of Philadelphia the sales during 1913 compared with sales in 1912 as follows: Electric, 13.3 per cent increase; manufactured gas, 5.84 per cent increase; natural gas, 19.97 per cent decrease. In the city of Philadelphia the sales increased 2.84 per cent. The total earnings were $8,613,194, a decrease of $1,875 from 1912. Expenses were $1,142,087, an increase of $51,708 over 1912. Net profits were $7,471,107, a decrease of $53,583 from the previous year. Dividends of 8 per cent were paid on the stock. The treasurer's statement shows a decrease in net profits of leased works and receipts from investments in stocks and bonds of $1,032,342 as compared with 1912. This was mainly due to a great advance in the cost of gas oil and an increase in the payments to the city of Philadelphia out of receipts from gas sold to private consumers. This was offset by a profit of $1,060,806 from the sale of a part of the holdings of certain securities acquired thirteen years ago. From the sale of the rest of these securities the company has made an additional profit in 1914 of $2,172,812, which will appear in the next year's report.

Ontario Power Company Operations.—The annual statement of operations of the Ontario Power Company of Niagara Falls and the Ontario Transmission Company, Ltd., covering the year 1913, shows sales of power of $1,559,127 as compared with $1,233,669 in 1912. There were deducted in 1913 for purchased power $69,662 and for government rental $79,376, leaving gross earnings of $1,410,089. Corresponding deductions in 1912 were $3,674 and $66,471. The remaining gross earnings were $1,410,089 in 1913 and $1,163,524 in 1912. Operating expenses last year were $194,773 as compared with $171,434 in the previous year. Net earnings were $1,215,316 in 1913 and $992,090 in 1912. Other receipts amounted to $68,526 in 1913 and $22,286 in 1912. Total net income was $1,283,842 last year as compared with $1,014,376 in the preceding year. Interest aggregated $755,675 last year and $648,936 in 1912. The balance over fixed charges was $528,167 in 1913 and $365,440 in 1912. Dividends of 5 per cent were paid on the stock. The balance sheet surplus as of Sept. 31, 1913, was $515,482. J. J. Albright, the president, comments on the fact that the growth of the business during the year shows a very decided increase over the previous year. There were generated in 1913 639,081,290 kw-hr. as compared with 510,965,958 kw-hr. in 1912. Through the Hydroelectric Power Commission forty-five municipalities were served at the date of the report and five more were to be added shortly. When the 1912 report was issued the company had ten generators installed with a rated capacity of 117,000 hp. Since then the company has completed the installation of four additional units of 14,000 hp each.

General Electric Results in 1913.—The annual report made to stockholders of the General Electric Company covering the results of the year ended Dec. 31, 1913, shows that the percentage of profit on sales in 1913 was 9.6 per cent. This is a little better than the record of 1912, which showed 9.1 per cent. It is not so large, however, as the profit of 1911, which reached 11.3 per cent on the sales billed. This is one effect of the condition mentioned in the annual report arising from the tendency toward an increase in the number of orders received and a reduction in the average value thereof. It is interesting to compare the increase in the capitalized value of the manufacturing plant account with the record of business growth. The percentage of increase in manufacturing plants account over 1912 was 19.8, which is close to the rate of gain in amount of sales billed. The increase in the number of square feet of manufacturing floor space was 14.3 per cent. The statement of income account shows that the profits from sales were 26.7 per cent greater in 1913 than in 1912. As there was a decrease in other income, however, accompanied by an increase in the interest charges, the balance applicable to dividends on the stock showed an increase of but 3.8 per cent over 1912. The decrease in other income was equal to 24.1 per cent. This appears to have been due principally to the fact that the company did not report any profit on securities sold, whereas in the previous year this was one of the factors in the return. The same conservative policy with respect to the non-capitalization of patents which has been followed in other years again characterizes the report. Another feature of a similar character is the expenditure of $691,429 for shop equipment, vehicles, furniture and office appliances during the year, all of which was written off, so that the net book value of these items remains unchanged from the $1 at which they had previously been carried in the balance sheet.

New York Edison Company Report.—Extracts from the annual report of the New York Edison Company for 1913 have been made public by the New York Public Service Commission, First District. In the report as made public "contingency expense" and "subway rents" were reclassified in accordance with the accounting regulations of the commission. Operating revenues amounted to $23,011,195. Operating expenses as corrected were $9,200,244. Taxes were $1,286,508. Uncollectible bills amounted to $107,857. The total revenue deductions as corrected were $10,594,609. The operating income as corrected was $12,416,586. Non-operating revenue amounted to $1,289,974, from which there were non-operating revenue deductions of $39,413, leaving $1,250,561 non-operating income. This made the gross income applicable to corporate and leased properties, as corrected, $13,667,147. Total income deductions as corrected were $4,198,506, leaving a net corporate income as corrected of $9,468,641. Other credits to surplus amounted to $5,315. The previous surplus was $26,352,220, making a total surplus of $35,826,176. From this amount there were deducted $3,197,665 as renewal and contingency reserve, $3,009,204 as dividends of 6 per cent on the stock and $4,603 as miscellaneous debits, a total of $6,211,472. The surplus at the close of the year as reported was $29,614,704. Installations during the year amounted to $5,039,264, divided as follows: Additions, $3,958,284; betterments, $535,776; replacements, $526,655; other department additions, $18,549. Withdrawals or retirements amounted to $1,181,222, of which $1,139,113 represented capital installed prior to Dec. 31, 1908, and $42,109 subsequent changes. The net additions in 1913, therefore, were $3,858,042. The total gross fixed capital as of Jan. 1, 1913, was $123,012,223; the amount as of Dec. 31, 1913, was $126,870,265. Deducting the reserve of $15,820,315 for renewals and contingencies, the net fixed capital as of Dec. 31, 1913, was $111,049,950. The credit balance in the renewal and contingency reserve at the beginning of the year was $13,602,130. The amount credited to the reserve during the year was $3,197,666, making a total of $16,799,796. Charges to the reserve during the year amounted to $1,181,222, or, after allowance for material placed back in the storeroom and materials sold, $201,742, to $979,480. The credit balance at the close of the year was $15,820,316. The principal classes of operating expense were as follows: Production expenses, $3,355,176, or 0.621 cent per kw-hr. sold; transmission expenses, $404,165, or 0.075 cent per kw-hr.; total electric storage expenses, $30,558, or 0.006 cent per kw-hr.; total distribution expenses, $1,410,620, or 0.261 cent per kw-hr.; total utilization expenses, $995,480, or 0.184 cent per kw-hr.; total commercial expenses, $1,363,004, or 0.253 cent per kw-hr.; total general and miscellaneous expenses, corrected, $1,641,241, or 0.304 cent per kw-hr.; total operating expenses, corrected, $9,200,244, or 1.704 cents per kw-hr. There was supplied to other companies 67,040,299 kw-hr.; sold to the public, 472,988,478 kw-hr.; used, 14,172,603 kw-hr.; unaccounted for (indicated not actual), 128,204,849 kw-hr. The number of consumers was 136,180 and the number of active meters 193,656. The average sales per meter were 207 kw-hr. The maximum load was 211,563 kw, carried for fifteen minutes on Nov. 5, 1913.

Central-Station Returns for the Atlantic States for March.—Central-station returns for the month of March received from companies operating in the Middle Atlantic States indicate a slower rate of increase, both on gross earnings and energy output, than has come to be regarded as usual. These states include New York, New Jersey and Pennsylvania, which between them are responsible for one-quarter of all the energy generated in the country. The companies operating in the cities of New York and Philadelphia, together with the great New Jersey system, were alone responsible for an output of over 143,000,000 kw-hr. in the month of March, and it is known that the output of the entire country was less than nine times that amount. Returns received by the *Electrical World* from properties in these three states, which, on the basis of output, combine to form some 67 per cent of the industry of the Middle Atlantic group, show gross earnings for March, 1914, of $5,603,720 as compared with $5,282,154 for March, 1913—an increase of 6.1 per cent. For the same period the kilowatt-hours of energy output increased, at a rate of 7.5 per cent, from 196,343,544 to 210,843,247. Taking these rates of increase as thoroughly typical for this section of the country, it is possible to estimate quite closely that for all the central stations in the Middle Atlantic group the gross earnings increased from $9,717,000 in March, 1913, to $10,300,000 in March, 1914, while the energy output in the same period increased from 292,500,000 kw-hr. to 314,500,000 kw-hr. From this it is not difficult to realize something of the demand which the growth of the industry in this area is making upon the banks. With the light and power utilities of the Middle Atlantic States acquiring business which represents some $600,000 of increased earnings in the month, it may be estimated quite conservatively that they have to find, and invest in their properties, some $3,000,000 or $4,000,000 of new capital every month. A considerably higher rate of increase is indicated by the central stations falling within the South Atlantic group, which comprises Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia and Florida. It may be remembered that it was within this group of states that the most spectacular figures of electrical expansion, as disclosed by the 1912 census, were to be found. Between 1907 and 1912 the output of all the central stations of the South Atlantic States increased from 266,437,115 kw-hr. to 749,856,425 kw-hr., or at an annual average rate of 36.4 per cent, while the income grew from $7,672,229 to $15,940,380, at an annual average rate of 21.6 per cent. March returns show some falling off from these phenomenal figures, but indicate that wonderful increases are still being obtained.. The *Electrical World* has received data from the companies in practically every one of the principal cities in this group, the combined output of which is a little less than 50 per cent of all the energy generated in the South Atlantic States. For these companies gross earnings increased from $993,248 in March, 1913, to $1,104,010 in March, 1914, or at a rate of 11.3 per cent, while the energy output of stations increased from 41,940,503 kw-hr. in March, 1913, to 51,452,013 kw-hr. in March, 1914, or at a rate of 22.8 per cent. It should be noted that these very striking figures involve no guesswork, but are founded upon authentic data. For the whole of the South Atlantic group it may therefore be safely computed that the March gross earnings of all the central stations was $1,798,000 against $1,615,000 for March, 1913, and the energy output 104,500,000 kw-hr. against 85,170,000 kw-hr. Than this no finer object-lesson can be found as to the stability of the electric industry in times of business depression. The period from 1907 to 1912 was a period of great industrial activity the country over. For the last twelve months the pace has materially slackened, until the spring of 1914 sees many of the greatest revenue-producing industries in a worse position than they have been for many years. In spite of this the electrical utilities in the states along the South Atlantic seaboard are still piling on new business at a rate of over 20 per cent per annum. It should be stated that all reference to gross earnings in the foregoing is intended to cover gross revenue from the sale of electricity only. The figures relate strictly to central-station companies, and though revenue from the sale of energy for railway loads is of course included, no inclusion is made of receipts from street-car fares, etc., of any of these companies.

Business Notes

The Koerting & Mathiesen Company moved its office on May 1 to 49-53 East Twenty-first Street, New York.

The Pittsburgh High-Voltage Insulator Company has moved its Los Angeles office to 757 South Los Angeles Street.

The Hollings Company, dealer in electric-lighting fixtures, has recently changed its corporation from Maine to Massachusetts.

The Pure Water Apparatus Company has moved its main office from Philadelphia, Pa., to the new Adams Express Building, at 61 Broadway, New York City.

Norton and Bird, consulting engineers on public service properties, have moved their Chicago headquarters to 111 West Monroe Street, in the Harris Trust Building.

The Copeman Electric Stove Company, Flint, Mich., has developed a complete new line of electric ranges and accessories and, having obtained considerable new capital, is planning to market these energy-consuming devices with renewed activity.

The High-Tension Electric Company has been organized, with headquarters at 321-325 Susquehanna Street, Indianapolis, Ind., to carry on a business of manufacturing and repairing high-tension coils and magnetos. A. H. Wagner, manager of the company, has spent ten years in the auto ignition business, and A. F. Robertson, its treasurer, has been in the automobile business since its infancy.

The Electrical Engineers' Equipment Company, formerly at 10 North Desplaines Street, Chicago, moved into a new and larger building at 711-715 West Meridian Street, that city, on May 1. With the purchase of this new brick building the company now owns and occupies a three-story factory, with basement, which contains approximately 29,000 ft. of floor area. The products of the company are power-house appliances and specialties. N. Woodmansee and W. McKerrow are respectively president and secretary of the company.

New Industrial Companies

The Detroit Electric Welding Company, Detroit, Mich., has been incorporated for $10,000. Among the principal stockholders are Harry M. Lau, B. M. Greenfield and George M. Sayles.

The Price Electric & Manufacturing Company, of Basic City, Va., has been incorporated with a capital stock of $500,000. The officers are Paul Steinman, of Waynesboro, Va., president, and T. A. Sammis, of Basic City, secretary.

The Henderson-Lee Company, of Chicago, Ill., has been incorporated with a capital stock of $500 by R. F. Henderson, Ray P. Lee and George J. Tramer. The company purposes to sell, buy and deal in electrical and mechanical industries.

Nathan Klein & Company, of New York, N. Y., have been incorporated by Nathan Klein, 208 Center Street, New York; David Price and Isadore Jacoby, of New York. The company is capitalized at $20,000 and proposes to deal in electric motors.

The Lucas Signal & Control Company, of Chicago, Ill., has been incorporated with a capital stock of $10,000 to manufacture and deal in electrical appliances, etc. The incorporators are Paul Pierce, Everett N. Murphy and Joseph N. Pierce.

The Piedmont-Electro Chemical Company, of Charlotte, N. C., has been incorporated by I. Bechenleikner, D. C. Carmichael and E. R. Bucher, all of Charlotte, N. C. The company is capitalized at $100,000, and proposes to manufacture and deal in electrochemical machinery, dyestuffs, etc.

The Johnson Electric Smelting Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,500,000 for the purpose of manufacturing electric furnaces, machinery, etc. The incorporators are H. R. Martindale, W. F. Cook and W. I. N. Lofland, all of Dover.

Trade Publications

Motors.—Bulletin 29 of Fairbanks, Morse & Company, Chicago, Ill., gives a comprehensive description of its "TRC" motors and generators for direct current.

Metal Molding and Fittings.—The National Metal Molding Company, Pittsburgh, Pa., has issued an attractive booklet of ninety-six pages, profusely and interestingly illustrated, which is entitled "A Handbook on National Metal Molding and Fittings." This handbook lists each fitting and describes its assembly and installation.

Meter Tester.—In Circular No. 19 the States Company, 19 New Park Avenue, Hartford, Conn., illustrates a resistor device for use as artificial loads in meter testing. The device is essentially a combination of a constant-potential transformer with low-voltage secondary, resistors connected in the secondary and switches for varying the load.

Condenser.—The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has issued a unique display card. It contains two small samples of its condensers, the one showing the material used in the making of the condenser and the other showing this material subjected to a pressure of 2.5 tons per sq. in. after being impregnated with pure paraffine.

Sewage Disposal Apparatus.—The Sanitation Corporation, 50 Church Street, New York, specialist in apparatus, equipment and complete plants for sewage disposal, has issued a bulletin, Series G, No. 1, which sets forth the facilities of the company for installing complete sewage-disposal plants. Some illustrations of apparatus used for sewage disposal are given, as well as a partial list of foreign installations.

Industrial Trucks.—Bulletin No. 109 published by the Elwell-Parker Electric Company, Cleveland, Ohio, tells in an interesting manner of the development of electrically operated railroad and industrial trucks for handling baggage, freight and other material. A general description of the Elwell-Parker truck is given, as are also some performance data. The numerous pictures make an effective and convincing argument as to the advantages of this modern way of handling material in bulk.

Engines.—Bulletin No. 111-B of the Buckeye Engine Company, Salem, Ohio, gives a complete description of the Buckeye-mobile. This is a self-contained power plant for effective utilization of high-pressure superheated steam. It is claimed that it will develop a brake horse-power on less than 1½ lb. of coal per hour. Many illustrations are given, with tables and drawings showing capacity and general dimensions. An interesting table gives the comparative heat losses and coal consumption of typical power plants.

Lighting Practice in Various Industries.—Three interesting, instructive bulletins, giving the latest information on incandescent lamps and lighting, have recently been published by the Edison Lamp Works of the General Electric Company, Harrison, N. J. The titles are "The Lighting of Wood-Working Plants by Modern Methods," "The Lighting of Machine Shops and Metal Working Plants," and "Modern Lighting Practice in the Clothing Industry." The bulletins are well printed, generously illustrated and are inclosed within neat covers.

A New Edison Publication.—The *Edison Business Builder*, Vol. 1, No. 1, is replete with up-to-date selling suggestions of value to the entire electrical industry. The publication has been issued by the Edison Lamp Works of the General Electric Company, Harrison, N. J. It represents a real spirit of helpfulness on the part of the manufacturer toward the dealer and cannot fail in its mission of education of the general public as well as of the dealer. The publication is well printed and contains some excellent illustrations, as well as useful lighting data.

Co-operation with the Dealer.—The New York Gas Appliance Company, 569 Broadway, New York, has its imprint as publisher on *Co-operation*, a publication that is to be issued monthly "in the interest of the gas and electric industries." Vol. 1, No. .1, contains some good illustrations of a well-selected line of gas and electric fixtures. The large size of the publication shows the various fixture combinations effectively and will be found of assistance to the dealer and the prospective purchaser in making selections. The editorial page contains some practical hints to dealers.

Purifying Transformer Oil.—The Elliott Company, 6910 Susquehanna Street, Pittsburgh, Pa., has issued Bulletin No. 87, describing its capillary filter and telling of the results accomplished with this apparatus in restoring used transformer and switch oils to their original value. An illustration is given of the filter, showing its method of operation. The filters are made in sizes from 10 gal. per day up to 50 gal. and are supplied with electric heating coils for 110-volt alternating current or direct current. The central-station manager will be interested in this useful accessory to his plant.

Heating Appliances.—The twenty-four page catalog of the Despatch Manufacturing Company, Minneapolis, Minn., gives practical evidence of the advance made in the design and manufacture of heating appliances, and more especially of electric ovens. In this catalog are shown ovens for testing in flour-mill laboratories, for bakeries, for drying, for moisture tests of soils, for baking enamel, japan and lacquer, for household use and for other purposes. Electric air heaters and hot-water heaters are also illustrated and briefly described. The electric ovens are used in a wide variety of industries. The catalog is well printed and illustrated.

Indicator for Lamps.—An ingenious device has been brought out by the Edison Lamp Works of the General Electric Company, Harrison, N. J. It consists of two celluloid disks, 3⅞ in. in diameter, which are calibrated to indicate at once the operating characteristics of lamps made by this company. The red marks traveling along the slotted curves give approximate figures for any change in voltage, while exact figures for changes of 1 per cent appear in the rectangular openings. The "cost of lighting" curve gives the relative cost of producing the same quantity of light at different voltages. It is based on a rate of 10 cents per kw-hr. with the 60-watt lamp at list price.

Rubber Insulation Report.—The report of the joint rubber insulation committee, recommending a well-defined method of procedure in the analysis of rubber for insulation and other uses, has just been reprinted by the Simplex Wire & Cable Company, Boston, Mass. The full report of this committee provides a method of avoiding misunderstandings in working with rubber analyses and consists of twenty-four pages. This report was prepared by a number of interests identified with this subject, including the United States Signal Service and Bureau of Standards, the American Chemical Society, two of the large trunk-line railroads, and four of the manufacturers of rubber-insulated wires, of which the Simplex company was one.

Portfolio of Lighting Data.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, Ill., has brought out a portfolio, in which are incorporated a fifty-two-page brochure relating to interior lighting planning and specifications and an envelope that contains twenty-four detail drawings giving complete illumination and installation data covering a wide range of installations. While intended primarily for architects, this elaborate work will be found of great interest to illuminating engineers. Practically all phases of modern illumination, both interior and exterior, have been considered, and the work has been well done. The envelope has been made large enough to admit of future additions. Each plate is indexed. The price of the publication is $5.

Booklet on Shop Lighting.—The Industrial Commission of Wisconsin has issued an instructive booklet on shop lighting, prepared by Mr. Fred Schwarze, electrical engineer of the Pfister & Vogel Leather Company, in whose plant many of the results outlined were obtained. The contents suggest the comprehensive manner in which the subject has been treated: "Good Light Saves Money," "Types of Lamps," "Reflectors," "Amount of Light for Various Departments and Conditions," "Suggestions for Installation," "Standards Recommended for Various Departments and Conditions," "Natural Light," "Orders of Industrial Commission on Shop Lighting." The reading matter is well prepared and fully illustrated. The publication is worthy of its sub-title, "A Handbook for Superintendents and Electricians."

Personal Mention

Mr. Alba H. Warner has been appointed manager of the Galveston (Tex.) Electric Company, succeeding Mr. L. C. Bradley.

Mr. R. W. Morrison has been appointed manager of the Laredo (Tex.) Electric & Railway Company, succeeding Mr. Frank E. Scovill, who recently resigned.

Mr. Frank E. Scovill has resigned as manager of the Laredo (Tex.) Electric & Railway Company and has entered the business of onion farming near Laredo.

Mr. C. H. Nandell has been appointed manager of the Marshall (Tex.) Electric Company, succeeding Mr. E. L. Wells, Jr., who recently resigned owing to ill health.

Mr. H. C. Sterling, of Three Rivers, Mich., president of the Michigan Section of the National Electric Light Association, has been appointed statesman of the Jovian Order for Michigan.

Mr. William C. Comer, assistant division superintendent of the Metropolitan Street Railway Company, of Kansas City, has resigned to enter the electrical contracting business independently.

Mr. Arthur Cushing has been appointed operating engineer of the Clinton (Ill.) Gas & Electric Company. He was formerly with the Decatur Railway & Light Company and other Illinois Traction properties.

Mr. David Daly, general manager of the Houston (Tex.) Electric Company and the Houston-Galveston interurban electric railway, is recovering from an unusually severe and protracted attack of typhoid fever.

Mr. F. J. Blaschke, of Cleveland, representing the engineering department of the National Lamp Works of the General Electric Company, gave an informal talk on May 11 before the Chicago Jovian League on "The Proper Lamp for the Circuit."

Mr. A. H. R. Jackson, formerly general superintendent of the properties of the Illinois Traction System in Jefferson City, Mo., has been made general superintendent of the Oskaloosa Light & Traction Company, Oskaloosa, Ia., which is also an Illinois Traction property.

Mr. H. M. Wall, who for the past year has been connected with the Memphis Street Railway Company as assistant chief engineer of power stations, has become associated with the firm of Ruebel & Wells, consulting mechanical-electrical engineers, Chemical Building, St. Louis, Mo.

Mr. Foster Hannaford has been appointed acting general superintendent of the Galesburg (Ill.) Railway, Lighting & Power Company, vice Mr. Dickerson McAfee, now on a leave of absence. Mr. Hannaford has been operating engineer of the company, which is one of the subsidiaries of the Illinois Traction System.

Mr. Emil Gruenfeldt, chief engineer for the Baker Motor Vehicle Company, of Cleveland, sailed last week for Europe. Mr. Gruenfeldt will be abroad about two months, during which time he expects to take a brief vacation in Germany, and also to make an investigation of recent foreign motor-car developments.

Mr. Harry Chapin Plummer has been engaged by the Society for Electrical Development as assistant in the news and advertising department. Mr. Plummer has had several years' training in active newspaper work, is a writer on engineering and technical subjects and has made a specialty of presenting in popular form subjects of an academic character.

Mr. D. W. Snyder, formerly superintendent of the Clinton (Ill.) Gas & Electric Company, has been appointed general superintendent of the Jefferson City, Bridge & Transit Company and the Jefferson City Light, Heat & Power Company, all of which properties are subsidiaries of the Illinois Traction System. Mr. Snyder has been succeeded at Clinton, Ill., by Mr. Charles Cline.

Mr. Arthur Casson Hobble, until recently electrical construction engineer for the Mexican Northern Power Company at Santa Rosalia, Chihuahua, Mexico, is spending some time in Chicago, having formed a connection with the Chicago Association of Commerce committee of investigation on smoke abatement and electrification of railway terminals. Mr. Hobble is a graduate of the University of Illinois and a member of the American Institute of Electrical Engineers.

Mr. Williston Fish, vice-president of the Chicago Surface Lines, has accepted appointment as vice-president of the West Penn Traction Company, of Pittsburgh, which operates electric-service as well as railway properties. Mr. Fish is a West Point graduate and former United States army officer. He was later admitted to the bar in Chicago, in which city he has resided since 1887. For twenty-four years Mr. Fish has been connected with the surface-railway companies of Chicago, nearly all of that time in executive positions. He took a prominent part in the negotiations leading to the traction-settlement ordinances of 1907. No man in public-utility circles in Chicago has made a better reputation for fair-mindedness. Mr. Fish is also the possessor of exceptional literary gifts, and some of his compositions, both prose and verse, have had a wide circulation.

Mr. H. C. Spaulding, who has just joined the staff of the Society for Electrical Development, Inc., as manager of the news department, is a graduate of the Massachusetts Institute of Technology. He was for some years identified with the Thomson-Houston interests, giving special attention to the development of motor applications. After organizing and for a time acting as manager of the electrical department of the Blake & Knowles Pump Company in New York he returned to Boston as New England manager of the Siemens & Halske Electrical Company, later occupying the same position for the American Stoker Company. For the last few years his headquarters have been in New York as assistant sales manager of the Triumph Electric Company and until recently district manager of the hoist department of the Yale & Towne Manufacturing Company Mr. Spaulding is a member of various engineering organizations and a Jovian.

H. C. SPAULDING

Mr. A. H. Jones, the newly elected president of the Mississippi Electric Association, which is a section of the National Electric Light Association, is general manager of the McComb City Electric Light & Power Company, McComb, Miss. He was formerly vice-president of the state association and for several years has been active in its affairs as secretary-treasurer. Mr. Jones was born at Boston, Mass., in 1881, and after the usual preliminary training entered the course in marine and electrical engineering of the Massachusetts Nautical School, Boston, from which he was graduated in 1899. He next took up the testing course offered by the General Electric Company at its Schenectady and Lynn shops, and in 1902 was transferred to that company's sales organization with headquarters at Atlanta, Ga., and later New Orleans, La. In 1904 Mr. Jones was appointed superintendent of the McComb company's system, but he has served as general manager since 1906.

Obituary

Dr. Paul L. T. Héroult, well known for his pioneer work in the electrometallurgy of aluminum and steel, died in Paris, France, on May 9. He was fifty-one years old, having been born on April 10, 1863, at Thury-Harcourt, Calvados, Normandy. His aluminum process, which he discovered simultaneously with and independently of Mr. Charles M. Hall, is in successful use in Switzerland, France, Canada and the United States, while his electric-steel-furnace patents have been taken over by the United States Steel Corporation.

Construction

New England

BANGOR, MAINE.—The Bangor Ry. & El. Co. contemplates extensions and improvements to its lighting, power and street railway systems, involving an expenditure of $191,000, of which $43,000 will be used for reconstruction work in Bangor, $28,500 for new waterwheels and generators at the Veazie power station, and $37,000 in extending the lines of the Bar Harbor & Union River Pwr. Co., a subsidiary company in Hancock County. The transmission lines are being extended from Ellsworth to Bluehill, a distance of 20 miles.

MILO, MAINE.—The town of Milo has awarded the contract for street-lighting to the Milo Elec. Lt. & Pwr. Co., for a period of 10 years. The contract calls for seventy 75-watt lamps, to take the place of the 60 lamps of 25 cp now in use. The company also agrees to light the new bridge without additional cost, the ornamental fixtures to be furnished by the town.

EAST BRAINTREE, MASS.—The electric light commissioners expect to purchase within the next six months some electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc. Fred B. Lawrence is manager.

FARLEY, MASS.—The Franklin County Pwr. Co., which recently purchased the property of the Farley Paper Co., at Farley, is reported to be making preparations to utilize the water-power at the dam to generate electricity. A high-tension transmission line will be erected from this new generating station to the main plant of the Athol Gas & El. Co., at Wendall. The latter company will probably erect the transmission line for the Franklin company, which will sell the energy generated at the plant to the Athol company.

LUDLOW, MASS.—The Ludlow Mfg. Associates has been granted pole locations for a transmission line from the Holyoke road west to Chicopee.

SPRINGFIELD, MASS.—The City Council has awarded the contract for street-lighting to the United El. Lt. Co. for a period of ten years. The new contract provides for relocating about 400 arc lamps and for about 250 additional new lamps.

HARTFORD, CONN.—Bids will be received by the Board of Contract and Supply, City Hall, Hartford, until May 26, for lighting fixtures for the Hartford municipal building. Drawings and specifications, etc., may be obtained at the office of Davis & Brooks, architects, 49 Pearl Street, Hartford. Joseph Butts is secretary.

MERIDEN, CONN.—The City Council has appointed a committee to make investigations with a view of installing an ornamental street-lighting system in the business section of the city.

SOUTH NORWALK, CONN.—The South Norwalk Electric Works are considering the installation of underground conduits and ornamental street lamps and standards. Albert E. Winchester is general superintendent of the South Norwalk Electric Works.

Middle Atlantic

ARGYLE, N. Y.—The engineers engaged to make an examination of the water-power available to operate an electric-light plant for the Washington County Almshouse at Argyle report that sufficient power is available without injuring the water supply. The cost of installing the plant is estimated at $3,500.

HORNELL, N. Y.—The Hornell El. Co. contemplates improvements to its plant, to cost about $80,000. The proposed work will include the erection of a power house, 50 ft. by 60 ft., to be addition to the present Hill Street plant; the installation of two 1000-hp turbo-generator sets, contracts for which have been awarded. A large electrical crane and several smaller machines will be installed. The company will also extend its transmission lines to North Hornell and make several changes throughout the city.

JAMAICA, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner Park Avenue and Fifty-ninth Street, New York, until May 18, for installing electric equipment in the addition to and alterations in Public School 45, on Maple Street, Jamaica. Blank forms, plans and specifications may be obtained or seen at the above office, and at the branch office, 69 Broadway, Flushing, borough of Queens.

JAMESTOWN, N. Y.—The Board of Water and Lighting Commissioners has awarded the contract for a 1000-kw turbo-generator for the municipal electric-light plant to the General El. Co., at $19,587.

LUZERNE, N. Y.—The Riddell El. Lt. Co. is installing an electric-lighting system in Luzerne. The distributing system will require 4 miles of wire (No. 4 and No. 6) erected on 35-ft. chestnut poles. Nitrogen incandescent lamps will be used for street lighting. The company is doing its own construction work. E. E. Riddell is president of the company.

MONGAUP, N. Y.—The Mongaup Lt., Ht. & Pwr. Co. has applied to the Public Service Commission for permission to construct a plant and to exercise franchises in Sullivan County.

NEW HARTFORD, N. Y.—Bids will be received by Clarence B. Brooks, clerk of the board of education of the Union Free School District No. 8, Chadwicks, N. Y., until May 25 for construction of school house, including electric wiring and fixtures, heating and ventilating apparatus and water system, etc. Plans and specifications are on file in the office of Walter G. Frank, architect, Clarendon Building, Utica, where copies may be obtained upon application.

NEW YORK, N. Y.—The New York Edison Co. has been granted permission by the Public Service Commission to issue $15,800,000 in additional capital stock.

NIAGARA FALLS, N. Y.—Bids will be received by the Board of Public Works until May 19 for lighting the streets of the city on three-year and five-year contracts. The contract with the Buffalo & Niagara Falls El. Lt. & Pwr. Co. expired last December.

OGDENSBURG, N. Y.—The Ogdensburg Pwr. & Lt. Co. has submitted a proposal to the officials of Maple City offering to install an ornamental lighting system on Ford Street, provided the city will enter into a new contract with the company for a period of five years, at $11,000 per annum. The company will erect 38 standards on Ford Street, 18 of which will carry five-lamp clusters, while the other 20 will carry four lamps each and, instead of carrying a fifth lamp, will support the trolley wires. The cost will be about $7,000. All wires will be placed underground.

CLAYSVILLE, PA.—The West Penn Ltg. Co. has applied to the Borough Council for a franchise to furnish electricity in Claysville. The company proposes to furnish the service from its power plant near Point Marion on the Cheat River.

ERIE, PA.—Plans for the conduit system in State Street have been approved by the power companies. An appropriation of $42,000 has been made for the system. Work will begin about June 1.

HANOVER, PA.—The capital stock of the Hanover Lt., Ht. & Pwr. Co. has been increased from $60,000 to $100,000.

HERSHEY, PA.—We are informed that the damage to the power plant of the Hershey Chocolate Co. was not so bad as reported in the issue of May 9. The generators have all been repaired and new buildings are being erected. The company is building a new power house which will have an output of 4000 hp, equipment for which has already been purchased. Ezra B. Hershey is treasurer.

PITTSBURGH, PA.—The contract for the construction of a large brick and steel addition to the power plant of the Duquesne Pwr. Co., of Pittsburgh, on Brunot's Island, has been awarded to D. T. Riffle.

PITTSBURGH, PA.—Extensive additions and improvements are contemplated by the West Penn Trac. Co. in the next two years, which will involve an expenditure of $4,000,000, of which about $84,000 will be used for the Pennsylvania electric lines, $80,000 for the Wheeling Trac. Co., of Wheeling, W. Va., $1,400,000 on generating stations, $500,000 on transmission lines, $230,000 on substations, and $650,000 on distributing systems.

POTTSVILLE, PA.—J. I. Reed, proprietor of the Union Knitting Mills, of Pottsville, it is reported, contemplates the installation of an electric power plant to operate the mills.

TARENTUM, PA.—The Borough Council has granted the Allegheny Valley Tel. Co. a franchise to install a telephone system in Tarentum. The company, which is to be capitalized at between $75,000 and $100,000, has also been granted franchises in the borough of Brackenridge and Harrison Township.

WILLIAMSPORT, PA.—Bids will be received by Samuel Stahler, superintendent of public affairs, Williamsport, until June 10 for lighting the streets, parks and public places with electricity for a period of three, five and ten years from Dec. 1, 1914; also bids for lighting the city hall and the several fire-engine houses for a similar period. The specifications provide for a minimum of 221 arc lamps.

RAHWAY, N. J.—The special committee appointed by the Council to investigate the feasibility of establishing a municipal electric-light plant has submitted its report, in which it states that a generating plant could be installed for about $25,000 and a distributing system for from $25,000 to $30,000 more.

CUMBERLAND, MD.—Leo T. Lawler has been appointed to make an investigation of the municipal electric plant and submit report with a view of making extension and improvements to same. J. S. Schriever is commissioner of water and lights.

FRIENDSVILLE, MD.—Plans are being considered by the Youghiogheny Pwr. Co. for the development of the water-power of Youghiogheny River and tributaries in Garrett County and construction of power plant near Friendsville. Three dams will probably be built, forming a reservoir 6 miles long, to develop about 40,000 hp. Electricity generated at the plant will be transmitted throughout western Maryland and to cities in western Pennsylvania. Parties interested in the company have also organized the Youghiogheny Wtr. & El. Pwr. Co., which is planning a hydroelectric development at Swallowsville, Md. John Bogart, 141 Broadway, New York, N. Y., is engineer, and Charles L. Pullen, of New York, N. Y., is vice-president.

WILLIAMSPORT, MD.—The proposal to issue $40,000 in bonds for the installation of a municipal electric-light plant and water-works system will be submitted to the voters on June 8.

WHITE SULPHUR SPRINGS, W. VA.—Plans are under consideration by the Mountain Milling Co. for remodeling its electric-light plant. It is understood that new equipment will be installed.

RICHMOND, VA.—The Old Dominion Iron & Nail Works are contemplating the construction of a reinforced-concrete and steel power house on Belle Isle, to cost about $50,000.

WINCHESTER, VA.—The Northern Virginia Pwr. Co., of Winchester, it is reported, is installing a 1050-kw generating unit, consisting of a generator and waterwheel, at its power house in Millville, W. Va. P. O. Keilholtz, Continental Building, Baltimore, Md., consulting engineer, has charge of the work.

WASHINGTON, D. C.—Bids will be received at the Engineer Depot, United States Army, Washington Barracks, D. C., until May 20, for furnishing 125-volt direct-current switchboards. For further information address, Lt. Col. Thomas E. Kuhn.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 2 for furnishing supplies at the various navy yards and naval stations as follows: Brooklyn, N. Y., Schedule 6778—6000 ft. of armoring and leading interior communication cable; Schedule 6772—270 seamless brass intercooler tubes. Norfolk, Va., Schedule 6775—5400 lb. hard-rolled sheet copper, lined on one side, 48 in. by 96 in., weighing 56 oz. per square ft. Annapolis, Md., Schedule 6773—one Curtis turbine, nozzles and wheels with blading model, one valve mechanism and governor, steam chest, full size. Boston, Mass., Schedule 6777—telephones, switchboard and spare parts. Bids will also be received until June 16 as follows: Mare Island, Cal., Schedule 6781—three two-motor electric traveling cranes; Schedule 6783—one 16-in by 5-ft. motor-driven quick-change gear, geared-head lathe. Puget Sound, Wash., Schedule 6782—two cranes, 15 and 40 tons, with 5-ton auxiliary hoists. Semi-annual supply of gum and rubber gasket to be delivered at all yards as per Schedule 6785. Applications for proposals should designate the schedule desired by number.

North Central

ALMA, MICH.—The Alma Illg. Engineering Co., which was recently granted a franchise through the townships of Sumner and Seville, will erect a power plant in Riverdale. Equipment not yet decided upon About 20 miles of wire will be required for transmission and distribution system; 35-ft and 40-ft. poles will be used. H. S. Conner is engineer in charge.

BAY CITY, MICH.—The Bay City Electric Light Department has recently purchased three 50-lamp (4-amp. Westinghouse metallic flame-arc) outfits and will also purchase 100 arc lamps, to be installed this summer, making a total of 600 lamps for street-lighting system. William H Fitzhugh is superintendent.

BAY VIEW, MICH.—The Bay View Camp Ground Association expects to purchase within the next four months about 50 meters, 20,000 ft. of wire with necessary pins, insulators, etc., and about 500 incandescent lamps from 20 to 60 watts. The plant is operated only during June, July and August. Electricity for operating the system is purchased from the Petoskey municipal plant. Luther C. Mason is superintendent of grounds.

BELDING, MICH.—The Citizens' Lt. Co., of Belding, is expecting to purchase about one carload of poles (30 ft. to 35 ft.). M. A. Reed is secretary.

CRYSTAL FALLS, MICH.—The electric light commission expects to purchase within the next four months one waterwheel (vertical type) and one 200-kw, three-phase, 60-cycle, 2300-volt generator. J. H. Sanders is superintendent.

DETROIT, MICH.—Preparations are being made by the Detroit United Ry. Co. for extensive improvements to its system both within and outside of the city limits of Detroit.

GREENVILLE, MICH.—The R. J. Tower El. Co., of Greenville, is rebuilding its dam and power plant and installing an additional turbine. All machinery and equipment has been purchased. S. L. Tower is manager.

ISHPEMING, MICH.—The City Council has decided to accept the proposal of the Marquette Gas & El. Co. for a new street-lighting contract.

LUDINGTON, MICH.—The Stearns Lt. & Pwr. Co., of Ludington, is planning to extend its transmission lines to New Era to furnish electrical service there.

LUDINGTON, MICH.—The contract for electric wiring and motors for the new factory of the Gile Boat Co., of Ludington, has been awarded to the Stearns Ltg. & Pwr. Co., of this place. The building will be one story high, 30 ft. by 160 ft. for the foundry and 50 ft. by 100 ft. for the testing room. W. L. Gile is general manager of the boat company.

MANISTIQUE, MICH.—Bids will be received by the school building committee of the St. Francis de Sales Congregation, addressed to Rev. B. J. Schevers, Manistique, Mich., until May 25 for construction of school building, according to plans and specifications prepared by Foeller & Schober, architects, Green Bay, Wis. Separate bids will be received on each of the following branches of the work: Mason work; cut-stone work; terra cotta; structural steel and iron work; carpenter work, including plastering and glazing; hardware and roofing; painting; plumbing; heating and ventilating; electric wiring. Bidders may submit proposals on two or more parts.

MENOMINEE, MICH.—The Menominee & Marinette Lt. & Trac. Co. has increased its capital stock from $1,000,000 to $1,250,000.

NORTH BRANCH, MICH.—The Council has practically closed a deal with the Schlegel Lt. & Pwr. Co., of Lapeer, whereby the latter will furnish electrical service here and light the streets of the village. The company asks for a five-year contract and will furnish a 24-hour service.

SAULT STE. MARIE, MICH.—The International Joint Commission has granted the joint request of the Michigan Northern Pwr. Co., of Sault Ste. Marie, Mich., and the Algoma Steel Co., of Sault Ste. Marie, Ont., for the erection of compensation works in the St. Mary's River midway between the two cities, subject to conditions which have been agreed upon by engineers of the two governments and the two corporations.

CANTON, OHIO.—The City Council is considering the question of compelling the electric, street railway and telephone companies to place their wires underground in the business section of the city.

CHARDON, OHIO.—Application has been made to the Ohio Public Utilities Commission by John B. Chapman, of Cleveland, for authority to issue $300,000 in capital stock and $425,000 in bonds, the proceeds to be used for the construction of an electric interurban railway between Chardon and Jefferson, 15 miles long.

CINCINNATI, OHIO.—The installation of electrically operated equipment at the central sewage pumping plant and the Main Street station is reported to be under consideration by Jerry O'Shaughnessy, superintendent of water-works.

CINCINNATI, OHIO.—The Union Gas & El. Co., of Cincinnati, is making investigations in Delhi, Sayler Park and Fernbank, which are suburbs of Cincinnati, with a view of extending its service to those towns. The company estimates that it will cost about $10,000 to extend its lines to the towns mentioned, but will do so if sufficient patronage is guaranteed. The Cincinnati, Lawrenceburg & Aurora Trac. Co., of Cincinnati, has also offered to furnish electricity in the above towns at city rates.

CLEVELAND, OHIO.—Bids will be received by A. R. Callow, commissioner of purchases and supplies, until May 28 for electric-light poles. Specifications are on file in the office of the commissioner of light and heat division, 1443 East Third Street, Cleveland.

CLEVELAND, OHIO. — Improvements and extensions will be made to the system of the Cleveland Tel. Co., involving an expenditure of $1,700,000, provided the State Public Utilities Commission authorizes an issue of $4,000,000 in notes, for which the company has made application.

COLUMBUS, OHIO.—Bids will be received by B. L. Bargar, director of public safety, City Hall, Columbus, until May 22 for 4996 ft. 20 twisted pairs of No. 16 B. & S. G. copper wire, in accordance with specifications copies of which are on file in the office of the director of public safety. All wire to be high-grade rubber-insulated lead-covered telephone cable.

JAMESTOWN, OHIO.—The Dayton Pwr. & Lt. Co., it is reported, will purchase the plant and holdings of the Jamestown El. Ltg. Co. Energy for operating the local system will be furnished from the central station at Dayton.

NELSONVILLE, OHIO.—The Hocking Pwr. Co., of Nelsonville, has applied for a 25-year franchise in Athens. The company, it is reported, contemplates the construction of a large central power station in Floodwood.

OAK HARBOR, OHIO.—Within the next three months the village of Oak Harbor expects to erect a substation, transmission lines, etc., to distribute electricity in Oak Harbor, to be supplied by the Northwestern Ohio Ry. & Pwr. Co. Contracts amounting to $13,991 for construction work and equipment have been awarded. The village recently purchased the property of the Oak Harbor El. Co.

PAINESVILLE, OHIO.—Plans and specifications have been prepared by the committee for the installation of an ornamental street-lighting system, to cost about $4,000.

PORTSMOUTH, OHIO. — The Portsmouth Tel. Co. is planning to extend its cables to New Boston, a distance of 5000 ft., and to lay a large quantity of underground conduit in Portsmouth.

SEBRING, OHIO.—The installation of an ornamental street-lighting system in the business section of the city is under consideration by the Board of Trade.

URBANA, OHIO.—The installation of cluster lamps in the business district of the city is under consideration by the City Council. About 40 standards will be required.

YOUNGSTOWN, OHIO. — Initial steps have been taken by the City Council for the establishment of a municipal electric-light plant by appropriating $3,000 to employ an engineer to make preliminary surveys and furnish estimates of the probable cost of the plant.

JACKSON, KY.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 17 for the construction, including mechanical equipment and lighting fixtures, of the United States public building at Jackson, Ky. For further information address the above office. O. Wenderoth is supervising architect.

BEDFORD, IND.—The Southern Indiana Pwr. Co., of Bedford, Ind., which furnishes electricity to stone quarries and mills in the Monroe and Lawrence Counties limestone district, has been taken over by a group of capitalists, headed by Chester P. Wilson, of Indianapolis, president of the Interstate Pub. Ser. Co., of Indianapolis. The new owners, it is said, contemplate the construction of another power dam at Shoals, on the White River, to furnish electrical energy in French Lick, West Baden and other southern Indiana cities. The new officers are: Chester P. Wilson, president; Frank P. Smith, Whiteland, vice-president, and Ira E. Guthrie, of Indianapolis, secretary and treasurer. The Southern Equipment & Supply Co., which handles heavy electrical and quarrying supplies, has also been taken over by the new officials.

COVINGTON, IND.—Improvements have been made to the municipal electric-light plant recently, consisting of the installation of the pumps (Dean Brothers). Two 150-hp Brownell boilers were installed last fall. New posts carrying five-lamp clusters are being installed (a few at a time) as arc lamps are taken down. Charles A. Baldwin is city clerk.

ELKHART, IND.—The Elkhart Manufacturers' Association contemplates the construction of a power plant on the site of the old mill, near the junction of Beardsley Avenue and Riverside Drive, at a cost of about $50,000, to furnish electricity to operate plants owned by the association. It is proposed to equip the plant with three units of 250 hp each.

MARTINSVILLE, IND.—The City Council has authorized the installation of electric lamps in the outlying sections of the city and has also provided funds for the erection of cluster lamps at the city hall.

MONTPELIER, IND.—The Montpelier Utilities Co. is now installing two Heine water-tube boilers having a working pressure of 180 lb. Last January the company installed one directly connected unit (60 cycles, three-phase, 2300 volts), and it expects to install a second unit this summer.

OAKLAND, IND.—The Oakland City El. Lt. & Pwr. Co. has recently changed the street-lighting system from inclosed-arc lamps to series incandescent lamps. The street-lighting system consists of 51 lamps George W. Clark is manager.

SHERIDAN, IND.—The Sheridan Wtr., Lt. & Ht. Co. is now installing an additional pump in its water-works system and has recently completed the installation of a 10-ton ice plant, manufactured by the Vogt Co., of Louisville, Ky., to be operated by exhaust steam. C. E. Layton is secretary and treasurer.

SOUTH BEND, IND.—The Indiana Public Service Commission has approved the application of the Indiana & Michigan Co., of South Bend, to issue $500,000 in bonds at 85. The Michigan Railroad Commission has passed favorably on the same petition.

THORNTON, IND.—Within the next 12 months the managers of the municipal electric-light plant expect to purchase a few electrical appliances, including cooking apparatus, electric irons, etc. E. P. Rose is town clerk and treasurer.

GENESEO, ILL.—A movement has been started favoring the establishment of a municipal electric and gas plant or taking over the plant of the Illinois Northern Utilities Company, which now serves the city. Under the terms of the franchise the city may at the expiration of any five-year period take over the system of the company One of the periods will expire next December.

MACOMB, ILL.—Bids will be received at the office of the supervising architect, Washington, D. C., until June 15 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Macomb, Ill. Drawings and specifications may be obtained upon application to the above office or from the custodian of site. O. Wenderoth is supervising architect.

MOUNT CARMEL, ILL.—The Mount Carmel Pub. Utility & Ser. Co. has recently placed contracts for a new 250-hp Stirling boiler and De Laval centrifugal pump of 1,000,000-gal. capacity, to be installed at once. The company may possibly install a new generating unit during the summer. Phillip Barnard is secretary and treasurer.

MOUNT VERNON, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 18 for the construction, including mechanical equipment, lighting fixtures and approaches, of the United States public building at Mount Vernon. Further information will be given upon application to the above office. O. Wenderoth is supervising architect.

OLNEY, ILL.—Bids will be received by J. C. Howard, secretary school board, Olney, until May 25 for the construction of township high school building. Separate bids will be received for electric wiring; also for heating and ventilation and for plumbing. Plans may be seen at the office of the secretary and may be obtained from L. H. Osterhage, architect, Second National Bank Building, Vincennes, Ind., upon receipt of $10, which will be refunded upon return of plans.

PLANO, ILL.—The Illinois Northern Utilities Co., of Dixon, Ill., has been granted a 25-year franchise in Plano. The City of Plano has also executed a contract with the company for street-lighting and for pumping the city water for a period of 25 years. The contract provides for 150 tungsten lamps of 80 cp, erected on four-ft. goose-neck fixtures, for lighting the streets, and 55 hp for pumping load. An ornamental street-lighting system is under consideration.

RANKIN, ILL.—A mutual company is being organized by local business men to erect an electric-light plant in Rankin. Scott Johnson is interested in the project.

SHELDON, ILL.—At an election held recently the proposal to establish a municipal electric-light plant at Sheldon was carried.

SPRING VALLEY, ILL.—Within the next three months the Spring Valley Gas & El. Co. expects to install a 300-kw directly connected steam-driven generating unit.

THOMASBORO, ILL.—The Champaign County El. Co., of Urbana, has applied to the Public Utilities Commission for a certificate of convenience and necessity to operate in Thomasboro.

WELDON, ILL.—Within the next two or three months the Village Board expects to purchase some poles, wire and meters. The Commercial Club is considering the question of installing a cluster-lamp lighting system on Main Street. George Gallaher is engineer and electrician.

EAU GALLE, WIS.—The Durand Lt. & Pwr. Co., of Eau Galle, has begun work on the installation of a new power plant. The equipment will include one 265-hp and one 110-hp waterwheel, one Woodward or Lombard (oil) waterwheel governor and one 225-kva, three-phase, 60-cycle, 6600-volt generator. E. M. Miles is engineer in charge.

KENDALL, WIS.—Arrangements are being made by the Kendall El. Co. for the installation of a new power plant.

ROME, WIS.—The power plant of the Bark River El. Lt. & Pwr. Co., it is reported, was recently destroyed by fire.

BARNESVILLE, MINN.—Steps have been taken for the installation of an ornamental street-lighting system here. Louis Norby is chairman of committee.

BEMIDJI, MINN.—The City Council is considering the installation of an ornamental street-lighting system.

BLUE EARTH, MINN.—The Board of Public Works, it is reported, has been authorized to expend $2,000 for equipping the water-works pumping station with electrically operated machinery.

HIBBING, MINN.—The Village Council is contemplating the installation of a new electric-light plant. W. J. Ryder is a member of the water and light board.

MADELIA, MINN.—The Consumers' Pwr. Co., of St. Paul, is to furnish energy for lamps and motors in Madelia, to be transmitted over a 9-mile transmission line being erected by the local distributing company.

VIRGINIA, MINN.—Bids will be received by H. J. Nathanson, secretary, City Hall, Virginia, until May 22, for furnishing a complete lighting system in Olcott Park and South Park, in accordance with specifications on file in the office of the secretary.

CEDAR RAPIDS, IA.—Bids will be received at the office of the board of education, Cedar Rapids, Ia., until June 4 for construction and completion of the Hayes grade school building at D Street and Twentieth Avenue West, according to plans and specifications prepared by the Ingold Unit System Co., of Cedar Rapids. Plans may be obtained upon application to the architect, for which a deposit of $15 will be required, to be refunded upon return of same. J. M. Ingold is secretary of board.

DAVENPORT, IA.—The State Automatic Tel. Co., recently organized, is planning to install a local system, consisting of 173 miles of cable, and will erect a telephone exchange building, at a cost of $45,000. E. H. Moulton, of Minneapolis, Minn., is president, and B. H. Osborne, of Franklin, Pa., secretary.

DELMAR, IA.—The installation of an electric-lighting plant in Delmar is reported to be under consideration. Electricity for operating the system will be secured from the plant in Maquoketa.

DENISON, IA.—Negotiations have been closed whereby the city of Denison has taken over the property of the Denison El. Lt. & Pwr. Co., at $28,000. Work will begin immediately on the construction of a new building. New machinery will also be installed.

DES MOINES, IA.—Within the next six months the Des Moines El. Co. expects to erect a 33,000-volt transmission line from Des Moines to Oskaloosa, a distance of about 66 miles, and to purchase material for smokestack (225 ft. high and 15 ft. in diameter); also material for enlarging power house to provide space for two additional 600-hp boilers and to purchase two 600-hp boilers. Contracts have already been placed for one 4000-kw turbo-generator set, with condenser and accessories. The company also expects to erect within the next four months about 4 miles of single-phase, 2200-volt distribution line within the city limits, to be used for lighting purposes. George B. Brush is operating engineer.

DUMONT, IA.—The Hampton Lt. & Pwr. Co., of Hampton, has been granted a franchise to install and operate an electric-light plant in Dumont. Construction work will begin at once.

EARLVILLE, IA.—The installation of an electric-light plant in Earlville is reported to be under consideration.

GREELEY, IA.—Bids will be received by the town of Greeley until May 28 for construction of electric-light system as follows: One 50-hp oil engine, one 30-kw, 125 250-volt, three-wire generator, one 25-amp capacity for eight hours, 62 cell and eight counter-cell storage battery, 2450 ft. No. 2 weather-proof, triple-braid copper wire, 6200 ft. No. 6 weather-proof, triple-braid copper wire, 12,700 ft. No. 8 weather-proof, triple-braid copper wire, 24,400 ft. No. 10 weather-proof, triple-braid copper wire, pole line material, including poles, cross-arms, guy wires, cast-iron lamp posts, street lamps, etc. Plans and specifications and proposal forms may be obtained from V. E. Dow, town clerk, Greeley, or from the Alamo Engine & Supply Co., Omaha, Neb., upon deposit of $5, which will be refunded upon return of plans.

MILFORD, IA.—A high-tension transmission line is being erected from Arnold's Park to Milford, to furnish electricity here. Local parties are interested in the project.

NORA SPRINGS, IA.—Bids will be received by the Independent School District of Nora Springs until May 25 for construction of school building, including electrical work, heating and plumbing. Plans and specifications may be obtained from Alban & Lockhart, 40 Chamber of Commerce Building, St. Paul, Minn., for which a deposit of $10 will be required, to be refunded upon return of plans. H. F. Schnedler is secretary of board of education.

OAKLAND, IA.—The local electric-light plant has been purchased by the Red Oak El. Co., of Red Oak. Steps will be taken to secure a franchise from the Board of Supervisors of Mills County to erect a transmission line from Malvern to the county line. It is proposed to furnish electricity from the Malvern plant to operate the system here.

SHELLSBURG, IA.—A franchise has been granted to F. J. Cross to install and operate an electric-light plant here.

SPIRIT LAKE, IA.—Dr. A. L. Peck, of Arnold's Park, is erecting a high-tension transmission line from Arnold's Park to Spirit Lake, to furnish electrical service here.

OZARK, MO.—The Public Service Commission has granted the Ozark Wtr. & Pwr. Co. permission to issue $2,000,000 in bonds.

BOWMAN, N. D.—The installation of an electric-light plant in Bowman is reported to be under consideration.

TOWER CITY, N. D.—Preparations are being made for the installation of an electric-light plant in Tower City. The equipment will include one direct-current generator, driven by a gasoline or kerosene engine, switchboard, etc. Contract for construction of plant will soon be awarded. S. F. Sherman is interested.

NORTH LOUP, NEB.—Bruce & Standevin, engineers, 604 Bee Building, Omaha, have been engaged to prepare plans for the proposed municipal electric-light plant in North Loup.

OMAHA, NEB.—The Omaha El. Lt. & Pwr. Co. has submitted a proposal to the City Council offering reduced rates for street-lighting if given an extension of its contract for five years. The company offers to install within seven months after the contract is entered into 2000 incandescent lamps of 400 cp each at $35 each per year, with overhead service and $40 each with underground wiring. The city now pays $57.50 each for 1387 arc lamps. The company also proposes to install 200 10-amp flaming arc-lamps in a district bounded by Cuming, Leavenworth and Twenty-fourth Streets, within six months after the contract is signed, at $60 each per year.

SYRACUSE, NEB.—The Nebraska City Wtr. & Lt. Co., of Nebraska City, has submitted a proposition to local business men offering to erect an electric transmission line to Syracuse to furnish electricity for lamps and motors here.

LEAVENWORTH, KAN.—Bids will be received at the office of the superintendent of prisons, Department of Justice, Washington, D. C., until June 5 for furnishing material required for electric-light, telephone and clock installations and lumber at the United States penitentiary at Leavenworth, Kan. Copies of specifications, together with further information, may be obtained upon application to the above office. F. H. Duehay is superintendent of prisons.

MANHATTAN, KAN.—The Manhattan Ice, Lt. & Pwr. Co. has recently installed a new substation and switchboard; also a 38-kva, three-phase feeder regulator, manufactured by the Westinghouse company. The company has also just completed the installation of ornamental lamps on three blocks. E. A. Wright is manager.

McPHERSON, KAN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 15 for the construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at McPherson, Kan. Drawings and specifications may be obtained at the above office and from the office of the custodian of site at McPherson.

OSAWATOMIE, KAN.—The electric light and water commissioners may purchase a car load of poles some time this year. B. L. Prier is superintendent of the light and water department.

Southern States

CENTER FALLS, N. C.—The Center Falls Pwr. Co., recently incorporated, has engaged the J. B. McCrary Co., engineer, of Atlanta, Ga., to take charge of the construction of its proposed plant.

GASTONIA, N. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 16 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Gastonia, N. C. Drawings and specifications may be obtained from the above office or from the custodian of site at Gastonia. O. Wenderoth is supervising architect.

WALNUT COVE, N. C.—The Walnut Cove Pwr. Co. is reported to be contemplating the installation of an electric-light system. J. Wesley Morefield & Son are reported to be interested in the company.

BENNETTSVILLE, S. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 11, for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Bennettsville, S. C. Drawings and specifications may be obtained from the above office or from the custodian of site at Bennettsville. O. Wenderoth is supervising architect.

CALDWELL, GA.—The City Council has awarded the contract for the installation of a municipal electric-light plant to the Modern Equipment Co., of Savannah, Ga.

EATONTON, GA.—The proposal to issue $25,000 in bonds for purchasing and developing the water-power at Griffin Mill and installing an electric system will be submitted to the voters on June 8. For further information address M. A. Shivers, chairman of special committee of water and light board.

SAVANNAH, GA.—The Savannah Ltg. Co. will install a new switchboard for main station and substation and also make a complete rearrangement of its transmission and distribution lines. The company has recently placed contracts for new machinery and equipment as follows: One 3750-kva General Electric turbine, three 375-hp Babcock & Wilcox boilers with superheaters, one 100-kw General Electric exciter set, one Crocker-Wheeler condensing set driven by a Kerr steam turbine, five 1500-kva high-tension General Electric transformers, and 5000 ft. of high-tension cable. S. O. Sauls is secretary and treasurer.

WAYCROSS, GA.—The Ware County Lt. & Pwr. Co., of Waycross, expects to purchase within the next three months a deep-well pump with a capacity of about 500 gal. per minute. Within the past 12 months the company has installed a 500-kw General Electric Curtis steam-turbine and Babcock & Wilcox boilers, superseding a gas producer outfit and gas engines. H. C. Gamage is manager.

AVON PARK, FLA.—Application, it is reported, has been made to the Town Council for a franchise to install an electric-light plant.

EUSTIS, FLA.—The Eustis Wtr., Lt. & Pwr. Co. has recently purchased a generating unit, consisting of one 125-kva alternator and Skinner engine (15 in. by 16 in.) and motor generator set. The company is also erecting a transmission line to Umatilla and Fola, 5 miles long, material for which has been purchased. C. A. Childs is president.

MIAMI, FLA.—The Tatum Brothers. Real Estate & Investment Co., of Miami, it is reported, is contemplating the construction of a power plant to furnish electricity to operate a street-railway system.

OCALA, FLA.—The Florida Pwr. Co., of Ocala, is erecting a substation in Inverness. The equipment will consist of two 200-kw transformers, stepping down the voltage from 60,000 volts to 550 volts, electrolytic lightning arresters and necessary switching apparatus. The station will serve the Southern Phosphate & Development Co.'s phosphate plant. R. C. Camp is president of the Florida Pwr. Co.

COVINGTON, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 13 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Covington, Tenn. Drawings and specifications may be obtained at the above office or from the custodian of site at Covington. O. Wenderoth is supervising architect.

MEMPHIS, TENN.—Plans and specifications are being prepared for equipment for the North Memphis pumping station, for which bids will soon be asked. The equipment will consist of four 6-ft. centrifugal pumps, each having a capacity of 135,000 gal. per minute; two 4-ft. centrifugal pumps of 45,000 gal. each per minute, and two priming pumps of 3000 gal. capacity each per minute. Each 6-ft. pump will be driven by an 800-hp alternating-current motor, and the 4-ft. pumps by a 400-hp motor. Bids for supplying a 20-ton traveling crane, transformers, electrical wiring and extra piping will also be asked for. At the same time bids will be advertised for building pumping station (60 ft. by 160 ft.) of concrete construction, which will include foundations for machinery and lifting the gates of the bayou. J. H. Weatherford is city engineer.

WINCHESTER, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 12, for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Winchester, Tenn. Plans and specifications may be obtained at the above office or from the custodian of site at Winchester. O. Wenderoth is supervising architect.

OZARK, ALA.—Preparations are being made to install new equipment in the municipal electric-light plant, including one 200-kw generator, one 300-hp Corliss engine and switchboard, work on which will begin in about 60 days. Contracts have not yet been awarded. B. C. Darling, superintendent, will have charge of the work.

GREENVILLE, MISS.—The power plant of the Delta El. Lt. & Pwr. Co., of Greenville, was recently damaged, putting the plant out of commission for several days. The large smokestack was blown down and crushed through the roof of the building. The electric plant at Lake Village, which secures power from the Greenville plant, was also put out of commission.

GRENADA, MISS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 16 for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Grenada, Miss. Drawings and specifications may be obtained upon application to the above office or from the custodian of site at Grenada. O. Wenderoth is supervising architect.

JONESBORO, ARK.—The board of directors of the State Agricutural College has authorized the rebuilding of the electric plant, recently destroyed by fire.

PLAINVIEW, ARK.—The Plainview Light Co. is contemplating the installation of an electric-light plant in Plainview, to cost about $5,000. W. W. Winters, of Danville, is interested in the project.

BELTON, TEX.—The property of the Belton Lt. & Pwr. Co. is reported to have been purchased by the Texas Pwr & Lt. Co., of Dallas.

EL PASO, TEX.—The El Paso El. Ry Co. is preparing to install additional machinery in its power plant, work on which will begin June 1. The equipment will include one 5000-kw Allis-Chalmers steam turbo-generator, one 1000-kw Westinghouse motor-generator set for street railway service, General Electric switchboard equipment, two 600-hp Babcock & Wilcox water-tube boilers, two Foster superheaters for boilers, two chain-grate equipments for above boilers and one self-supporting steel stack (153 ft. high and 11 ft. in diameter). Contracts for machinery have been awarded. The Stone & Webster Engineering Corpn., of Boston, Mass., has charge of the work.

GALVESTON, TEX.—Bids will be received by John D. Kelly, city secretary, Galveston, until May 28 for furnishing 18 ornamental posts (combination trolley and arc-lamp design) and 34 ornamental posts for arc lamps only; also for 52 ornamental inverted arc lamps and for complete installation of posts and lamps, and also for installation of approximately 12,000 ft. of cable, in accordance with specifications which are on file in the office of the secretary Specifications may be seen at the office of W. D. Masterson, city superintendent of electricity.

Pacific States

CHEHALIS, WASH.—Application has been made to the Council by Benjamin Walling, Jr. It is understood that he represents a capitalist who contemplates building a power plant to furnish electricity to cities in southwest Washington.

SPOKANE, WASH.—The Washington Wtr. Pwr. Co., of Spokane, has purchased the transmission lines of the Lewiston-Clarkston Improvement Co., of Lewiston, Idaho, extending from Leon Station, Idaho, to Moscow, Pullman, Uniontown, Genesee and Colton. The local distributing systems in the towns mentioned were purchased by the Washington Wtr. Pwr. Co. last summer. surveys have been made to Troy, Kendrick and Julietta, and it is expected that a transmission line will soon be erected into that territory.

WENATCHEE, WASH.—The Chicago, Milwaukee & St. Paul Ry. Co. has recently purchased large tracts of land on both sides of the Columbia River, below Priest Rapids, where, it is reported, a large power plant will be erected to supply electricity for the railway lines of the company between Wenatchee and Spokane. It is understood that a large dam will be built about 15 miles below Beverly.

CANYONVILLE, ORE.—Application has been filed by David A. McKeown, of Prairie City, for a permit to appropriate additional water from Strawberry Creek, in order to develop 1527 hp.

PORTLAND, ORE.—The City Council has granted the merchants on Third Street, between Yamhill and Burnside, permission to erect a series of illuminated arches at street intersections.

ROSEBURG, ORE.—The California-Oregon Pwr. Co. has petitioned the Douglas County Court for permission to erect a transmission line from Glendale to the city limits of Roseburg. If granted a franchise, the company will extend its lines from Glendale to Riddle and thence to Myrtle Creek and possibly to Canyonville, with service wires branching wherever needed.

HANFORD, CAL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 18 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Hanford, Cal. Drawings and specifications may be obtained at the above office or from the custodian of site. O. Wenderoth is supervising architect.

LOS ANGELES, CAL.—At an election held May 8 the proposal to issue $6,500,000 in bonds to complete the aqueduct power project and for distribution system for same was carried.

SAN FRANCISCO, CAL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 10 for furnishing and installing lighting fixtures in the United States sub-treasury at San Francisco, Cal., in accordance with specifications and drawings, copies of which may be obtained at the above office.

SAN FRANCISCO, CAL.—The Board of Supervisors has appointed Prof. W. F. Durand, of Stanford University, and John D. Galloway and F. G. Baum, of San Francisco, as a board of hydroelectric engineers for the purpose of advising as to plans for the first hydroelectric development in connection with the construction of the Hetchy-Hetchy water-power supply system.

CULDESAC, IDAHO.—W. J. Morrow, of Cœur d'Alene, has applied to the City Council for a franchise to construct and operate an electric-light plant in Culdesac. He proposes to build a dam across Lapwai Creek.

TWIN FALLS, IDAHO.—The Farmers' El. Co., it is reported, will establish a power plant in Twin Falls at once.

SALT LAKE CITY, UTAH.—R. S. Campbell has applied to the City Commission for a franchise to construct conduits through the commercial district for a heating and power distribution system. A company, to be known as the Public Utility Co., will be organized by Mr. Campbell and associates to install and operate the system.

NOGALES, ARIZ.—Application has been made to the Council by S. S. Proctor and M. M. Mansfield for an electric-light and power franchise in Nogales. An election will be held May 25 to submit the franchise to the voters.

GLASGOW, MONT.—Within the next two months the electric-light committee expects to purchase one 50-kw, three-phase, 60-cycle, 2300-volt generator, with directly connected exciter, one four-panel General Electric switchboard, one condenser, and one compound Ideal engine; also to purchase within the next 30 days 69 luminous-arc lamps (26 6.6-amp and 45 4-amp), one 25-lamp, 6.6-amp mercury-arc rectifier and one 50-lamp, 4-amp mercury-arc rectifier. A. J. Melvin is superintendent.

PHILLIPSBURG, MONT.—The Royal Basin Mining Co. is contemplating the construction of an electric power plant on Flint Creek, a short distance below Maxville

Canada

VANCOUVER, B. C.—The question of equipping the Canadian Pacific Railway between Vancouver and New Westminster for electrical operation is reported to be under consideration.

VANCOUVER, B. C.—Plans have been prepared for the installation of ornamental street lamps. The plans provide for the erection of 50 standards, each carrying five 100-watt lamps, maintained by underground wires, at a cost of about $7,800. About 4900 ft. of underground conduit will be laid and lead-covered, rubber-insulated wire will be used. Contract for part of the work has been awarded. C. H. Fletcher, city engineer, has charge of the work.

SHOAL LAKE, MAN.—Tenders will be received until May 28 for various contracts in connection with the installation of an electric-light plant in Shoal Lake, plans and specifications for which may be obtained from the John Galt Engineering Co., consulting engineers, Winnipeg, Man., and Calgary, Alta.

STAMFORD, ONT.—A by-law authorizing an appropriation of $40,000 to purchase the plant and equipment of the Ontario Distributing Co. in Stamford has been adopted by the Township Council. The company, it is understood, will sell the property for $33,000; the remainder will be used for improvements to the plant and extending the lines. The by-law will be submitted to the rate-payers in June.

TILBURY, ONT.—The Town Council, it is reported, will purchase the local electric-light plant, owned by Thomas C. Vickerman, and operate part of it in connection with the hydroelectric system soon to be installed.

SASKATOON, SASK.—At an election held recently the by-laws to appropriate $15,000 for a new power house and $200,000 for extensions to electric light and power plant in Saskatoon were defeated.

SASKATOON, SASK.—Tenders will be received by the city commissioners, Saskatoo, Sask., until May 30, for furnishing and installing the following equipment in the municipal power plant: Two 750-hp water-tube boilers, two chain-grate stokers, two sets of economizers and two sets of superheaters. Specifications, tender forms, etc., may be obtained from E. Hanson, city electrical engineer.

SWIFT CURRENT, SASK.—The contract for the construction of the power house for the municipal electric-light plant is reported to have been awarded to Gilstrom Brothers, of Swift Current, at $21,000.

Miscellaneous

KAUAI, HAWAII.—The House committee on territories at Washington has practically reported the bill to authorize the establishment of an electric-light and power plant and distributing system in the county of Kauai, Hawaii.

New Incorporations

PARKER, ARIZ.—The Colorado River El. Ry. Co. has been chartered with a capital stock of $250,000 by Thomas Taylor, David Connor, J. E. Beck, W. H. Thorpe, I. W. Wallace and William Drury. The company proposes to construct and operate electric railways and to maintain telephone and telegraph system in and around Parker and throughout the Colorado River Indian Reservation.

SHEFFIELD, MASS.—The Sheffield El. Lt. & Pwr. Co. has been organized for the purpose of furnishing electricity in Sheffield and Ashley Falls. Electricity for operating the system will be secured from the Berkshire Pwr. Co., of Canaan, which will extend its transmission line to the Massachusetts line. The officers of the company are: Walter S. Van Deusen, of Ashley Falls, president, and H. C Clark, secretary and treasurer.

BELLINGHAM, MINN.—The Bellingham El. Lt. Co. has been incorporated by L. F. Clarke and others.

GRANITE FALLS, MINN.—The Stony Run Lt. & Pwr. Co., of Stony Run Township, has been incorporated by John J. Mooney and others.

SPENCER, S. D.—The Spencer Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by William Hoese, H. C. Sleuth and others.

HOUSTON, TEX.—The Houston El. Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by M. C. Cayce, E. K. Lyles and C. E. Coleman.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 5, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,095,182. Trolley Harp or Head; J. J. Barnick, Bloomsburg, Pa. App. filed April 22, 1911. Quickly detachable self-locking trolley harp.

1,095,214. Electric Cooker; F. Johnson, Winnipeg, Manitoba, Canada. App. filed July 3, 1913. Open-topped casing with a cooking grate and coreless heating coils below the same.

1,095,236. Electric Signal for Hay Presses. C. Schade, Cropsey, Ill. App. filed Oct. 28, 1913. Sounds after a predetermined amount of hay has been passed so as to insure uniform bales.

1,095,273. Testing Device for Gas Engines; W. C. Force, North Plainfield, N. J. App. filed April 28, 1913. For short-circuiting the spark plugs.

1,095,284. Instrument for Locating Breaks and Grounds in Electric Wires, M. J. Myers (deceased), F. O. Myers, administratrix, Syracuse, N. Y. App. filed May 5, 1910. For comparing capacity or resistance of circuits.

1,095,279. Electric Switch; R. C. Hull, Germantown, Pa. App. filed Dec. 4, 1912. Push-button type with lock.

1,095,300. Arc Welding Apparatus; T. Varney, Pittsburgh, Pa. App. filed Sept. 18, 1911. For maintaining welding current substantially constant

1,095,328. Plating Apparatus; J. H. Jordan, St. Louis, Mo. App. filed July 9, 1913. Terminal arms extend inwardly at ends of rotating article containing drum.

1,095,331. Field-Magnet Winding for Dynamo-Electric Machines; B. G. Lamme, Pittsburgh, Pa. App. filed Jan. 26, 1910. For single-phase commutator motor.

1,095,342. Wireless Receiver; H. Merton, London, England. App. filed May 8, 1913. Keeps a record of messages received.

1,095,354. Telephone Transmitter; J. Redding, Malden, Mass. App. filed June 17, 1910. For high-voltage currents.

1,095,357. Process for the Production of Varied Colorations and Black Shades on Metals; F A. Roux, Paris, France. App. filed Jan. 19, 1914. Electrolytic bath.

1,095,358. Call Box, H. O. Rugh, Sandwich, Ill. App. filed Nov. 13, 1909. Impulse-sending mechanism at central station.

1,095,365. Oil-Well Heater, J. E. Williamson, Pittsburgh, Pa. App. filed Aug. 30, 1909. The metallic sand line forms one side of the heater circuit.

1,095,379. Roentgen-Ray Apparatus; S. Cabot, Brookline, Mass. App. filed Sept. 23, 1912. Employs a charged condenser.

1,095,382. Alarm Press-Button Contact; A. V. and O. T. Clorius, Copenhagen, Denmark. App. filed April 8, 1913. Push-button contact is simultaneously employed for a fire-alarm contact

1,095,387. Engine Starter; H. N. Edens, New Holstein, Wis. App. filed June 28, 1912. Special timing of magneto.

1,095,392. Electrically Heated Waving Tongs. L. Frey, Munich, Germany. App. filed Aug. 28, 1913 Heating resistances are carried in the operative legs of the tongs.

1,095,405. Heating Apparatus; C Kratt, Glasgow, Scotland. App. filed Sept. 29, 1913. Liquid heater in which oscillatory lever first turns on liquid and then throws on switch.

1,095,425. Process and Apparatus for the Production of Long Continuous Electric Arcs; O. Schönherr and J. Hessberger, Dresden-Striesen, Germany, and Christiansand, Norway. App. filed May 18, 1910. Causes currents of gas to pass in opposite directions lengthwise of the arc.

1,095,426. Process of Producing Long Continuous Electric Arcs. O Schönherr and J. Hessberger, Dresden-Striesen, Germany, and Christiansand, Norway. App. filed May 18, 1910. Gas flows into mid-part of space surrounding the arc and toward opposite ends of the same

1,095,427 Means for the Production of Long Continuous Electric Arcs. O. Schonherr and J. Hessberger, Dresden-Striesen, Germany, and Christiansand, Norway. App. filed May 18, 1910. Embodies conical electrode into which gas is caused to flow.

1,095,437. Spark-Coil; C R. Underhill, Muskegon, Mich. App. filed Feb. 10, 1911. Vibrator having adjustable armature and adjustable as to tension.

1,095,439. Ground Detector for Insulators; J. Wahn, Vienna, Austria-Hungary. App. filed Feb. 2, 1912. Conductor separating main and secondary insulators and fusible means between conductor and the customary pin.

1,095,453. Motor Mechanism; C. W. Coleman (deceased), Westfield, N. J. App. filed Sept. 10, 1910. "Top-post" motor mechanism for semaphores.

1,095,473. Apparatus for Treating Articles with X-Rays; F. S. Smith, Philadelphia, Pa. App. filed May 28, 1909. For killing destructive insects which infest tobacco, furs, woolens, etc.

1,095,474. Snap Electric Switch; J. A. Smith, Bellevue, Ky. App. filed Sept. 9, 1912. Has reciprocating finger piece which operates a rock shaft.

1,095,486. Testing Device for Electrical Ignition Apparatus for Explosive Engines; E. Yoss, South Richmond, Va. App. filed July 20, 1912. Switch attachable to spark-plug for producing visible spark gap.

1,095,491. Remote Switch Control for Electrical Circuits; P. C. and C. F. Butte, San Francisco, Cal. App. filed Sept. 3, 1912. Adaptable for installed switches to render them remote-control.

1,095,507. Motor-Controlling System; W. D. Lutz, Allendale, N. J. App. filed Dec. 6, 1909. For effecting dynamic brake action and automatically varying the degree of the brake action.

1,095,512. Combined Gas Supply and Lighting Device; E. R. Mills, Sabina, Ohio. App. filed Feb. 16, 1911. Valve with switch to control flow and lighting of gas auto-lamps.

1,095,525. Call Box, H. O. Rugh, Sandwich, Ill. App. filed May 4, 1909. For selective signaling telephone systems.

1,095,539. Calling Device for Telephone Exchanges, C. A. Anderson, Chicago, Ill. App. filed Jan. 19, 1911. Party-line system.

1,095,557. Electric Vaporizer, C. L. Davis, Detroit, Mich. App. filed Dec. 28, 1912. Heat generated electrically in the center of the fluid column.

1,095,586. Alternating-Current Motor; B. McCollum, Lawrence, Kan. App. filed Nov. 11, 1909. Reversing single-phase motor of variable speed.

1,095,609. Purifying Electrolytes; F. von Kugelgen and F. von Bidder, Holcomb's Rock, Va., and G. O. Seward, East Orange, N. J. App. filed Sept. 16, 1908. Electrolysis of sodium chloride.

1,095,632. Dynamo-Electric Machine; C. J Heineman and A. H. Hensley, Chicago, Ill. App. filed Sept 4, 1909 Varies the magnetic flux to produce substantially uniform voltage and current from generator driven at variable speed

1,095,639. Railroad Switch; A. G. Johnson, Huntington, Ind. App. filed May 13, 1912 Spring and electromagnetically actuated trolley switch operated from car.

1,095,645. Vaporizer for Internal Combustion Engines, E. Koster, Yonkers, N. Y App. filed Jan. 14, 1914. Gasket applied to intake pipe and carrying heating wire

1,095,648 Armored Conduit or Conductor, G. A. Lutz, Plainfield, N J App. filed July 22, 1910 Outside wire laid over the spirally wound armor

1,095,655. Selective Signaling Means; J McFell, Chicago, Ill. App. filed July 27, 1910. Special selector construction.

1,095,661 Make-and-Break Sparking Plug. G. Nagel, Stuttgart, Germany App. filed Dec. 2, 1911. Compression in cylinder operates the plug to produce the spark.

1,095,666 Telephone System F. R. Parker and E. R. Corwin, Chicago, Ill. App. filed Dec 7, 1904 Operation and control of supervisory signals, provides a "dead-ring" on one of the spring jacks.

1,095,686. Electric Lamp for Small Firearms; A. L. Webb, Sudbrook Park, Md. App. filed July 26, 1913. Flash lamp attachable to barrel of revolver.

1,095,692. Food-Conveying System; R. F Almirall and R. A. McColloch, New York, N. Y. App. filed Nov. 3, 1911. Food car which is lowered in elevator from kitchen travels on tracks to another elevator, where it is raised to final destination.

1,095,722. Secondary or Storage Battery. B. Ford, Philadelphia, Pa. App. filed Jan. 27, 1914. Battery jars placed while plastic in rigid supporting walls, to which they fit themselves and become hardened

1,095,733. Ground Connector; E. Klein, New York, N. Y. App. filed April 28, 1913. For clamping to a pipe.

1,095,748. Electrolytic Apparatus. W Thum, Hammond, Ind. App. filed Sept. 23, 1911. Weight of the anodes and cathodes borne by means independent of the containing tank.

1,095,774. Electric Bath; H. Aub, Munich, Germany. App. filed Feb. 21, 1914. Urogenital treatment.

1,095,811. Electric Low-Level Signal for Tanks; O. C. Carr, Lansing, Mich. App. filed July 26, 1912. Flashes light on dashboard to warn of low level of gasoline.

1,095,816. Crossing Arrangement for Block-Signaling Systems; M. Conrad, Adrian, Mich.; W. G. Kelly, Winslow, Ariz. App. filed April 11, 1911. Train-stopping system for crossings.

1,095,845. Electric Mail Box; P. O. Gaudreau, Burlington, Vt. App. filed May 19, 1913. Bell rings when letters or packages are placed in box.

1,095,860. Insulator Holder; H. C. Heffner, Martinsburg, W. Va. App. filed May 25, 1912. Made of wire coiled to take the insulator threads.

1,095,893. Process of and Apparatus for Treating Water; C. P. Landreth, Philadelphia, Pa. App. filed Sept. 13, 1911 Electrodes arranged in banks so that in case of wear or derangement the plates of one bank may be cut out of circuit.

1,095,902. Rear-End Signal for Vehicles. C. F. Marston, Cedarhurst, N. Y. App. filed Feb. 18, 1913. Solenoids lift the signal panels into exposed position.

1,095,925. Creasing Iron; H. W. Pogue, Decatur, Ill. App. filed March 20, 1913. Electric iron with opposed members between which trousers, or parts to be creased, are pressed

1,095,949. Fire-Alarm Circuit Closer. B. Trent, Clifton, N. J. App. filed April 14, 1911. Fusible member holds movable member away from fixed member.

1,095,950. Device for Disinfecting Telephones; R. B. Adams, L. Adams, C. H Wells and H. G. Payne, Westerville, Ohio. App. filed Aug. 3, 1911. Atomizing attachment for injecting spray into transmitter mouthpiece.

1,095,957. Electric-Bath Cabinet; G. B Campbell, White Bear, Minn. App. filed Feb. 19, 1914. Table support for the patient, movable to carry the patient from outside into the bath casing.

1,095,967. System of Propulsion; J. T. Lister, Cleveland, Ohio. App. filed Nov 7, 1910. Embodying engine-driven generator and storage batteries.

1,095,982. Railway Block Signal and Train-Controlling System; G. R. Guild, U. S. A., App. filed Jan. 9, 1911. Has third-rail divided into blocks corresponding to blocks in the track rails.

1,095,985. Combined Magneto and Battery Ignition System; T. M. Mueller, Pittsfield, Mass. App. filed June 30, 1909. Battery may be switched in to supplement the magneto.

1,095,990. Trolley; C. A. Soule, Canandaigua, N. Y. App. filed Feb. 11, 1910. Wheel spindle carried by insulating collars and current carried to harp by brushes.

1,096,004. Temperature Regulator, W B. Dahl, Minneapolis, Minn. App. filed Oct. 25, 1912. Thermostatic strips held together by stamping portions of one strip into and over portions of the other strip, thus avoiding the customary welding.

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The Small Consumer

We take great pleasure in publishing in this issue the results of an elaborate investigation by Mr. S. E. Doane of electrical distribution for the small consumer in Europe. His article records an immense amount of labor well spent in collating the facts regarding the methods used by the Continental electric-light stations to increase their business by reaching the humble homes heretofore lighted only with gas or petroleum. We have double pleasure in commending this investigation to the earnest attention of our readers since for half a dozen years past we have been hammering steadily away at this neglected duty of the central station toward the public. We have felt sometimes as if our voice were one crying in the wilderness, but the time has now come when accomplishment seems less distant and reiteration of the facts less futile.

As every observing investigator knows, in most American cities the use of electric light in homes of the humbler class is limited. We say this advisedly, since in the examination of most urban territory where gas and electric companies coexist the latter will be found putting in their time in building up the business of supplying energy to commercial installations of motors and lamps, while the former will be found to live and move and have their being in and pay their dividends—generally liberal ones—from chiefly those small consumers whom the central-station man, drunken with fanciful ideas of expansion, has neglected altogether. In recent years gas has been well-nigh driven out of the larger commercial field, and gas companies make their earnings by lighting the small home and furnishing gas wherever needed for heating and cooking purposes. In these latter functions, save for a few industrial uses, they find the large business upon which they live.

Mr. Doane has gathered a mass of statistics from abroad which ought to be convincing evidence that electric companies have not only missed an opportunity but have failed to perform a plain duty in reaching the whole of the public. The data collected bear chiefly upon three things—methods of getting business, methods of making installations, and the establishment and collection of charges for service. Competition between gas and electricity abroad is keener than here, and the gas companies, pushed out of their profitable commercial field, promptly intrenched themselves in the home, making deliberate and highly successful efforts to cause every householder to become a gas user and a friend of the gas company. It is only recently that the electric supply companies have realized the situation and appreciated that a contented customer is a good friend when a political hue and cry is raised against a public utility. In our own cities the man on the street is even more important by reason of our form of government, yet he has been persistently neglected.

To render effective a campaign for business on a small scale suitable methods of charging, bookkeeping and collection are necessary. In this country use is made for the most part of an elaborate system which discourages small business on account of the large fixed charges. The Continental small-business campaign is carried on at the present time mostly by some kind of flat-rate scheme, so much per lamp per month, with a cheap current-limiting device to prevent the installation of larger lamps than those bargained for. The meter, with its maintenance charges, its cost of reading and its participation in the long procession of entries in the bookkeeping department, is cast into outer darkness. Only in rare instances is metering employed in this class of work on the Continent, and then only as an alternative. In the larger business the meter system is very generally employed in much the same form as in this country.

The favorite method of charging for small business is a flat rate paid in advance, with the simplest kind of system for collection and bookkeeping, sometimes by means of regular collectors, again by the aid of the post office or of local shopkeepers—in fact, any way to keep down expense. As to results it is found from experience that the flat rate thus administered enables the stations to serve at a profit even the very smallest consumers. It is not found that the flat rate leads to an abuse of privileges in using the lamps. The extent of use is, to be sure, very variable, but it averages well, say, between four and six hours per day, which at the rates customarily charged leads to returns per kilowatt-hour actually used quite up to the ordinary. Such, indeed, has been the experience in our own country wherever the flat-rate system has been intelligently and skilfully applied. In Continental as in American practice a current-limiting device is generally installed, but free renewals are not given, since the renewal cost of the tungsten lamp seems to serve as a useful check against too persistent burning.

The secret of the success reached on the Continent in dealing with these small consumers seems to be in coupling a cheap wiring system on the instalment plan with a flat-rate method of charging which makes the price to be paid perfectly definite and collects it in advance. There are few American cities in which a similar policy would not bring profitable results when once fairly under way. People must have light and would always use electric light if it were to be had without too much expense. Yet for some inscrutable reason the policy of most American central-station managers has been such that the solicitor would rather spend a week trying to place a small electric sign over a suburban beer saloon than put in the same time to the greater profit of his station in obtaining the much despised small consumer. We trust that Mr. Doane's far-reaching investigation of the facts as disclosed in European practice will lead to better things. If the central-station manager is tempted to despise small payments, let him take notice that the whole street-railway business lives upon nickels. If the supply manufacturer prefers to sell only high-priced equipments, let him consider the greater business that can be done in reaching the large number of humble homes where electricity is not now known.

Some New Methods in Shop Illumination

An account of some very striking innovations in department-store lighting is published in the article beginning on page 1145 of this issue. The illumination of such a store has always been rather troublesome on account of the nature of the spaces and the necessity of having as far as possible good color values in the illuminants. In the present instance the engineer who planned the installation awoke to a realization that the illumination of the shop windows, for example, is essentially a bit of stage setting, to be treated according to theatrical rather than ordinary precedents. He therefore worked out a window-lighting system with foot-lamps and border-lamps, equipped, as in the best stage practice, with movable color filters giving whatever tone may be desired at the time for the illumination of the objects on the stage. It is found that the use of such filters is much better than staining the lamps, as the colors stand better and can be changed with the utmost ease. In the window lighting, therefore, any display can have an appropriate and effective color of illumination and plenty of it, thanks to the efficiency of modern light sources. The fundamental lighting of the building, too, is carried out with color values in mind. It is of the semi-indirect type, and the diffusing bowls are lined with bluish bowls which serve as color screens, giving in the general illumination of the store a much closer approximation to daylight effects than could be obtained by the use of any single type of unscreened illuminant.

This scheme is carried still further in the special provision for trying on theatrical costumes. Here are not only the general provisions for color modification, but foot-lamps and border-lamps fitted with dimmers, and also the customary spot-lamps for special effects. Taken as a whole the installation furnishes an admirable instance of scientifically designed lighting especially arranged to meet the exacting requirements of its use and to provide for every variation in color tone that may be necessary most effectively to display the goods on sale. In addition to these particular features the plant is thoroughly up to date and worthy of attentive consideration.

Transformer Core-Loss Separation

Core-losses are always present in electrical machinery, as a cheerful reminder that nothing in this world can be perfect. A reasonable amount of core-loss is, therefore, a thing that no good-natured engineer will protest against. Core-losses are attributed to two different phenomena; namely, hysteretic loss and eddy-current loss. The former is essentially magnetic and the latter electric. The two effects follow very different laws. The former is considered to be largely independent of temperature and to depend solely on the frequency as well as on the 1.6th exponent of the flux density. The latter is considered to vary as the square of the frequency and to be affected by temperature variations in resistivity. Consequently, it is assumed that by operating a core at cycles of varying frequency it becomes possible to find how much loss varies as the first power, and how much as the second, in order to separate the hysteretic sheep from the eddy-current goats.

When careful measurements are made in the laboratory, upon cores specially selected and wound, it is not easy to draw the line precisely between sheep and goats. The sheep refuse to conform strictly to the first power, and the goats also decline exactly to obey the second power of the frequency throughout any considerable frequency range. The fact seems to be that the 1.6th power is only a first approximation to the energy-versus-density relation, while the skin effect of the eddy currents distorts the flux distribution from uniformity to a condition of greatest density at the surface of the laminas and least at their mid-plane. The analysis of core-loss into hysteretic and eddy-current components, even under laboratory conditions, thus often becomes very difficult, when accurate division is attempted.

Finally, when the core of some actual machine or apparatus, such as the core of an assembled transformer, is tested, the difficulties are further increased. Some eddy-current loss in the copper coils throws itself in a sympathetic but sadly perplexing way into the measured total. The flux density in the steel varies, not only owing to eddy-currents, but also on account of magnetic and mechanical departures from symmetry. The result is that analysis based on losses measured at different frequencies becomes inconsistent, and the relative distribution of sheep and goats becomes doubtful in yet larger degree. In the case of very complicated and irregular cores one may have to be content with rough approximations only. Fortunately, in most engineering work, it suffices to measure the core-losses as a whole, and, accepting the quadruped analogy, statistical inquiries into the relative proportions of generic types become a matter of merely zoölogical interest.

The article by Prof. E. R. Shepard which appears in this number, on a practical example of transformer core-loss separation, illustrates the above-mentioned difficulties in the way of accurate analysis. In this case the core-losses of a transformer were measured at two different frequencies. The hysteretic loss was also measured by flux-meter, at a frequency which must have been substantially zero. From these data the analysis into hysteresis and eddy-current losses is made in several different ways. These are in agreement to a first approximation. It appears, for example, that at a computed flux density of 9 kilogausses the core-losses were about equally divided in the ratio of two-thirds hysteresis and one-third eddies; but if a division of 1 per cent precision were required, it would be very difficult to comply. Far from being discouraged, however, by such discrepancies, we should be stimulated by the conclusions from such tests to renewed vigor in attacking the experimental problem, with a view to obtaining, when necessary, more precise results. This application of the article rests over and above that indicated by Professor Shepard, as to the wholesome effects of such studies on the student mind.

The Utility Holding Company

Representatives of holding companies in the public utility industry are urging Congress to exempt such companies from the operation of the trust regulation bill. Arguments in support of their proposition, presented before a committee of the Senate on May 12, were published in last week's issue. The arguments dealt more with the finances of the holding company than with the operating point of view. There is economic justification for the public utility holding company from both points of view, but it would have made the case stronger if operating officials had explained the technical questions involved. The public utility holding company confronts at present the fact that the holding company as an institution is regarded by the Washington administration and leaders as intrinsically undesirable. Sweeping as this judgment is, the burden rests upon the public utility holding companies to show that they should not be classed with the general type of holding company, that their operations are limited to local public utilities and that they do not unreasonably restrain trade. These facts are so plain to public utility operators that these men can scarcely realize that their corporations may be condemned by the new law. If Congress chooses to legislate against public utility holding companies, it should do so with a perfect understanding of their function. It would be extremely unfortunate if Congress should legislate against companies of this nature without a perfect understanding of their purpose or without a definite intention on its part to bring such companies within the scope of the law. It is to guard against such a contingency that the *Electrical World* has urged representatives of the companies to defend their position.

The normal business of the public utility holding company is the control and management of a number of plants furnishing gas, electric or other forms of public utility service, these plants being generally widely separated physically. This holding company does not seek to dominate an entire industry. It does seek to perfect monopoly of its service in each community for reasons of economy to itself and the public it serves. Its desire so to do and the large uncertainties that arise in the definition of the term "interstate commerce" make jurisdiction by Congress a matter of certainty in many cases and a matter of probability or construction of the law in others. We contend that the question of the public policy of monopoly of each class of public utility service in a single community is not one that is before Congress for judgment. The proposition that the settlement of this question is best left to state commissions does not seem to be open for argument. The state commissions have held almost uniformly that such monopoly is better than competition. In the control through a holding company of gas plants in Philadelphia, an electric plant in New York, an electric railway in Buffalo and an electric-lighting and electric-railway system in San Francisco there is no competition. In the control similarly of twenty or of fifty plants located in separate cities of less population there is no competition.

The public utility holding company fills a useful place in the economic structure of the country, and it should not be put out of business. The basis of its revenues and growth is the local plant, which is subject to complete regulation by commissions in most states. If local plants are not under this form of regulation, they ought to be. The form of control which has proved to be so salutary where it has had effective trial should be extended to all states. The regulation of such plants is the problem and function of the several states, and it is not likely that they will surrender their rights in these respects. The states have the same power to regulate public utility plants held by holding companies that they have to regulate public utility plants held independently. If the states cannot prevent abuses in the one kind of plant, they cannot do so in the other kind. If they cannot enforce proper conditions of service, rates and capitalization in one, they cannot do so in the other, and in that case state regulation would have to be counted a failure. We believe that the best results will be obtained if the states retain control of plants within their borders with full powers of regulation to require proper practices without regard to whether properties are owned at home or abroad. If the public utility holding company cannot justify its existence under the most rigid form of state regulation it will fail and no act of Congress will save it. It should have, however, a fair opportunity to demonstrate its usefulness, and it will not receive such an opportunity unless it is exempt from the general prohibition against holding companies which appears in trust regulation bills.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Municipal Isolated Plant Scheme Relinquished at Springfield, Mass.

As a result of a bid by the United Electric Light Company and acting under the advice of Prof. H. E. Clifford, of Harvard University, consulting illuminating engineer of the city of Springfield, Mass., the city property committee has decided to abandon the proposed municipal isolated lighting plant for the city buildings in the urban center. The company has offered to supply energy to the municipal group at a flat rate of 4 cents per kw-hr., which will save the city $7,500 per year over the existing 7-cent rate. The 7-cent rate is to remain in force in city buildings elsewhere in Springfield. The police and fire-department headquarters, vocational school, city hall and auditorium will receive the lower rate. After a few minor alterations are made in the bid, the committee will recommend that a five-year contract be signed by the company and the board of supervisors.

Hearing on Boston Street-Lighting Contracts

At a hearing before the Boston City Council President Charles L. Edgar of the Edison Electric Illuminating Company appeared on behalf of the proposed ten-year street-lighting contract. Mr. Edgar stated that the company desired a contract of this duration on account of the large investment involved in underground and pole equipment and pointed out that no concessions in price could be made on a short-time contract. The committee on municipal affairs of the Boston Chamber of Commerce reported that the price offered—$87.53 per lamp per year—is substantially in accord with that which other cities are now required to pay for the same kind of service under similar conditions. The committee urged that both the pending gas and electric contracts should be redrafted and made more nearly uniform as regards provisions for arbitration, extensions and penalties. Mr. Edgar said that on account of local conditions comparisons of Boston prices with those in other cities are of little value. The company desires a fair price for its service and has met the city more than half way in the whole matter of contract renewal.

Electric Pleasure Vehicles Exhibit in New York

There is at present being given under the auspices of the New York Electric Vehicle Association in the new showrooms of the New York Edison Company, Irving Place and Fifteenth Street, New York, an exhibit of electric pleasure cars. Six of the leading builders have brought together in this display the finest product of their factories. Among the cars shown are an Ohio brougham, a Rauch & Lang town car, a Detroit electric runabout, a Baker brougham, a Waverley roadster, a Rauch & Lang five-passenger brougham, a Waverley brougham and a Ward coupé chassis. President Arthur Williams of the New York Electric Vehicle Association said regarding the exhibition: "It has been our endeavor to make an electric-vehicle display free from turmoil, dust, heat and other disquieting features and to conduct an exhibit of quiet elegance, in a properly ventilated and tastefully decorated hall, where one may examine the cars at leisure and without annoyance from either surrounding conditions or too attentive salesmen. The exhibit includes all that is new in electric-car designs and really indicates that gratifying progress has been made in this direction within the past year. The cars are truly suggestive of dignity, safety, comfort and cleanliness."

New England Section, N. E. L. A.

More than 200 members and guests of the New England Section of the N. E. L. A. assembled at the American House, Boston, on May 8, for the annual spring meeting of the organization, the principal speaker being Mr. Frederick P. Fish, of Boston, Mass., upon "The Present Status of Public Service Corporation Development." The speaker reviewed the development of the electrical industry from the days of small and inefficient apparatus to the present highly powerful and co-ordinated equipment, and pointed out the evils of duplication, the benefits of regulated monopoly, and the importance of the average man's and the government's encouragement of modern development along centralized lines. Mr. Fish said that it is for the best interests of the public for utility corporations to have exclusive rights in the districts covered, and that the cost of waste generally falls upon the public. The speaker held that the value of such corporations is becoming more and more appreciated by the public at large and the evils of corporate utility management have largely disappeared, resulting in better relations between the companies and their patrons. Another speaker, Mr. Thomas Wilbor, discussed conditions in Mexico.

Foreign Trade Convention at Washington

At the National Foreign Trade Convention to be held in Washington, D. C., on May 27 and 28, 1914, existing conditions in distant markets will be set forth by Hon. Cameron Forbes, ex-Governor-General of the Philippines; Mr. Edward N. Hurley, of Chicago; Mr. Welding Ring, of New York; Mr. S. D. Webb, of New York, and Mr. Alba B. Johnson, of Philadelphia. What the government is doing will be described by Mr. Wilbur J. Carr, director of the Consular Service, and Mr. A. H. Baldwin, chief of the Bureau of Foreign and Domestic Commerce. "Present Commercial Conditions in the United States, with Special Reference to Foreign Trade," will be discussed by Messrs. E. C. Simmons, James J. Hill, H. G. Herget and Robert Dollar. The effect of the Sherman law on foreign trade, the contention that large corporations are best fitted effectively to handle foreign trade, and the desirability of specifically permitting combinations of American manufacturers for foreign as distinct from domestic trade are to be the subjects of papers by Mr. J. D. Ryan, president of the Amalgamated Copper Company. The tariff will be discussed by Prof. Henry C. Emery, of Yale. The relation of the new currency law to foreign trade, the merchant marine, ocean transportation, and government assistance in foreign trade are other topics on the program.

The convention will be held under the auspices of the American Manufacturers' Export Association, the American Asiatic Association, and the Pan-American Society, and will be opened by Secretary Redfield of the Department of Commerce. The chairman of the general committee on arrangements is Hon. Lloyd C. Griscom, ex-American Minister to Japan and Ambassador to Italy. The official headquarters of the committee are in the Manhattan Life Building, 66 Broadway, New York.

A. I. E. E. Business Meeting

At the annual business meeting of the American Institute of Electrical Engineers, held on May 12, announcement was made of the result of the election of officers. The directors' nominees, listed on page 684 of our issue dated March 28, 1914, were elected. Including the newly elected members, the officers of the Institute for the year beginning Aug. 1, 1914, will be as follows:

President, Prof. Paul M. Lincoln; vice-presidents, Messrs. H. H. Barnes, F. S. Hunting, J. A. Lighthipe, Farley Osgood, C. F. Scribner and N. W. Storer; managers, Messrs. Comfort A. Adams, Frederick Bedell, B. A. Behrend, J. H. Finney, Bancroft Gherardi, William B. Jackson, Peter Junkersfeld, H. A. Lardner, A. S. McAllister, William McClellan, Lewis T. Robinson and H. Franklin Stevens; treasurer, Mr. George A. Hamilton; secretary, Mr. F. L. Hutchinson.

According to the report of the board of directors, the membership on April 30, 1914, consisted of five honorary members, 439 fellows, 1027 members and 6405 associates; total, 7876, a net increase of 222 since April 30, 1913.

Following the business meeting a technical session was held under the auspices of the committee on the use of electricity in marine work. Lieut. C. S. McDowell, of the United States Navy, chairman of the committee, acted as chairman of the session. Two papers were presented by the authors, as follows: "Electricity, the Future Power for Steering Vessels," by Mr. H. L. Hibbard, and "The Future of Electric Heating and Cooking in Marine Service," by Mr. H. J. Mauger. These papers were discussed by Messrs. G. Pierce, M. Pfatischer, W. J. Day and W. S. Hadaway, Jr. Abstracts of the papers will appear in a later issue.

Ohio Utilities Committees Organize

The two special committees recently appointed by the Ohio Electric Light Association to assist the central-station interests of the State in making valuations and appraisals in obedience to an order of the Ohio Public Utilities Commission, as noted in the *Electrical World* for May 9, 1914, met at the Hotel Chittenden, Columbus, Ohio, on May 15 to elect chairmen and adopt plans for work. Mr. Robert Lindsay, vice-president and general manager of the Cleveland Electric Illuminating Company, was elected chairman of the committee on appraisal. The other members of this committee are Messrs. F. M. Tait, Dayton; M. F. Millikan, American Gas & Electric Company, New York; F. J. Derge, Toledo, and W. W. Freeman, Cincinnati.

Mr. L. K. Funkhouser, secretary and treasurer of the Dayton Power & Light Company, was elected chairman of the committee on uniform accounting. The other members of this committee are Messrs. J. H. Scobell, Cleveland; T. F. Wickham, Cincinnati; F. B. Lasher, Republic Railway & Light Company, New York, and F. W. Drager, American Gas & Electric Company, New York.

Both committees were to meet again at Cleveland on May 22, at which time they were to make reports and present forms and schedules on a standard type on which the returns from the central stations of the State can be made. It was understood that at this time the suggested forms and schedules would be submitted to Mr. Nau, expert accountant for the Ohio Public Utilities Commission, for his approval. By thus co-operating with the State authorities it is hoped that the order of the commission, which requires valuations as of July 1 to be filed by Aug. 1, may be obeyed with the minimum of expense and effort on the part of the central stations. In this way it is hoped to make the returns in a standard form which will be acceptable to the commission. It is also understood that a small tax has been assessed upon the central-station interests of the entire State to provide funds for the work of the two committees.

Entertainment Features of the N. E. L. A. Convention

The program of entertainment arranged for the convention of the National Electric Light Association to be held at the Bellevue-Stratford Hotel, Philadelphia, Pa., June 1-5, has been given out by Mr. W. C. L. Eglin, vice-president of the Philadelphia Electric Company and chairman of the general convention committee. During the afternoon of June 1 a preliminary baseball game for the Westinghouse trophy will be played at the Franklin field between the Philadelphia and Baltimore teams.

The usual reception to the President and officers of the association will be given on the evening of June 1 in the ballroom of the Bellevue-Stratford Hotel. On the morning of June 2 visits will be made to municipal points of interest and the larger department stores. The new home of the Curtis Publishing Company, in Independence Square, will be open for inspection to the ladies, and a special recital will be given during the morning on the pipe organ in the Grand Court at Wanamaker's.

On the afternoon of June 2 a musical has been arranged for the ladies in the assembly room of the Manufacturers' Club. The entire convention will make an excursion to Willow Grove Park on Tuesday evening. Special trains will leave the Reading Terminal for the park, which is considered one of the finest amusement resorts in the world. The electrical decorations are most attractive, and there will be a special exhibition of the electric fountain. The entire seating capacity for the band concert has been reserved for that night. A rejuvenation of the Sons of Jove will also take place in Willow Grove on Tuesday night.

Wednesday, June 3, has been called "university day." During the morning an automobile trip through Fairmount Park has been proposed for the ladies, and during the afternoon the annual championship baseball game will take place at the Franklin Field of the University of Pennsylvania. Provost Edgar F. Smith of the university has extended the privileges of the Houston Club, the swimming pool and the gymnasium to all the delegates. Before the baseball game a tour of inspection will be made of the University of Pennsylvania buildings, concluding with a reception by Provost Edgar

F. Smith. The public policy meeting is scheduled for Wednesday evening, June 3, and card parties have also been arranged for the ladies, the prizes consisting of electrical appliances.

A river excursion is scheduled for the morning of June 4 for the ladies, a visit being planned to the League Island Navy Yard. Luncheon will be served on board the steamer. All the great shipbuilding industries and other points of interest on the Delaware River front will be passed on the sail. Orchestral concerts will be provided throughout the trip. On Thursday evening a dance will be given in the ballroom of the Bellevue-Stratford Hotel. There will be an exhibition of modern dances together with music and singing.

Mr. H. A. Wagner, of the Consolidated Gas, Electric Light & Power Company, of Baltimore, has extended an invitation to the delegates to visit the hydroelectric development of the Pennsylvania Water & Power Company at Holtwood (McCall's Ferry), on the Susquehanna River. If a sufficient number express a desire to visit the plant, a special train will be provided, leaving the Broad Street station of the Pennsylvania Railroad about 1 o'clock in the afternoon and returning about 8 o'clock in the evening. The trip requires about two hours each way, and luncheon will be served en route.

Program of the District Heating Associafion

A wide and important range of subjects will be considered at the sixth annual convention of the National District Heating Association, to be held at Rochester, N. Y., from May 26 to 29.

Among the reports to be presented are the following: Underground construction committee, Mr. H. A. Woodworth, Indianapolis, chairman; nominating committee; meter committee, Mr. A. D. Spencer, Detroit, Mich., chairman; record committee, Mr. A. P. Biggs, Detroit, Mich., chairman; rate committee, Mr. E. L. Wilder, Rochester, N. Y., chairman; educational committee, Mr. D. S. Boyden, chairman, and station-operating committee, Mr. B. T. Gifford, Grand Rapids, Mich., chairman.

The papers will include the following: "Public Policy of Utilities," by Mr. R. M. Searle, Rochester, N. Y.; "Manufacture of Welded Iron and Steel Pipe" (accompanied by moving pictures showing the progress of manufacture), by Mr. D. R. Mason, Pittsburgh, Pa.; "Use of Bleeder Turbines in Connection with Steam Heating," by Mr. R. D. DeWolf, Rochester, N. Y.; "Hot-Water Heating Under Forced Circulation," by Mr. Thomas Donahue, Lafayette, Ind.; "Expense of Operating Centrifugal Pumps Versus Double-Acting Pumps," by Mr. A. C. Rogers, Toledo, Ohio; "Some Effects of Utility Regulation as Affecting District Heating," by Messrs. H. Almert, Chicago, and D. L. Gaskill, Greenville, Ohio; "Effect of Superheated Steam on Heating Systems," by Mr. D. S. Boyden, Boston; "District Heating for Small Towns and Cities of 10,000 Population and Under," by Mr. L. T. Mason, Hornell, N. Y.; "Heat Losses from Buildings of Latest Construction," by Mr. J. Byers Holbrook, New York City; "Which Is More Profitable: To Shut Off Steam at Night or Keep It on Continuously?" by Mr. E. L. Wilder, Rochester, N. Y.; "Economic Advantages to Consumers of Central-Station Heating Service Over Individual Heating Plants," by Messrs. N. M. Argabrite and Thomas F. English, Muncie, Ind.; "Customers' Steam-Heating Systems," by Mr. H. R. Wetherell, Peoria, Ill., and "Commercial Steam Heating in New York City," by Mr. George W. Martin, New York City.

An attractive program of entertainment has been arranged for the visiting ladies. The headquarters, meeting place and exhibit of the convention will be at the Seneca Hotel.

Michigan Section, N. E. L. A.

The plans for the convention of the Michigan Section of the National Electric Light Association, which will be held on the steamer *Rochester*, June 17-20, are rapidly assuming shape. The following papers and addresses have already been arranged for: "Regulation of Public Utilities and Returns Allowed Thereunder," by Mr. Halford Erickson, Wisconsin Railroad Commission; "Water-Power in Michigan," by Mr. G. W. Bissell, of the Michigan Agricultural College; "The Gas-Filled Lamp," by Mr. J. R. Colville, of the National Lamp Works of the General Electric Company; "Interior Illumination," by Mr. M. Luckiesh, of the National Lamp Works; "Outdoor Substations," by Mr. A. Meyer, of the Edison Illuminating Company, Detroit; "Description of Automatic Substations," by Mr. James W. Bishop, of the Edison Illuminating Company, Detroit; "Depreciation and Obsolescence," by Mr. H. A. Fee, Adrian, Mich. An address will be made by Mr. J. B. Oxtoby, of Detroit.

The meetings will be held on board the boat at night, and an endeavor will be made to have most of the papers illustrated by lantern slides. In conformity with a resolution passed by the executive committee early in the year, the reading of papers by abstract will be inaugurated. A rejuvenation of the Jovian Order will also be held on board the boat.

The itinerary calls for a departure from Detroit on the evening of June 17 for Buffalo, which will be reached the next morning. The delegates will then visit Niagara Falls, and at the invitation of Mr. Philip P. Barton will inspect the American and Canadian plants of the Niagara Falls Power Company. The boat will leave Youngstown on June 18, passing up the St. Lawrence through the Thousand Islands, arriving at Ogdensburg on June 19. The return trip will begin on June 19, the delegates arriving at Toronto on June 20, where they will board a special train on the Canadian Pacific Railway for Detroit.

Wakefield, Mass., Changes from Municipal to Central-Station Service

Wakefield's municipal light commission has just signed for the town a contract with the Edison Electric Illuminating Company of Boston whereby the latter will furnish all the electric service the town will use. This will include street lighting and all electricity for commercial and domestic purposes.

Wakefield has been operating, under the supervision of its commission, the town's electric generating plant to furnish the service from dark until daylight and has taken such additional service as has been needed for daytime use from the Reading municipal plant. The commission some time ago began investigating the possibilities of securing service from the generating and distribution system of the Boston Edison company and after a careful study of all the conditions has decided to shut down the town's own old plant, discontinue using the Reading municipal service and take the Boston Edison service. The change will be made as soon as the Boston Edison company can extend its lines to the town, which will be done in a comparatively short time. The latter company will furnish 2300-4000-volt, four-wire, sixty-cycle alternating-current service from which either single-phase for lighting or three-phase for motor purposes can be delivered as desired. The lines will be run in duplicate in order to insure the extra protection of the town.

The change from the use of a municipal generating station of limited output to the efficient, economical service of a public service corporation with practically unlimited output, which may mean much in the development of Wakefield's manufacturing business, has been made without any increase of the town's financial obligations or investment in property and machinery.

Purchased Energy for Electric Railways

Mr. Peter Junkersfeld, assistant to the vice-president of the Commonwealth Edison Company, gave an illustrated address on "Power Production for Electric Railways" at the meeting of the Illinois Electric Railways Association in Chicago on May 15. Mr. Junkersfeld pointed out that in 1902, according to the United States Census Bureau, the amount of electrical energy purchased by electric-railway companies was negligible. Ten years later the government's figures showed that 33 per cent of all the electrical energy used by the electric railways of the United States was purchased. In Illinois in 1912 the proportion of purchased electricity for railway operation was 58 per cent, while in Chicago during the first four months of the present year the amount of purchased electrical energy for the operation of surface and elevated railways was 90 per cent.

Economic reasons, of course, account for this development. The electric-service company specializes in the production of electrical energy, and by serving the diverse wants of the community and by utilizing the most economical apparatus in large units it is often able to sell electricity for the operation of electric railways cheaper than the electric-railway companies can manufacture it. Assuming an average load-factor of 40 per cent, the rate at which electrical energy is furnished by the Commonwealth Edison Company to the railways of Chicago works out a little over 0.7 cent per kw-hr. The amount paid by the Chicago electric railways for purchased energy in 1913 was in round numbers $3,750,000. The cost per kilowatt-hour has so far shown a constant tendency to decrease. During the last six years electric-railway power houses with a total rating of about 80,000 kw have been shut down in Chicago, owing to the fact that their owners purchase electrical energy from the electric-service company.

Another point of interest to electric-railway operating men is the fact that by purchasing electricity in a large city from a large central organization it is possible to increase the number of feeding points available for both surface and electric-railway operation. Mr. Junkersfeld exhibited a number of curves, one showing how the investment and operating costs are much less for the railway customers than for the average lighting and motor customers, thus indicating how it is possible to sell the energy purchased wholesale for railway operation at such a low rate. A curve of annual load-factors showed that as the output per capita increases the load-factor improves and the income and cost per kilowatt-hour decrease. Another diagram gave a graphic illustration of the manner in which the diversity-factor enters into the economical production of central-station energy.

In the afternoon the railway men were taken on a trip of inspection through the Fisk Street and Quarry Street generating stations of the Commonwealth Edison Company.

Record Year for Westinghouse Electric & Manufacturing Company

The Westinghouse Electric & Manufacturing Company reported Wednesday a gross business in the fiscal year ended on March 31 of $43,733,646, a total far surpassing the record of any other year of the company's history. The turnover was $3,756,081 larger than in 1913, which was the next best period for sales. Expenses absorbed $39,016,424, an increase of $3,610,131, and net income of $4,717,222 was considerably smaller than in 1911, but $145,950 greater than in 1913. After paying interest charges on bonds, etc., a balance of $4,058,809 was left for dividends and other purposes, as against $3,164,032 last year.

Mr. Guy E. Tripp, chairman of the board of directors, told shareholders in the annual statement that orders were fewer at the end of the year than at the beginning. "The value of unfilled orders on March 31, 1813," said he, "was $12,061,473; on March 31, 1914, the value of unfilled orders was $7,951,385. The average number of employees during the year was 18,635, as compared with an average of 20,542 for the previous year. A net decrease in the total investments in foreign companies is chiefly accounted for by the depreciation of $1,000,000 in the book value of the debentures of the Russian company. The liquidation of this company has proceeded most satisfactorily, and during the year remittances aggregating over $900,000 were received by the company in reduction of the amount due for advances made. It is expected that the liquidation will be completed during the current fiscal year. The reports of the British Westinghouse Electric & Manufacturing Company, Ltd., for the year ended Dec. 31, 1913, reflect a continued improvement in the affairs of that company. The affairs of the French company again show improvement during 1913. Its net income exceeded that of any previous year in its history. The Italian company has received additional orders for locomotives from the Italian government beyond those referred to in last year's report and it now has orders in hand sufficient fully to occupy its facilities during the current year. The total liabilities of the company show a decrease of over $5,000,000 as compared with the previous year. The funded debt shows a decrease of over $500,000, due to the payment of the outstanding balance of debenture certificates due July 1, 1913, and the sinking fund payment." The gross surplus was $12,002,305, and total surplus was given in the report as $7,659,130 as of March 31, 1914. The balance sheet showed aggregate assets valued at $82,672,240, of which more than $6,000,000 was in cash.

Mr. Cravath on "Brightness"

At the regular meeting of the Chicago Section of the Illuminating Engineering Society on May 13 Mr. W. A. Durgin opened the meeting with the fourth and last of a series of twenty-minute talks on "Fundamentals of Illumination." Taking up the characteristics of light sources, Mr. Durgin performed some interesting experiments with various types of incandescent and arc-lamp sources to show how the light given off from each of these differed from the others. The feature of the demonstration was the experiment which showed the whiteness of the light from the tungsten filament operated at double normal voltage and giving a light similar to that of the new high-efficiency tungsten lamp.

Reading a paper entitled "Brightness," Mr. J. R. Cravath, consulting engineer, Chicago, gave a statement of the elementary principles involved in calculation and measurement of surface brightness, at the same time demonstrating the use of the new small-type Sharp-Millar photometer. In an extensive table compiled from personal observations and such other authorities as Ives and Luckiesh, Bell ("Art of Illumination") and the American Luxfer Prism Company, Mr. Cravath presented data showing the enormous difference in brightness within the field of view to which the eye is subjected. Taking, for example, a small room illuminated by a clear tungsten incandescent lamp, the filament presents a brightness of 1060 cp per sq. in., while the walls of the room may easily show as low as 0.00015, giving a ratio of about 7,000,000 to 1. From the data in this table it was concluded that the contrasts or differences of brightness within the field of vision with the undiffused light of modern artificial illuminants are much greater than those to which ordinarily the eye is similarly exposed for considerable periods with natural light. It was concluded further that indirect artificial lighting is being commonly carried out with differences of brightness in the field of view approximating northern-exposure daylight. The distribution of brightness, however, within the field of vision in the two cases is different. A set of experiments conducted by the speaker showed why indelible-pencil marks become invisible under certain light conditions. Carrying these tests further, Mr. Cravath showed that upon white bond paper blue ink, black-pencil and indelible-pencil marks are respectively least objectionable from the standpoint of glare. Commenting upon these tests, the speaker said in conclusion that writing and printing do not present such marked contrasts with the paper as is popularly supposed.

At the next meeting, on June 10, a paper on Chicago street and subway lighting will be read by Mr. P. E. Haynes, of the city electrical department, and Prof. A. H. Ford, Iowa City, will speak on the design of electric signs.

Patent Office Salaries

A bill was introduced in the House of Representatives on May 12 by Representative Oldfield. Its purpose is to improve the efficiency of the Patent Office. The bill was referred to the committee on patents. Representative Oldfield expresses confidence that the bill will be reported out of committee in practically its present form, and that it will be passed by this Congress, although probably not at this session.

The position of first assistant commissioner of patents would be created if the bill becomes a law. There would be five examiners in chief, instead of three as at present. The salary proposed in the bill for the first assistant commissioner of patents is $4,500. The salaries of the examiners-in-chief would be raised from $3,000 to $3,500. The positions of commissioner, first assistant commissioner, assistant commissioner and examiners-in-chief would be filled by Presidential appointment.

The bill proposes to raise the salary of the Commissioner of Patents from $4,500 to $5,000 a year. To the salary of the assistant commissioner of patents $500 would be added, making it $3,500 a year.

Positions in the examining force created by the bill are: Five law examiners, at $2,750 a year; one examiner of classification, at $3,600 a year; twenty-one additional principal examiners, with salaries of all forty-three examiners advanced from $2,500 to $2,700; sixty-two additional first assistant examiners, with the salaries of the entire eighty-six who may hold these posts advanced from $1,800 to $2,400; sixty-two additional second assistant examiners, with the entire force of eighty-six who would hold these positions increased from a salary of $1,600 to $2,100 a year; sixty-two additional third assistant examiners, increasing the force to eighty-six, with advance in salary from $1,400 to $1,800; eighty-six fourth assistant examiners, a new position created by the bill, at a salary of $1,500, and four draftsmen at $1,000 a year salary.

The salary of the chief clerk would be increased from $2,500 to $3,000 a year. The language of the bill provides that the chief clerk shall be qualified to act as principal examiner.

Other increases in salary which the bill would provide are: From $2,500 to $2,700 for the examiner in charge of interferences, and from $2,500 to $2,700 for the examiner in charge of trade-marks. Salaries of the librarian at $2,000 a year and one messenger and property clerk at $1,000 a year would remain unchanged. The former title of "messenger and purchasing clerk" would be changed to "messenger and property clerk."

Positions that the bill would abolish are: One machinist at $1,600 a year; thirty-five copyists of drawings at $1,000 a year; one skilled laborer at $1,200; eight attendants in the model room at $1,000, and eight attendants in the model room at $900 a year.

Meeting of Philadelphia Engineers and Scientists

More than 400 members of scientific and engineering societies of Philadelphia attended the get-together meeting held in that city on May 15. Prof. George A. Hoadley, of Swarthmore College, who acted as chairman of this, the first meeting of its kind in Philadelphia, stated that the committee in charge had obtained a complete list of names and addresses of the members of the scientific and engineering societies of Philadelphia, the total without duplicates being in excess of 4000.

Director George W. Norris of the Department of Wharves, Docks and Ferries, Philadelphia, outlined the extent to which civic problems have become engineering in nature and require the services of engineers for solution. Dr. W. W. Keen, president of the American Philosophical Society, showed that the great advances in civilization have been directly attributable to the discoveries of the scientists and the inventions and developments made by the engineers. Dr. Walton Clark, president of the Franklin Institute, described the work accomplished and being carried forward by the Institute directly for the benefit of scientists and engineers and indirectly for the benefit of all humanity.

Dr. Alexander C. Humphreys, president of Stevens Institute of Technology, delivered an address on "The Engineer as a Factor in Modern Progress." He criticised engineers for not taking a more active interest in public affairs. He claimed that commissioners for regulating public utilities should be selected from men familiar with the problems of the utilities and not from incompetent persons looking for jobs. The country suffers from the destructive criticism of persons incapable of improving the conditions but anxious to attempt to do so for the pay thereby to be obtained. Legislators are attempting to destroy the business which has become big by reason of the very laws which the politician-legislators have brought into existence. If present business is bad, the remedy is to be found in doing away with the politicians rather than in placing uneconomical fetters on big business. Dr. Humphreys predicted that conditions will be worse before they become better. He urged engineers, and especially those having had the opportunity of college training, to become active in public affairs, wherein their knowledge will prove of immense benefit in the solution of the great problems now confronting the nation.

Dr. C. P. Steinmetz and President James M. Dodge of the American Society of Mechanical Engineers were unable to be present to deliver their addresses on "Electricity in Modern Industry" and "Engineering Societies."

In addition to Prof. Hoadley, the committee in charge of the arrangements for the meeting consisted of Messrs. L. B. Eichengreen, Joseph D. Israel, H. A. Hornor, R. B. Owens, C. C. Tutwiler and J. A. Vogelson. It is expected that similar meetings will be held at convenient intervals in the future.

Convention of Oklahoma Electric Association

The fourth annual convention of the Gas, Electric and Street Railway Association of Oklahoma was held at Oklahoma City May 13 to 15 inclusive, with an attendance numbering nearly 100. Col. J. W. Johnson welcomed the delegates on behalf of the city, and the president of the association, Mr. F. E. Bowman, Ada, responded with an appropriate address in which he urged upon utility managements their duty to dispense "moral light" in their communities twenty-four hours a day, no less than to dispense physical light during the hours of darkness. Despite the general advancing cost of living, said President Bowman, the price of electric-lighting service has steadily decreased, while for a 5-cent fare the street-car passenger now enjoys a longer, swifter and safer ride than ever before. Many of the Oklahoma electric plants, he pointed out, were built in advance of their communities, although with prophetic vision and implicit confidence in the ultimate development of the local townsite. Such pioneer utilities, he declared, have been great factors in the rapid growth of the new State. The public, concluded Mr. Bowman, should be informed of this important service to the commonwealth, among others, and should be educated to a realization that the Oklahoma utilities intend to give to all "the best of service and a square deal."

Grounding of Secondaries

In the absence of Mr. Burton French, engineer for the Public Service Company of Oklahoma, Mr. Galen Crow, Guthrie, read the author's paper on "The Grounding of Secondaries." Mr. French especially recommended that the smaller plants follow the practice of grounding secondaries already universally adopted by the larger companies, since it is in the smaller towns that the majority of accidents occur. In some parts of Oklahoma the quality of the soil makes grounding difficult and expensive. The water mains would, of course, furnish a good ground connection, but these pipes are not always available nor will permission for their use be always granted by the authorities, although it has been repeatedly shown that no possible electrolytic damage can be done by such an alternating-current ground connection. A ground-wire system with frequent ground plates may also be employed. For use under ordinary soil conditions Mr. French described the galvanized-pipe, charcoal-cone, copper-plate and wire-coil methods of grounding, recommending for general use the galvanized-iron-pipe ground.

Mr. J. M. Brown, of Oklahoma City, told of the difficulties of obtaining safe grounds locally with either pipes or grounded cones. After having proceeded half way with the grounding of the local system, reports of poles on fire, smoking sidewalks, electrified buildings, etc., began to come in at such a rate that construction was stopped and many grounds already in were at once removed as constituting hazards. Tests then made showed the poor character of the "grounds" after the soil had become dry. The Oklahoma water-supply authorities have refused formal permission to have ground connections made to the water pipes.

Mr. Lincoln Beerbower, Enid, described his practice of grounding all secondaries by the galvanized-pipe method, which he said was both easy to install and satisfactory in service. Messrs. Galen Crow, W. M. Dunn, Holdenville, and F. W. Insull, Oklahoma City, also spoke briefly.

Electric Drive in Shops and Factories

Prof. A. P. Little, Oklahoma Agricultural and Mechanical College, Stillwater, Okla., followed with a paper on "Electric Drive in Shops and Factories as a Means of Increasing the Central-Station Day Load." The author described special applications of various types of motors in order to take advantage of their torque characteristics and gave figures for the ratings required to drive wood-mill machinery, printing presses, etc.

Mr. Galen Crow, Guthrie, remarked that most operators of small private plants verily believe they are producing energy more cheaply than it can be purchased from a central station, although this is invariably self-delusion.

In comparing the cost of oil and coal as fuels, Mr. F. W. Insull, Oklahoma City, cited an instance in which firing with coal at $2.25 per ton was found to be 25 per cent cheaper than burning oil at $1 a barrel. Mr. W. Tritle, Kansas City, Mo., compared oil at $1 per barrel with coal at $2.25 per ton. Mr. W. J. Dibbins, Guthrie, reported that economy resulted from replacing coal at $2 with 10-cent gas.

Messrs. P. L. Lewis, Dallas, Tex.; G. W. Knox, Oklahoma City; H. V. Bozell, Norman; L. D. Means, Hobart, and F. E. Bowman, Ada, also took part in the discussion, advancing arguments for replacing private plants by motor drive.

At the session of Thursday morning Mr. R. H. Lyon, the Holophane Company, Dallas, Tex., gave a talk on and demonstration of the scientific use of glassware in illumination. Mr. C. H. Talmage, Western Electric Company, Kansas City, Mo., followed with an illustrated paper on methods of pole manufacture and preservative treatment, which he illustrated with lantern slides.

Franchises, Rates and Revenues

The Thursday afternoon meeting was held in the engineering building of the University of Oklahoma, Norman. A paper advocating the adoption of the "indeterminate permit" in Oklahoma and pointing out the unfairness of omitting municipal plants from commission supervision was presented by Mr. W. J. Norton, Norton & Bird, engineers, Chicago, and was read in the author's absence by Mr. F. W. Insull. Mr. Norton gave a number of arguments and cited many precedents to show the advantages of indeterminate franchises over term franchises. The subject of his paper and the proposal to subject municipal plants to commission regulation provoked a lively debate. Those who took part were Messrs. Bozell, Insull, Knox, Dibbins, John A. Williams, Shawnee; H. S. Cooper, Weatherford; W. M. Dunn, Holdenville; W. J. Mathias, Frederick; N. R. Gasho, Alva; T. Miller, Oklahoma City, and W. E. Blackwell, Afton.

Prof. L. W. Morrow, of the electrical engineering department of the State University, followed with his paper on Oklahoma rates and revenues, representing a careful compilation, from the files of the corporation commissions and other sources, of the finances, incomes, expenses, costs, etc., of the privately owned electric and gas properties of the State, as well as of a few municipal plants from which replies were received.

An Explanation of Order No. 774

On Friday morning the Hon. A. P. Watson, member of the Oklahoma Corporation Commission, spoke on the subject of original cost as a factor in the regulation of gas and electric utilities. The commissioner sought to justify the now famous commission order No. 774, which requires all gas and electrical utilities to file with the commission complete and detailed drawings of all their properties, plants and buildings. The purpose of the commission in this, he explained, is to establish a basis for the proper valuation and rate regulation of utilities, a measure for their own protection as well as for that of the public. This ruling, he predicted, will ultimately earn the gratitude of all the utility operators in the State, including even the small-plant men, who are now the chief objectors.

In the brief discussion which followed President Bowman and Mr. Knox expressed their approval of the commission's attitude. In reply to a query from Mr. Cooper, Commissioner Watson said that in those cases where the commission has found evidences of poor plant management and unwarranted expense it could not order a reduction of rates on the basis of what some plant in a nearby community was doing, although the commissioners have not hesitated in such cases to advise the owners to procure capable operators.

Problems in Dealing with the Public

The "Handling of Complaints" was the subject of Mr. George B. Saunders' paper. In this he described the classes of occasional and chronic "kickers" enencountered by a public-service company, and he recounted his own methods of meeting complainants and winning their confidence and friendship. "Of all the crimes with which public-service corporations have been charged," quoted Mr. Saunders, "the greatest is the one they have committed against themselves—the crime of non-publicity."

Mr. F. J. Meyer, Oklahoma City, discussed methods for preventing tampering with meters and theft of energy. Where evidence of theft can be secured Mr. Meyer recommended assessing the culprit a liberal estimate of the energy fraudulently taken, finally offering to drop the case if restitution is made promptly. This method, he said, often proves to be more remunerative to the company than a prosecution would be.

Election of Officers

The official report of Secretary H. V. Bozell, Norman, was followed by a general hearty tribute to the value of his services to the association. The committee on resolutions, Messrs. Beerbower, Morrow and Means, then presented its report. The electoral ticket proposed by the nominating committee—Messrs. Gasho, Insull and Carey—was next unanimously approved and the following officers elected for the year: President, Mr. George W. Knox, Oklahoma City; vice-presidents, Mr. W. J. Dibbins, Guthrie, and H. S. Cooper, Weatherford; secretary-treasurer, Prof. H. V. Bozell, Norman; directors (in addition to the above officers), Messrs. Lincoln Beerbower, Enid; C. S. Dawley, Okmulgee, and W. R. Molinard, Oklahoma City. Committees with chairmen were appointed as follows: Public policy, Mr. F. W. Insull, of Oklahoma City; membership, Mr. Thomas Carey, of Norman; accounting, Mr. H. Willmering of Oklahoma City; public safety, Mr. J. J. Johnson, of Oklahoma City; relations with customers, Mr. F. H. Tidman, of El Reno; fuel efficiency, Mr. A. P. Little, of Stillwater, and entertainment, Mr. F. J. Meyer, of Oklahoma City.

Mr. George W. Knox, president-elect of the Gas, Electric and Street Railway Association of Oklahoma, is vice-president and general manager of the Oklahoma Railway Company, which operates the street and interurban electric railways of Oklahoma City and vicinity. He is also president of the Knox-Heskett Engineering Company, Chicago, and is largely interested in the Chisholm (Minn.) Electric Lighting Company, of which he is a director. Mr. Knox has had a long and varied experience in the electric railway and lighting fields, dating from the pioneer days of the later eighties. On his graduation from the Northern Illinois College in 1885 he first engaged in steam-railroad work, but in 1887 he was employed by the old Thomson-Houston company to install the street-car system at Omaha, Neb. Two years later he joined the staff of the Sprague Electric Company, Chicago, but in 1891 his services were engaged by the Edison General Electric Company and for the latter he carried out the complete electrification of the Milwaukee horse-car lines. In 1892 he converted the Dubuque (Ia.) battery-driven street-car system to overhead trolley. Returning to Chicago, he next superintended the electrification of the 160 miles of track of the Chicago City Railway Company, and then continued as electrical and construction engineer of the company until 1899. In 1901 he organized the Knox Engineering Company at Chicago, the name of which has been since altered to the form noted above. Among the executive positions which Mr. Knox has held in the electric-railway and lighting fields are those of president of the Choctaw Railway & Light Company, McAlester, Okla., and general manager of the Freeport (Ill.) Railway & Light Company. Mr. Knox in 1901 made the original study and report on the Oklahoma electric-railway situation which resulted in the construction of the present modern system. He first acted as consulting engineer during the construction period, but in July, 1911, transferred his headquarters to Oklahoma City, becoming vice-president and general manager of the system. Mr. Knox is a member of the American Institute of Electrical Engineers and of the American Electric Railway Association. During 1913 he served on the latter's committee on power generation, and this year he is on its committee on taxation.

PRESIDENT-ELECT GEORGE W. KNOX

Among the entertainment features of the convention was a banquet Thursday evening, over which Mr. Galen Crow presided as toastmaster. Addresses were made by Prof. Jerome Dowd, of the University of Oklahoma; Mr. E. C. Patten, attorney for the corporation commission; Mr. F. W. Insull, and others.

Public Service Commission News

Illinois Commission

The Public Utilities Commission of Illinois has now in course of preparation rules fixing standards for gas and electrical service. Representatives of the commission are having conferences with committees of the electric-light and gas associations of the State and with engineers of different companies. It is expected that within five or six weeks the commission will have an open hearing at which all companies will be asked to be represented. It is probable that the rules when finally adopted will follow very largely those adopted by the other state commissions.

Wisconsin Commission

The Chippewa Valley Railway, Light & Power Company has been authorized to issue $6,000 in preferred stock to be exchanged for the property of the Inter-County Light & Power Company, of Elmwood.

The Bark River Electric Light & Power Company has been authorized to issue $12,000 in stock, part of which is to be exchanged for stock illegally issued and the rest is to be used for new construction.

The Coleman-Pound Light & Power Company has been granted permission to issue $6,000 in stock to apply on the construction of an electric-light plant to supply the villages of Coleman and Pound.

Pennsylvania Commission

The Public Service Commission of Pennsylvania has issued general orders Nos. 8 and 9, giving instructions as to the matters of filing tariffs with the commission and of issuing rates on less than statutory notice. Companies subject to the law are required to file with the commission not later than June 1, 1914, all tariffs issued which were in effect on Jan. 1, 1914, together with the amendments or re-issues. The companies are also to file rules and regulations that in any manner affect the rates or facilities.

Indiana Commission

The commission has entered an order requiring all of the utility companies in Indiana to file by Sept. 1 of this year complete inventories of their property "used and useful for the convenience of the public." The commission has already valued a number of the larger utility plants of the State and others have filed appraisals made by experts hired by the individual companies. Still other concerns have filed inventories. All of the foregoing are exempt from the operation of the new order.

New York Commissions

The Public Service Commission for the First District has decided to reopen the rate case of the Kings County Lighting Company, which was decided recently by the Court of Appeals. A resolution was adopted calling for a further hearing, beginning May 7, 1914, before Commissioner Milo R. Maltbie. This case was decided by the commission last year, when an order was passed directing the company, which serves the Coney Island district of Brooklyn, to reduce the price of gas to 95 cents per 1000 cu. ft. The company took the matter into the courts. The Appellate Division in May, 1913, decided the case adversely to the commission, which appealed to the Court of Appeals. The Appellate Division's opinion sustained the commission's action except in respect to going value, paving over mains and treatment of the annual increase in land value as part of income. The Court of Appeals, while agreeing with the Appellate Division as to going value and annual increase in land, disagreed with it and sustained the commission in regard to paving over mains. It also greatly enlarged the Appellate Division's opinion as to the nature of going value.

Current News Notes

To Discourage Job-Seeking Aldermen.—Alderman Charles E. Merriam has reintroduced into the City Council of Chicago his amendment to the rules intended to prohibit aldermen from importuning public service corporations operating in Chicago to give employment to themselves "or any other persons." The resolution was sent to the judiciary committee.

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Toronto Company Wins Pole Case.—Through an opinion handed down last week by Judge Middleton, the Toronto (Ont.) Electric Light Company obtained an injunction against the city of Toronto, which sought to remove the company's poles from Playter Boulevard, Ellerbeck Avenue and adjacent streets. The court held that the company may erect poles and string wires on any street or highway within any part of the existing or future limits of the city.

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Summer Courses at University of Wisconsin.—Announcement is made of the fourteenth annual six weeks' summer school of the College of Engineering of the University of Wisconsin, which opens on June 22. Courses of instruction and laboratory practice are offered in electrical, hydraulic, steam and gas engineering, mechanical drawing, applied mechanics, testing of materials, machine design, shopwork and surveying, in addition to which subjects may be taken in the College of Letters and Science.

* * *

Chicago Jovian League.—In order to make its organization locally self-sustaining the Chicago Jovian League is considering a plan by which membership dues at $2 a year will be paid by those who subscribe to the plan. In addition it has been suggested that a class of sustaining members be provided, such members to agree to contribute annually such proportion of a certain pledged sum as may be required. Another suggestion is that provision be made for non-Jovian members of the Chicago Jovian League, such members to pay $2 a year, with the understanding that their membership is for one year only.

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Pink Special from Pittsburgh for N. E. L. A. Convention.—The transportation committee of the National Electric Light Association announces another special train leaving Pittsburgh in the morning of Sunday, May 31, and making a daylight run to Philadelphia. This train will carry passengers from St. Louis, Cincinnati, Columbus and other points centering in Pittsburgh in the early morning of May 31, and these, in connection with the large Pittsburgh contingent, will make up the special train, which will be known as the "pink special" and will be under the personal direction of Mr. J. C. McQuiston, of East Pittsburgh, Pa.

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Energy Used for Charging Vehicles in New York.—In connection with the published statement of the revenues of the New York Edison Company which appeared on page 1033 of the *Electrical World* of May 9, an explanation has been made by Mr. Arthur Williams of the classifications "charging vehicles" and "storage battery." The revenues indicated of these classifications in the May 9 issue show only the amount of energy sold by the New York Edison Company under its special automobile and storage-battery-charging schedule, the rest of the energy sold for battery-charging purposes being included under "commercial metered power." According to Mr. Williams, the total output of the New York Edison Company for electric-vehicle charging is in the neighborhood of 7,000,000 kw-hr. a year.

Reprint of Wisconsin Electrical Association Papers.—Papers presented at the annual convention of the Wisconsin Electrical Association of last January have been reprinted by Secretary George Allison (418 Stephenson Building, Milwaukee), acting under the authority of the association. The papers and discussion preserved in this form are as follows: "Some Facts Relating to Depreciation and Rate Making," by Mr. Halford Erickson, member Wisconsin Railroad Commission; "Voltage Regulation, Its Necessity and How Accomplished," by Mr. G. G. Post, electrical engineer of the Milwaukee Electric Railway & Light Company; "Report of Committee on Standards of Inspection for Overhead Distribution Systems," by Messrs. S. B. Way, Peter Valier and C. R. Phenicie; "An Accounting System for Small Central Stations," by Mr. H. G. D. Nutting, assistant to the president Clement C. Smith Properties.

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SOCIETY MEETINGS

Yonkers Division, New York Companies Section, N. E. L. A.—The final meeting of the season of the Yonkers division of the New York Companies Section, N. E. L. A., was held May 15. Mr. H. J. Otto presented a paper on "Service Rendered and Maintained by the Yonkers Electric Light & Power Company," and Mr. B. J. Aplin, general agent, presented a paper on "Contract Forms of the Yonkers Electric Light & Power Company." The principal speaker of the evening was the Rev. F. W. Cutler, who delivered his illustrated lecture on "The Panama Canal."

* * *

New York Electrical Society.—Dr. L. A. Bauer, director of the department of terrestrial magnetism at the Carnegie Institution of Washington, will lecture on the subject of "The Non-magnetic Yacht *Carnegie*—Her Work and Her Cruises" at the next meeting of the New York Electrical Society, to be held in Havemeyer Hall, Columbia University, May 25, at 8 p.m. The lecturer will relate in popular language the object and results of a general magnetic survey of the oceans undertaken on board the *Carnegie*. Dr. Bauer will also give a brief account of special exploratory parties sent under his direction to more or less unexplored countries in execution of the task intrusted to his department. Lieut. John Cyril Porte, R. N., will discuss informally "Aerial Navigation."

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Patent System Large Contributor to Industrial Advance.—With Mr. Frederic P. Vose presiding and Mr. Max W. Zabel the speaker of the day, members of the Chicago Jovian League listened to an instructive discourse on patent law on May 18. Formerly, said Mr. Zabel, even a comparatively simple patent litigation could not be entered into at a cost of less than $3,000, but remedial rules have reduced this cost to from $500 to $1,000 for the less complicated suits, making it more practicable for an inventor to defend his rights in the courts. The United States Patent Office is not only self-supporting but is a paying organization, now having to its credit about $7,000,000. This money, many patent lawyers think, ought to be used to erect a new building and enlarge the system so that more speedy action could be had on applications. At present the Patent Office is about six or seven months behind with this work.

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Initiating Employees.—Before the Illinois Electric Railways Association in Chicago on May 15 Mr. Robert B. Stearns, vice-president of the Milwaukee Electric Railway & Light Company, read a paper on "Present-Day Electric Railway Problems." He gave some account of the extensive operations of his company and the companies that are allied with it in and near Milwaukee under the ownership of the North American Company. He said that the electric-service properties supply 45,000 customers and that the rating of the steam generating stations is about 80,000 kw. Mr. Stearns paid particular attention to the welfare work of the Milwaukee system. There are company sections both of the American Electric Railway Association and the National Electric Light Association. One rather novel feature is the maintenance of a "lodge hall" where employees are "initiated" with dim light, slow music and considerable hilarity. Second and third degrees of the "initiation" are given to those who desire to avail themselves of the insurance protection offered by the company.

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Chicago Section of A. S. M. E.—At the meeting of the Chicago Section of the American Society of Mechanical Engineers on May 13 officers for the ensuing year were put in nomination as follows: Chairman, Mr. Samuel G. Neiler, Neiler, Rich & Company, consulting engineers; vice-chairman, Mr. H. M. Byllesby, of H. M. Byllesby & Company; secretary, Mr. H. M. Montgomery, of the Permutit Company. Other members of the executive committee are Mr. P. A. Poppenhusen, president of the Green Engineering Company, and Mr. Herbert S. Philbrick, professor of mechanical engineering in Northwestern University. The retiring executive committee consists of Mr. Paul P. Bird, C. W. Naylor, C. R. Birdsey, W. B. Jackson and A. W. Moseley. Speeches were made by Mr. James Hartness, Springfield, Vt. president of the American Society of Mechanical Engineers; Dr. W. F. M. Goss, Chicago, past-president of the society, and Mr. P. H. Gates, Chicago, past-vice-president. The paper of the evening, entitled, "Designing the Product," by Mr. Arthur M. Houser, of the Crane Company, Chicago, told of methods which should be applied in designing manufactured products so that they can be handled economically in the shop. Among the other speakers were Mr. Calvin W. Rice, New York, secretary of the American Society of Mechanical Engineers, and Capt. Robert W. Hunt, of Chicago.

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Jovians of Southern California.—Under the direction of Mr. James N. Colkitt, statesman for southern California, a banquet followed by a rejuvenation was held on May 15 at the Clark Hotel, Los Angeles, with an attendance of 160, the record for southern California. Mr. K. E. Van Kuran acted as toastmaster and short speeches were made by a number of Jovians and candidates present. Mr. Max Lowenthal reviewed the development of the Jovian Order and made a plea for still further co-operation among its members. He expressed the belief that electrical merchandising should be carried on through its logical and legitimate channels. Mr. R. H. Ballard spoke in behalf of the candidates. A musical program was given during the banquet, and entertainment was furnished by Stentors J. H. Pieper and A. E. Morphy. Sixty candidates from Los Angeles and surrounding cities were initiated. The permanent degree team of Los Angeles carried on the work. This team is composed as follows: Messrs. J. G. Pomeroy, Jupiter; Ralph B. Clapp, Neptune; T. E. Burger, Pluto; L. E. Darrow, Vulcan; H. L. Miller, Hercules; J. C. Rendler, Mars; G. E. Arbogast, Apollo; D. H. Conover, Mercury; S. T. Snow, Avrenim. The Los Angeles degree team has been invited to go to San Diego during the convention of the Pacific Coast Jobbers' Association. It is planned to hold a rejuvenation on May 29 during this convention, and a large class of candidates is expected.

Illumination Features in New York Department Store

Show-window lighting and special features of interior illumination, various applications of motor drive, isolated generating-plant equipment, etc., at the Lord & Taylor store

LORD & TAYLOR'S recently completed eleven-floor department store on Fifth Avenue at Thirty-eighth and Thirty-ninth Streets, New York City, is unique among department stores because of its specially lighted show windows, its elaborate interior illumination, and the method of dressing its show windows (by lowering the window floors to the basement). In general the building is considered one of the most completely equipped of its kind in the world, many innovations having been made possible by electricity. Electrical energy is used also extensively in the packing and shipping departments and in the kitchen and laundries connected with an artistically illuminated restaurant on the top floor. A generating plant in the sub-basement supplies all of the electrical energy used in the building.

Show-Window Illumination

Since show windows are in reality nothing more or less than miniature stages especially intended for display purposes, it was decided to provide the principal windows in this store with a suitable system of illumination based upon modern stage-lighting principles. Each window is lighted so as to bring out the color value of the goods or gowns displayed in a manner that will give them as far as possible the appearance intended when in use, particular attention being paid to the illumination of street and evening gowns, furniture, millinery, silks and dress goods.

The system of show-window lighting employed in this building consists in general of the use of foot-lamps and front-border lamps inclosed in trough reflectors equipped with color filters instead of dipped lamps. It was found that the hue of the color filters is more permanent than that of the lamp dyes, and that no deleterious effects are produced on the lamps, such as reduced life and frequent burn-outs. Furthermore, color filters may be changed easily when it is desired to alter the color scheme of the illumination.

By the use of subdivided color filters (relatively few in number) practically any hue can be given to the color of the light, and even a fairly good match for daylight can be obtained. By employing color filters of different hues in the border lamps and the foot-lamps and by varying the relative intensity of light most interesting and beautiful natural effects can be produced, the tone of the light from above slightly modifying the color of the upper surfaces of goods in one direction, while the light from below modifies the color of the under surfaces in another direction. The resultant or mixed color appears on the high lights only.

This method of illumination as employed in Lord & Taylor's store is new to show-window lighting, although it has been previously employed in stage lighting. The

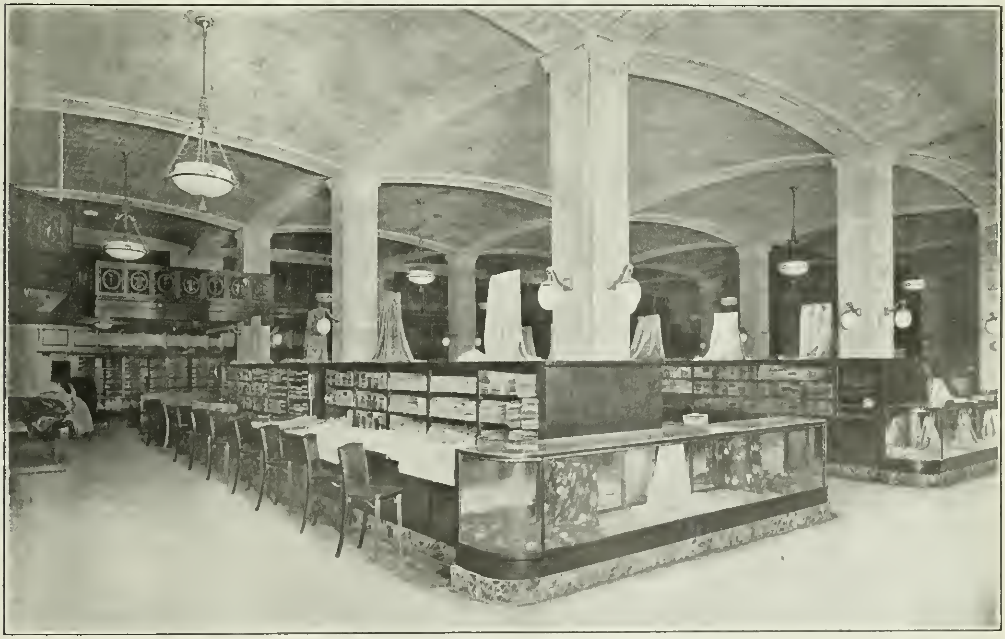

FIG. 1—BOWL AND BRACKET FIXTURES ON MAIN FLOOR

filters used had to be selected not merely from the viewpoint of the color of the light but also with relation to the color and texture of the goods illuminated. The successful application of the system demanded not only a knowledge of the spectral composition of the light transmitted by the several filters but also a knowledge of the coefficients of reflection throughout the spectrum of the many dyes used in coloring goods. In each case the reflectors used in the show windows under discussion were designed to give the proper distribution of light required to set forth the displays. They are generally of the shape shown in the cuts.

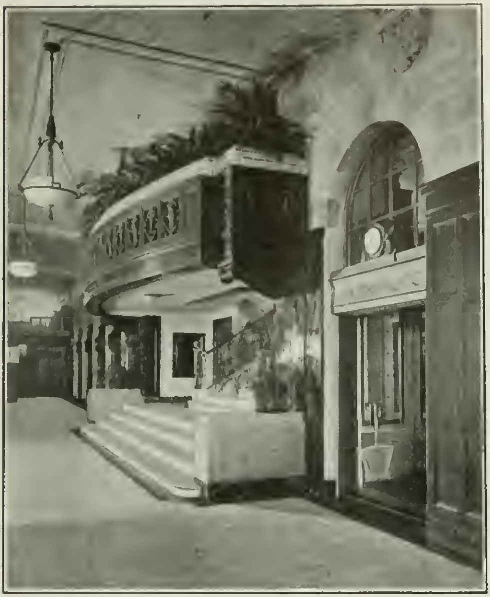

FIG. 2—ENTRANCE TO MEZZANINE FLOOR

All street-floor windows facing on Fifth Avenue are 7 ft. 6 in. deep and 10 ft. 6 in. high, the corner window and those on each side of the main entrance being only 6 ft. wide, while the intermediate windows are 16 ft. wide. Facing the side streets are four types of display windows—shallow, deep, low and some arranged so that the displayed goods can be viewed from both the interior and the exterior of the store.

One-hundred-watt concentrated-filament tungsten lamps spaced about 1 ft. apart are used in the reflectors in the deep-set windows. Metal louvers and partitions are placed between the lamps in all corner-window reflectors to hide the filaments. Concentrated-filament lamps are used since they permit more accurate reflector design than is the case with other types of lamps having extended filaments. The foot-lamp reflectors are concealed by ornamental screens.

As the corner windows and those on each side of the main entrance can be looked into from more than one direction, special care had to be exercised in the arrangement of the lamps and reflectors to prevent any glare striking the eyes of passers-by. The corner display compartment is open to view through three plate-glass windows arranged at about an angle of 135 deg. with each other. Parallel to the middle pane is a reflector similar to the type used in the deep-set windows. Two other similar reflectors are placed parallel to the street walls, or at an angle of 135 deg. with the first. To prevent the filaments of these lamps being seen by the persons on the street, parallel sheet-metal vanes painted a dull black are attached to the reflectors about 2 in. apart and placed perpendicular to the longitudinal axis of the trough. The interior walls of the larger display compartments, which are made of dull-finish marble, assist in distributing the light evenly without producing any glare.

The Evening Room

Practically every modern dry-goods store is provided with what is known to the trade as an "evening room," lined with wall mirrors and brilliantly lighted. The limitations of such equipment have been eliminated in the Lord & Taylor "evening room" by employing a system of illumination that makes it possible to display gowns or materials under any color of light desired. If a tentative purchaser desires to see herself arrayed in a street dress, the room can be lighted to simulate daylight. If, on the other hand, an evening gown is to be observed under some particular color of illumination, that hue can be produced by the equipment installed.

The desired results are achieved by employing a development of the system of illumination used in the main show windows. Several reflectors with permanent color filters are used, the lamps behind each color filter being separately controlled as to intensity by remotely controlled dimmers. The latter are operated by push-buttons in the room itself, and the degree of each color required is set by indicating instruments calibrated in terms of color instead of current. The calibration is variable and can be readily adjusted. The color screens employed are selected for such spectral composition of transmitted light that the composition of the resultant light will closely approach the composition of a predetermined value of daylight. The light transmitted through the color filters is projected into the room through diffusing plates of low absorption set in the ceiling. By this arrangement the color of light in any direction in the room is consistent, the interior of the room being white and gray.

Mechanical Devices for Show Windows

An innovation has been made by constructing the Fifth Avenue show windows with movable floors which may be lowered to the basement for redressing. The floors in most cases are raised and lowered by hydraulic plunger pistons, but motor-driven apparatus is employed on one which is situated over an underground

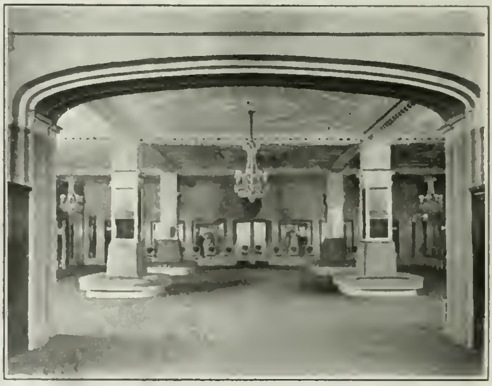

FIG. 3—CHANDELIER IN SALON

driveway to avoid obstructing the passageway with a hydraulic plunger.

The floors of the windows, instead of being permanently fastened to the hoisting apparatus, are clamped to platforms which are themselves rigidly attached to the plungers. After a floor is lowered for redressing it may be replaced by another usually kept in readiness. For transferring the floors from the lift to the dressing platforms in the basement transfer trucks have been provided which run on a track parallel to the sidewalk on the street above. With a floor resting on one of the dressing platforms the window decorator can arrange things and obtain an idea of how the display will appear before it is raised to the street level.

The windows on each side of the Fifth Avenue entrance have circular floors pivoted on vertical shafts which can be slowly rotated by a motor through a worm and gear. On each turntable will be supported two intersecting vertical partitions, dividing the circular platform into four equal sectors. Dummy models will be placed in each of the compartments thus formed, only one of which can be seen from the same window at a time, the others being successively brought into view as the platform rotates. About six to eight minutes elapses between each change, and during the transition a curtain is automatically drawn across the plate-glass windows. The turntable and curtain-operating mechanism are interconnected so that the drape is drawn before the platform revolves.

Another feature of the show-window equipment is the provision for utilizing the space in front of the main entrance after closing hours to accommodate a disappearing display cabinet which exactly fills the recessed entrance. The floor in front of the main entrance is actually the roof of the disappearing cabinet, which is designed to harmonize in depth, height, fittings and illumination with the other Fifth Avenue windows. The cabinet is raised and lowered by a plunger piston. This cabinet is also illuminated by Frink reflectors containing concentrated-filament lamps separated by louvers.

Other Types of Show-Window Illumination

At the south entrance to the building is a low, shallow show window open to view from both the interior and the exterior of the store. The street-observation floor level is lower than the store floor level so that illumination different from that in the other windows is provided to protect the eyes of observers on either side from glare. Concealed in a recess in the ceiling by a rectangular, diffusing-glass plate are 100-watt tungsten lamps supported in a Frink reflector trough. The diffusing plate is inclosed in a frame hinged along its longer edge so as to swing downward and allow inspection or replacement of the lamps and reflectors above.

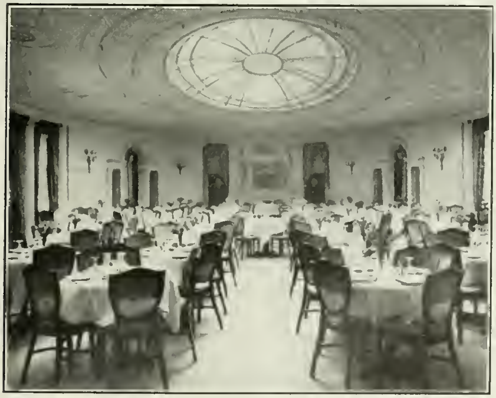

FIG. 4—ONE OF THE RESTAURANT HALLS

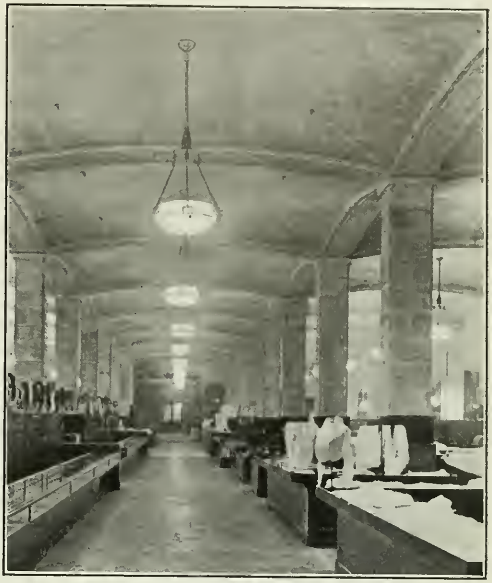

FIG. 5—MAIN-FLOOR AISLE

Interior Illumination

Another feature of store illumination is that special combination direct-indirect fixtures are used throughout the entire eleven floors of the building. Supported by chains from groined-arch bays in the main floor are about ninety polycase opal-bowl direct-indirect fixtures emitting light approaching the color of subdued daylight.

Each fixture consists of a bowl within a bowl—the inner one blue and the outer one opalescent. The light from the tungsten lamps in passing through both bowls is tempered in quality, giving an illumination which is extremely desirable for examining colored goods. The fixtures on the street floor as well as those on the other floors are arranged in bays 20 ft. square. The ceiling on the street floor, which is made of dull-finish tan-colored Travertine marble, similar to that used in the larger show windows, prevents any specular reflection from the lamps in the fixtures. Stretched across the lower surface of each bowl is a fine wire mesh which will prevent pieces of glass falling if the fixtures are broken by heat or mechanical injury. Six 150-watt tungsten lamps are supported in each fixture by Benjamin clusters. Each bowl fixture is covered with an opal glass plate which allows about 30 per cent of the light to strike the ceiling, the remainder being directed downward through the bowls. All lamps on this floor are controlled by master switches.

Direct-indirect fixtures are also used on the other floors, but they are supported by a central pendent rod and are not protected with wire mesh as the bowls are more rugged in construction than those on the main floor. A larger proportion of the illumination is indirect on these floors, about 50 per cent of the light being directed toward the ceiling.

Showcase Lighting

Showcase lighting is quite generally the same throughout the building, straight filament fixtures being concealed under the outer upper edge of the cases.

In the women's millinery section the showcase lighting is different. The cases rest on stands about waist-high and are painted with white enamel within and without. The light is emitted entirely from the ceiling of the cases through a translucent glass plate and is adjusted in intensity so that it is not apparent on first observation where the light originates.

For trying on hats special lighting fixtures, multi-view mirrors and seats at regular and frequent intervals are employed. The fixtures consist of pendent-type, conical-shaped, buff-colored silk reflectors containing one 40-watt tungsten lamp.

Illumination for Theatrical Costume "Tryons"

Large metropolitan stores usually have their "evening rooms" for trying on evening gowns and theatrical costumes, but the Lord & Taylor store has been equipped with a stage to give the actual illumination effects on costumes which are obtained back of the lighted foot-lamps. There are two stages, one quite large stage in the auditorium and a smaller stage in the salon. The large stage is provided with the usual border and foot-lamps with dimmer equipment and plugs for spots and floods so that a complete production can be shown.

The salon stage is intended more for individual stage-gown demonstration than for ensemble presentation. The stage is architecturally a foyer, with a provision at the rear for introducing suitable scenic backgrounds. The sides of the foyer are provided with large mirrors in front of which are hung curtains of rich material that can be readily drawn aside. Disappearing foot-lamps are arranged across the front of the foyer and along both sides at the foot of the mirrors. These foot-lamps are operated by an ingenious mechanical device that opens up a part of the stage floor and simultaneously brings the "foots" into position.

Concealed border lamps are provided back of the proscenium arch and along each side of the foyer. The back drop is lighted by means of a new type of border lamp recently introduced into stage lighting. This reflector produces a sheet of light which can be thrown over the drop surface without setting the reflector more than a few inches from the drop, thus economizing both space and light.

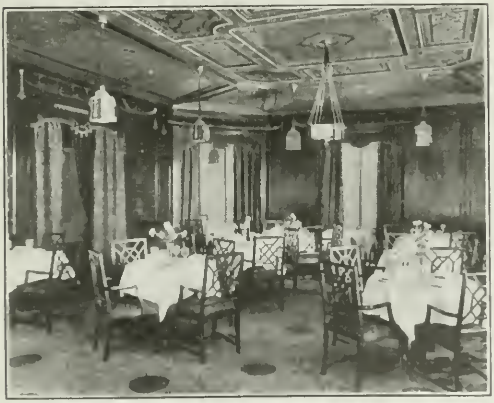

FIG. 6—ORIENTAL FIXTURES IN MANDARIN ROOM

The foot-lamps are novel in that they consist of separate cellular units, each with a color filter, the units in each color being controlled separately. This type of "foot" has several advantages over the usual form and has been recently introduced into theatrical work. By means of this form of reflector not only the color of light but also its direction is under control.

On the same floor as the salon is a promenade lighted by crystal chandeliers where models may parade to give patrons an idea how gowns will appear under similar conditions of lighting. Along the walls of this promenade are cases in which dummy models are displayed. The interior of each case is lighted in a similar manner to that employed in the hat-display cases previously described.

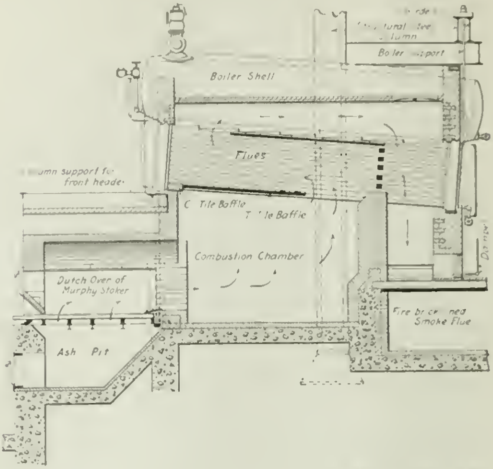

FIG. 7—HIGH-EFFICIENCY BOILER FOR SMOKELESS COMBUSTION

Restaurant Lighting

On the eleventh floor of the building is an elaborately decorated and illuminated restaurant and lobby. Portable pedestal fixtures are used extensively on this floor. They consist of sand-blasted vase-shaped glass lanterns supported on filigree bronze and marble standards conforming with the architecture of the rooms. Bracket-type fixtures supporting lanterns of similar design are also employed. The architecture on this floor follows that of the Adams period.

In the "mandarin room," which is one of the three halls composing the restaurant, are used elaborate imported ornamental, electrically lighted Chinese silk lanterns of various designs. In another part of the restaurant adjoining this room artificial light is provided by an electrically illuminated stained-glass dome. It is elliptical in shape and consists of numerous vari-shaped sections of stained glass intermeshed to form an attractive antique pattern. About 100 60-watt tungsten lamps inclosed in Frink reflectors are arranged near the periphery and above the crown of the dome to give even illumination.

Elevator Lighting

Lighting features were not exhausted in equipping the parts of the building already described. The elevators, of which there are twenty, are provided with direct-indirect fixtures, having elliptical-shaped oval glass bowls supported just below the ceiling of the cage. The greater part of the light is diffused through the bowl, as the ceiling is coated with gold-leaf, which is inefficient as a reflector or diffuser because of its light-absorbing qualities. The walls of the elevator are paneled with glass and decorated in the Louis XVI style. Attached to the top of each cage directly over the lighting fixtures is an electric fan for ventilating the elevator.

Exterior Illumination

The exterior upper portion of the Lord & Taylor building is decorated by a handsome colonnade capped by architrave, frieze and projecting cornice. By setting reflectors between the columns on the base line a sheet of light is thrown upward along column and frieze to the underside of the cornice, every molding and relief being sharply contrasted with the sharp shadow above. By this means the structural lines are emphasized and the fine proportion of the order clearly set forth, while the source of light is entirely concealed. This arrangement can also be used for lighting sheer wall surfaces, the reflectors being set close to the wall foot.

Package Sorting, Packing and Delivery Departments

Sorting, packing and preparation for the delivery of packages is accomplished in the basement. Rigid-pendent X-ray reflector fixtures containing 100-watt lamps are employed for illuminating this section. Goods are delivered from each of the main-floor sections to wrappers and change-makers in the basement by pneumatic elevators. Duo-credit phones are placed at each change-maker's station so that charge accounts may be verified by calling the credit office. These devices are designed to make duplicate marks on the auditor's and customer's stubs, instead of making only one impression on the sales slip as is usually done.

The signaling apparatus on the credit phones is arranged to facilitate rapid investigation of a patron's credit. On the base of each telephone is a set of push-buttons each representing a certain group of letters in the alphabet. By pushing the button representing the first letter of the customer's name the calling party is brought into direct communication with the girl having the particular record in charge.

Wrapped goods from floors up to the ninth, not including the street floor, are conveyed to the basement by a chute and delivered onto a motor-driven canvas-belt conveyor which conducts them to primary sorters. Here the packages are distributed systematically direct from the belt conveyor, among men who sort them according to their destination. Goods going to Jersey City, for instance, are thrown onto a belt conveyor leading to the particular loading platform of that district, while those for Manhattan Island are conveyed by similar means to another platform. The conveyor equipment, which was furnished by the Alvey-Ferguson Company, Cincinnati, Ohio, is most elaborate. About thirty-six motors, ranging in size from 0.5 hp to 5 hp, are used to drive it.

All delivery wagons are driven into the basement of the building along a sloping driveway and are backed up to concrete platforms for loading. To avoid congestion in the driveways, to lower the cost of delivery and to decrease the delay in delivering, Lord & Taylor are replacing all of their horse vehicles with forty-three electric delivery wagons and a few large Peerless gasoline trucks. The drives leading from the basement to the street level are illuminated by 150-watt tungsten lamps inclosed in enameled-steel reflectors recessed flush with the concrete ceiling. The garaging facilities were more completely described in the April 11 issue of the *Electrical World*.

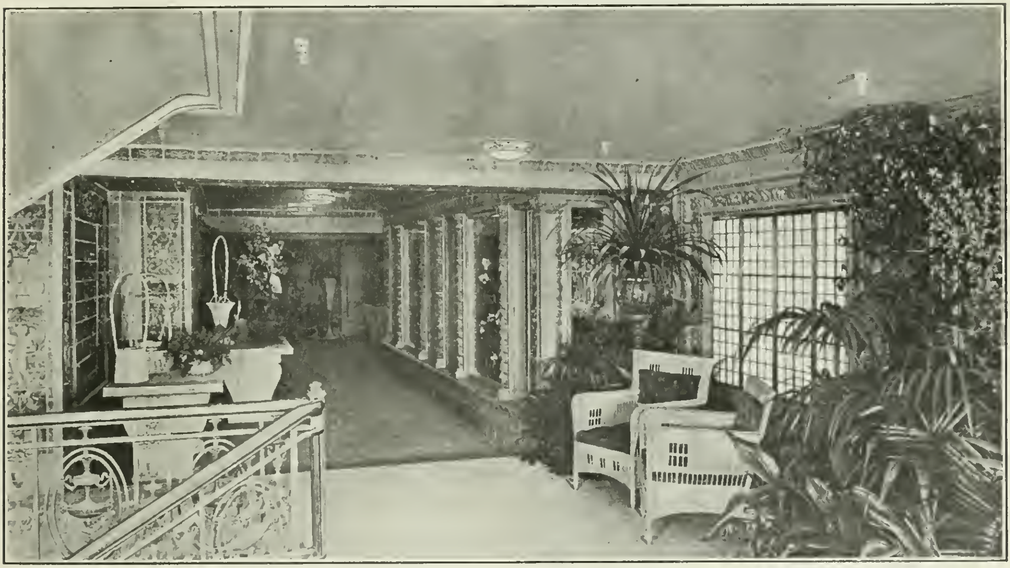

FIG. 8—ILLUMINATING FIXTURES ON FLOWER BALCONY

Motor Applications in Kitchen and Laundry

Connected with the restaurant are a kitchen and a laundry in which motors are employed to drive various pieces of machinery. All china is washed in electrically operated washing machines, meats are sliced by machinery, ice-cream is made in a motor-driven freezer, the ice machine is driven by a motor, ice is sawed into blocks and crushed to various degrees of fineness by electric machinery, etc. The kitchen equipment, which required ten motors in sizes from 0.25 hp to 3 hp, was furnished by the Du Parquet, Huot & Moneuse Company, New York.

In the laundry where table linen and waiters' clothes are washed the machinery is all driven by motors. Installed in that department are three washers, a drier, a mangle and an ironer furnished by the Troy Laundry Company, Chicago. For ironing the more delicate fabrics electrically heated flatirons are used. Nine motors, ranging in sizes from 0.5 hp to 10 hp, are employed.

Boiler and Generator Room

All of the energy used in the building is generated in an isolated plant in the sub-basement. In the boiler room are installed seven Heine boilers, six of which are rated at 250 hp and one at 400 hp, making a total of 1900 hp. These are equipped with Murphy stokers, and both forced and natural draft are provided.

The furnaces have large combustion chambers which permit of burning bituminous coal without the production of smoke. By covering the lower row of boiler tubes with T tiles the flames are prevented from striking a cold surface before they have traveled 10 ft. from the grate. The same tubes adjacent to the front boiler header are covered with C tiles. The gases enter the first pass at about the middle of the boiler, flow parallel to the tubes until they reach the front header, when they reverse in direction, passing under the boiler drum, and then flow downward across the rear end of the boiler tubes into a concrete smoke duct connecting with the stack. The boilers are supported at the front by columns bolted to brackets on the front water legs and at the rear by girders laid on the building beams.

FIG. 9—LORD & TAYLOR'S BY NIGHT

In the engine room are installed four 300-kw, 250-volt, two-wire Crocker-Wheeler generators directly connected to simple horizontal steam engines manufactured by the Robert Wetherill Company, New York. The generators deliver energy to two buses supplying motor and lamp circuits. Across the lamp-circuit buses are connected two Crocker-Wheeler balancer sets. All of the machines are remotely controlled from a benchboard by master switches.

No storage batteries are employed to operate the switches, as each unit including its momentary-contact relay is energized directly from the particular machine which it controls. Machine panels are installed near each generator, and the generator bus leads are run through the floor to the rear of the main switchboard. The field rheostats are operated by motors, which are also fed directly from their respective machine terminals. At present both motors and lamps are being supplied with energy from the same bus to hold up the load-factor. The normal lamp load is about 700 kw and the motor load about 113 kw. The energy consumed per day is approximately 8300 kw-hr.

The exhaust from the engines is used for heating the building and boiler-feed water. There are also installed in the basement a refrigerating system, some hydraulic pumps for lifts and domestic water service, and a compressor delivering air for operating elevator doors and dumb-waiters.

Other Motor Applications

This building is equipped with a small machine shop, in which the machine tools are driven by individual motors ranging in size from 0.5 hp to 5 hp. A gymnasium has been equipped with Zander-Swedish exercise apparatus for the use of the employees during rest hours. Some of these machines are driven by electricity. Motors for operating the extensive ventilating system in this building were furnished by the Sprague Electric Works of the General Electric Company, while all of the rest of the motors (numbering about eighty-five) were supplied by the Crocker-Wheeler Company.

The Lord & Taylor building and its equipment were designed by Messrs. Starrett & Van Vleck, architects, New York City. The engineering work was supervised by their engineer, Mr. Edward E. Ashley, Jr. The show-window lighting system, as well as the lighting of the evening room and some features of the stage lighting, was designed for Lord & Taylor by Mr. Bassett Jones. All reflectors, including those used in the stage equipment, showcases, show windows, exterior illumination, evening room, etc., were made by I. P. Frink and furnished by the H. W. Johns-Manville Company. Messrs. Johnston, Livingston & Company, New York, installed the lighting fixtures and were the general electrical contractors. All the semi-indirect lighting glassware was made by the Gleason-Tiebout Glass Company, of New York.

Atmospheric Electric Observations on Ocean Air

Incidental to the second cruise of the non-magnetic yacht *Carnegie* from June, 1910, to December, 1913, a number of observations of atmospheric electrical phenomena were made in the various oceans over which the cruise extended. Potential gradients were read by electroscopes supported over the rear of the ship by long bamboo poles. Radioactivity was measured in terms of the rate of discharge of a bare copper wire which had had an initial charge of 2000 volts. In reporting the results obtained before the American Physical Society at Washington, D. C., recently, Mr. C. W. Hewlett said that while the potential gradient of the atmosphere over the ocean was found essentially the same as that over land, the radioactivity of sea air was smaller compared with that over land. On the other hand, the conductivity of the air over the ocean proved to be larger than for air over land, the rule apparently being that the smaller the ocean the larger was the conductivity observed. For the Pacific Ocean the average conductivity found was 2.51; for the Atlantic, 3.35, and for the Indian Ocean, 4.28.

"Electric" School Building of Rupert, Idaho

An educational institution which is heated by electrical energy—Manual-training and scientific departments and cooking classes also depend on it. By T. W. Halliday

WHILE the West is regarded—chiefly by the Easterners—as less advanced in many ways than the East, the town of Rupert, in the newly reclaimed sage-brush desert of Idaho, has come forward as a rival to the older and supposedly more progressive cities of the East by converting a dream of the past into a reality of the present. This dream looked forward to the complete utilization of a power that was once merely a magic force, but through the persistent efforts of the dreamers stage after stage of practical application has been reached, first for lighting, then for motors, and more recently for cooking. Rupert has gone still one step farther and has adopted electric heating. Nor is this to any limited extent, for all other methods of heating are being rapidly supplanted.

Since the first of the year a new installation has been completed, which not only overshadows all the previous equipments of this locality, but stands out as a successful demonstration of the practicability of its wider application to all the needs of a community. Rupert's new high school building is equipped electrically throughout. Warmth is provided for by an electric furnace, the cooking of the domestic science department is done on electrical appliances, the machinery of the manual training room is electrically driven, the apparatus of the science departments is electrically operated, and the lighting is, of course, electric in keeping with the rest of the equipment.

The Heating Plant

The heating plant is similar to the combined heating and ventilating systems now in common use in public buildings with the exception that an electric furnace is substituted for one using coal, oil or gas. This substitution not only saves a great deal of space that may be more profitably used but is absolutely free from dirt and the gases of combustion.

The furnace unit consists of eleven Simplex cast grid resistor units, each unit taking 83 amp at 440 volts and therefore consuming 36.52 kw, the total rating of the furnace being 401.72 kw. These units are arranged in a breast of seven and with a wing of two units at each end across the openings from the fresh-air ducts and at 90 deg. to the main breast. The units are each 12 in. deep, 18 in. wide and 56 in. high and occupy a floor space of but 16.5 sq. ft. This space would have been hard to utilize with any other form of heating apparatus as the end of the fan room communicating with the fresh-air ducts, where the units are placed, is below the landing of the main entrance and the ceiling height is but 5 ft.

Regulation is accomplished by a switchboard placed in the superintendent's office on which are mounted eleven double-pole, double-throw knife switches, each switch controlling one unit of the furnace. The board is supplied with both 220-volt and 440-volt, three-phase current. As cutting the voltage down to 220 on a unit will reduce its kilowatt rating to one-fourth, any unit may be cut down in rating to 9.13 kw by simply throwing over its control switch, and so by using the proper combination of switches and voltages the furnace rating may be increased or decreased in about 9-kw steps throughout practically the whole of its entire range, there being forty-one steps in the control.

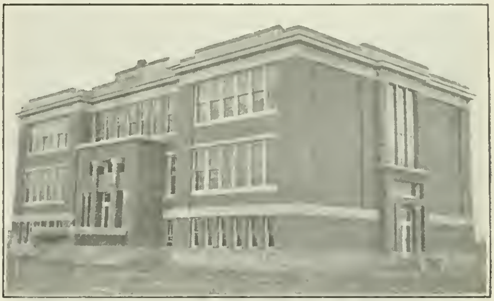
FIG. 1—THE "ELECTRIC" HIGH SCHOOL, RUPERT, IDAHO

The building is kept warm at night by placing all units on a 220-volt circuit. The inside re-circulation of the air of the building then maintains the temperature and at the same time furnishes sufficient ventilation so that there is no danger of the units burning out from overheating. To protect the units from overheating in case the circulating fan should stop when the heating units are on a 440-volt circuit and delivering full heat, thermostats are located at intervals above them and are connected in circuit with a solenoid in the transformer room which operates the trip on the oil switch and switches off the circuit.

The ventilating fan, built by the Louis Burton Company, of Seattle, delivers 20,000 cu. ft. of air per minute. This fan is driven by a General Electric 10-hp adjustable-speed motor installed in the manual-training room, the power being transmitted to the fan by a line shaft passing through the wall. This motor is also used to drive the band-saw, turning lathe and other machinery of the manual training department.

The transformer used for the heating plant is a Westinghouse three-phase, 300-kva unit, with 3800-volt

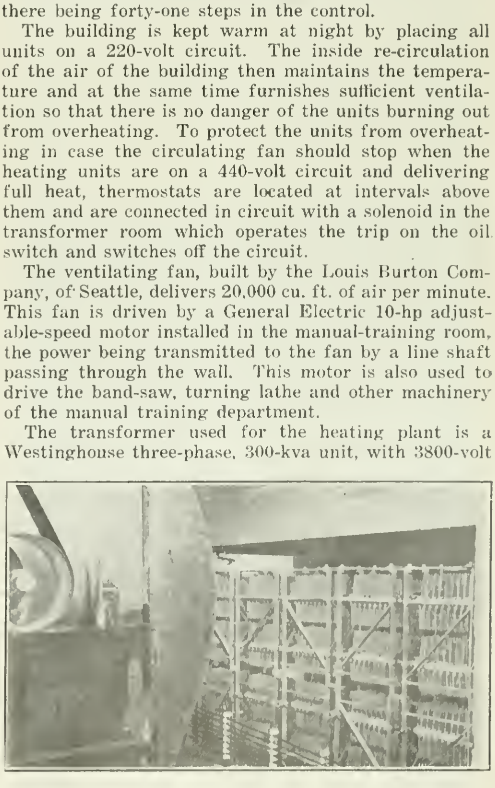
FIG. 2—HEATING UNITS, SHOWING VENTILATING FAN AT LEFT

star-connected primaries and 220-440-volt delta-connected secondaries. This transformer, as well as a 10-kva unit for lighting, the oil switch and other accessories, is housed in a fireproof room 8 ft. by 11 ft. In the original plans of the building a steam plant was contemplated, and the library room, which is 20 ft. by 30 ft., was to have been used for the boiler room. The electric installation therefore gives an additional floor space of 382 sq. ft., while a considerable saving in the original cost of the building was effected by being able to do away with a large underground cellar that was planned to be used for coal storage and for the removal of ashes.

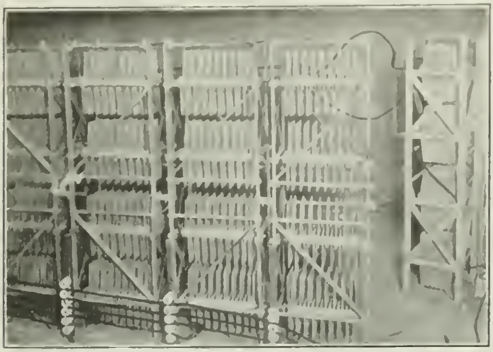

FIG. 3—PART OF MAIN BREAST OF HEATING UNITS

The total cost of the plant as compared with plants employing other forms of heat was about half that paid for the systems installed in other public buildings in that part of the country for similar service. In going into the operating cost of the heating plant only the cost of the electric energy need here be considered, and attention is called to the fact that practically no attendance is required and that the ventilating cost in any other system would be the same.

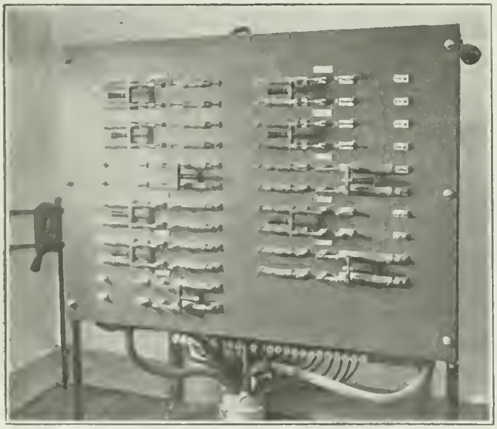

FIG. 4—SWITCHBOARD IN SUPERINTENDENT'S OFFICE FOR CONTROLLING HEATING UNITS

In the original estimate given the school board, with all factors considered and the total energy cost placed at $1,760 per annum, the electric plant showed a saving of about $300 a year over other forms of heating. In making this estimate a maximum load of 300 kw was used as a basis, but actual operation has placed the maximum demand at 264 kw, and on this basis the yearly estimate is placed at about $1,440, showing an additional saving of $320 annually. The heating rate for energy is $1 per kw-month, and the maximum load must be paid for four months continuously in each heating season.

The plant, as a practicable idea, was first conceived of by Mr. B. Dibble, the government electrical engineer of the Minidoka Reclamation Project, his assistant, Mr. Bixby, and the Rupert Electric Company, the design and details of construction having been worked out by the Rupert Electric Company.

FIG. 5—DOMESTIC-SCIENCE CLASS

Domestic Science

The present electrical equipment of the domestic science department requires 5970 watts and consists of eighteen Simplex 4½-in. disk stoves with a rating of 250 watts each and two 8-in. disks of 735 watts rating each. Each stove is supplied with a "blazer" or frying pan and a double boiler, these utensils being all that are necessary to carry on the operations ordinarily performed on top of the stove. The cost of operating this equipment is about 12 cents per hour on high heat. In the near future an addition is contemplated in the way of a range of about 7770 watts rating and a pair of hot plates, to be used for serving cafeteria lunches to the pupils. These articles were not included in the original equipment for reasons easily appreciated by those experienced in trying to equip a new building completely on a bond issue based on the estimated cost.

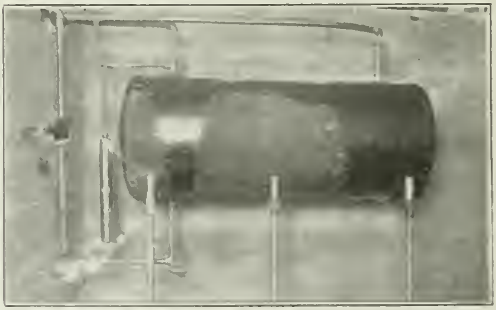

FIG. 6—HOT-WATER SUPPLY TANK AND CIRCULATING HEADER

The initial equipment of the laboratories, for reasons above mentioned, amounts to but 2235 watts and is utilized in a still, evaporating plates, and test-tube heaters. Other devices, such as an electric furnace, individual test-tube heaters, etc., are being made by the instructor and the students to meet their individual views and requirements.

Hot water is furnished by having a 3000-watt Simplex circulating heater connected to a 280-gal. tank. This tank is placed in the plenum chamber in order to avoid the necessity of insulating it against loss of heat and supplies all of the hot water used in the building.

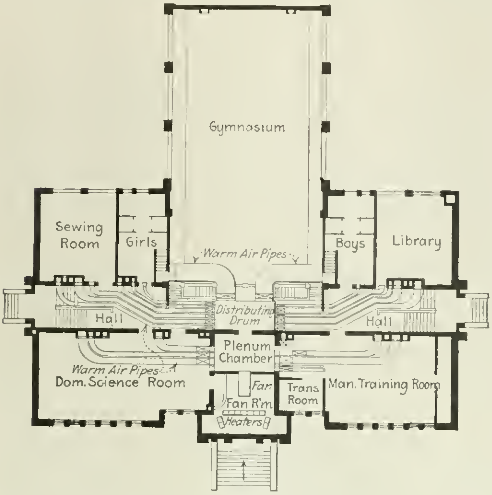

FIG. 7—PLAN OF SCHOOL BUILDING

The total installed lighting load amounts to 12,505 watts, although an ultimate maximum installation of 20,120 watts is contemplated and has been provided for.

Cost of Operating for the Month of February, 1914

The costs of the various uses of electricity in this building for the month of February were as follows:

Heating	$264.00
Power	25.90
Water heating	7.35
Lighting	6.90
Cooking and appliances	3.35
Total	$307.50

A brief summary of the rates in effect in Rupert is as follows:

	Per Kw-hr.
Lighting and small appliances	7 cents to 5 cents
Cooking—fifty-hour-demand basis	2 cents to 0.55 cent
Power	5 cents to 0.55 cent
Water heating	1 cent to 0.70 cent

The heating rate is $1 per kw per month, flat rate, provided that the maximum connected load be paid for four months continuously in each heating season, which runs from Sept. 1 to June 1.

The Boston Navy Yard's Big Electric Crane

The electrically operated 150-ton cantilever-bridge-type crane recently completed at the Charlestown Navy Yard, Boston, Mass., is the largest floating crane on the Atlantic Coast. The "bridge" overhangs at each end of the 125-ft. pontoon and the trolley travels the entire length of the bridge. The hoisting equipment consists of two main hoists, each with a capacity of 75 tons, able to operate simultaneously. There is an auxiliary trolley and hoist with a capacity of 15 tons.

Accentuation of Pain at the Cathode in Undergoing Electric Shock

In the course of several years' experimentation Prof. F. J. Rogers, of Princeton University, has tested the endurance of a large number of students and others to discover the maximum direct current which can be borne without excessive pain, and he finds this value to average about 20 milliamp, although some hardy subjects withstood 40 milliamp without wincing. It is commonly known, of course, that if a given current strength be passed into the body over a small electrode area the pain will be more intense than if a larger contact is used. Where, however, both electrodes were of the same size, the subject often complained of greater pain in one arm or the other, and on investigation Professor Rogers found it to be invariably the cathode where sensation was accentuated. The same rule appeared to hold true whether the current was passed between the fingers, the ankles, the hands or other parts of the body—always the cathode member was the first one to become painful with the increasing strength of the electric current. Not a single exception occurred to mar the invariability of the result thus attained.

Improved Method Used in Magnetic Separation of Iron Ore from Gangue

An interesting modification of the usual method of separating magnetic iron ore from gangue is employed at the Witherbee, Sherman & Company's mines, Mineville, N. Y., where it is applied to 0.25 in. lumps or finer ones. The belt feeding the crude ore is placed with respect to the take-off belt as shown in the diagram. A series of electromagnets is suspended above the lower span of the take-off belt. The coils are connected so that adjacent magnets are of opposite polarity. As the crude ore on the feed belt passes under the first magnet the magnetic ore is attracted to the take-off belt, while the gangue drops off into the tailings hopper.

The particles of ore in being carried along by the take-off belt have first one end attracted by one magnet and then the other attracted by the adjoining pole-piece because of the changing polarity. This turn-over process continually mixes up the ore and allows the gangue to drop out. The concentrated ore drops off from the take-off belt in the concentrates hopper after passing by the last magnet. The bulk of material delivered from this hopper to the rolls and final treating machine is thus reduced without in any way sacrificing the iron content.

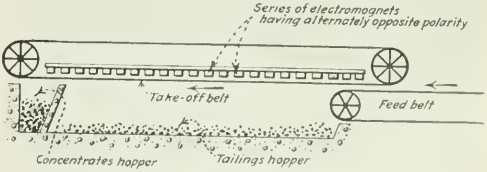
Series of electromagnets having alternately opposite polarity
Take-off belt
Feed belt
Concentrates hopper
Tailings hopper

DIAGRAM ILLUSTRATING THE MAGNETIC SEPARATION OF IRON ORE FROM GANGUE

Direct-current energy at 125 volts is used in the magnets. From 3 amp to 7 amp is required in the belt machines, depending on the size of the ore handled. The degree of refinement obtained depends partly on the attractive force of the magneto, the air-gap and the belt speed.

Transformer Core-Loss Separation

Experimental investigation of the variation of eddy-current and hysteresis losses with change in frequency and magnetic density. By E. R. Shepard

In making an experimental study of a transformer, the necessity of an intimate knowledge of the magnetic properties of the iron involved presents itself. To assume that a magnetization curve found in a handbook and labeled "transformer iron" will fit the particular specimen under consideration is far from satisfactory. To select hysteresis and eddy-current constants from values which may vary by 100 per cent or more is inconsistent with the best academic practice. The magnetic properties of the transformer iron may be obtained by experiment provided the core dimensions and the winding data can be secured, and it is sometimes possible to obtain the desired data from the manufacturer.

The total core loss of a transformer at different flux densities can be determined by measuring with a wattmeter the input to one winding supplied with energy at different voltages, while the other winding is on open circuit. The input as indicated by the wattmeter includes both the hysteresis and eddy-current losses and a small I^2R loss in the copper of the primary winding which under ordinary conditions may be neglected. The separation of the hysteresis and eddy-current losses may be accomplished by several independent methods. One of these methods involves the assumption that the hysteresis loss varies as the 1.6 power of the maximum flux density. While this is not a violent assumption, the constant 1.6 is only an average value obtained from tests on many samples of iron and may not apply to the particular sample under consideration.

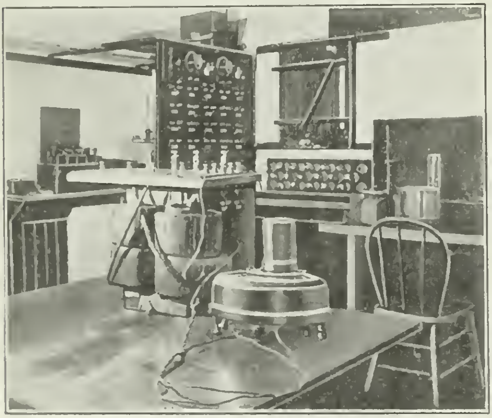

FIG. 1—LABORATORY TRANSFORMER AND FLUX-METER

Another method depends upon the fact that the eddy-current loss varies as the square and the hysteresis loss as the first power of the frequency. This method requires the measurement of the losses at widely different frequencies and is attended with more or less uncertainty. A third and theoretically correct method involves the measurement of the hysteresis loss directly from the areas of a number of hysteresis loops taken on a sample of the iron, under various degrees of maximum induction. All three of these methods were employed and the results are shown by the accompanying curves.

For conducting the tests herein recorded use was made of a standard 2.5-kw lighting transformer of the core type, to which were added a special twenty-five-turn winding with taps at two, five, ten and twenty turns for use in connection with a flux-meter or ballistic galvanometer. A terminal board was mounted on the transformer and all leads were brought to binding posts on this board. The accompanying figure shows the transformer and flux-meter.

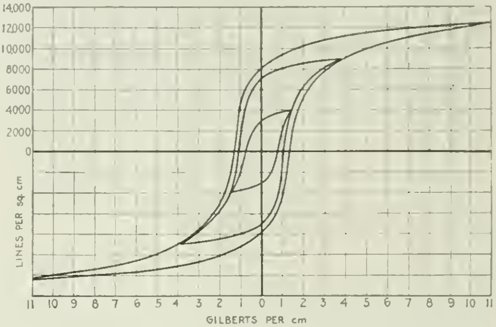

FIG. 2—HYSTERESIS CURVES TAKEN ON 2.5-KW TRANSFORMER

The results of a core-loss test which was conducted at the Oregon Agricultural College under the direction of the author may be of interest.

The tests were designed to give a thorough understanding of magnetic hysteresis and eddy currents and the energy losses attending these phenomena. The following constants apply to the transformer under test:

Cross-sectional area of core	36.4 sq. cm = 5.65 sq. in.
Mean length of flux path	73.7 cm = 29.0 in.
Thickness of laminations	0.0356 cm = 0.014 in.
Weight of iron	20.6 kg = 45.3 lb.
Volume of iron	2670.0 cu. cm = 163.0 cu. in.
Primary winding contains approximately 2800 turns of No. 18 wire	
Secondary winding contains 281 turns of No. 8 wire.	
Primary resistance	22 ohms
Secondary resistance	0.18 ohm

In obtaining the hysteresis loops on the transformer core use was made of a flux-meter. This is by far the simplest and quickest device for carrying out what is ordinarily a tedious and laborious test. The flux-meter is essentially a very sensitive ballistic galvanometer. The deflection is independent of the rate of change and the readings may be taken leisurely. With this instrument the readings for a complete hysteresis loop may be obtained by the step-by-step method in fifteen minutes, and if the proper care is exercised the results should check within 1 per cent. Eight hysteresis loops, three of which are shown in Fig. 2, were obtained from the transformer core in this manner, the flux densities ranging from 4000 maxwells to 14,000 maxwells per square centimeter. The areas of these loops were carefully measured with a planimeter and the results plotted as curve E in Fig. 3. Curve A in the same illustration shows the total core loss in ergs per cubic centimeter per cycle as measured by a Thompson indicating wattmeter when the transformer was subjected to a sine-wave emf at a frequency of seventy cycles. By making the assumption as indicated above this curve can be separated into eddy current and hysteresis loss in the following manner: Select two points on the curve having ordinates W_1 and W_2, then

$$W_1 = \eta\,\mathfrak{B}^{1.6}_1 + \varepsilon f t^2\,\mathfrak{B}^2_1$$

and

$$W_2 = \eta\,\mathfrak{B}^{1.6}_2 + \varepsilon f t^2\,\mathfrak{B}^2_2$$

f being the frequency and t being the thickness of the laminations. The constants η and ε were determined from two such equations and found to be 0.00142 and 0.000215 respectively. Using these constants in the well-known hysteresis and eddy-current equations, the curves B and C are obtained. Their sum is plotted as D and is seen to coincide almost exactly with A. However, this gives a value too small for the hysteresis and a value too large for the eddy-current loss. By subtracting curve E, the true value of the hysteresis loss, from curve A, curve F, the true value of the eddy-current loss, is obtained.

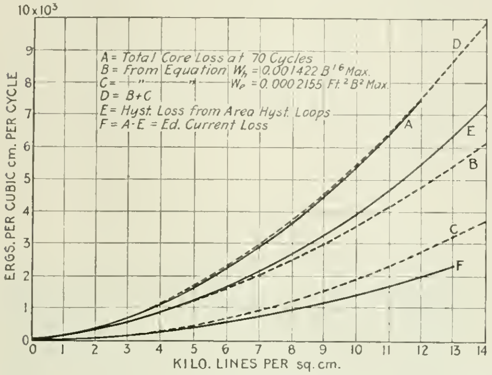

FIG. 3—OBSERVED AND CALCULATED CURVES OF TRANSFORMER CORE-LOSS

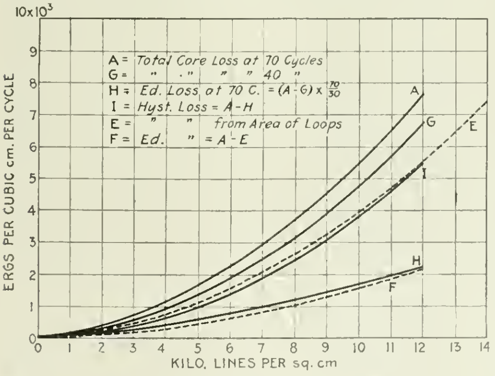

FIG. 4—OBSERVED AND CALCULATED CURVES OF TRANSFORMER CORE-LOSS

The two-frequency method of separation depends upon the fact that the energy loss per cycle due to eddy currents varies as the frequency, while the hysteresis loss per cycle is independent of the frequency. This is equivalent to saying that the power loss due to eddy currents varies as the square of the frequency and that due to hysteresis directly as the frequency, all data in this case being given in ergs per cubic centimeter per cycle.

Curve A, the total core loss per cycle at seventy cycles, is replotted in Fig. 4. Curve G is the total loss at forty cycles. Since the hysteresis loss is the same for both, their difference must be due to the eddy-current loss at the difference of the two frequencies, namely, thirty cycles. Therefore by multiplying the difference between curves A and G by $\frac{70}{30}$ the curve H, the eddy-current loss at seventy cycles, is obtained. Curve H is subtracted from curve A to get curve I, the hysteresis loss. Curves E and F are here replotted for the sake of comparison. The conformity is seen to be reasonably close.

By analysis it is found that curve E, the hysteresis loss, cannot be expressed by any simple equation, the exponent of $\mathfrak{B}$ being an increasing variable. The value 1.72 fits the curve very closely when used with the coefficient 0.000535. The curve J in Fig. 5 has been plotted using these values. It coincides almost exactly with curve E during the greater part of its length. Using the coefficient 0.0016 with the exponent 1.6 gives curve K. It is interesting to note that in changing the exponent from 1.72 to 1.6 the coefficient must be tripled. By reducing the eddy-current coefficient from 0.000215 to 0.00018 curve N is obtained, which is in closer agreement with the experimental results.

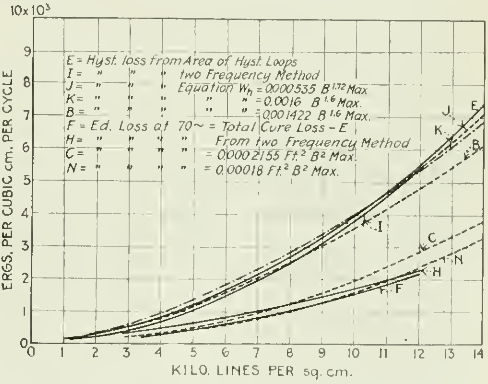

FIG. 5—OBSERVED AND CALCULATED CURVES OF TRANSFORMER CORE-LOSS

In the two-frequency method of separation the eddy-current loss is obtained from the difference between curves H and G. This difference is small unless the two frequencies chosen are widely different, and a slight error in either of the curves or an error in measurement will be exaggerated in the eddy-current curve.

The ordinary student is apt to consider an empirical formula which he finds in a textbook as infallible, and when substituting in it will carry his results to three or four significant figures. It is hoped that the experiment here outlined will help to teach him the need of caution and judgment in accepting constants and formulas as well as give him an understanding of the principles involved.

Letters to the Editors

The Determination of Glare

To the Editors of the Electrical World:

Sirs:—In the article by Prof. L. R. Ingersoll on the measurement of glare in your issue of March 21 there appears to be a confusion of illumination with brightness, which has led to erroneous results in the use of his instrument.

In this instrument the surface to be examined is placed at the bottom of a box and illuminated by a translucent window at the far end of the box. This surface is viewed through a tube at the rear. In the case of purely specular reflection (black glass, for example) the apparent brightness of the surface is that of the illuminating window viewed directly multiplied by the reflecting power of the surface, or $I_0 R_1$. On the other hand, the brightness of a diffusely reflecting surface is the illumination at that surface multiplied by its diffuse reflecting power IR_2. I is approximately equal to the brightness of the window, I_0, multiplied by its area, A, divided by the square of its distance, d, from the surface illuminated, and again multiplied by the cosine of the angle of incidence, C, or $I = I_0 AC/d^2$.

Professor Ingersoll has apparently measured correctly the fraction of polarized light in the light from the surface, but in failing to distinguish between illumination and brightness has greatly overestimated the percentage of specular reflection. Approximately correct results may be obtained as follows: The apparent brightness of the surface due to its specularly reflected light is $S = I_0 R_1$; that due to its diffusely reflected light is $D = I_0 R_2 AC/d^2$. What Professor Ingersoll measured was $S/(S + D)$ instead of $R_1/(R_1 + R_2)$, the percentage polarization sought. In his instrument $A = 9$, $C = 0.73$ and $d = 11\frac{5}{8}$, all in inches; hence what he measured as 50 per cent glare is really only 4 per cent; 75 per cent is 12 per cent, and 25 per cent is really only 1.5 per cent glare, so that the error is serious.

P. G. Nutting, *Eastman Research Laboratory.*
Rochester, N. Y.

Water-Power Developments on Public Lands

To the Editors of the Electrical World:

Sirs:—In your issue of May 9, 1914, it is stated that I advocated, at a recent hearing before the committee on public lands of the House of Representatives, a federal tax of 25 cents per hp on all developments located on the public lands of the West. As this statement does not conform to my views in the matter, I shall be grateful if you will publish the following:

The purport of my testimony was that any federal tax or rental must inevitably become a charge on the consumer; that in case of general public utility service the producer is relatively indifferent as to federal tax so long as it is not made so large as to affect adversely hydroelectric service in competition with steam-electric service; that if members of Congress believe it wise to increase consumers' rates in order to provide additional revenue to the treasury, the explanation of the matter to the consuming public logically falls upon the members of Congress and not upon the power producers; that in the case of water-power sites developed for electrochemical, electro-metallurgical or other purposes requiring very cheap power, even a small federal tax would be highly detrimental, especially in view of the fact that the United States is obliged to compete for such industries with the very cheap water-powers of Norway, Sweden and other countries.

The proposal to tax at 25 cents per hp was made by a previous witness and referred to me on cross-examination. My reply was to the effect that if a federal tax must be imposed it should be sufficient to cover merely the cost of federal administration; that in my judgment 25 cents per hp would cover all these costs; that, in view of all the inevitable uncertainties in estimates of cost and productivity of water-power plants, any proposal financed on so narrow a margin that a 25-cent tax would become a significant factor would fail to constitute a reasonably safe investment and should therefore remain undeveloped.

Washington, D. C. M. O. Leighton.

System of Charges for Energy

To the Editors of the Electrical World:

Sirs:—I wish to call attention to some important omissions in the interesting letter of Mr. L. C. Tomlinson in your issue of April 11. He appears to claim that there are three elements entering into the cost of energy, namely, the demand, or maximum rate of consumption; the quantity, or consumption, and the time. The fact is, however, that the cost depends very largely on other elements.

The cost depends greatly on the distance from the point of supply and on whether the circuits are overhead or underground. The cost, further, depends on the density of customers; that is, on whether the supply of a given quantity of energy is delivered at a single point, in which case the cost is the lowest, or a large quantity is delivered as the total of a number of supplies of small quantities delivered at different points close together, or, finally, as the total of a number of small supplies delivered at widely scattered points.

Moreover, there are numerous other items that affect cost and must be considered, but I mention these in particular as some of the most important to show that demand, quantity and time are by no means the only elements that determine costs.

An important omission from Mr. Tomlinson's statement is the unfortunate but nevertheless true fact that the value of the service to the consumer must be considered whenever two or more consumers use the same investment or service. For instance, whenever several consumers use the same investment at different times of the day and year, or when there is any initial expense for supplying one customer that is not needed again for supplying a second customer, the cost of such investment or service must be divided between these customers. However, if the division of this cost between these customers results in making the price to either of them above the value of the service to that customer, that customer will not pay, and the total of this cost must be divided among only those customers that are willing to take the service and pay their share. Hence the price in any case of joint use depends cn the value to the user.

No system of charges can be developed that does not, first, take account of the actual elements of cost and, second, when dividing up these elements of cost among different customers, take account of the fact that no customer will pay more than the value of the service to him, and that if any customer will pay anything for investment which would otherwise be idle, or for a service or product which would otherwise be wasted if he did not use it, then such payment will reduce the price to all the other customers even if it be less than some theoretical cost.

Boston, Mass. R. S. Hale.

Handling the Small Consumer in Europe*

Statistics from continental Cities showing how electricity for domestic purposes is furnished to the poorest inhabitants—Even the peasants are reached. By S. E. Doane

At the beginning of the electric-lighting industry not only were the means for conversion of electric energy into light more incomplete and less efficient than to-day, but the price of energy itself was higher and electric illumination was decidedly a luxury. As the art advanced the cost of producing the energy was gradually reduced, and at the same time, owing to the progress of the lamp industry, the transformation of electricity into light became more and more economical, the lamps becoming at once more efficient and less expensive. Thus many causes co-operated to cheapen the cost of light to the ultimate consumer to an unthought-of degree.

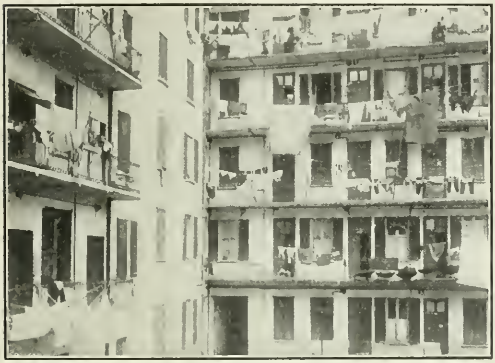

FIG. 1—COURT OF POPULAR BUILDING IN MILAN, ITALY, SHOWING OVER TWENTY CUSTOMER CONNECTIONS

About six years ago, when the high-efficiency incandescent lamp began to be used in earnest, apprehension and uneasiness seized many central-station men on this side of the Atlantic as well as on the other. It was believed that a 70 per cent reduction in the watt-hour consumption for a certain number of candle-power-hours would mean a similar reduction of revenue. Experience has shown, however, that the increased demand for light by the individual consumer, as well as the increase in the number of consumers, which was brought about by the lowered lighting costs offset to a large extent the reduction of income per candle-power-hour. It is now acknowledged that the reduction in the cost of producing electric light incident to the use of the metal-filament lamp placed electricity in a position to compete with gas. The situations happened to run nearly parallel, inasmuch as not only had the price of gas gradually decreased as the methods for making it were improved but the efficiency of utilization of gas in the production of light was also improved by two comparatively sudden steps, namely, the invention of the Welsbach mantle and the introduction of the inverted burner, which two steps may be compared to the introduction of the tantalum and tungsten lamps respectively. Both gas and electricity—especially the latter—can now compete successfully with petroleum, the rays from which thus far have been considered the "poor man's light."

In the case of electricity, however, experience seemed to show that under existing conditions, although the consumer could be served at the same or lower cost to him than with other illuminants, the small consumer was unprofitable to the central station. Very small consumers would use so few kilowatt-hours that the revenue collected from them would not even cover such expenses as meter reading, accounting, billing and collecting, in addition to the maintenance of the meter and the interest and depreciation on it.

The Small Customer

One of the most interesting results of the writer's trip to Europe originally undertaken for the purpose of studying the inexpensive methods of wiring developed and used abroad—was the discovery that European central stations have found a way of making the

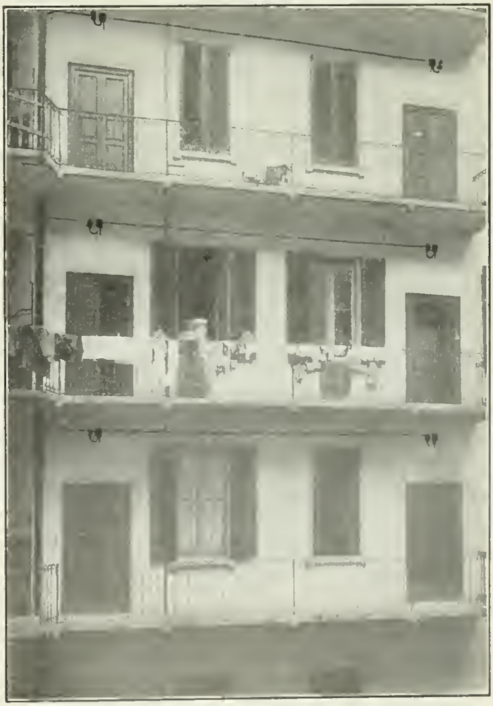

FIG. 2—SIX-CUSTOMER CONNECTIONS IN POPULAR HOUSES IN MILAN, ITALY

small customer profitable. Not only do the managers there appreciate the small consumer, but a very large and ever-increasing number of central stations are making every possible effort to attract this class of consumers to their lines.

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*This article is published by arrangement with the National Electric Light Association and will be reprinted for the Philadelphia convention as an appendix to the report of the committee on the wiring of existing buildings, R. S. Hale, chairman.

In some cases the original motive for soliciting the small consumer was to thwart municipal or competitive developments. With a vast majority of the possible users of electric service connected in circuit the use of the unconnected individual as a political asset of the demagogue politicians was greatly diminished. After the movement toward the acquisition of small customers (residences, small shops, etc.), had been started, the central stations found that this class of business, instead of being a financial burden, was a very valuable asset, if handled in the proper way.

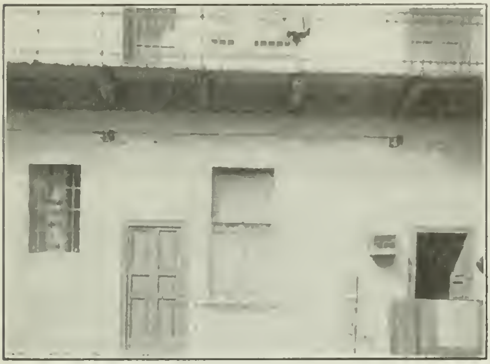


FIG. 3—TWO-CUSTOMER CONNECTIONS IN POPULAR HOUSES IN MILAN, ITALY

Intensive Development of Latent Market

The reason that this movement started earlier in Europe, particularly in Germany, may be because in the comparatively thickly settled districts the territory is limited and the population is not always growing as rapidly as in the United States, where in some places the increase of population alone is enough to keep the central station busy connecting up consumers that have moved from older communities. Consequently the central stations in Germany and other countries of Europe had to reach out for the smaller customers and had to develop methods to make them profitable, in order to increase their own incomes.

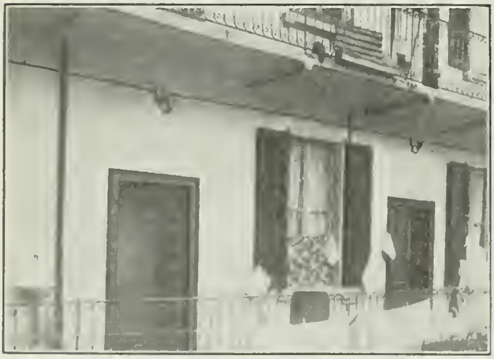


FIG. 4—SERVICE CONNECTIONS IN MILAN, ITALY

Another reason may be found in the competition between electricity and gas, which is severer in Germany than in any other country. Cause and effect were here probably working in a circle. In Germany, as well as in the rest of Europe, when electricity was introduced about twenty or twenty-five years ago, gas had already been established to a greater extent than in the new and rapidly growing American cities, and this may be one of the reasons why the competition between gas and electricity is so much keener there than in the United States, where gas and electricity have had their respective territories more nicely defined from the beginning.

When through great improvements electric light began to cheapen, the gas companies in Europe saw their territory encroached upon by the electric central-station companies, and, in order to compensate for the losses inflicted upon them by electric competition, they reached out for the smaller consumer. In general, therefore, it was the gas companies that started this campaign by making gratuitous installations, installing prepayment meters, etc., and the electric light companies followed. In some places the central stations have been leading the way with the gas works following closely after.

According to a most prominent expert on methods of developing the use of electricity, Director E. Wikander, of Berlin, to whom the writer is indebted for many valuable statements, it is the admitted intention of the gas industry to equip all small residences in the cities with gas pipes and prepayment gas meters as quickly as possible. This policy of the gas companies and the gratifying financial returns resulting therefrom have prompted the electric-light companies to adopt similar methods.

Apart from the direct financial gain secured through the small consumers' business, it has been observed that the medium-sized customer, who represents the middle class, is attracted automatically by a reduction in soliciting expense. This is easily understood if one imagines a man of the middle class, for instance, hearing from his maid that his poorer neighbor has electric light at home, whereas he himself is still using inferior illumination. It is for this reason that the solicitors of some electric-light companies are being paid more for the small consumers acquired than for larger ones, though, of course, the effort and trouble may also be greater.

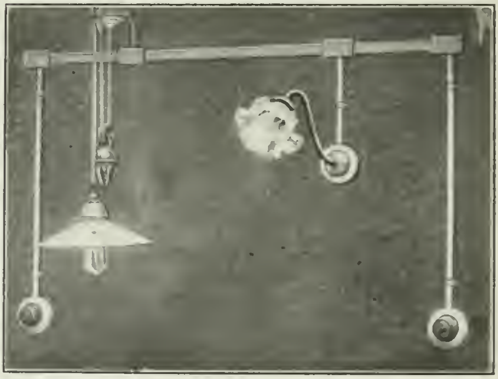


FIG. 5—FITTINGS USED IN MILAN, ITALY

Inexpensive Wiring

For several years the writer has been particularly interested in the inexpensive wiring methods used in Europe, and he finally decided that the progress there in handling very small customers had been such as to warrant a study of their methods. More than one year ago one of the writer's assistants, Mr. Eisenmenger, went to Europe to study the small-customer situation, preparatory to the writer's own visit to Europe last spring. It was quickly found that chief interest centered in Germany and some places in Italy, Austria and Switzerland having followed rather than led, and developments in France having been quite backward. As regards England, time did not permit of covering the ground fully, but enough was seen and heard to indicate that Germany offered the best field in that particular matter. Circular-letters were sent to 660 central stations (mostly in Germany), asking particularly as to their experience in obtaining and handling small customers. Approximately 300 replies were received, about 200 of which contained something of interest.

A number of the central stations which seemed most interesting from this point of view were visited in order to get the ideas of their managers. Interviews were also held with other men prominent in the industry who, although not connected with any one particular central station, still were in a position to know the trend of the times in this respect, and it is a pleasure here to express appreciation for the kindness everywhere received and for the amiable readiness with which the investigations were aided. Mention should especially be made of Mr. C. F. v. Siemens and Dr. O. Feuerlein, of the Siemens & Halske Aktien Gesellschaft, Berlin; Mr. E. Wikander, director of the Geschäftsstelle für Elektricitäts-Verwertung (Society for Electrical Development), of Berlin, and Dr. G. Siegel, of the Allgemeine Elektricitäts Gesellschaft, also of Berlin, for their kind assistance and for the information furnished by them.

In deriving the maximum benefit for the central station from the small consumers two distinctly different problems are involved: (1) making the small customer a profitable one, and (2) soliciting the business of the small customer.

These problems have various features in common. Some of the details of the solution of one contribute toward solving the other. It is impossible, therefore, in treating this subject to distinguish nicely between the two and maintain a thorough and perfect classification of the means of their solution.

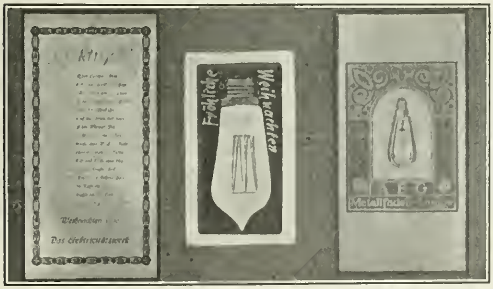


FIG. 6—HONEY CAKE (IN CENTER) AND CARTON DISTRIBUTED IN WERDAU

The small consumer can be made profitable by (a) lowering and holding down in general the cost of furnishing him with electricity, in addition to reducing the capital necessary therefor, and (b) regulating the income by the application of proper rates so that financial losses from individual consumers are avoided and a decided financial advantage for the central station from every consumer is obtained. The former can be accomplished by simplifying and cheapening the system in use for accounting, billing and collecting, as, for instance, by the adoption of "department-store methods." The regulation of the income does not necessarily imply an increase of cost of light to the consumer, but rather a reduction.

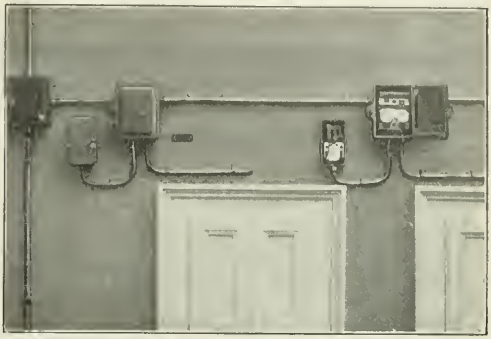


FIG. 7—RISER, CABINET, CUT-OUT AND EXCESS INDICATOR IN USE IN MILAN, ITALY

In soliciting the small customer the use of all sorts of advertising methods, canvassing personally and by printed matter, etc., is contemplated.

Proper rates form one of the most important means of making the small consumers' business as profitable as possible.

Another group of methods which fall under the heading "Soliciting" are the different means used by electric-light companies to finance the cost of installation for the prospective customer. The greatest obstacle to the acquisition of very small customers from the consumer's standpoint is the initial expense for wiring and fixtures. Inexpensive wiring methods relieve the customer either directly (in case he pays for his installation in cash) or indirectly (in case the money is advanced by the electric-light company).

To give some comprehension of what the electric-light companies are doing in Europe to make the business of the small consumer profitable, reports of what is actually being done in typical cities are appended. No attempt is made to give a detailed account of what was found in every single place. Data on the most interesting installations, however, are given in tabular form.

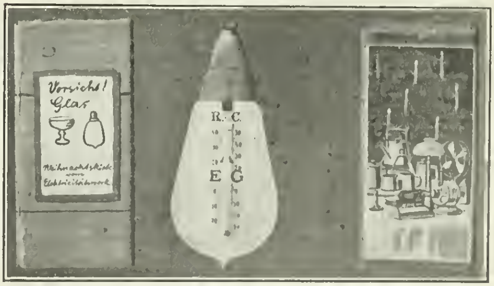


FIG. 8—THERMOMETER AND CARTON DISTRIBUTED IN WERDAU

Accounts of inexpensive wiring schemes obtaining in Europe are also included.

Wiring at Central Station's Expense at Strassburg

One of the first central stations to apply successfully methods of financing small customers was the electric-light company at Strassburg, Germany. The conditions are essentially as follows: Only houses already completed are wired under this system, and then only in installations of from one to four lamps. The wiring for the first outlet, excluding the fixture, is installed at the expense of the electric-light company without any obligations on the part of the customer other than a contract to pay an annual minimum bill for energy of $4.30 for six years at the ordinary rate of 9.6 cents per kw-hr. For the wiring of the second, third and fourth outlets 6 cents is to be paid per month per lamp for six years, after which time the electric-light company waives the right of ownership. In any case a meter rent of 6 cents a month is also charged. Before any house is connected there must be at least four customers applying for connections. It is evident therefore that this system of wiring applies only to tenements and apartment houses, of which, according to the German way of city building, the city of Strassburg proper, as well as almost all other Continental cities, chiefly consists.

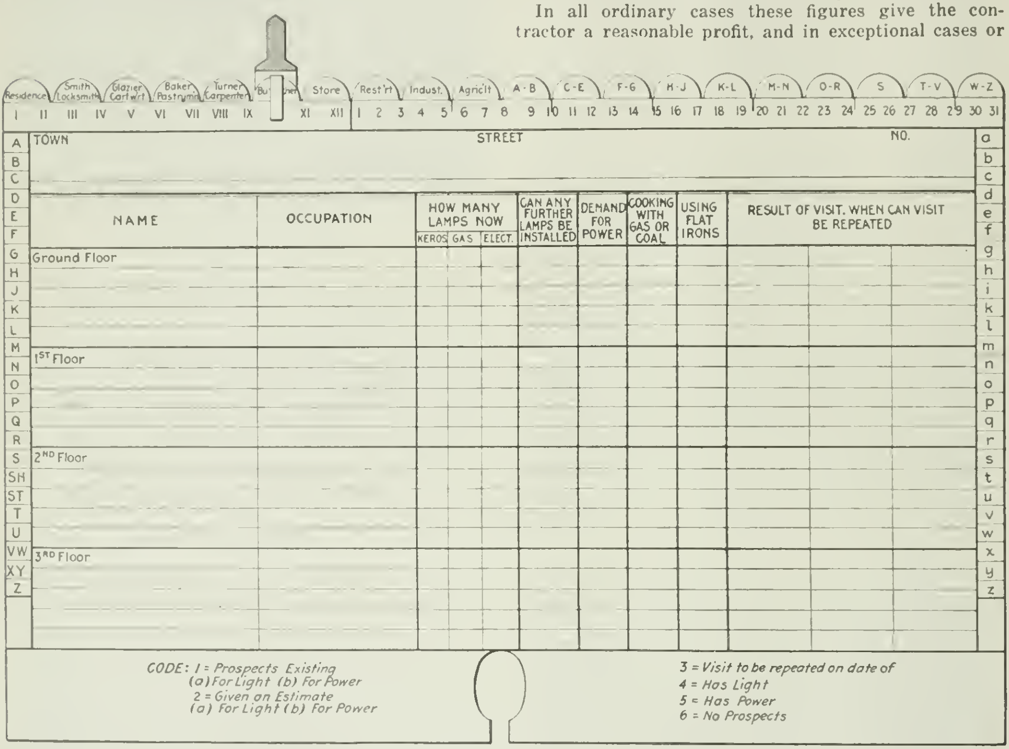
Wiring Village Houses

The territory of the central station comprises the city of Strassburg itself (178,000 inhabitants) and also 166 adjacent villages, with a total population of 185,000. The methods for connecting the small houses in these villages, where there are no apartments or tenements, but one-family houses, vary slightly. The lighting company advances the money for wiring houses to the prospective customer and collects the amounts from him in instalments within from one to three years. The number of instalments is arranged to suit the convenience of the consumer, and in many cases the time of payment is fixed at harvest time, since the occupation of the inhabitants is largely agricultural.

Relations with Wiring Contractors in Strassburg

The electric-light company does not do any wiring itself. It has agreements with the contractors, who make installations at the fixed unit prices given below.

In all ordinary cases these figures give the contractor a reasonable profit, and in exceptional cases or under particular conditions, should this not be so, the contractor has to deal directly with the consumer for the difference. The office work resulting from these standardized installations is therefore reduced to a minimum. The electric-light company encourages not only the prospective customers by advancing the installation costs but also the contractors. The latter receive on account a certain allowance of wiring material if desired, and immediately after an installation is


Residence
Smith Locksmith
Glazier Cartwrt
Baker Pastrymn
Turner Carpenter
Bu…her
Store
Rest'rt
Indust.
Agric'lt
A - B
C - E
F - G
H - J
K - L
M - N
O - R
S
T - V
W - Z
I II III IV V VI VII VIII IX XI XII
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
A B C D E F G H J K L M N O P Q R S SH ST T U VW XY Z
a b c d e f g h i k l m n o p q r s t u v w x y z

TOWN STREET NO.

NAME	OCCUPATION	HOW MANY LAMPS NOW			CAN ANY FURTHER LAMPS BE INSTALLED	DEMAND FOR POWER	COOKING WITH GAS OR COAL	USING FLAT IRONS	RESULT OF VISIT. WHEN CAN VISIT BE REPEATED
		KEROS	GAS	ELECT.					
Ground Floor									
1st Floor									
2nd Floor									
3rd Floor									

CODE: 1 = Prospects Existing
(a) For Light (b) For Power
2 = Given an Estimate
(a) For Light (b) For Power

3 = Visit to be repeated on date of
4 = Has Light
5 = Has Power
6 = No Prospects

FIG. 9—SOLICITING CARD USED AT WERDAU (TRANSLATED)

UNIT PRICES FOR WIRING IN STRASSBURG

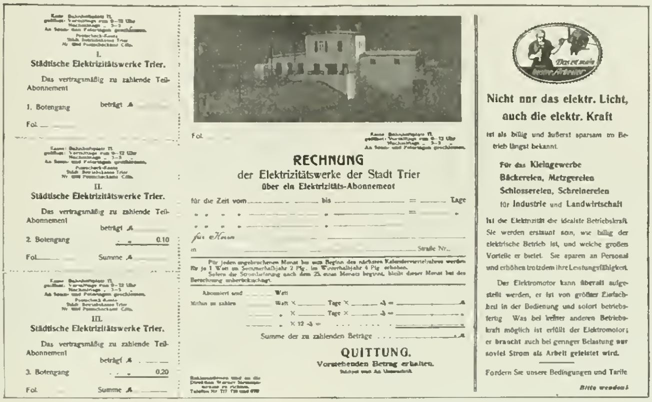
City		Country	
Riser per foot	$0.087	Outlet in dry places	$3.00
First outlet	3.60	Outlet in moist places	4.00
Second outlet	3.10	Additional for a two-way switch	1.45
Third outlet	2.90		
Fourth outlet	2.40		

finished the bulk of the contract sum (about 75 per cent) from the electric-light company. The balance is paid immediately after the installation has passed inspection.

Results Obtained in Strassburg

The following statistics, for which we are indebted to the managing director of the company, Mr. Alfred Loewe, illustrate the results obtained by these methods."[1]

In January, 1913, in the city district, with 165,000 civilian inhabitants, 27,300 meters were installed, or sixty-eight meters to every 100 households, or one meter to every six inhabitants. In the rural part of the territory supplied, having 185,000 inhabitants, there were 20,000 meters installed, or one meter to every nine and one-fifth inhabitants. The number of installations paid for on the instalment plan in the city (and a few places in the rural territory) was not less than 13,700, which shows the great importance of the latter type of installation and also of the small consumer (four lamps and under). The income per inhabitant per annum was $4.60 in the city district and $1.20 in the country district. The number of kilowatt-hours sold was 106 and 26 respectively, including that for railway and motor service (kilowatt-hours for railway service are approximately 20 per cent of the total kilowatt-hours consumed). The number of incandescent lamps installed per inhabitant was 2 in the city and 0.74 in the country district.[2]



I.
Städtische Elektrizitätswerke Trier.
Das vertragsmäßig zu zahlende Teil-Abonnement
1. Botengang beträgt ℳ
Fol.

II.
Städtische Elektrizitätswerke Trier.
Das vertragsmäßig zu zahlende Teil-Abonnement
beträgt ℳ
2. Botengang 0.10
Fol. Summe ℳ

III.
Städtische Elektrizitätswerke Trier.
Das vertragsmäßig zu zahlende Teil-Abonnement
beträgt ℳ
3. Botengang 0.20
Fol. Summe ℳ

Fol.

RECHNUNG
der Elektrizitätswerke der Stadt Trier
über ein Elektrizitäts-Abonnement

für die Zeit vom ______ bis ______ = ______ Tage
für Herrn
in ______ Straße Nr.

Abonniert sind ______ Watt
Mithin zu zahlen ______ Watt × ______ Tage × ______ ₰ = ______ ℳ
× ______ Tage × ______ ₰ =
× 12 ₰ =
Summe der zu zahlenden Beträge . . . ______ ℳ

QUITTUNG.
Vorstehenden Betrag erhalten.

Nicht nur das elektr. Licht, auch die elektr. Kraft

ist als billig und äußerst sparsam im Betrieb längst bekannt.

Für das Kleingewerbe
Bäckereien, Metzgereien
Schlossereien, Schreinereien
für **Industrie** und **Landwirtschaft**

ist die Elektrizität die idealste Betriebskraft. Sie werden erstaunt sein, wie billig der elektrische Betrieb ist, und welche großen Vorteile er bietet. Sie sparen an Personal und erhöhen trotzdem ihre Leistungsfähigkeit.

Der Elektromotor kann überall aufgestellt werden, er ist von größter Einfachheit in der Bedienung und sofort betriebsfertig. Was bei keiner anderen Betriebskraft möglich ist erfüllt der Elektromotor; er braucht auch bei geringer Belastung nur soviel Strom als Arbeit geleistet wird.

Fordern Sie unsere Bedingungen und Tarife

Bitte wenden!

FIG. 10—FORM OF FLAT-RATE BILL USED IN TRIER

This system has been in use in Strassburg since 1909, and Director Loewe observed in 1911 that gas as a competitor of electricity was vanishing and that in almost every case it was even possible to compete with kerosene.

Schlesische Elektricitäts- und Gas-Actien-Gesellschaft, Gleiwitz.

1913

Pauschalvertrag

Aenderungen

Bemerkungen

FIG. 11—QUARTERLY BILL FORM USED IN GLEIWITZ, SILESIA

Städtische Elektricitätswerke u. Straßenbahnen, Potsdam

E.W.P.

Pauschalvertrag

Änderungen

Bemerkungen

FIG. 12—QUARTERLY BILL FORM USED IN POTSDAM, GERMANY

The average yearly income from instalment installations is $7.64 for energy plus 72 cents for meter rent, making a total of $8.36.

The number of customers wired on the partial payment plan was in January, 1910, 1460; January, 1911, 5070; January, 1913, 13,700.

In April, 1911, when 5570 installations were connected under this system, it was found that 205 consumers did not pay the instalments due. The larger number of cases in question were caused by removals, and this loss of about 3.7 per cent in temporarily empty apartments was reduced as the apartments were rented again, so that only a very small loss has to be taken into account.

The financial side of this instalment wiring system can be appreciated from the following figures: Installations to the number of 5573 required a capital of $73,400, excluding the service connections, which cost $33,600. It is assumed that the expense of the service connections will be amortized gradually as ordinary capital invested, whereas the interior wiring will be repaid within the six years of the consumer's contract. The consumers are paying, according to the terms of the contract, during the six years (as monthly instalments for the second, third and fourth outlets) $51,000, so that $22,400, or $3.730 a year, must be written off. The income for energy from these rental installations was about $40,000 per annum, and the benefits of this system correspond to a discount of about 10 per cent to the consumer (at the straight meter rate of 9.6 cents per kw-hr.).

The statistics of the Strassburg central station show that of 500 partial-payment installations only 37 failed to consume the yearly guarantee of $4.30 and therefore had to make a supplementary payment for energy not consumed. The same statistics also show that the average number of lamps in these 500 installations was about 3.1. Since most deferred-payment installations have been ordered from the electric-light company with a connected load of only two lamps, this figure shows that many consumers have made extensions at their own expense.

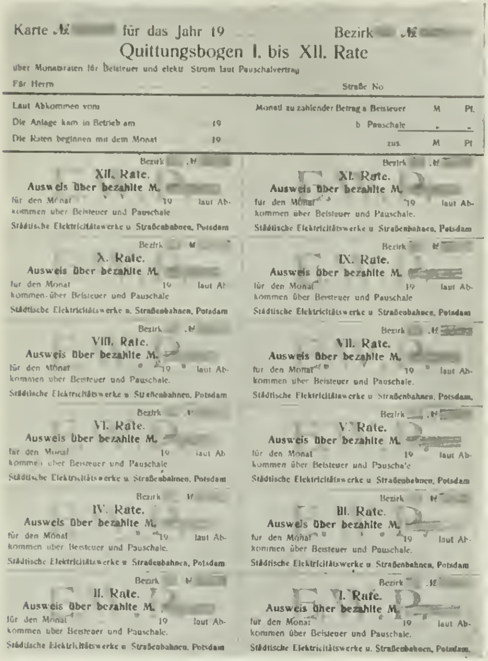
---

[1] In reviewing these statistics it should be understood that in Germany, as well as in the rest of Europe, electric illumination, when it came to be introduced about twenty or twenty-five years ago, found gas lighting more firmly intrenched than in the newer and generally more rapidly growing American cities, and therefore it had and is still having a harder fight against gas than in America.

[2] The average corresponding figure for forty-four German cities selected at random was found to be 0.55 lamp per inhabitant.

The last annual report of the central station at Strassburg showed a dividend of 11 per cent.

It was found that in all other cases where small customers were being handled systematically and profitably an exclusive or optional flat rate was being applied for that class of customers, together with a meter rental. The central station at Strassburg furnishes an example of the excellent results which can be achieved with a pure meter rate. It should be emphasized, though, that the company requires one 60-watt lamp to be installed and does not encourage the use of any smaller lamps.



Karte № für das Jahr 19 Bezirk №

Quittungsbogen I. bis XII. Rate

über Monatsraten für Beisteuer und elektr. Strom laut Pauschalvertrag

Für Herrn Straße No

Laut Abkommen vom

Die Anlage kam in Betrieb am 19

Die Raten beginnen mit dem Monat 19

Monatl. zu zahlender Betrag a Beisteuer M Pf.

b Pauschale

zus. M Pf

Bezirk №

XII. Rate.

Ausweis über bezahlte M.

für den Monat 19 laut Abkommen über Beisteuer und Pauschale

Städtische Elektricitätswerke u. Straßenbahnen, Potsdam

Bezirk №

XI. Rate.

Ausweis über bezahlte M.

für den Monat 19 laut Abkommen über Beisteuer und Pauschale.

Städtische Elektricitätswerke u. Straßenbahnen, Potsdam

Bezirk №

X. Rate.

Ausweis über bezahlte M.

für den Monat 19 laut Abkommen über Beisteuer und Pauschale

Städtische Elektricitätswerke u. Straßenbahnen, Potsdam

Bezirk №

IX. Rate.

Ausweis über bezahlte M.

für den Monat 19 laut Abkommen über Beisteuer und Pauschale

Städtische Elektricitätswerke u. Straßenbahnen, Potsdam

Bezirk №

VIII. Rate.

Ausweis über bezahlte M.

für den Monat 19 laut Abkommen über Beisteuer und Pauschale.

Städtische Elektricitätswerke u. Straßenbahnen, Potsdam

Bezirk №

VII. Rate.

Ausweis über bezahlte M.

für den Monat 19 laut Abkommen über Beisteuer und Pauschale.

Städtische Elektricitätswerke u. Straßenbahnen, Potsdam.

Bezirk №

VI. Rate.

Ausweis über bezahlte M.

für den Monat 19 laut Abkommen über Beisteuer und Pauschale

Städtische Elektricitätswerke u. Straßenbahnen, Potsdam

Bezirk №

V. Rate.

Ausweis über bezahlte M.

für den Monat 19 laut Abkommen über Beisteuer und Pauschale

Städtische Elektricitätswerke u. Straßenbahnen, Potsdam

Bezirk №

IV. Rate.

Ausweis über bezahlte M.

für den Monat 19 laut Abkommen über Beisteuer und Pauschale.

Städtische Elektricitätswerke u. Straßenbahnen, Potsdam

Bezirk №

III. Rate.

Ausweis über bezahlte M.

für den Monat 19 laut Abkommen über Beisteuer und Pauschale.

Städtische Elektricitätswerke u. Straßenbahnen, Potsdam

Bezirk №

II. Rate.

Ausweis über bezahlte M.

für den Monat 19 laut Abkommen über Beisteuer und Pauschale.

Städtische Elektricitätswerke u. Straßenbahnen, Potsdam

Bezirk №

I. Rate.

Ausweis über bezahlte M.

für den Monat 19 laut Abkommen über Beisteuer und Pauschale.

Städtische Elektricitätswerke u. Straßenbahnen, Potsdam.

FIG. 13—MONTHLY FLAT-RATE CARD USED IN POTSDAM

Of interest are the special agreements which the electric-light company at Strassburg has made in order to introduce electric light into such groups of laborers' residences as are under the administration of building corporations. Thus, in a garden city near Strassburg, where up to now 500 apartments, renting at from $4.50 to $6 a month, have been erected, electricity is used exclusively and 14,000 lamps have been installed. The building company has guaranteed an income of $3.50 per flat a year. In another district, in a similar way, about 800 apartments of one, two or three rooms each have been furnished with electric light.

Tenement House Wiring in Milan, Italy

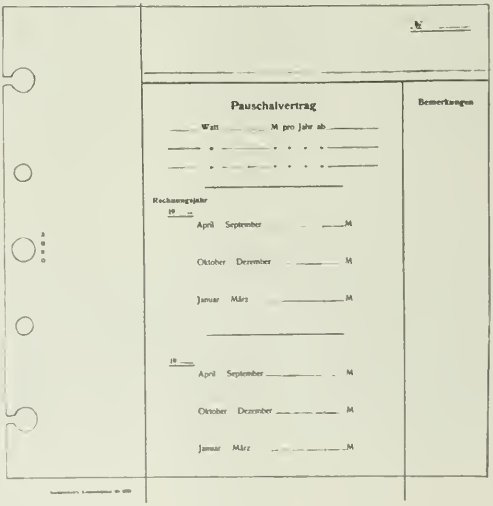
Another most interesting system for connecting small consumers to the lines is being used by the Edison Company of Milan, Italy.[3] Milan is an industrial and growing city of about 650,000 inhabitants. The laboring classes live, as elsewhere, in one, two or three rooms, in large tenement houses. The typical home is made up of two rooms and kitchen. The rent per room is between $25 and $30 per annum. The average income of the family head is between 80 cents and $1 a day. Figs. 1 to 4 show typical views of tenement-house installations.

Deferred Payment and Flat-Rate Plan

It would be hopeless, of course, to attempt to introduce electric lighting to this class of population without taking the burden of the cost of installation from their shoulders. At the same time, it is also evident that the consumption of such consumers would be so small that the outlay for a watt-hour meter for each consumer and the expense of billing and collecting could hardly, if at all, be covered.

The controlled flat rate was therefore introduced for such consumers in October, 1909, with a simple current-limiting device costing about $1. No meter is used at all, and the flat rate includes the energy used as well as the rental of the installation and simple fixtures.

Very small lighting units were installed, so as to keep the cost of lighting very low. Tungsten-filament lamps of 10-watt, 20-watt and 30-watt ratings are installed at a cost to the customer of 16, 24 and 34 cents respectively a month. This price also covers the charges for using the wiring owned by the company. In order to make conditions as favorable as possible for customers separate rates are given for lamps wired with a change-over switch, so that either one or the other lamp can be burned, at the choice of the tenant, but never both at the same time. The monthly charge for a set of these lamps is only 4 or 5 cents higher than for one single lamp, viz., 20, 29 and 39 cents for 10-watt, 20-watt and 30-watt lamps respectively. This additional price is for any additional energy consumed and the expenses of additional wiring. Supply and renewal of lamps are, however, not included. The customer buys his own lamps and in that way very soon learns that to waste energy is disadvantageous. Lamps are sold at from 20 to 25 cents each to the consumer by the electric-light company. They may be purchased elsewhere, but the lamps used must be "one watt per



№

Pauschalvertrag

Watt M pro Jahr ab

Rechnungsjahr

19

April September M

Oktober Dezember M

Januar März M

19

April September M

Oktober Dezember M

Januar März M

Bemerkungen

FIG. 14—LOOSE-LEAF ACCOUNT USED IN TRIER

hefner candle" lamps. The current limiter is adjusted to the full connected load—counting a couple of lamps so connected that each may be controlled separately but not simultaneously as one lamp. The consumer can therefore switch on all of his lamps simultaneously, the object of the current limiter being only to prevent the use of larger lamps than contracted for. Bills are payable in advance.

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[3] Through the courtesy of Mr. J. W. Lieb, of the New York Edison Company, letters of introduction were obtained to Mr. G. Semenza, chief engineer of the Milan Edison Company, who extended a very kind reception and gave very valuable information. Valuable assistance was also rendered by Mr. Renzo Norsa, of Milan, in compiling data about the Milan methods

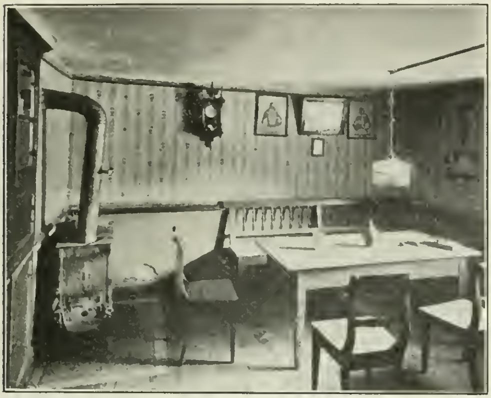

FIG. 15—ELECTRICITY IN PEASANT'S HOME IN TRIER

Relations with Contractors in Milan

Before the wiring of these so-called "popular houses" is started the owner signs a contract permitting the company to install and maintain the wiring for a period of fifteen years. Only the wiring of the riser and of the main distributing circuits is done by the company itself. The inside wiring is done by the contractors at fixed prices per outlet, by a system similar to that used in Strassburg. The prices paid by the company are $2 for each outlet and $4.20 for each pair of lamps so controlled that both cannot be lighted at the same time, including switches and fixtures. Open wiring is extensively used in ordinary residence work in Milan, but the lighting company realized that the proper upkeep of the installations in workingmen's houses would not be possible unless all the wiring were protected by tubing or molding, on account of the fact that tenants move frequently, that they belong to the poorer classes, etc. A typical two-room installation may be considered as made up of two lamps, one for each room. Fig. 5 shows the materials and fixtures used. The wires on the walls close to the ceiling are incased in wooden molding, and the leads to the fixtures and to the switches are in impregnated paper tubes with a thin metal-sheet covering.

Results Obtained in Milan

The following statistics regarding the above described popular lighting business of the Edison Company of Milan have been kindly furnished by Mr. Bertini, general manager of that company:

DATE: Dec. 31, 1912.

Buildings supplied	1,638
Customers	25,016
Total lamps connected	45,945

Lamps to the number of 12,636 are in pairs, only one of which can be lighted at a time. The number of lamps which can be lighted simultaneously is, therefore, 33,309. Of these 33,309 lamps:

	Kw
13,584 are 10-watt lamps	135.84
18,420 are 20-watt lamps	368.40
1,305 are 30-watt lamps	39.15
The corresponding total connected load is	543.39

In addition, there were 4750 flats (with 7834 lamps), corresponding to about 100 kw, which were wired but which were not rented.

The total connected load amounted, therefore, to about 650 kw. (This increased during the year 1913 to about 750 kw.) The capital invested for installations in popular houses (in December, 1912), was approximately $300,000, or about 7 per cent of the total investments of the company for generation, transmission, transformation and distribution, since the latter were valued at over $4,400,000. From the data above the following averages have been derived:

Average number of customers per building (25,016 ÷ 1638)	= 15
Average number of lamps installed per customer (45,945 ÷ 25,016)	= 1.83
Maximum number of lighted lamps per average customer (33,309 ÷ 25,016)	= 1.33
Total connected load per average customer in watts[4] (543.39 ÷ 25,016)	= 21.71
Total investment for installation per customer approximately (300,000 ÷ 25,016)	= 12.00

The company pays the local wiring contractors the following rates for the wiring in the rooms, the fixtures and the switches:

Each individual lamp	$2.00
Each pair of lamps so controlled that only one can be lighted at a time	4.20

Cost of Wiring in Milan

The cost of installation per customer is about as follows:

Riser and main distributer circuits, including auto transformer[5]	$5.50
Current limiter, fuses and connection	2.00
Wiring for one and one-third outlets at $2 an outlet	2.70
Wiring for one-half specially controlled lamps, at $4.20 per pair	1.05
Testing of the installation	0.40
Total average cost of installation per customer to company	$11.65

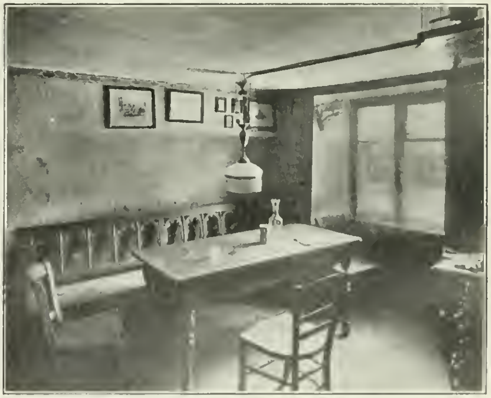

FIG. 16—INTERIOR OF TRIER COTTAGE

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[4] It is particularly interesting to note the very low wattage demand of the average customer of that class of business.

[5] When the system was first installed tungsten lamps were not yet manufactured for the voltage of the Milan system, which is 160 volts, and therefore the company decided to use 40-volt lamps with auto transformers.

This figure checks fairly with the figure of $12 given above.

The monthly gross income from this class of business amounted in December, 1912, to about $7,600, or about $14 per month per connected kilowatt, not counting houses wired but not rented. The cost of installation per kilowatt from the above figures (including installations not rented at the time) would be $300,000 ÷ 650 = $460.

FIG. 17—ELECTRICITY IN HUMBLE TRIER HOME

These figures seem to indicate a gross yearly income per kilowatt connected from this kind of business as follows:

(a) Including flats not rented: $7,600 × 12 ÷ 650 = $140. (b) Not counting unrented flats: $7,600 × 12 ÷ 543 = $168.

This, of course, must also cover the fixed charges on the money invested in the installations in the popular houses themselves, as given above.

It is the practice of the company to obtain a check on the energy consumption of such consumers as are supplied under the controlled flat rate by installing a certain number of meters and also maximum-demand indicators of the Wright type. The result of a test made on 154 buildings in that way showed that the use of the maximum demand amounted to 2270 hours a year.

Improvements Considered in Milan

Experience with this system during the space of four years has shown the desirability of some improvements. A plan now being considered and which may be adopted in the future is to have the house owner refund to the company the initial cost of wiring in instalments, the wiring becoming in the end the property of the house owner. From Table III it will be seen that this system is already largely used in Germany, where it is showing excellent results. In that case the landlord will materially assist the company in supervising the installations so that maintenance expenses will be considerably cut down. The repayment plan will also reduce the financial burden of the company.

The method of collecting bills is also open to improvement, and it has been suggested that since both the rent for the flat and the electric-light charges are payable monthly, the owner of the building be required to collect the monthly charges for lighting, together with the rent of the rooms, in return for the financial aid he received from the company in the cost of the installation. (See under Gothenburg.) This will reduce the expense of account keeping and rendering of bills, as well as the expenses of collecting, which are comparatively high, the latter being further increased by the fact that it is often necessary for the collectors to call during evening hours or on holidays in order to find the tenants at home. The collectors now receive a certain percentage of the amounts they collect. In spite of the possibility of improvements in handling this kind of business, the system has proved very effective in popularizing the use of electricity among the poorer classes. The municipal central station of Milan, which is competing with the Edison Company, is employing the same system and has also about 24,000 customers in workingmen's buildings, with 47,000 lamps. The Edison Company says in its latest (1912) annual report the following: "The notable augmentation of $86,000 is in large part due to numerous installations made in the 'popular houses' for furnishing light. . . . We have been obliged to discourage the acceptance of new applications in the 'popular houses' for a time, with a view to keeping the business within bounds, and we are now contemplating a gradual assimilation of more of this business, with some modification of the conditions under which the installations are made."

Central Station at Werdau, Saxony

The central station at Werdau, Saxony, belongs to a large company, the Elektricitäts-Lieferungs-Gesellschaft of Berlin, closely allied to the Allgemeine Elektricitäts Gesellschaft, which is operating a number of lighting stations in Germany on very progressive lines. That at Werdau may be considered as representative of these central stations.

Werdau is a city of roughly 25,000 inhabitants. The central station, however, is also supplying electricity to about fifty surrounding villages, so that the number of inhabitants served approximates 100,000. Werdau, being situated in an industrial district, has a large number of families of the laboring class who are using electric light exclusively, owing to methods of facilitating the use of electricity. As in most other cases, the controlled flat rate (current limiter), with or without methods for financing the small customer, is found to be particularly useful.

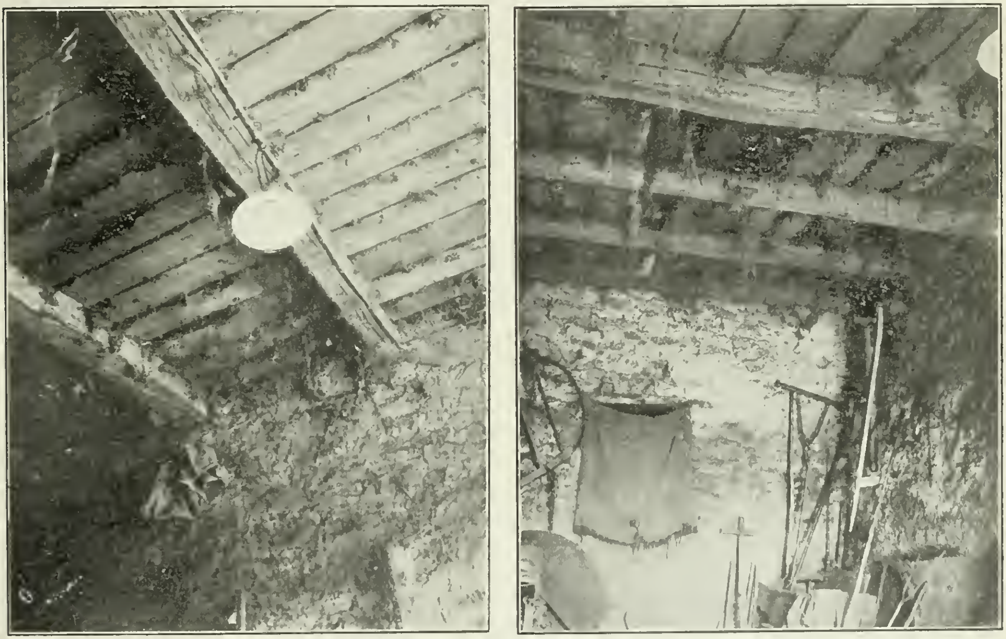
FIG. 18—PEASANT COTTAGES IN TRIER EQUIPPED FOR ELECTRICITY

The monthly rates for residences are 11 cents per 16-cp lamp, 18 cents per 25-cp lamp, 24 cents per 32-cp lamp, etc.

If the flat-rate consumer pays for his installation, he has to buy the current limiter from the central station, at a cash price of $1.80, but if a customer desires to make instalment payments he is generally accommodated

Rental Installations at Werdau

The wiring also is installed at the expense of the central station, if the customer so desires. In that case he has to pay a supplementary charge of 3.6 cents a lamp a month as rent for the installation, which includes simple fixtures but not the lamps themselves. The consumer also must contract to continue these payments for at least three years. This amount of 3.6 cents a month is based on the assumption that 15 per cent of the average selling price of the installation shall be paid off every year by the rent. The average selling price has, therefore, been assumed as being $2.90 a lamp outlet. Flexible twin cord is chiefly used in wiring these outlets. Most customers, of course, are using lamps a longer period than the contract calls for. In the few cases where the customers have moved and refused to continue the payments the central station has not found it worth while to bring any action against them.



FIGS. 19 AND 20—TWO VIEWS OF PEASANT'S BARN LIGHTED WITH ELECTRICITY IN TRIER

The customer has to pay for maintenance and repairs and for the insurance on the wiring. He does not, however, acquire the ownership of the installation by paying the rent, as is done in most other similar cases in Germany.

According to the literal wording of the conditions for connection of flat-rate installation, not less than two lamps will be connected per consumer, but, as a matter of fact, the central station also frequently connects one single lamp. Although a single 16-cp lamp at 11 cents per month does not bring any profit, experience has shown that a considerable number of customers start with one lamp and then gradually work up to a larger number.[6]

Those customers who have at least six lamps can also be charged under the Hopkinson rate scheme (demand charge plus running meter charge) and can get their installation made at the expense of the central station, at a monthly charge of 3.6 cents a lamp.

Tungsten Lamps Prescribed

Under both rates, the flat rate and the Hopkinson rate, the exclusive use of tungsten lamps is expressly prescribed, and the customers who have to pay for their lamps are particularly warned that use of the lamp reduces its life.

The central station at Werdau is also very progressive and thorough in its methods of soliciting. A very complete card-filing system is kept, every house in the city and the surrounding villages having a card of its own (size 8 in. by 5 in.) of the type shown in Fig. 9.

Of the semicircles on the upper edge of the card, the first ten on the left side indicate the occupations of the inhabitants of the respective houses, the first semicircle indicating residences, the second smiths and locksmiths, the third glaziers. The ten semi-circles on the right-hand side of the upper edge are given over to the initials of the street names. All the semicircles which do not apply to the respective building are cut off the card in the ordinary way, so that the card system becomes self-indexing. The cards for all the buildings in streets beginning with "S," for instance, or for all the locksmiths, can be taken from the file for inspection without loss of time. Below this row of semicircles there is a horizontal row of figures to indicate a date for purposes to be stated later. On the left part of this second horizontal row twelve roman

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[6] A similar experience has been recorded for Strassburg and many other places.

TABLE I—EFFECT OF FLAT RATE ON VILLAGES SURROUNDING TRIER

CONNECTIONS IN VARIOUS RURAL DISTRICTS OF SUPPLY CAUSED BY THE FLAT RATE WITH LIMIT DEVICE PARTLY WITH ASSISTANCE OF A WIRING SUBSIDY

VILLAGE NO.	RATES	VILLAGE CONNECTED SINCE YEARS	NUMBER OF CONNECTIONS IN %		REVENUE FROM PRIVATE LIGHTING PER INHABITANT PER YEAR		FLAT RATE INTRODUCED SINCE	SUBSIDIARY WIRING INTRODUCED
			PREVIOUS TO FLAT RATE AND TO SUBSIDIARY WIRINGS	NOW	PREVIOUS TO FLAT RATE AND TO SUBSIDIARY WIRINGS	NOW		
1	10.8¢ per kw hr + 12¢ per mo meter rent or double rate*) 10.8¢/4.8¢ per kw hr Ave. price 7-7½¢ per kw hr meter rent 36¢ per month	8	10	31	$0.32	$0.61	Oct 1st 1911	No Subsidy
2		3	19	42	0.43	0.65		
3		3	11	27	0.37	0.55		
4		3	10	44	0.34	0.60		
5		3	20	29	0.45	0.55		
6	8.4¢/kw hr + 24¢ meter rent per mo. double rate 10.8¢/4.8¢ per kw-hr Ave price 7-7½¢/kw hr meter rent 36¢ per	9	6	22	0.13	0.29	Oct 1st 1911	No Subsidy
7		7	10	30	0.21	0.46		
8		7	14	33	0.47	0.74		
9		9	19	45	0.42	0.72		
10	8.4¢/kw hr. + 10¢ meter rent per mo Flat rate 1-Lamp of 60 W $3.60 p.y every successive lamp $2.40 p.y.	4	18	61	0.27	0.67	Apr. 1st 1912	$4.80 Subsidy for every new lighting installation since Jan 1st 1913
11		7	17	74	0.31	0.70		
12		7	22	66	0.38	0.66		
13		4	47	97	0.71	0.96		
14		4	50	100	0.70	1.00		
15	10.8¢/kw-hr. + 12¢ meter rent double rate*) 10.8¢/4.8¢ Ave price 7-7½¢ per kw-hr. meter rent 36¢ per mo. Flat rate 8.6¢ p. 10 Watts Min 60, Max 300 Watts	1		74		0.74	Apr. 1st 1912	$0.96 Subsidy for every lamp installed within 3 mo after operation of local lines is begun
16		1		60		0.60		
17		1		68		0.74		
18		1		90		1.37		
19		1		76		0.65		

*) "Double Rate" is a rate system rather frequently used in Germany whereby a certain higher charge is made during peak load hours – in this case 10.8¢/kw-hr – and a lower one – in this case 4.8¢ – for off peak hours. Meters which automatically switch over to on- and off-peak rates resp. every day are used. The development is not yet concluded

Dated Feb. 1st 1913

figures indicate the month, and thirty-one arabic figures on the right side allow the date of the month to be marked. Below this a space of about half an inch in height is set aside to write down the village, the street and the street numbers of the respective houses, below which space a table can be seen, the four horizontal divisions of which are set aside for the first, second, third and fourth floors. Every one of these horizontal divisions is then divided into vertical subdivisions to receive the names and data of the respective tenants on each floor as indicated in the translated reproduction of the card.

The code printed at the bottom of the card is used for filling in the last column. Of this code the cipher "3" (next visit to be made on date of ———) has to be followed by a date, and this same date is indicated by green riders as shown in the illustration. This is the object of the second row of figures from the top, which indicates dates as mentioned above. These riders, therefore, serve also to indicate at a glance which visits should be made every day. Red riders are used if there are prospective customers in the respective houses, and blue riders for such large customers as are of particular importance and on whom an eye should be kept. The vertical rows of letters on the left and right edges of the card are used to indicate the first and last letter of the name of the respective village.

The solicitor, when starting on his rounds, gives receipts for cards from the filing system for as many streets as he thinks he can work within a certain period of time and proceeds quite systematically from one house to the next. The cards are filled in only with pencil, so that the entries can be changed as necessary. The solicitors, as in almost all other cases, receive a fixed salary, and a commission for every lamp or horse-power secured, the commission being 18 cents per incandescent lamp and 24 cents per horse-power connected.

Werdau Advertising Methods

Personal visits of the solicitors to the prospective customers are recognized in Germany to be the most effective means of advertising. This does not mean, however, that invariably they are the only method of advertising. A vigorous advertising campaign is being

TABLE II—SYSTEMS EMPLOYED IN PAYING FOR WIRING INSTALLATIONS

	METHODS OF FINANCING SMALL CONSUMERS						
METHOD	Installation made at Electric Light Company's expense Sometimes called "Gratuitous Installations"				Installations made at consumer's expense Non repayable subsidies towards cost of Installation granted by Electric Light Company		
	Consumer acquires ownership by:-		Consumer does not acquire ownership and pays for capital invested by Electric Light Co. by:-				
	Having made installment repayments for a certain number of years	Having paid the minimum bill guaranteed under these contracts for the stipulated number of years	Paying a certain rent which in case of flat rate can be included into the latter	Using prepayment meters which charge a higher rate than the ordinary one	In cash as certain amount per lamp	As reduction of rates for a certain period of time	
						Gratuitous Energy One Year not exceeding amount of (previously approved) Cost of Installation	70% Discount First Year
NAME	Instalment "Installation" System		"Rental Installations"	"Gratuitous Installations with Prepayment Meter"	"Subsidiary Installations"	"Gratuitous Energy One Year System"	
EXAMPLES	Strassburg Country, Strassburg City 2nd 3rd and 4th Lamp Dortmund, Munich for Fixtures Dortmund	Strassburg City 1st Lamp	Milan (rent included in flat rate,) Werdau (both with flat rate and meter rate) For Fixtures Munich	Dortmund Elsterberg	Trier Borås	Gothenburg Borås	Drammen
	The large soliciting power of the flat rate alone without any methods of financing or advertising is illustrated by the example of Oberschlesische Elektrizitätswerke						

carried on in newspapers and by pamphlets. Groups of consumers are invited to inspect the central station. Speeches are delivered at these times, for instance, to the effect that the factory chimneys must disappear, everything must become electrical, etc., and the daily press prints these speeches. At other times all the farmers of the surrounding country receive invitations, care being taken that they get acquainted with everybody in the administration of the central station. At Christmas consumers and prospective consumers receive little presents, with the compliments of the central station; for instance, one year the latter sent out honey cakes with a colored sugar crust showing a picture of a tungsten incandescent lamp as good as it could be made with that crude material (Fig. 6). This cake was inclosed in a box, both sides of which are also shown in this illustration. The bottom side shows a picture of an incandescent lamp, whereas on the top are printed doggerel rhymes about the many different uses to which electricity can be put, each line beginning with the word "electric." Another year a thermometer on a base in the shape of an incandescent lamp (Fig. 8) was given, packed in a cardboard box. Both sides of the box are also shown in the illustration, one side having a picture of a number of energy-consuming devices under a Christmas tree, the other side being marked with the ordinary signs which are used with shipping cases with fragile contents, except that, besides the rough drawing of the glass which is ordinarily used in such cases, the outline of an incandescent lamp also appears.

The result of all these methods of soliciting and advertising, of financing and charging, is that at present, in the country communities around Werdau which belong to the supplied territory, about 90 per cent of all possible customers are already connected, and in the city of Werdau 30 per cent are connected. To appreciate this latter figure, it should be remembered that, as stated before, Werdau has only about 25,000 inhabitants. The percentage of consumers in small towns is not so great as in larger cities, and moreover in the little town of Werdau electricity has to compete with gas. It should be noted also that the gas company has followed the example of the electric company and imitated its financing methods. The gas company does even more than the electric-light company and promises the customer to install his gas mains gratuitously if he will contract to use no electricity on his premises within five years.

Instalment Installations at Dortmund

Among the many central-station companies where systematic and successful efforts are made for increasing the load by the acquisition of small consumers, the central station of Dortmund, in the Westphalian industrial district, is one of the most prominent and interesting. As can be seen from Table III the company provides both instalment-plan installations and rental installations.

The installations on the instalment plan are made for from one to twelve sockets. The consumer pays 58 cents a year per lamp and an additional sum of $2.30 for the panelboard; or, if more than one panelboard should be used in the house (as, for instance, in tenement houses), this latter charge is reduced to $1.15 per board. These charges are payable in monthly instalments for four years and include the refunding of the cost of wiring, so that, after that time, the installation becomes the property of the consumer. As the table also shows, this period of four years is rather short as compared to the time allowed in some other cities, which is as long as ten years. These consumers are served under the regular meter rate at from 7 cents to $9\frac{1}{2}$ cents maximum per kw-hr. (the rates vary slightly in different villages).

Rental Installation with Prepayment Meter Rate

Very small consumers with from only one to three lamps connected can choose a prepayment meter rate with the installation also made at the expense of the electric-light company. In such a case the customer does not have to refund the cost of installation; the latter accordingly remains the property of the electric-light company for an indefinite time. These prepayment meter consumers buy energy at a slightly higher rate than the ordinary meter-rate customer, namely, at 12 cents per kw-hr., and have to bind themselves not to use any other illuminant. As is evident, such a rate is especially adapted for the poorest people, since only very small amounts are payable at one time.

The third optional rate for very small consumers is a flat rate with a limiting device, at 24 cents per month for 30 watts, 30 cents for 40 watts, 48 cents for 60 watts, and so on, 24 cents being charged for every 30 watts up to $2.88 for 360 watts, which is the maximum.

The number of installations made at the expense of the central station was most gratifying in Dortmund, with its large laboring population. In two months 1000 sockets were installed at the expense of the electric-light company for gratuitous prepayment meter installations of from two to three lamps each. Lamps and fixtures are not included, but the consumer may rent the fixtures from the electric-light company.

Rental of Fixtures

About four years ago the municipal plant at Dortmund discovered that there were quite a number of residences in the city which, although wired, were not connected to its lines. The bill collectors were commissioned to find out why the houses were not connected. In Dortmund itself, a city containing about 150,000 inhabitants, 700 wired houses in laborers' quarters were not receiving service. The reason given ordinarily was that electricity was "too expensive," but on delving more deeply into the matter it was found that the real reason was that the tenants had come from flats where they had been using only gas or oil and were not willing to incur the expense of installing electric fixtures. As a result of these investigations, the lighting company resolved to rent electric fixtures as the local gas company had already been doing with gas fixtures. At present thirteen different types of fixtures are being rented at prices ranging from 4 cents monthly for simple ceiling fixtures with enamel reflectors to 72 cents per month for elaborate chandeliers for four lamps. The price for putting the fixtures in place is 48 cents. After the rent has been paid for three successive years, the tenant acquires ownership, so that the payments which are designated by the company as rent are actually instalment payments. In order not to cause dissatisfaction among the contractors, and to avoid criticism by them, the rents are fixed high enough so that a three years' rent amounts to the list price of the fixture, the list prices being, moreover, so high that discounts of from 60 per cent to 70 per cent are ordinarily given.

On Jan. 1, 1913, about three and one-half years after the system had been introduced, rental contracts for 11,300 fixtures had been made, of which 5500 were contracted for in the last year alone. It was possible to fulfil these 11,300 contracts with a supply of only 10,500 fixtures, since a certain number had been returned to the company before the expiration of the three years in cases where the tenants moved out of town, and these returned fixtures were polished up (and, if necessary, repaired) and rented out a second time. The customer when moving before the expiration of the three years has the option either to return the fixtures or to pay the balance in cash. Ordinarily the customers choose the latter alternative, in case they have paid the rent for more than one and one-half years; otherwise they usually return the fixtures.

The total capital invested for these 10,500 fixtures is $17,800. The revenue from renting fixtures during these three and one-half years was $12,600. The capital outlay during the greater part of these three and one-half years was, however, considerably lower than $17,800. Since the instalment payments for the fixtures extend over a period of three years, the company may expect an additional $26,400 from that capital of $17,800 within the three succeeding years, 1913-15. Aside from this, there was the increase in energy sales, which after all was the real object.

It should be stated that the fixtures are furnished complete, including tungsten lamps and the labor for connection. The cost of the lamps and labor is not included in the above figures, but it does not materially change the results. The experiences in Dortmund show clearly that it is not only the cost of wiring but also the cost of fixtures which deters the small customers from getting their light from the central station.

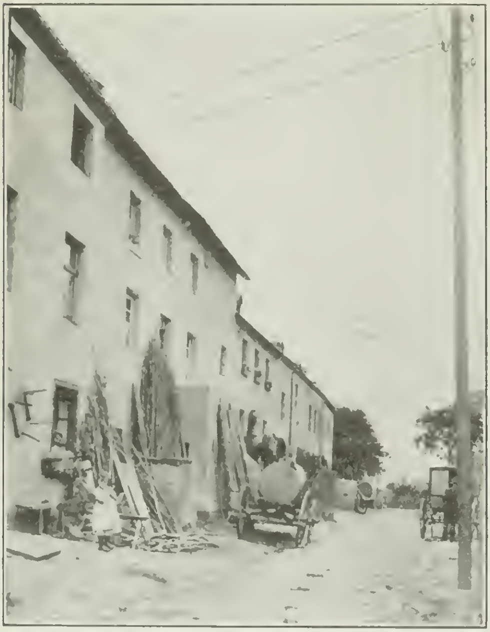

FIG. 21—TRIER COTTAGES WIRED FOR ELECTRICITY

Energy Consumption of Flat-Rate Customers

Director Döpke of the Dortmund central station has made some interesting experiments with demand limiters. For purposes of comparison, in 500 houses watt-hour meters were installed in addition to the demand limiters, with the following results: The amount paid under the flat demand rate, reduced to the average price per kilowatt-hour actually consumed, was between the limits of 3¼ cents and 10 cents and in one case reached 20 cents per kw-hr. In this latter case, however, the consumer was notified that he was not using the electric light to its full advantage, as the electric-light company is of the opinion that where the flat rate is used the people should get the full benefit of it. The total average price per kilowatt-hour for all flat-rate consumers was 6¼ cents. The annual use of the maximum demand flat-rate consumers varied between 3007 and 840 hours a year.

Advertising and Soliciting

Outside of these schemes of wiring houses at the central stations' expense and of renting installations and fixtures, the company also carries on an active advertising and soliciting campaign. Personal canvassing is considered the most effective means of advertising. It has been found important in soliciting the small man's business, especially in the country, that the prospective customer find in the solicitor a man of about his own education and possessing his own ways of thinking and talking. Consequently the solicitors are mostly chosen from the staff of wiremen, such men being selected as have shown a certain gift of speech and ability for handling men. These wiremen go out with their uniform caps and talk in Low German dialect to the customers, thereby obtaining a better hearing from the latter.

Nor is the more impersonal method of advertising by printed matter neglected. The central-station company, for instance, issues a monthly periodical describing the various uses of electricity, notes about the progress of the central station, etc., and everything is of course profusely illustrated. Theater programs have printed on the border: "Electric Light—Everybody's Light! Cheap! Cheap! Cheap!"

Canvassing Rural Population at Neuss

Another interesting case of canvassing among the rural population is afforded by the municipal central station of the city of Neuss. According to Mr. Frank, of Neuss, lectures are given in winter in the village inns, and expositions are held to which the people are invited at the close of the church service. Every village is revisited about every second year. The lectures, of course, give information about the cost of electric light. During the lecture the audience is informed that repairs will have to be made on the electric lines near the respective villages, and that all applicants for electric light during that time will be connected to the lines without charge for service connections. Wiremen take seats among the audience at the tables and are paid a commission for every application they get. After the lecture applications and discussion are invited.

Electric Service at Munich

Among the many interesting places where similar efforts are made to extend the use of electricity is the city of Munich. In 1911, simultaneously with the electric exhibition in Munich, the electrical rates in that city were lowered from 14½ cents to 12 cents per kw-hr., and a few optional rates were introduced in addition to the straight meter rate. Three other innovations were made to push the use of electricity, as follows: (1) An information office was established in which an employee of the central station gave all required information by word of mouth. This office is maintained in connection with a permanent exhibition of heating and cooking appliances. (2) Wiring for staircase lighting in apartment houses, as well as the mains for lighting the rest of the building, is installed at the expense of the city; repayment of the cost to be made in eight yearly instalments. In Munich and in a number of other German cities staircase lighting is done on a flat rate in connection with an automatic time switch. (3) Every apartment-house owner who installs the mains with branches to every flat and guarantees to light his staircase electrically with at least three lamps for five years is connected to the street circuits free of charge.

The effect is shown by the following figures: In 1911 547 house connections were made and 2077 meters installed, and in 1912 1225 house connections were made and 5286 meters installed.

Furthermore, light fixtures, flatirons, etc., are rented at prices covering only the expenses, as, for instance, a desk lamp at 5 cents a month and a four-lamp chandelier at from 15 cents to 20 cents a month. These fixtures, however, do not become the property of the consumers after a certain period of time, as in Dortmund, but remain the property of the city. Printed on the backs of bills are illustrations of fixtures which are for rent.

As regards the effect of articles on the uses of electricity, which are printed every now and then in the daily papers, Director Zelle of the municipal central station in Munich pointed out that the inquiry office, established for the use of consumers and prospective consumers, ordinarily gets from fifty to sixty inquiries a day, but on the days following the appearance of an article in the papers from 180 to 200 inquiries are received.

Trier

Also in the city of Trier the central station gets good results from its methods of pushing the use of electricity among small consumers. These methods have to be confined, however, to rural communities, since in the city itself the (municipal) central station is not permitted to make any advances or payments on wiring installations because the gas works also belong to the city.

Rural customers, however, receive a subsidy of $4.80 from the central station for the first two lamps installed, which subsidy is not repayable and is granted only if the customer connects within a certain number of months after his respective village has been connected to the lines of the central station. The result has been that no village has yet been connected with less than 50 per cent of the possible consumers on the lines. The contractor who does the wiring receives the $4.80 directly from the central station and has to subtract that amount from the bill rendered to the consumer. Moreover, no charge is made for service connection and no fees are levied for examining and testing the installation.

Flat Rates at Trier

The following experiences and views are taken from lectures and other statements by Director Henney of the Trier central station:

Flat rates, about 87 cents per 10 watts a year, are extensively applied by the city of Trier. The inhabitants of the agricultural communities around Trier for the most part have very limited incomes and would not countenance the watt-hour meter. The management of the central station concluded that the watt-hour meter is and always will be an odious instrument for small consumers, and one in which they will have no confidence. This method of charging is foreign to most of them. The impossibility of knowing the annual expense in advance, and the irregularities which occur make the meter an instrument of control, in their eyes, which has to be viewed with the greatest distrust. This distrust cannot be banished, either by lectures or by experience. In addition to this, the meter rent is regarded as unjustifiable. Farmers, small tradespeople and laborers can therefore generally not be induced to use electric light under the meter rate. Moreover, in those few households which are connected under the meter rate, the yearly income of the central station for lighting, due to excessive economy on the part of the consumer, often does not exceed $2.50 per family. These revenues will still decrease in the years to come, in consequence of the brilliant progress which the art of lamp manufacture has made in the past few years. In many plants they will not cover actual expenses.

The flat rate with current limiter is an excellent method to push the business, to secure a sufficient revenue from the customers, to reduce the fixed expense per customer, and to reduce the capital invested.

Table I shows the results of the flat rate in nineteen communities around the city of Trier, proving the first two points of the above statement, as far as that particular central station is concerned.

Flat Rate a Feeder for the Metering System

It might be stated here that in a number of cities—for instance, in Eschwege—experience has shown that frequently customers who were connected up under a flat rate after some time shifted over to the optional meter rate. Although, therefore, the relation between the numerical values of the flat rate and the meter rate in these cases apparently is such that these consumers pay less on the meter basis, still the flat rate was more successful in getting them on the lines. These customers could not be connected at the meter rate; in other words, the flat rate is a good business getter.

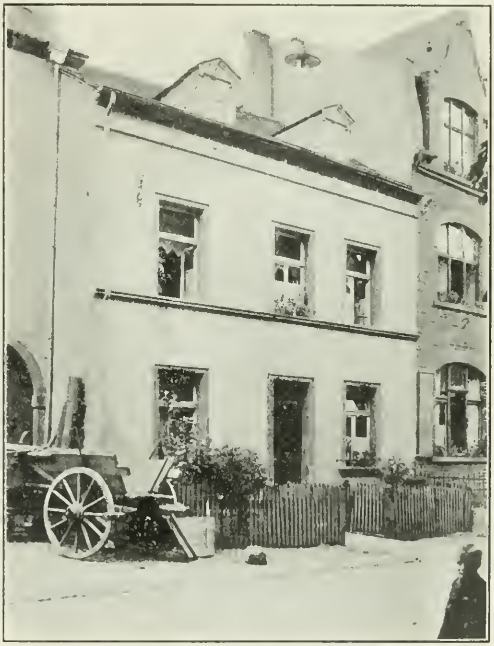

FIG. 22—SERVICE TO TRIER COTTAGE

As regards the third point, the reduction of fixed expense per consumer, the Trier flat-rate charge of about 87 cents per 10 watts is collected in three equal instalments on Oct. 1, Jan. 1 and April 1, thus leaving six months to cover for the summer instalment and three months only for each of the winter instalments. This, of course, simplifies accounting and collecting very much. In the bookkeeping department every consumer gets a leaf in a loose-leaf accounting book (Fig. 14) and a card in a card file. On the head of the leaf below the name, address and number of the customer are entered the number of watts for which he has contracted and the corresponding yearly amount. Below these are printed forms of the following shape, for a number of successive years:

Year
19..
April September . . . . . marks. . .
October, December . . . . marks. . .
January/March . . . . marks. . .

These three lines are sufficient for the whole year, and since in every line the same amount has to be inserted, unless the consumer's contracted load is altered, it is evident how very much simplified bookkeeping becomes with this rate system. As regards billing and collecting, the bill is simplified in a similar degree and is remarkable for a little scheme of charging the customer for delays in payment which necessitate a second and third visit of the collector. Fig. 10 is a photograph of the bill showing on the left-hand side three detachable coupons, the top one reading:

FIG. 23—COTTAGES IN TRIER WIRED FOR ELECTICITY

COLLECTING OFFICE: BAHNHOFSPLATZ 11.
Open 9-12, 3-5. Closed on Sundays and Holidays.
POST-CHECK ACCOUNT NO. 8800. POST-CHECK OFFICE.
COLOGNE.
1.
MUNICIPAL CENTRAL STATION TRIER.
The flat-rate payment agreed upon amounts to M. . .
First visit of collector.

The second coupon (leaving out the head of the coupon, which is the same as above) reads:

The flat-rate payment agreed upon amounts to M. . . . .
Second visit of collector. 0.10
Total M. . . . . .

Similarly the third visit shows also an increase of 0.10 mark, or 2.4 cents, for the collector's visit. In case the customer pays the collector at once on receiving the first visit, the whole bill, with all three coupons, is left with him, and the second and third coupons are of no further use. Otherwise he keeps only the top coupon, and the rest are taken by the collector.

Flat-Rate Collecting Cards

Other instances of collecting cards in other places with a flat rate are given in Figs. 11, 12 and 13, one of the Oberschlesische Elektricitätswerke, where the amount is collected quarterly, and the other one in Potsdam, near Berlin, where the bill is to be paid either quarterly or monthly. A receipt form is made out for the whole year and the amount is collected every month in advance. This receipt form on cardboard is divided by perforations into twelve coupons, and one of them is simply torn off every month when the payment is made and handed over to the customer as a receipt by the collector. In this way clerical work is very much reduced.

Even this simple procedure is still further simplified by a number of central stations for certain consumers, especially if the periodical payments are to be made weekly, which, of course, is desirable for the poorer class of people, such as laborers, etc. Sometimes, for instance, the proprietor of a beer garden does the collecting for the central station, either for a small fee, or he may be satisfied by drawing the people into his locality in that way, on the same principle as the drugstores in this country are selling postage stamps without any direct profit, simply relying on the increased opportunity for sales which they get thereby.

In other cases the municipalities of villages and small towns will do the collecting for the central station for a nominal compensation. Also the post is used for collecting by means of the so-called "post-check system," which might be described as a simplified and cheapened money order, whereby the sender does not have to go to the post office but can use any letter box.

In industrial districts, where weekly payments are made on the flat-rate basis by laborers, the bills are collected by factories by deducting the constant and known amount of these payments each week from the wages. The factories do not make any charge for attending to this collection, because they are glad to contribute in this way to the betterment of the social conditions of their laborers without any expense worth mentioning.

The expenses of the central station with 3000 meter consumers have been found to average in Trier about $1 a year for meter reading, accounting and collecting, an amount which seems low in comparison with that given by other central stations. Meter reading, of course, becomes entirely unnecessary with flat rates, and collecting is done in three annual instalments as described above, thereby reducing the collecting charges considerably in comparison with meter rates. According to the experiences made so far, 75 cents can be saved from these expenses per customer a year, which is a very substantial percentage of the average revenue from small lighting customers.

Losses from Extravagant Use of Energy Under Flat Rate Not to Be Feared

It is sometimes stated as a drawback to the flat rate that losses can be caused to the central station by the extravagant use of the energy on the part of the flat-rate consumer. In reply to this it ought to be considered that the above saving of 75 cents enables the central station to provide with energy the average small consumer of 70 watts at a cost of 0.75 cent per kw-hr. for about 1400 hours a year beyond the ordinary period of time without incurring a loss. It might also be stated that the energy loss in the potential coil of a watt-hour meter ranges from 12 kw-hr. to 20 kw-hr. a year and more, according to the type of instrument used and the voltage. The meter system, therefore, in addition to the maintenance expenses of the meter, causes an extra expense which for small consumers is not at all negligible. By considering the losses in the potential coil the above figure of 1400 hours is raised by several hundred hours.

As regards the fourth point, the capital invested, it is self-evident that by using demand limiters, which cost only a fraction of the price of a meter, in place of a meter, the capital invested for small customers will be considerably reduced. It is also sometimes considered an injustice of the flat rate that "one consumer pays more per kilowatt-hour than another one."

The fundamental lines of reasoning in the following paragraph are taken from lectures, addresses, etc., by Director Agthe, of Gleiwitz, it being principally a quotation from his Berlin lecture on Feb. 17, 1913:

The cost of construction of the total equipment for furnishing electricity approximates roughly $400 per kw.[7] The diversity-factor for the general system appears to be somewhere between two and one-half and three and one-half. Considering, however, very small residences, for which the flat rate is chiefly recommended, it may be assumed that the diversity-factor is not more than perhaps two, since a larger percentage of the lamps will be burning during the whole evening than in average residences. Under these assumptions the capital per kilowatt of connected load will be roughly $200 and, allowing 12 per cent for interest and depreciation, the fixed expense will be about $24 a year per kw. The operating expenses consist of fixed and variable charges, the former amounting to approximately $12 per kw and the latter to about ¾ cent per kw-hr. or less. The yearly expenses per kilowatt are, therefore, in case of a very small load-factor, roughly from $37 to $40 and, in case of a load-factor of 1900 hours per year, roughly $50.

This small increase in the expense between no load and the large load-factor represented by 1900 hours shows that the flat-demand rate is comparatively just, even in cases of rather variable load-factors. If it is claimed as an objection against the flat rate that the customer who is wasting electricity gets his energy cheaper than his neighbor, it will be understood from the foregoing that the objection to a straight meter rate, where a customer with a small load-factor obtains his kilowatt demand cheaper than his neighbor, is a more severe one, because the kilowatt demand bears a more important part in building up the cost than the kilowatt-hour.

The results of the flat rate in Trier, combined with the wiring subsidies previously mentioned, are shown in Figs. 15, 16 and 17, which are photographs of some inside installations in the residences of very poor peasants around the city of Trier. Figs. 19 and 20 show a typical barn of a poor peasant lighted electrically, and Figs. 18, 21, 22 and 23 depict the outside of a number of cottages which clearly indicate that they belong to the poorest classes, whereas the insulators on the walls and the house connections prove that electric light is used within.

As regards the influence of a proper flat rate on the use of electric illumination among the poorer population another instance may be cited. Mr. R. G. Hochstein reports in the *Elektrotechnische Zeitschrift* of Feb. 20, 1913, page 215, that flat rates in Egypt have been introduced with such good effect that in many Arab quarters even the most ruinous, rickety, tumble-down shanties have their flat-rate lamp and oil is hardly used at all any more.

Flat Rate in Leipsic

In the city of Leipsic, in Saxony, flat rates have been in effect since 1900, on the connected load basis. Since 1910 the flat rate has been changed over to a demand-limit flat rate, with the following results:

1900: 688 flat-rate installations and 964 meter installations.
1905: 1,952 flat-rate installations and 5,131 meter installations.
1910: 7,989 flat-rate installations and 6,919 meter installations.
1911: 12,343 flat-rate installations and 5,717 meter installations.
1912: 16,293 flat-rate installations and 5,148 meter installations.

The printed statistics on this matter are rather confusing. The number of inhabitants of Leipsic is 600,000.

The 16,293 flat-rate installations brought a revenue of $188,000, or $66.50 per kw-yr. The total average revenue of the central station from all consumers is $48 per kw-yr.

Oberschlesische Elektricitätswerke

One more example of a flat rate with a limiting device is afforded by the Oberschlesische Elektricitätswerke in Prussian Silesia. This company is a pioneer in spreading the use of electricity among the small consumers merely by the use of a judicious rate system. This latter is a flat rate with limiting device for small loads of between 30 watts and 1000 watts. The price is $57.60 per kw per year plus a constant yearly amount of $1.44 for every installation, with the restriction that the average cost per kilowatt-year must not be more than $72. This means that small consumers up to 100 watts pay 72 cents for every 10 watts per year, and larger consumers, gradually decreasing with the size of the installation, from 72 cents to 59 cents per 10 watts per year.

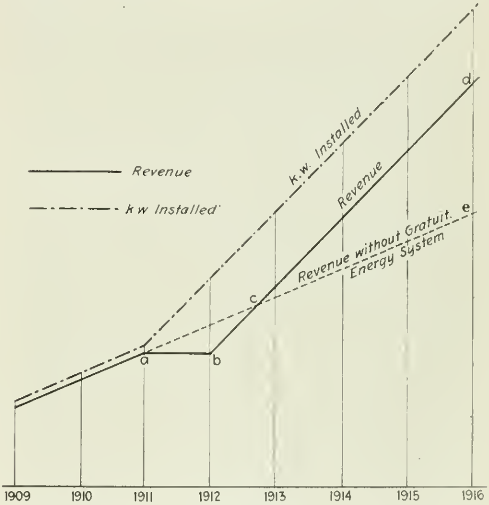

FIG. 24—EFFECT OF FREE-ENERGY SYSTEM OF WIRING ON REVENUE

The electric-light company outlines the advantages of the flat rate to the consumers as follows:

(1) The consumer knows in advance what amount he has to pay every year.

(2) Payments are made in equally distributed quarterly instalments.

(3) By the installation of a limiting device the consumer is protected from unintentional increases of load and from the resulting additional expense.

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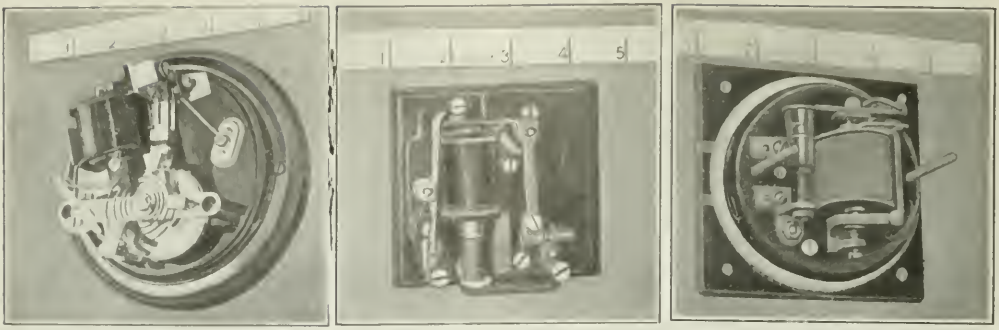
[7] According to Table 72 on page 70 of the Bureau of the Census, "Special Report, 1907, on Central Electric Light and Power Stations," the average cost of plant and equipment per kilowatt rating of the plants of the United States in 1907 was $405.



FIGS. 25, 26 AND 27—VARIOUS TYPES OF INEXPENSIVE MAXIMUM-DEMAND INDICATORS

(4) The annual expenses for small and medium-sized installations are, as a rule, lower with the flat rate than with the meter rate.

The latter point, of course, as well as the success of the flat rate as a whole, when compared to the meter rate, depends largely on the relative value of the figures (cents per kilowatt-year and cents per kilowatt-hour) employed in the rate schedule.

Flat Rate in Competition with Oil and Candles

The electric-light company further points out that with this flat rate electricity can be used in any household if $2.15 a year, or 18 cents a month, can be allowed for lighting (30 watts). Where kerosene oil is used experience shows that even very small families use more than 2 gal. of oil, at a cost of about 35 cents per month. This example quoted by the electric-light company of a family using a maximum simultaneous demand of 30 watts only to cover their total demand for lighting shows what very small consumers the electric-light company has on its lines and is soliciting.

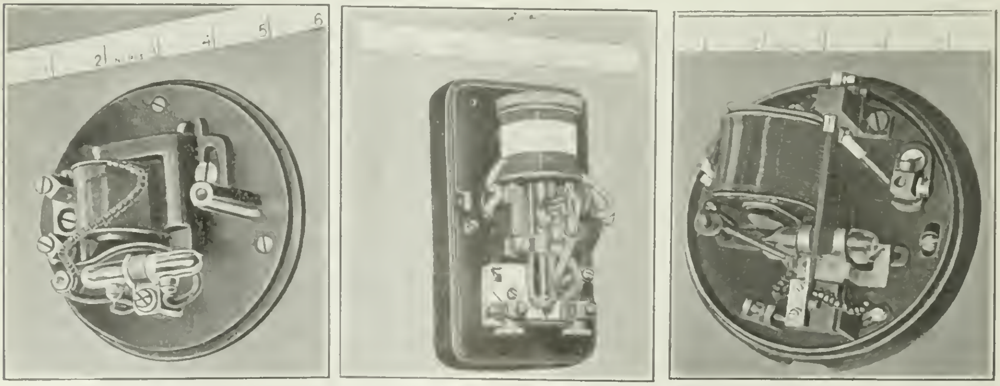
Another rate of the Oberschlesische Elektricitätswerke optional with the flat rate is the Wright demand rate, at 9.6 cents per kw-hr., up to 500 hours' yearly use, and 1 cent per kw-hr. for the rest. The flat rate, however, is so popular that on July 31, 1913, over 18,000 consumers were using the flat rate and only 2500 consumers were connected on the Wright demand rate.

Data on Flat-Rate Consumers

The relative size and number of flat-rate consumers on March 1, 1911, are given in a table which was published in the *Elektrotechnische Zeitschrift* on Nov. 30, 1911. The 9818 flat-rate consumers who were on the lines on that date were subdivided into the following groups:

772 with loads from 30 to 50 watts.
2852 with loads over 50 to 100 watts.
2345 with loads over 100 to 150 watts.
1333 with loads over 150 to 200 watts.
727 with loads over 200 to 250 watts.
840 with loads over 250 to 375 watts.
479 with loads over 375 to 500 watts.
267 with loads over 500 to 750 watts.
112 with loads over 750 to 1000 watts.
70 with loads over 1000 to 1500 watts.
21 with loads over 1500 to 2500 watts.

On July 31, 1913, there were 18,051 flat-rate consumers connected out of a total of 23,000 consumers. This, taken in connection with the above figures of 9800 flat-rate consumers on March, 1911, shows that within two and one-half years the number of flat-rate consumers has increased by more than 8200, or 84 per cent. The territory of supply extends over thirty-nine towns and villages, with 650,000 inhabitants. It is claimed that even the most prominent large cities of Germany rank far behind Upper Silesia, the territory of supply of the Oberschlesische Elektricitätswerke, with regard to the consumption of energy for private lighting per capita. These results are all the more remarkable since the company has no solicitors at all and does not do much advertising. According to German statistics of 1913, about 10 per cent of all the customers were on the flat rate on that date.



FIGS. 28, 29 AND 30—VARIOUS TYPES OF INEXPENSIVE MAXIMUM-DEMAND INDICATORS

Gothenburg

Another method of popularizing the use of electricity was first introduced by Mr. Wikander, at present in Berlin. Mr. Wikander had been building the municipal electric central station in Gothenburg in Sweden some six years ago, and a yearly income of $80,000 to $110,000 had been estimated, when, just at that time, the metal-filament lamp made its appearance, and it was then believed that the revenues of the central station would be seriously impaired and fall below the required amount. At that time there were only 100,000 lamps installed, whereas the capacity of the newly erected central station and its feeders was sufficient for double the amount. Energy for another 100,000 lamps would therefore not have cost much more than the extra fuel used. Current limiters were not a commercial possibility at that time, and the scheme of free installations or wiring subsidies was not feasible, since nearly $2,000,000 had already been spent and it would have been impossible to obtain more capital from the municipality for that purpose.

Gratuitous Energy Scheme

Another inducement to secure new customers had to be found, and Mr. Wikander announced that every consumer who would wire his house at his own expense would have the expense refunded in gratuitous energy (computed at 9 cents per kw-hr.) during the first year, provided the consumers guaranteed the consumption of a certain number of kilowatt-hours for the year following. This plan has been in effect since October, 1909, and the result is that the central station has furnished a large number of kilowatt-hours "gratuitously."

The central station rapidly reached the limit of its capacity. The original number of 4800 customers had risen to 12,000 in 1912 and 20,000 in April, 1914 (total population 165,000), and the city expects to have all residences as customers within a few years.

To any one who has an electric installation made at his own expense the central station furnishes free energy for a period of time until the price which this amount of energy would have cost under the regular rates reaches the cost of installation, provided that this period does not exceed one year, and under the following conditions:

(1) That electric installations in the respective localities have not been connected to the central station previously (so that consumers cannot replace old installations by new ones at the expense of the central station).

(2) That the new installation necessitates separate meter readings (so that no unprofitable extensions in attics, cellars, etc., can be made at the expense of the central station).

(3) That the cost of installations for which gratuitous energy is furnished be not more than $4 per lighting fixture, or $13.50 per motor (so that only simple installations are paid for in this way).

(4) That a revenue for the following year is guaranteed to the central station from the respective installations of at least $1.35 per lighting fixture and at least $5.40 per motor.

The above applies only to residences, staircases, small shops and workshops in special cases, according to the judgment of the central station (so that gratuitous energy shall not be furnished for many new buildings in which other lighting methods are out of question).

The house owner has to agree to keep the installation in good repair for at least five years and to keep it at the disposal of the tenants gratuitously.

The installations are made exclusively by private contractors, and after approval of the estimate by the central station the consumers ordinarily agree with the contractor for a payment on account to be made at once and instalment payments for the balance. The most convenient payment method for the consumer is, of course, by monthly instalments, so that he has the impression of paying a bill for energy used. Since the cost of the installation is higher than the cost of energy during one year, the customer gets the habit of using electricity freely, which in its turn benefits the central station in the following year.

To illustrate the effect of this system on the development of the central station Mr. Wikander, whose own words have been followed closely in the preceding, has prepared a diagram (Fig. 24) which assumes that this system has been introduced at the beginning of the year 1912. Before that time the kilowatts installed and the revenue have been increasing proportionately to each other. On the introduction of this system the revenues remain constant for a year, because almost all newly installed lamps are using energy gratuitously. The kilowatts installed, however, have increased very much more than in the preceding years.

In the second year, 1913, the revenues, too, are increasing more rapidly than previously.

The additional cost to the central station for energy furnished is only about ¾ cent per kw-hr., so that every lamp installed under this system costs the central station (the rates being 9 cents per kw-hr.) not more than 33 cents if the cost of installation reaches the upper limit of $4.

Showing of the System

The method has been applied in Gothenburg since 1909 and has had the following results: During 1910 alone the number of consumers increased by 31 per cent from 5980 to 7785, although the building activity was very small.

The numbers of customers connected under the free-energy system during the first three years, in the order of the size of installation, were as shown in the accompanying table.

Presumably most of the 2864 consumers with fewer than five lamps could be induced to connect only on the "free-energy system." The expenditure for "free energy" was nominally $77,000—computed at the rate of 9 cents per kw-hr., although the actual additional expense to the central station was in the neighborhood of ¾ cent per kw-hr. Therefore the energy furnished actually represents $6,400, or $2,100 a year, or less than one-half of 1 per cent of the company's total revenue of $500,000.

CUSTOMERS CONNECTED UNDER FREE-ENERGY SYSTEM AT GOTHENBURG

Size of Installation	During First Three Years	Percentage
1 lamp	353	5.7
2 lamps	1168	18.9
3 lamps	689	11.1
4 lamps	654	10.5
5 lamps	532	8.6
6 lamps	481	7.8
7 lamps	440	7.1
8 lamps	352	5.7
9 lamps	288	4.6
10 lamps	222	3.6
11 lamps and more	1015	16.4
Total	6194	100.0

The gross returns in 1910 were $230,000, with a capital invested of $1,960,000, or 11.7 per cent, and in 1912 they rose to 18.2 per cent ($324,000 from an invested capital of $1,780,000), although the transmission and distribution system is only two-thirds loaded.

Flat Rate in Gothenburg

Gothenburg has also a flat-rate system. About 2500 of the 13,000 consumers of a year or two ago were served on the flat rate (inhabitants 165,000). This rate ($1.90 a year per 20 watts, as per schedule) is also combined with the gratuitous energy system. The consumer gets as many watts free as he wants (the equivalent in yearly rent, however, not to exceed the cost of the installation), and the consumer has to contract to pay for the same number of watts the following year. This flat rate has been reduced recently from $1.90 to $1.62 per every 20 watts if the owner of a laborer's tenement house installs one lamp in every room of the latter. Only one current limiter is provided for every building, and the house owner does the collecting by making a corresponding addition to the rent. In return he gets one staircase lamp free of charge for every ten lamps installed.

The "gratuitous energy" system is mostly applied in the Scandinavian countries, where it originated.

Drammen

A similar system has been in use in Drammen, Norway, since Jan. 1, 1911. Small consumers occupying three rooms and kitchen get a discount of 70 per cent from the price of energy for the first year, instead of free energy as in Gothenburg. A flat rate prevails, either 4.9 cents a year per hefner candle installed, corresponding to a little over $5 per 100 watts installed a year, or, with current limiters, the consumers pay $3.93 per 100 watts maximum demand a year.

Boras

A system of this kind is also in use in Boras, in Sweden, where the customer has the option of gratuitous energy for a year under conditions similar to those of the Gothenburg system, or, if he prefers, a subsidy in cash of $2.15 per lamp outlet. In the latter case he must guarantee the central station a minimum income of $1.62 per lamp outlet a year for the first two years.

In the thirty-two months during which this system had been in force at the time of investigation the number of customers had increased from 600 to 1750, and, according to the management of the central station, of these additional 1150 customers at least 600 consumers were due to this system alone and would otherwise never have been connected.

Delft Real-Estate Agency as Solicitors

An interesting method of pushing the use of electricity was found in Delft, Holland, where the central station pays to real-estate agencies $2 for each kilowatt connected for which application is made during the time when the building is for rent or sale. This commission applies only for houses which are not yet connected; in buildings which are already connected to the lines it is reduced to 80 cents per kw installed. The result is that the rental agency has an increased interest in recommending to the house owner the wiring and connection of the respective buildings and in pointing out the increased possibilities for sale or rent.

Prepayment Meter as Solicitor at Elsterberg

An interesting opinion was given by the manager of one of the central stations about the prepayment meter. In this place (Elsterberg) gratuitous installations are made by the electric-light company with prepayment meters, and the consumer has to contract to use $4.80 every year with these prepayment meters. The interesting information was imparted that every prepayment installation of that kind results in the connection of two or three other consumers who pay for their installation themselves.

Ordinarily the small consumers who contract for prepayment meter installations do not figure their expenses very closely. As a consequence, they are not so well off as friends and acquaintances with a like income. Electricity, of course, pleases these friends very much and is also praised by the prepayment customers. The desire to have such safe, clean and beautiful light will assert itself the more since these friends and acquaintances can afford this kind of light even better than the original prepayment meter customer. Envy also plays its part. Inquiries are made at the electric-light office and the information is imparted that the use of prepayment meters is really more expensive than that of ordinary meters (17 cents as against 12 cents per kw-hr.). Many then decide to pay for the installation themselves.

It is impossible to quote in detail every instance found where successful methods for increasing the business by attracting the small consumers are employed. These instances are too numerous, and a reference to Table III, although necessarily incomplete, must suffice.

Table II is an attempt at a classified summary of the methods of financing small consumers. This table shows that there are two large subdivisions, (1) installations made at the expense of the electric-light company and (2) those made at the consumer's expense. In the first case either the consumer by his payments automatically acquires ownership after a certain number of years or the installation remains the property of the electric-light company indefinitely. Where the installation is made at the consumer's expense, the electric-light company may give a subsidy which may consist of a cash payment or energy free of charge.

In the lower part of the table are noted various instances described more fully in the text. Of course there are a large number of other citations besides those mentioned, but they are more or less all covered by the same classification.

It is also possible that different features of the different systems may be combined in a new system. Thus, for instance, a consumer might get an installation at the electric-light company's expense provided he contracts for a certain minimum bill for a certain number of years (as in the city of Strassburg), but instead of becoming the owner of the installation after that time the installation might remain in the ownership of the central station, as, for instance, in Werdau. This and other combinations, however, have not been found in practice.

The writer is convinced beyond doubt: (1) That the small customer has become an important source of revenue to many of the central stations in Europe; (2) that the possibilities of this source of income and the degree to which it is being appreciated by the European central stations are growing constantly as the efficiency of the methods of transforming electricity into light is improving. It may also be predicted that in the near future the small customer will become recognized as of greater value to the central station than heretofore. It is to be observed that to bring this about will involve radical changes in the present methods of billing, metering, meter reading, inspection, methods of introducing services, lamp-renewal policies, rates for energy, etc.

Much of the work done in connection with the small consumer depends on a cheap form of demand indicator. There are many such on the European market, costing in the neighborhood of a dollar. Various forms of these indicators are shown in Figs. 25 to 30, on page 1172.

Inexpensive Wiring Methods Followed in Europe

The methods of wiring vary even within the same country.

Flexible twin cord on glass buttons, one of the oldest wiring schemes, is still used when the installation must be very cheap or where extensions are made to existing installations in finished buildings; but there is a marked tendency in most places to break away from this system in favor of more substantial construction. A number of central stations in Germany and Austria—for instance, in the whole northern part of Bohemia—are already prohibiting the use of flexible cord and glass buttons entirely.

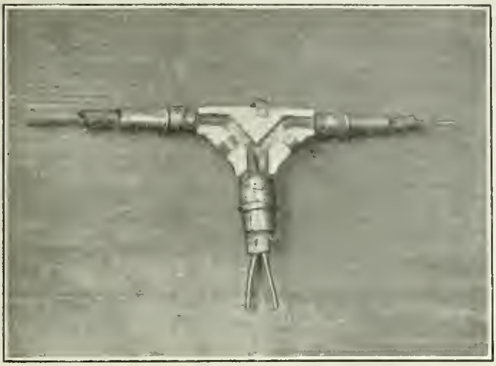


FIG. 31—T-CONNECTION BOX FOR KUHLO WIRE

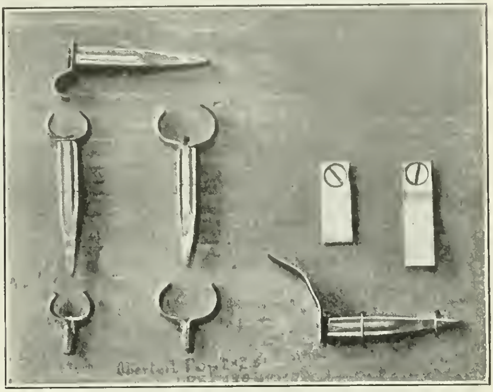


FIG. 32—DEVICES FOR FASTENING KUHLO WIRE TO WALLS

The next system to obtain favor was wiring in tubes made of paper impregnated with an asphaltum-like substance (Bergmann tubes). In later years these were protected by a thin cover (0.01 in. thick) of iron or sheet brass. These tubes were laid on or under the wall and rubber-insulated wires were drawn into them. Under the German rules the use of unprotected Bergmann tubes is now prohibited. These tubes must now be covered with brass or iron. The metal cover, however, is very thin and does not offer much protection against nails. One of the largest electrical firms in Germany, the Siemens-Schuckertwerke, introduced about thirteen years ago a system of enamel-covered steel pipes with open seams to permit condensation to escape. These tubes, which are called, after the inventor, Peschel tubes, are very thin, being about 0.03 in. thick. The weight of 100 ft. of tubes of 14-mm (9/16-in.) inside diameter is less than 19 lb. This pipe is also used on or under the wall, as the case may be. The separate pieces of tube, which are made in lengths of 10 ft., are joined to each other and to the fittings by means of couplings and held together, not by screw threads, for which the walls of the pipe would be too thin, but by the spring action of the open-seam steel pipe. The outside of the pipe is just a trifle larger than the inside of the couplings, and when inserting it into the latter the pipe must be slightly squeezed together.

In many instances this Peschel tube is used as a return circuit in cases where one of the conductors is grounded. In such a case, before joining the tubes and couplings together, the enamel of the former is scraped off as far as the coupling extends, and experience has shown that the electrical resistance of the system of steel pipes put together in that way is far below the permissible maximum. The cross-section of the tubes is dimensioned with a view to giving the tube the proper current-carrying capacity.

FIG. 33—DRAWING-ROOM INSTALLATION MADE WITH KUHLO WIRE

In Austria an inexpensive system of wiring is employed largely in stone and brick buildings, called "plaster hose." A groove 1½ in. deep is chiseled into the plaster and the brick wall, and a piece of very thick-walled rubber hose, greased with soft soap on

FIG. 34—DINING-ROOM INSTALLATION MADE WITH KUHLO WIRE

the outside, is laid in the groove. The whole is then plastered up again and finished off smooth on the outside. Both ends of the rubber hose, however, stick out of the plaster, and after the latter has hardened the rubber hose is pulled out, the soap preventing the plaster from sticking to the hose. The result is a hole running under the surface of the wall through which the rubber-covered wires are fished. If junction boxes are required a piece of wood in the shape of a truncated cone is inserted into the plaster, and after the plaster has hardened is removed in the same way as the hose. The round hole in the wall is afterward covered by a piece of circular sheet iron kept in place by two elastic metal strips riveted to the back of the sheet. The strips press against the side of the hole in the wall and keep the cover in place by friction. This cover may afterward be painted over or covered with wall paper, so that the whole installation when finished is practically invisible. This system, however, is now being more and more superseded by the Peschel system, since the latter is only slightly more expensive and much more substantial.

Recently a system of wiring which is rapidly taking its place beside the different inexpensive wiring methods named and is superseding them, especially in the wiring of existing buildings and in extensions of older installations where the installation must be made with as little disturbance and dirt as possible, has made its appearance. In this system two-conductor or three-conductor cable protected by thin brass or by thin lead-covered iron sheet is used. The thickness of this sheet covering is about 1/100 in. The metal is pressed around the insulated wire or cable and the edges are folded over one another in such a way that a seam results running lengthwise of the wire. This seam, which is tightly pressed together, is water-tight for all practical purposes, and, on the other hand, the metal cover which takes the place of metal tubes in other systems of wiring is in close contact with the insulation, without leaving a pocket for condensed water (Fig. 38).

In cases of grounded return circuits the metal covering may be used as the return circuit, the carrying capacity of the metal covering having been considered in dimensioning the latter. Thus, for instance, in case of a wire of 2.5 sq. mm cross-section (which corresponds approximately to No. 13 wire B. & S.), the metal cover has a cross-section of 5.5 sq. mm.

As the number of inside conductors of this kind of wire is one, two or three, the total number of conductors will be two, three and four respectively, in case the outer cover is used as a conductor also. Of course, the largest part of the material used is two-conductor wire, which means one or two inner wires, according to whether the outer cover is used as a conductor or not, and for small installations practically only such wire will have to be considered.

Extensive Use of "Kuhlo" Wire

This kind of wire was invented a few years ago by Mr. Kuhlo, director of the electric central station in Stettin, and put on the market on a large scale by the Siemens-Schuckertwerke and named "Kuhlo" wire. A year ago six or seven other firms—among them the Allgemeine Elektricitäts Gesellschaft—took up the manufacture of this wire under the name of "Rohrdraht," which means tube wire.

This Kuhlo wire can be put up in a number of different ways, either buried in the wall or under the surface of the wall. The former is at present not permitted, according to the literal wording of the German

FIG. 35—WIRING INSTALLATION MADE WITH KUHLO WIRE

rules, which were made before the general introduction of the Kuhlo wire, but in practice the scruples against burying wires in plaster do not seem to be shared generally, and many wiremen are concealing the Kuhlo wire when occasion demands. For this purpose a particular instrument, consisting of two 4-in. saws riveted together in parallel position so as to leave a space of about ¼ in. between them, is used. This double saw cuts a very nice, clean groove into the mortar on the wall, especially when guided by a straight-edge. The Kuhlo wire can then be placed in this groove and plastered up.

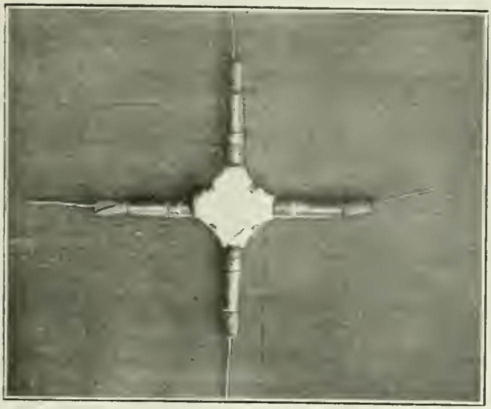


FIG. 36—SINGLE-POLE SOLDERED CROSS-PIECE WITH KUHLO WIRE

In most cases, however, it is preferable to fasten the Kuhlo wire to the surface of the wall, not only for reasons of greater cheapness, but also because less disturbance and dirt will be caused that way in finished buildings with painted or papered walls. Kuhlo wire is unobtrusive in appearance, the thinnest wire with single conductor (capable of carrying 6 amp under the German rules) having an outer diameter of only 4.3 mm, or less than 3/16 in. Moreover, this wire can be run in the corners of rooms or along the frames of doors and windows and picture molding, etc., thus rendering the installation less visible.

There are several methods in use for fixing Kuhlo wires to the surface of a wall, the simplest being to nail it down with proper staples. Other methods are permitted by the German rules, such as holding the wire down by straps which are made of brass-covered or lead-covered iron, in accordance with the material covering the Kuhlo wire. These straps have lugs on one side with holes in them. A piece of square steel of about 1¼-in. length is driven into the brick wall until it is flush with its surface. The strap mentioned above is then screwed down on the wall by means of a small iron machine screw into the center of the square piece of steel tapped for that purpose (Fig. 32). Before screwing the strap down the Kuhlo wire is passed under it and then held in place. Instead of having rigid straps to fit the Kuhlo wire, flexible brass straps may also be used (Fig. 32) which are bent around the wire after one end is screwed onto the square piece of steel, as mentioned before. This has the advantage that the square pieces of steel can be driven into the wall along the path of the wire whereas with the first-named type of straps the square pieces of steel have to be driven in about ⅜ in. or ½ in. to the side of that line. These flexible straps, which are rolled around the wire by hand, do not look quite so neat and tidy as the others, but are good enough, especially if cheapness is the first consideration.

By a third method the Kuhlo wire is held to the wall with little soft brass fork-shaped supports (Fig. 32) which also are screwed into the pieces of square steel and then pressed by means of pliers around the wire. On ceilings it is sometimes preferred to carry the wire about 2 in. or 2½ in. away from the surface, in order to avoid plastic ornaments which may happen to be on the ceiling. The illustration also shows such carriers screwed into the ceiling and holding the wire by means of clamps.

The outlet boxes for residences are made of porcelain. Where mechanical abuse is likely, or in dusty places, metal outer boxes are used, consisting of cast-iron bases with tight-fitting brass covers kept in place by friction.

The porcelain fittings used for residence and other lighter work are of two types—one for soldered and the other for screwed connections. Both types have a sheet-brass base under the porcelain parts, which insures good electrical connection between the outer covers of all the wires entering into that outlet box, which connection, of course, is essential in case the metal coverings form part of the circuit. The connection between the sheet-brass base of the outlet boxes and the outer conductors of the Kuhlo wire is made in the same way as that of the inner conductors, namely, soldered or screwed, depending on the type of fitting used. The porcelain fittings, especially of the soldered type, are very small and unobtrusive in appearance. Fig. 31 shows a T-connection box with the cover off for connecting an ordinary single-pole switch into a horizontal one-wire conductor with grounded return circuits. The length of the porcelain piece is only 1⅜ in. As can be seen, the vertical conductor which leads to the switch must be, of course, a two-wire conductor, since the return circuit passes unbroken through the metallic base of the T-fitting, and it is not necessary to carry the grounded return circuit to the switch at all. Fig. 36 shows a single-pole soldered cross-piece.

As regards the necessary curvature of the wire, the smaller types of single and double conductor, which are almost exclusively used in ordinary house wiring, can be bent by hand. Stronger wires have to be bent by means of a special tool (Fig. 40).

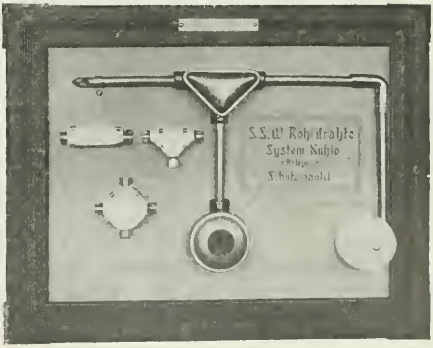


FIG. 37—KUHLO WIRING FITTINGS

Another handy tool for Kuhlo wire is a pair of special pliers used when stripping the wire of its cover at the ends (Fig. 41). This tool has a set of semi-circular grooves corresponding to different diameters of wire, which grip the wire tightly. These pliers are used solely to hold the wire and prevent tearing off the covering for a greater length than intended.

One of the great advantages of this method of wiring is its cheapness. When the method was new a prize competition was arranged and it was discovered that one wireman could run 200 ft. of Kuhlo wire per day. Since that time a record has been set of 650 ft. a day per wireman. Of course, the wiremen must be trained to the work and become thoroughly accustomed to it before proper comparisons as to the cost of wiring can be made.

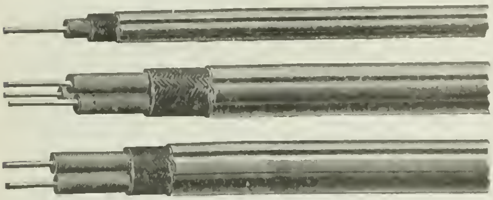


FIG. 38—TYPES OF KUHLO WIRE

Many other kinds of installations besides residences have been wired on the Kuhlo system, such as public buildings, theaters, churches, schools, hospitals, factories, agricultural establishments, offices, hotels, castles, villas, also ships and railway cars, and work of this kind is still increasing. Kuhlo wire is not found to any great extent outside of Germany.

Wiring Practice in England

A few words may be of interest regarding the wiring methods found in England. A very large proportion, which at a rough guess might be said to be 50 per cent, is of the so-called slip-joint tube wiring; that is, tubing which is not screwed. There are two distinct types of plain tubing, the first and cheapest type consisting of a flat piece of steel bent into circular form so that the edges butt only. This is known as split or closed-joint tubing. The second type is made up in the same manner except that in addition the edges are brazed together. It is known as brazed tubing. The fittings are either of cast steel or stamped.

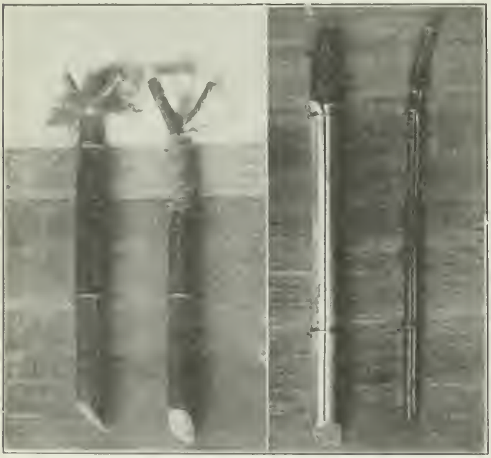


FIG. 39—INEXPENSIVE BRASS-COVERED CABLE

Wooden molding is also used to a large extent in England, and still more so in France and Italy, whereas it is absolutely forbidden by the German and Austrian rules. It seems that in England also it is going out of use in favor of "Stannos" screwed tubing and wire-armored twin conductor.

The so-called "Stannos" wire is equivalent to the Kuhlo wire in Germany. It consists of a rubber-insulated copper wire covered by a thin copper sheet which is rolled around the rubber in several layers (lengthwise, not in spirals) which are soldered together afterward, so as to form a solid, water-tight, seamless, tin-covered copper tube. The Kuhlo wire is a later type and is an improvement in so far as the price is cheaper. It is not considered in Germany to be inferior to the Stannos wire. The fact that Stannos wire, which was also put on the market by the Siemens concern, the same as Kuhlo wire, is used more in its native country, England, whereas the German Kuhlo wire is used more in Germany, may be due to climatic as well as to commercial causes, inasmuch as the moist weather prevailing in England may make an absolutely water-tight wiring material more advisable.

Screwed tubing is used for very high-priced work and is either welded or solid-brazed or solid-drawn. Wire-armored twin conductors are considered most promising, but at present are too expensive. Flexible twin cord on glass or porcelain knobs was never much employed in Great Britain on account of the inferior quality of this kind of wiring and is going out of use, just as in Germany and Austria.

Brief mention may be made here of the so-called cab-tire sheathed cable, which, although not much employed for inside installations, still may be found interesting. Each conductor of this cable is insulated with pure vulcanized india rubber, then sheathed with one layer of tough rubber, called by the makers cab-tire sheathing; this is put on under heavy pressure. The cable is made either in single-conductor, twin or multiple, the separately insulated conductors in such cases being laid together and sheathed over all. This sheathing is exceedingly tough; it is waterproof and resists the action of steam, oils, acid and alkaloids. Moreover, the sheath prevents the cable from becoming kinked. It can be used for ordinary flexible cords, for hand-lamps, etc., and for house-wiring work, being attached by means of suitable brass saddles.

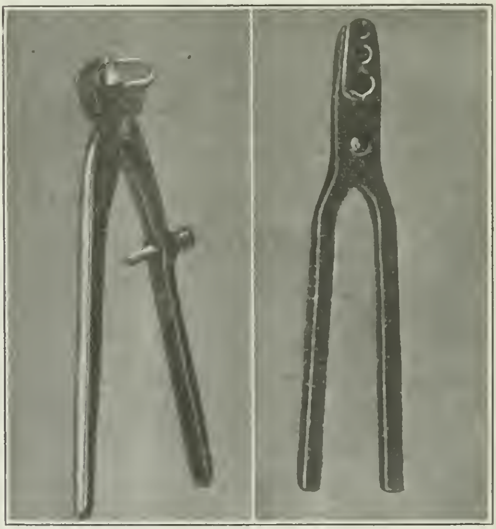

FIGS. 40 AND 41—PLIERS USED WITH KUHLO WIRE

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TABLE III—PEAN CITIES

	TERRITORY OF SUPPLY		INSTALMENT				ETER FOR LL MERS	PREPAYMENT METER RATE	METER RENT SMALL CONSUMERS PER YEAR	NOTES	RESULTS
	POPULATION	CHARACTER	LIMITS OF SIZE	AMOUNT PER YEAR	PAYABLE	NO. AFT CEN STA OWN					
AACHEN KOHLSCHEID	60,000	78 Villages mining and farming	4 Lamps	$1.44 per Customer	Monthly, as add'l to meter-rent		¢	10.8¢	$1.44		**With preceding methods incand. conn. doubled in four years.**
			residences							ation also	cost of consumer
WARBURG	6000	Industry, Agriculture	3-5 Lamps	29¢ per Lamp	Monthly	6 yr 8 r			72¢		
VIENNA AUSTRIA	2,100,000	City	No Limits	Min. of Average of $2.16 per outlet(1)	Prepayment meter			14½¢ kw-hr for current + 14½¢ kw-hr for rent of installation		(1) Collected by stipulating a supplementary payment of 0.6¢ per outlet for every hour use short 360 hours per year (2) Include rent for wiring and fixtures and renewal of 10 lamps per socket per year. time meter installed, excess over 650 burning hours paid according to size of lamp.	
WERDAU	103,000	49 Towns, industrial and Agricultural	Min. $1.80 per yr	36¢ per Lamp	Monthly		(1) o per conn 4¢ hr.		86¢	(1) For residences, other figures for stores etc.	8000 out of a total of 12,000 consumers have installations at Central Sta expense, of which 1500 using instalment installations (existing since 1906) and 6500 Grat. install (since 1909) of the latter 5000 flat rate install & 1500 Hopkinson
			2 Lamps if house not yet connected	43¢ per Lamp	Monthly	Inte					
ZARA (DALMATIA) AUSTRIA	13,000	Town	No Limits(1)	12% of Cost	Monthly	Int	y very ers)			(1) The average small customer has 2 lamps installed	
ZWICKAU (OELSNITZ)	20,000	Mining and industrial town	Meter Rate from 1 lamp up No limits	43¢ per lamp first lamp free	Monthly					(1) First lamp must be 32 cp.	In 1912 ab't 7000 new lamps connected for small cons'rs, bringing yearly revenue of $170 on capital invested there for $12000 for install'ns. Av small cons. 50w inst after 7½ yrs $24000 for inst's. which secure ann. income of $21,000
			Flat rate (house owners only) 1-5 Lamps	43¢ per lamp first lamp 72¢	Monthly						
GOTHENBURG SWEDEN	60,000	City									Number of customers risen after introduction of system within about 3 yrs. from 4000 to 12,000. 16.2% gross returns. particulars. see in text of report

On account of limited space, all Regulations could not

where country is not stated are in Germany.

Supplement to ELECTRICAL WORLD, May 23, 1914.

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TABLE III—DETAILS OF CHEAP WIRING SCHEMES IN VARIOUS EUROPEAN CITIES

	TERRITORY OF SUPPLY		INSTALMENT INSTALLATIONS								INSTALMENTS FOR FIXTURES			GRATUITOUS AND RENTAL INSTALLATIONS AND CASH SUBSIDIES						"GRATUITOUS ENERGY" SYSTEM	FLAT RATE					MAX. METER RATE FOR SMALL CONSUMERS	PREPAYMENT METER RATE	METER RENT SMALL CONSUMERS PER YEAR	NOTES	RESULTS
																						RATE PER YEAR								
	POPULATION	CHARACTER	LIMITS OF SIZE	AMOUNT PER YEAR	PAYABLE	NO. OF YEARS AFTER WHICH CENTRAL STA. WAIVES OWNERSHIP	RATE FOR ENERGY	GUAR. ENERGY CONS. PER YR.	OTHER OBLIGATIONS & ETC. OF CONSUMER.	LAMPS AND FIXTURES	PAYMENT PER YR	PAYABLE	NO. OF YEARS	LIMITS OF SIZE	RATE FOR ENERGY	GUAR. ENERGY CONS. PER YR.	OTHER OBLIGATIONS & ETC. OF CONSUNER	AMOUNT OF SUBSIDY ETC.	LAMPS AND FIXTURES		LIMITS OF SIZE	DEMAND LIMITER REDUCED TO 10 W. UNITS	CONNECT LOAD	PAYABLE	OBLIGATIONS ETC.					
AACHEN KOHLSCHEID	60,000	8 villages mining and farming	4 Lamps	$1.44 per Customer	Monthly, as add'l to meter-rent	6	96¢ kw-hr.	$4.30						3 Lamps	Pre-payment 10.8¢ kw-hr.			Whole installation made gratuitously								9.6¢	10.8¢	$1.44		With preceding methods incand. conn. doubled in four years.
ALTONA	130,000	City																			Building Association for laborers flats sells energy at $8.40 per year for 100 watts maximum dem. (2 room apartments 5 sockets) and $9.60 for 110 watts (3 room apartments 6 sockets) demand limiter.									Since Sept. 13
ARNHEM HOLLAND	65,000	City												None	Flat		Apply before Dec. 31st 1913	$4.10 for the whole installation				96¢ per 10 w		Monthly						Since May 1st 13.
AUSSIG AUSTRIA	50,000	Town	3 Lamps	$1.00 per Lamp = $3.00	Monthly	6	Meter or flat	$3.00	Only made in the months Feb. to Aug. every year	Excluded													Individual Contracts			12¢		$1.40		In villages of 160 households 95% connected
BESTWIG	8,500	Agriculture	INSTALLATIONS AT MONTHLY REPAYMENTS																							9.6¢				
BITTERFELD	50,000	Industrial	4 Outlets	1st Outlet $2.16 2nd " " 1.00 3rd " " 0.44 4th " " 0.29	Monthly	10	Meter	$2.88		Excluded																		Max 67¢		
BLOEMENDAL HOLLAND	30,000		5 Lamps	12% of Cost	Monthly																	$1.45 per 10 w	16 cp. $2.88 25 " " 4.32			10¢ For heat accumulat. 12-6 A.M. 1¼¢		$1.92		3600 Customers from 30000 inhab.
BRAND-AACHEN	145,000	Agricultural												3 Lamps	Flat		In villages where flat rate newly introduced	Either 3 lamps at expense of Central Sta. or non repayable subsidy of $10.80	Fixtures Included		60-300 w	96¢ per 10 w (Residences)		Thrice a year or monthly					Jan 1st 24¢ Apr 1st 36¢ Oct. 1st 36 } per 10 w	Experimental Stage 270 customers. Result flat rate foundry satisfactory, general introduction of flat rate planned
BARMEN	195,000	City, much Industry	Minimum 2 Lamps	60¢ per Lamp	Monthly	5	Flat		1 Years contract Maintenance	Excluded	INSTALLMENT SYSTEM												16 cp $1.44 (Res) 25 " " 2.28 Etc	Monthly						
BOCHUM	580,000	Mining City	15 Lamps	58¢ excl. fixture, 15¢ simple fixture	Monthly	5	Meter		1 Years Contract	Included or excluded	INSTALLMENTS																			1000s of lamps otherwise not within reach have been conn. Shifting population, but certainly 95% of inst. in use
BORÅS SWEDEN	22,000	City												12 light points	Flat or meter (optional)	$1.62 per light point	Two years contract	$2.16 per light point		1st yr grat. current amounting to cost of install. and fixture max $3.24 p. light point; 2nd yr. consump. $1.35 p. light pt. guar.	20 W-300 W	$1.08 per 10 W		Quarterly		9.7¢ Kw-hr				In 32 months customers increased from 800 to 1750
BREMEN	265,000	City																				94¢ per 10 W		Jan 1st April 1st, Oct. 1st short-circuiting of limiter at 40¢ per night		12¢ Kw-hr		$1.92¢	Jan 1st 29¢ Apr 1st 36¢ Oct. 1st 29¢ 94¢	
BRUEX AUSTRIA	95,000	29 Towns	"Small" Installations	According to cost of installation 50 to 70¢ per outlet	Monthly	10	Optional meter or flat		Maintenance														Complicated Schedule	Monthly	1 Year Contract	12¢ Kw-hr		$1.44		In one month $400.00 for installment payments collected from customers
BUDWEIS AUSTRIA	60,000	City		72¢ per Outlet	Monthly	20			Maintenance Fire Insurance	Excluded	24% of selling Price	Monthly	Indefinite										Complicated Schedule	Monthly						
COSCHUTZ	27,000	Laborers																					29¢ per 5 cp. Carbon			9.6¢		$1.44		2600 flat rate cust'rs. Average small cons. 25 w conn.
COETHEN I. ANH.	24,000	City	Minimum 2 Lamps	62¢ per Lamp	Weekly	Indefinitely	Flat		Excl. use of electric light 1 Year fire insurance maint'ce	Lamps excl. simple fixt. included				Min 2 Lamps	Flat rate 62¢ per lamp year as rent of install. (also paid m'ly)	Flat rate none but el. light one year	Maintenance, Fire Insurance, install. remains property Elec. Light Co	Whole installation gratuitous	Lamp excl. Simple fixture included		Minimum 2 Lamps		Schedule ab't 80¢ 10 W	Weekly	Excl. use of electric light one year	9.6¢		$1.44		Satisfactory, Recommend use of flat rate and Installment systems.
			Minimum 5 Lamps	35¢ per lamp	Monthly	10	Option		3 Years contract maintenance fire insurance																					
DELFT HOLLAND	34,000	City	Minimum 6 to 8 Lamps	28¢ per lamp minimum $2.40	Yearly	10	Option	$4.80 (1) $10.00 (2)	Maintenance	Excluded										About 50% reduction of rates for 1st year	Maximum 300 W	Schedule on the basis of lamps burning simultaneously		Monthly		Double Rate 8¢/4¢		Double rate meter $4.80	(1) Flat rate (2) Meter rate	
DORTMUND	560,000	City, many Laborers	1-12 Lamps	$2.30 for distributor board and 53¢ per lamp	Monthly	4	Option		Building connections to lines without heavy expenses, Maintenance	Excluded	About ⅓ of list price, cheapest fixture 43¢	Monthly	3	1-3 Lamps	Prepayment meter 12¢ per Kw-hr.		Maintenance excl. use electric cheap connect'g. of building must be possible	Whole Installation Gratuitously	Excluded. Sold on instalment plan		30-360 W	Ab't 96¢ 10 W		Monthly	1 Years notice, in case of moving 4 weeks	7/9⅓¢			Sewing mach. motors at 36¢ per mo.; Flatirons Varies in the different villages	In 2 months 1200 lamps installed for prepayment meter installations of 2-3 lamp
ELSTERBERG	6,600	Town													Prepayment meter 16.8¢ per Kw-hr			Whole Installation Gratuitously												Number of customers rose in two years from 550 to 1150 (Central Sta. 18 Years Old)
DRAMMEN NORWAY	77,000																			70% discount on 1st years current bill, up to 3 room residences	Small Consumers	40¢ 10 W	4.9¢ per Hefn. Cp.	10 Yearly payments vacations for employees						Number of customers rose 50% in two years
ERBACH i/Odwd	3700		No Limits	40% of Cost	Quarterly	2½	Meter																			10.8¢				Introd. Jan. 1st '13. First 6 days 36 applications. Total number of cons. previously 400 (Central Sta. 10 years old)
GENEVA (SWITZERLAND)	160,000	City, and 16 Villages												1-3 Rooms	5¢ kw-hr and 4¢ for all energy above 750 hrs. yearly use		6 years contract, house owner must maintain installation for 10 years	$11.40 (max) with extra of $1.00 per lamp if residence occupied	Excluded							15¢/4¢			Installation goes into house-owners ownership at once	Good results esp. since [illegible] when subsidies for small consumers (1-3 Rooms) without guarantee for current consumption were introduced
														Above 3 Rooms		Amount of wiring subsidy		Up to cost of wiring, max $2.85 per lamp												
GENOA (ITALY)	350,000	City															Only electric light in kitchen and dining room used	Max $2.85 per lamp and not over $7.60 altogether												
GLAUCHAU	33,000	City, and 8 Villages	Residences	72¢ per lamp	Monthly	6		72¢ per lamp																						

ELSTERBERG	6,500	Town													Prepayment meter 16.8¢ per Kw-hr			Whole installation Gratuitously												rose in two years from 550 to 1160 (Central Sta 18 Years Old)
DRAMMEN NORWAY	77,000																			70% discount on 1st years current bill up to 3 room residences	Small Consumers	40¢ 10 W	4.3¢ per Hefn. Cp	10 Yearly payments vacations for employees						Number of customers rose 60% in two years
ERBACH i/Odw	3700		No Limits	40% of Cost	Quarterly	2½	Meter																			10.8¢				Introd Jan 1st '13 First 10 days 86 applications Total number of cons previously 400 (Central Sta 10 years old)
GENEVA (SWITZERLAND)	160,000	City, and 16 Villages												1-3 Rooms Above 3 Rooms	5¢ Kw-hr and 4¢ for all energy above 250 hrs yearly use	Amount of wiring subsidy	6 years contract, house owner must maintain installation for 10 years	$11.40 (max) with extra of $1.00 per lamp if residence occupied Up to cost of wiring, max $2.85 per lamp	Excluded							15¢/4¢			Installation goes into house-owners ownership at once	Good results esp since 1910 when subsidies for small consumers (1-3 Rooms) without guarantee for current consumption were introduced
GENOA (ITALY)	360,000	City															Only electric light in kitchen and dining room used	Max $2.85 per lamp and not over $7.60 altogether												
GLAUCHAU	33,000	City, and 8 Villages	Residences	72¢ per lamp	Monthly	6		72¢ per Lamp																						
HOECHST a/m	85,000	Overland	1-5 Lamps	1st-3rd Lamp 72¢ 4th " 29¢ 5th " 43¢	Monthly	6			6 years contract for using the installation	Excluded												87¢				8.4¢	Very few prepayment meters			
ILMENAU	13,000	Town	3-5 Lamps	29¢ per Lamp 73¢ per Lamp	Monthly	Indef. 5	Meter 12¢		Repair, lamp renewal, Fuse renewal	Included	(1)	(1)	(1)	3-5 Lamps	Meter 12¢ per Kw-hr (normal rate) + 29¢ per lamp per yr rent of install.		Repairs, Lamp renewal, Fuse renewal.	Whole installation made gratuitous	Included							12¢		58¢	(1) Heat and cooking apparatus under installment payments (monthly) 1 or 5 years	In first 5 months 420 instalment installations added to previous number of 1600 customers (Central Sta. 14 yrs. old)
INSTERBURG	32,000	Town	Minimum 5 Lamps	36¢ per Lamp	Monthly	10	Meter		3 years contract maintenance Fire Insurance	Excluded																13.2¢		$1.15		Annually 100 small consumers added Central Sta 8 yrs. old 1400 customers
KIEL	145,000	City																			30-100 W	$1.15		3 annual instalments		13.2¢				Since April 1st 1913
KLAGENFURT AUSTRIA			Abandoned, considerable increase of business not achieved and central station was not protected against losses in case of tenants moving Municipal works, Gas competition. Fixture installment system maintained								24% of value min $2.40	Monthly	10										Complicated Schedule, abt. 5-14¢ per c.p. yr.	Monthly, (1) very small sums also quarterly, yearly		8¢			(1) Flat rates for very small residences collected from house owner, and the latter is considered the consumer	
COPENHAGEN DENMARK	470,000	City and Agricult		23 2% of Cost	Quarterly	5	Meter		Fire Insurance	Excluded																9.5¢		$1.62		
KOENIGS-HUETTE																					30-800 W	Combination				7.2¢		$1.44	(1) For inst. 30 W max demand 30 W conn $3.15 60 W conn $5.40 etc	About ¼ of consumers on flat rate
KRISTIANIA NORWAY	250,000	City												Rental Residences	Normal	None	Residences to be lighted electrically throughout	3¢ per outlet			25-300 W max 6 lamps	54¢ per 10 W +8¢ for limiter			one yrs contract	7¢		$1.62	consumers can switch over to meter at 8.1¢ per kw-hr	Jan 1st 1912 11900 flat rate consumers
LANDSKRONA SWEDEN	16,200	City	No Limits	Repayments in 1-4 years		1-4	Meter			Excluded																8.5¢		None		
LAURA-HUETTE																					50-1000 W	72¢ (up to 100 W) larger cust less		Quarterly		6¢ (1)		?	(1) Collected from house owner for all tenants on one bill	Large increase in number of small customers in 1910 when flat rate was introduced
LIMBURG a/d L			2-4 Lamps	Varying about 50¢ per socket per year, if house connected, otherwise more	Monthly	6	3.6¢ per socket per mo + 7.2¢ per Kw-hr			Excluded simple fixt complete sold at 84¢																13.3¢ or 7.2¢ + 3.6¢ per sock. per mo.		$1.44		
LINZ AUSTRIA a/d	100,000	City and Agricult	No Limits	40¢ per lamp and 20¢ for additional lamps at same outlet. min. 60¢	Monthly	10	Flat or Meter		3 years contract; maintenance Fire Insurance	Excluded	20% of list price	Monthly	5⅓ yrs; contract for 3 yrs. min.	50-300 W	Flat rate increased by 20% for rent of installation	(Flat Rate)		Total installation gratuitous, remains property at Central Sta.	Included (renewals excluded)			$1.20 at least 40% of conn ld		Monthly	Short-cir of limiter at 30¢ per night	16¢ if more than 100 Kw-hrs. by 5% discount		$1.20		
MANNHEIM	190,000	City	–	100% of Cost	Monthly	1			Maintenance. Fire Insurance	Excluded										In installment installations a certain number of Kw-hrs during first year free		In Preparation								
MILAN ITALY	Approx 600,000	City		PLANNED										Smallest Residences	Flat rate incl. rent of instal.	(Flat Rate)		Total installation gratuitously, remains property of Central Sta.	Included (renewals excluded)			$1.36-2.40 according to size of lamp etc including rent of installations		Monthly						
MÜHLHAUSEN i/Thüer	35,000	City												Max 5-lamps	Prepayment Meter	$1.44 per fixture	Maintenance renewals 1 years contract	Total install gratuitous; remains property of Central Sta	Included (renewals excluded)											
MUELHAUSEN i/E	275,000	41 Towns and Villages	Meter Rate 2-5 Lamps Flat Rate max. 250 W. 2-4 Lampe	1st Lamp free the rest at 72¢ per lamp 72¢ per Lamp	Monthly Monthly	6 6	Meter Flat	$4.30 per install for 3 yrs annually	3 years contract Repairs 6 years contract, repair ren.	Excluded	29¢ Simple fixture and lamp	Monthly	6								250 W max 2-4 lamps	$1.20 at least 50% conn load		Monthly		9.6¢		87¢		Within 2 years 3000 new consumers under installment installation Previous number of cons. abt 5000 Central Sta. 25 yrs old
OBERSCHLES EL. WERKE	650,000	68 towns Industry																			Min 50 W	72¢ up to 100 W larger cust less				8.6¢/[illegible]				18000 flat rate consumers, 2500 meter cons.
OPPELN	34,000	City		NOT YET							26⅔% of selling price	Quarterly	3				NOT YET													
ORANIENBURG	15,000	Town	No Limits	48¢ per Lamp	First year in advance in full, then quarterly	10	Meter or Flat		3 Years Contract	Excluded	10% of selling price	1 Yr in advance in full, then quarterly	5% interest at 2 yrs.								Min. 2 lamps. 50 w.	86¢		Monthly	only electric light one year only metallic filament lamps	[illegible]		$1.72	(1) 6 lamps if building not connected	
POTSDAM	103,000	14 Towns	Small Apartments (2-Rooms and Kitchen)	1st lamp free every following one 72¢	Monthly	6	Meter or flat	$5.05		Fixture in kitchen Included, otherwise excluded											60-500 W	72¢ per 10 W + fixed charge of 72¢		Monthly (1) Quarterly (2)	None put but electric light one yr.	9.6¢			(1) with } installment (2) without } installation	
SCHLETTSTADT	10,000		First Three Lamps	36¢ per Lamp	Yearly	6			6 Years contract																					In less than one year

																				year free										
MILAN ITALY	Approx 600,000	City		PLANNED										Small-est Resid-ences	**Flat rate incl. rent of instal.**	(Flat Rate)		Total install-ation gratuit-ously, remains property of Central Sta	Included (renewals excluded)			$1.36-2.40 according to size of lamp etc including rent of installations		Monthly						
MUHLHAUSEN i/Thur	35,000	City												Max 5-lamps	Prepay-ment Meter	$1.44 per fixture	Maintenance renewals 1 years contract	Total Install gratuitous, remains property of Central Sta.	Included (renewals excluded)											
MUELHAUSEN i/E	275,000	41 Towns and Villages	Meter Rate 2-5 Lamps	1st Lamp free the rest at 72¢ per lamp	Monthly	6	Meter	$4.30 per instal for 3yrs generally	3 years contract Repairs	Excluded	29¢ Simple fixture and lamp	Monthly	6								250 W max 2-4 lamps	$1.20 at least 50% conn load		Monthly		9.6¢		87¢		within 2 years 3000 new consumers under install ment installation Previous number of cons abt 5000 Central Sta 25 yrs old
			Flat Rate max 250 W 2-4 Lamps	72¢ per Lamp	Monthly	6	Flat		6 years contract, repair ren																					
OBERSCHLES EL WERKE	[illegible],000	56 towns Industry																			Min. 50 W	72¢ up to 100 W larger cust less				8¢/16 wright				18000 flat rate consumers, 2500 meter cons.
OPPELN	34,000	City		NOT YET							26⅔% of selling price	Quarterly	3				NOT YET													
ORANIENBURG	15,000	Town	No Limits	43¢ per Lamp	First year in advance in full, then quarterly	10	Meter or flat		3 Years Contract	Excluded	10% of selling price	1Yr in advance in full, then quarterly	5% interest at 12 yrs.								**Min. 3 lamps. 50 w.**	86¢		Monthly	only electric light one year only metallic filament lamps	9.6¢		$1.72	(1) 6 lamps if building not connected	
POTSDAM	103,000	16 Towns	Small Apartments (2-Rooms and Kitchen)	1st lamp free every following one 72¢	Monthly	6	Meter or flat	$5.05		Fixture in kitchen included, otherwise excluded											60-500 W	72¢ per 10 W + fixed charge of 72¢		Monthly (1) Quarterly (2)	None but electric light one yr.	9.6¢			(1) with (2) without } instalment installation	
SCHLETTSTADT	10,000		First Three Lamps	36¢ per Lamp	Yearly	6	Meter	$4.30 Yearly for 6 years	6 Years contract except if cust moves during that time (Rep at central sta expense)	Excluded																9.6¢		72¢		in less than one year 1400 applications for installment installations Previous number of cust 900 Cent. Sta 10 yrs. old
SCHOENEBERG	300,000	Parts of Berlin	Minimum $10 per Year	20% at Cost)1 96¢ per Lamp)2	Monthly	7	Meter or Flat		3 years contract maintenance. Fire Insurance	Excluded				1-3 Rms. 1 circuit only max 20 lamps	Flat rate of min 80, 120 or 160 watts for 1, 2, 3 rm. flats resp at 72¢ per 10 W	Flat Rate 1 Years contract	1 Years contract one half of the flats on one riser must apply	Either whole instal grat 3) or subsidy of $9.60, $12.00 and $14.00 for 1, 2 and 3 rms flats resp	Excluded		Max 3 Rooms	72¢		Monthly	1 Years Contr-act	36¢		$2.40	(1) If wiring made accord. to spec of consumer. (2) If made accord. to Judgment of Cent Sta (3) Install remains property of Cent Sta	Flat rate since July 1st, '08, 100 Applications in less than 1st 3 months
STEGLITZ (BERLIN)	180,000	14 Suburbs																			50-500 W	86¢		Quarterly					(1) April 1st and July 1st 17¢, Oct 1st and (2) Jan. 1st, 26¢	
STETTIN	240,000	City	Max. 12 lamps installed	29¢ per lamp	Monthly 1st yr. total in advance	10	Flat Rate		Pay instalments and flat rate in advance for whole first yr. Maintenance	Lamps excluded Simple fixtures included											30-200 Watts Above 200 watts	98¢ 96¢		Monthly Monthly		12¢		$1.44	(1) Limiter can be short-circuited and kw-hrs. paid at 12¢ kw-hr on basis of max possible excess load and hrs. short circuited (Time Meter) (2) Flat rate on basis of meter readings of preceeding yr only, with disc of [illegible] meter rate	Not yet available, system only recently introduced
STOLP	[illegible]000	Town	Min $1.44 per yr.	Simple one-way switch 36¢ per Lamp	Quarterly	10	Flat or Meter		Maintenance	Excluded											Max 100 W	$1.01-1.08		Quarterly, Summer ¼, Winter ¾	Contract for min 50% of conn load	10.1¢		$1.44		
STRASSBURG i/E	165,000	City	1-4 Lamps	1st Lamp free 72¢ per lamp	Monthly	6	Meter	$4.30		Excluded											Min 2 Lamps		C P Schedule for inst 30 cp $1.44	Monthly	Show-windows only, 3 yrs contract	9.6¢		72¢		Jan 1st 1913 13700 consumers with instalment installations in the city and some parts of the surrounding country (see Text of Report)
	185,000	Agri-cultural	Lamps only	No free Lamp, 72¢ per lamp	Yearly Max	6	Meter	$3.60	3yrs. Contract	Excluded											SHOW WINDOWS ONLY									
	[illegible] Villages		No Standard Limits	Repayment of cost in 1-5 yrs	Individual Agreements	1-5 yrs	Meter		Generally 3yrs. contract	Included																				
TILSIT	45,000	5-Towns	Max. 4 outlets	60¢ per outlet (1)	Monthly, Less in summer and more in winter	5	Hopkinson [illegible] kw-hr charge at 7.2¢. Meter [illegible]			Excluded, Fixtures sold at extra low prices																5¢ + 60¢ per yr per outlet (Hopkinson)		87¢ waived with instalment installations against increase of kw-hr charge	(1) If at least 3 outlets, one receptacle for flatirons, cooking appliances etc wired free of charge	Introduced 1910. Connected in: 1910 1 Installment Inst. 1911 41 " " 1912 156 " " 1913 135* " " 333 Total *First nine months
TRIER	54,000 + 35,000	City + 28 villages												Varies in different villages a non-repayable subsidy of $1 to 2 per lamp (max. 2 lamps) if customer connects within 3 months after his village is connected to the system (Originally 96¢ for every lamp) [no max number]							60-300 W	86¢		Jan 1st Apr. 1st Oct. 1st ⅓ each		10¢		$1.44		See Table I of Report
TRONDHJEM (NORWAY)	40000	City	No Limits	53¢ per lamp payable by house owner	Yearly	6	Mostly Flat	$1.08 per Lamp	Maintenance Fire Insurance													Both Limiter and conn. load about 43¢		Limiter: 10 yearly instalments conn Load: 6 yearly instalments						**Installment installations since May, 1912; 95 in 16 months**
VILLACH AUSTRIA	25,000	Town	Limits required only for small residences	8% of Cost	Monthly	10(1)	Meter and Flat		Maintenance (Fire Insurance paid by Central Sta)	Lamps excl Fixtures included													Complicated Schedule			3¢		$2.00	(1) Would really be 10 yrs (at 3 & 5%) but profit from current sale used for amortization also	No considerable results yet, central station only 2 years old and busy with applications at cost of consumer
WARBURG	6000	Industry, Agriculture	3-5 Lamps	29¢ per Lamp	Monthly	6yrs., 6 months	Meter		Contr for 6½ yrs house owners guarantee payment if residence vacant	Included																9.6¢		72¢		
VIENNA AUSTRIA	2,100,000	City	No Limits	Min of Average of $2.16 per outlet(1)	Prepayment meter	5	Prepayment meter, rate raised 100% [illegible]	[illegible] hrs use	Maintenance contracts for 5 yrs but not longer than until cust. moves	Included, also lamp renewals				Shops only burning 650 hrs per yr	**Flat rate as follows**			Whole Installation gratuitous	Included, also renewals of 10 lamps per yr		Shops only burning 650 hrs. per yr		30cp $9.60(2) 55 " " 13.20 75 " " 18.00	Monthly			14½¢ kw-hr for current + 1¼¢ kw-hr for rent of installation		(1) Collected by stipulating a supplementary payment of 0.6¢ per outlet for every hour use short 360 hours per year (2) Include rent for wiring and fixtures and renewal of 10 lamps per socket per year. Time meter installed, excess over 650 burning hours paid according to size of lamp	
WERDAU	103,000	49 Towns, industrial and agricultural	Min $1.08 per yr	36¢ per Lamp	Monthly	10	Hopkinson demand		1 Years Contract	Excluded												Abt 55-65¢ in Residences				132¢ or {$2.20 per kw conn + 2.4¢ kw-hr (1)		86¢	(1) For residences, other figures for stores etc.	8000 out of a total of 12,000 consumers have installations at Central Sta expense, of which 1500 using instalment installations (existing [illegible]) and 6500 Gratis Install (since 1903) of the latter 5000 flat rate install & 1500 Hopkinson
			2 Lamps if house not yet connected	43¢ per Lamp	Monthly	Interminate	Hopkins demand or flat rate		3 Yrs contract, Maintenance Fire Insurance	Lamp excl simple fixture incl.																				
ZARA (DALMATIA) AUSTRIA	13,000	Town	No Limits(1)	12% of Cost	Monthly	Intermin-ate	Wright Demand		Maintenance done by Cent Sta at lump sum + 24¢ per yr for installation up to 10 lamps	Excluded				**See preceding**												16¢ (Paid by very few consumers)			(1) The average small customer has 2 lamps installed	
ZWICKAU (OELSNITZ)	20,000	Mining and industrial town	Meter Rate from 1 lamp up No limits	43¢ per lamp first lamp free	Monthly	5	Meter		3 yrs contract waived if cust moves; no gas introduced during contract	Lamps excluded, Fixture included Lamp renewals at extra low prices	Heating and Cooking Appliances										No Limits		First 32 cp lamp $2.88, 2nd $1.73(1) 3rd and following ones $1.30 1st 16 cp lamp 1.15, following ones 87¢	Monthly or yearly	5yrs contract; waived if cust moves, (gas not allowed)(1)				(1) First lamp must be 32 cp.	In 1912 abt 7000 new lamps connected for small consts. bringing yearly revenue of $170 on capital invested there for $2000 for installation. As small cons. 50% instalment [illegible] yrs $[illegible] for instl. which secure an income of $[illegible]
			Flat rate (house owners only) 1-5 Lamps	43¢ per lamp first lamp 72¢	Monthly	5	Flat		3yrs contract suspended as long as flat is vacant		12% of Price	Monthly	Remain property of Cent Sta																	
GOTHENBURG SWEDEN	160,000	City																		Gratuitous current one year not exceeding amount of cost of installation current comp at meter rate [illegible]		95¢; if every room of laborers tenem. one lamp installed and one limiter only for whole building, rate reduced to 81¢				9¢				Number of customers risen after introduction of system within about 3 yrs. from 4500 to 12,000, to 2% gross returns. particulars see in text of report

On account of limited space, all Regulations could not be included in the table. Slight changes made where necessary, which do not alter the essentials; for instance flat rates reduced to 10 watt units throughout, even if expressed otherwise in schedule. Residences considered in first place. All places where country is not stated are in Germany.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Poor Shaft Alignment

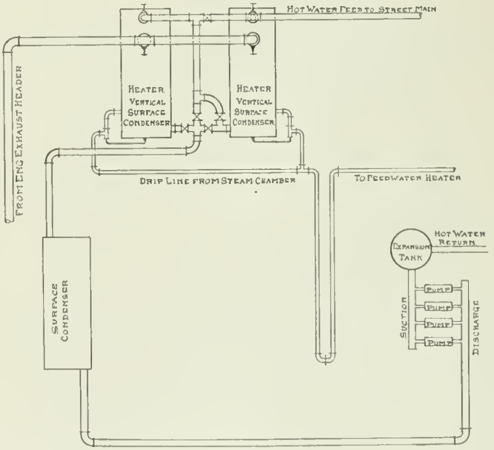
Even with the best of shaft alignment it has been found profitable in many cases to substitute individual motor drive for engine drive. This is not only to give individual speed control but to eliminate ever-present bearing and belt losses. Furthermore, the low-water rating of hydraulic plants has been increased by applying the waterwheel to drive a generator for motor supply instead of having the wheel drive the mill shafting direct. An inspector was called in to find out why an induction motor got "so hot when the cornmeal machine was thrown on." The motor drove 30 ft. of shafting the hangers of which were lagged to the floor. To the shafting were belted the meal grinder and several smaller machines. With only the smaller machines working, the motor was running supposedly light. The ammeter showed, however, that under this condition the motor was fully loaded and that throwing out the small machines did not appreciably affect the load, but that throwing in the grinder increased the load 50 per cent. The cause of the overload was traced to sacks of corn and meal piled so high upon the floor as to sag it and pull the shaft hangers out of line, the shaft then taking the shape of a letter S in three dimensions. The mill operator unloaded the floor so that the hangers could spring almost back into line, then braced the floor from beneath so that it could stand a load without sagging. Application of the ammeters then showed that the motor was just loaded when all machines were in operation. The inspector got his clew to the trouble from a couple of very hot hanger boxes.

Gradual Overloading

One accustomed to engine drive and who adopts electric-motor drive is usually solicitous about having a motor sufficiently large for the work, and this is especially likely to be so after he has compared the size of the engine with that of the motor that is to replace it. Once the motor has been installed and has shown what it can do, however, all solicitations as to the possibility of overloading the motor seem to end, and one machine after another is added to its load without a thought as to its welfare. The case of a 5-hp induction motor the original duty of which was to operate one small beam hammer and a blower for two forges is typical. Three forges were added, one at a time, and the size of the blower was doubled; then another small beam hammer was added; then a drill press and a large beam hammer. Each addition called for another belt, and the total length of shafting was doubled. Then the inspector was called to find out why the motor blew fuses "when the big hammer was thrown on." The compensator was connected on the highest tap, yet the motor required one and one-half minutes to come to the highest speed obtainable on the starting side of the compensator. It should have required about thirty seconds. Ammeters connected into each of two legs showed that the full motor current rating was required to run the shafting, belts and blower, and that under average operating conditions the motor was just 100 per cent overloaded. On account of the heavy overload the difference between the maximum speed obtainable on the starting side of the compensator and that on the running side was so great that throwing the compensator over would blow all fuses.

Combination Water-Heating System at Springfield, Ill.

In order to supply hot water to the 336,000 sq. ft. of radiating surface on its hot-water-heating system the Springfield (Ill.) Light, Heat & Power Company uses surface condensers operating in connection with cross-compound condensing engines and vertical heaters arranged to be operated singly, in parallel or in series. The temperature of the water in the heating system is, of course, regulated to accord with the temperature out of doors. Fundamental variations in water temperature are produced by varying the vacuum in the surface condensers, the vacuum gage on these condensers being allowed to fall at times as low as 10 in. of mercury. As additional heat is required beyond this point the water is circulated through the vertical heaters and brought up to the desired temperature by the use of exhaust steam brought in from the engine exhaust header.


Hot Water Feed to Street Main
From Eng Exhaust Header
Heater Vertical Surface Condenser
Heater Vertical Surface Condenser
Drip Line from Steam Chamber
To Feedwater Heater
Hot Water Return
Expansion Tank
Surface Condenser
Suction
Pump
Pump
Pump
Pump
Discharge

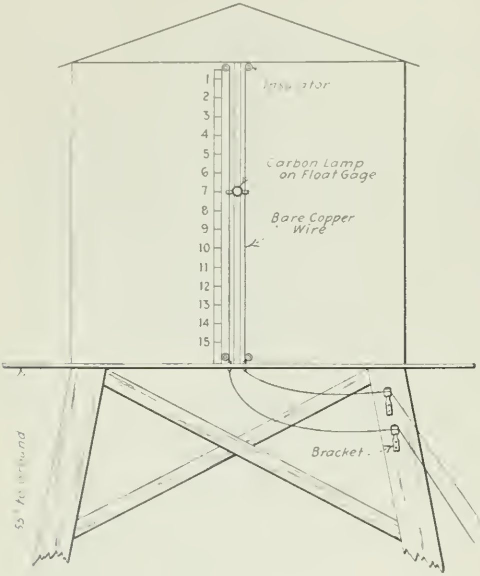
ARRANGEMENT OF SPRINGFIELD HOT-WATER HEATING SYSTEM

Circulation of the water through the system and return to the expansion tank is accomplished by three reciprocating pumps and one turbine-driven centrifugal pump. Within a short time the three reciprocating pumps will be replaced by turbine-driven units. Mr. R. E. Hagenah is superintendent and chief engineer for the company.

Illuminated Float Gage Saves Water

Water for boiler-feed and condensing purposes, for transformer cooling and for plant service in an Ohio central station is supplied from deep wells driven on the company's property. For the first three uses the water is taken directly from the wells, but for house service the supply is first pumped to a tank which stands outside the plant, at a height of 55 ft. above the ground. As most of the pumping for the house-service tank is done at night when the station load is light some means of reading the water level in the overhead tank in the dark had to be devised in order that water might be saved and the operating expense kept at a minimum.

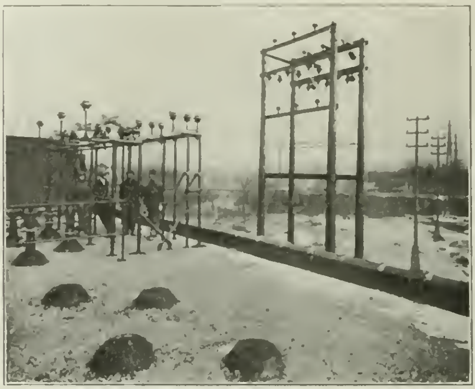
As will be seen from the accompanying sketch, a small carbon lamp was attached to the water-level indicator and bare-copper wires were stretched between insulators at the top and bottom of the tank. Contactors were then arranged at all times energizing the filament of the lamp. As the float indicator moves up and down the scale it carries with it the lighted lamp illuminating the numeral opposite. The circuit is controlled by a switch near the boiler-room door, through which the engineer has to pass when going to see the scale on the tank.



ILLUMINATED FLOAT GAGE

An Inexpensive and Substantial Pole Base

To the man who has to do the climbing a spliced pole is always more or less of a necessary evil. It is not, however, always practicable for the central-station company to buy a few high poles for the sole purpose of grading a line or going over an obstruction; hence spliced poles are often found. The idea that a spliced pole is always necessary has been exploded by the scheme used by the Elwood (Ind.) Electric Light Company on two poles which were set between the station disconnecting switches and two high towers used to clear the wires on the nearby railroad right-of-way. In this instance the length of span demanded that two poles be set in the low ground between the station and the railroad embankment. As it would have been necessary to set the poles in concrete, regardless of their height, on account of the water which runs through the low ground during the spring freshets, it was decided to continue the concrete to a point which would make a splice unnecessary. The poles as they stand present a neat appearance and do not offer the difficulties to the climbing lineman which are met with in the ordinary spliced pole. The stability of the poles was tested during recent floods when the water stood nearly at the top of the concrete base. Some apprehension was felt for the new type of construction at that time, but the subsiding water left the poles as upright as it had found them.

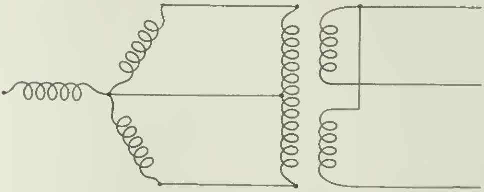


POLES ON HIGH CONCRETE BASES

Transformer Connections to Change Phase Relations

Can two single-phase transformers be connected in open delta across a four-wire grounded-neutral three-phase system to deliver three-phase energy? O. M. P.

The connection of single-phase transformers to deliver three-phase energy when in open delta across the outer terminals of a four-wire grounded neutral system is the same as would be used if no neutral were employed. If, however, it is desired to connect single-phase units in open delta between two outer terminals and the neutral, the connections have to be made as shown in the sketch to obtain three-phase energy. To obtain a power output with an open-delta connection equivalent to that with three transformers connected in closed delta, use should be made of two units each having about 73 per cent larger rating than those in the former case. In any event the voltage under load will be distorted from the true three-phase relation by reason of the lack of equality in the impedances in the various circuits.



THREE-PHASE TRANSFORMER CONNECTIONS FROM NEUTRAL POINT

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Three-Phase Series Commutator Motors.—Oskar Srnka.—The use of the three-phase series commutator motor is increasing in favor especially on account of the possibility of regulating the speed without losses at any load. If these motors are to be used for traction purposes, the question of recuperating energy during braking becomes of increased importance. The author shows how the three-phase series commutator motor with an intermediary transformer and a double set of brushes can be used to return energy into the network.—*Elek. u. Masch.* (Vienna), May 3, 1914.

Lamps and Lighting

Rating of Lamps.—The German Illuminating Engineering Society proposes to rate the candle-power of a lamp by one of the following three quantities: The mean spherical candle-power J_o, the mean low hemispherical candle-power J_u, and the mean horizontal candle-power J_h. It must always be stated which of these three candle-powers is meant. From a purely physical viewpoint the mean spherical candle-power is the most important one, but for practical reasons it is often advisable to stick to the ratings by lower hemispherical candle-power and horizontal candle-power. The committee recommends stating the conversion factors for changing the mean horizontal and the mean lower horizontal candle-power into mean spherical candle-power. This report of the committee is preliminary, and it is intended to bring about an agreement with other societies, especially the Association of Electrical Engineers. —*Elek. Zeit., April* 30, 1914.

"Objective Photometry."—Voege.—A paper read before the German Illuminating Engineering Society. The purpose of an objective photometer is to make the routine photometer tests in factories and laboratories independent of the human eye by means of a simple galvanometer reading. Since the thermo-element and the bolometer are not sufficiently sensitive for light rays and the selenium cell has too much inertia, the author uses the photo-electric alkali cell. This consists of a spherical glass vessel filled with argon. One wall is covered with a metallic potassium or sodium layer forming the cathode, while the anode is formed by a platinum wire. When the cell is illuminated by light and an emf is impressed on the cell electrons are emitted by the potassium layer, producing a current which is weak but can easily be measured. This current is proportional to the illumination within the widest limits, from 0.0001 lux to 80,000 lux. The cell is free from inertia. Its chief disadvantage is that the maximum sensitiveness is in the blue-violet part of the spectrum while that of the eye is in the yellow-green part. To overcome this difficulty the author uses suitable light filters whereby the maximum of the sensitiveness of the cell is made to coincide with that of the eye, although the sensibility curves are not yet entirely identical. The results obtained for practical purposes with the photo-electric cell are identical with those of a photometer as shown by Table 1, which gives the results for a carbon-filament lamp and a tungsten lamp at different voltages. The table gives the candle-powers determined by the photo-electric cell and the photometer and their differences. The differences are entirely within the limits of experimental error. Fig. 1 shows the experimental arrangement. The photo-electric cell Z is connected in series with the battery E and the galvanometer G, which is calibrated in candle-power. First the standard lamp is inserted at N and the distance a is so adjusted that the galvanometer needle gives the correct value for the standard lamp. If the lamps to be tested are substituted for the standard lamp N, the galvanometer gives directly the candle-power. The voltage of the photo-electric cell should be between 60 volts and 120 volts, according to the sensitiveness required. The sensitiveness increases rapidly with increasing voltage. E is a battery of small cells. Hardly any current is taken from them during the measurement. The method is useful for tests of electric incandescent lamps, for photometry of gas incandescent lamps, for tests of small hand and pocket lamps, etc.—*Elek. Zeit.*, April 30, 1914.

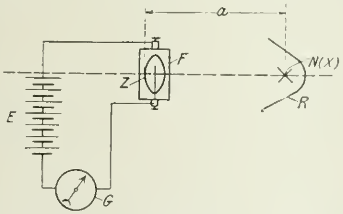


FIG. 1—EXPERIMENTAL PHOTOMETRICAL ARRANGEMENT

RELATIVE DATA ON CANDLE-POWER

	Candle-Power		
	Potassium Cell	Photometric	Difference, Per Cent
Carbon-filament lamps:			
85 volts	5.85	6.00	— 2.5
90 volts	8.53	8.57	— 0.4
95 volts	12.25	12.37	— 0.98
100 volts	17.00	17.06	— 0.35
105 volts	23.26	23.18	+ 0.35
110 volts	31.00	31.00	0
Tungsten lamps:			
110 volts	25.00	25.00	0
115 volts	29.62	29.60	+ 0.07
120 volts	34.70	34.90	— 0.57
125 volts	40.10	39.70	+ 1.0
130 volts	46.25	46.60	— 0.75
135 volts	52.30	52.00	+ 0.6

Illumination Calculations.—W. C. Clinton.—An abstract of a paper read before the (British) Illuminating Engineering Society giving a comparison between results actually attained in artificial lighting installations and the predetermination from known data of the types of illuminants used.—London *Electrician*, April 24, 1914.

Electric Train Lighting.—Jacob.—A paper read before the German Illuminating Engineering Society on systems of electric train lighting. The author distinguishes pure storage-battery systems and systems using both a storage battery and a generator. The author briefly describes the principal features of four typical systems.—*Elek. Zeit.*, April 30, 1914.

Generation, Transmission and Distribution

Traveling Waves.—W. O. Schumann.—A mathematical article on the deformation of waves traveling along conductors and especially the change to which the steep front of a traveling wave is subjected when it meets a resistance, inductance or capacity in the line.—*Elek. u. Masch.* (Vienna), April 26 and May 3, 1914.

Electric Winding Machines.—W. Phillippi.—The conclusion of his paper on the present status of the electric winding machine. The author gives a comparison of the principal systems of electric winding and then compares steam driving with electric driving.—*Elek. Zeit.*, April 30, 1914.

Traction

High-Tension Direct-Current Traction.—P. Amsler.—The motor-generator system for lighting low-voltage lamps on trains from the high-tension direct-current trolley supply, recently described in the Digest, may also be used for driving the railway motors. When the rating of an electric locomotive is as high as 2500 kw, it is necessary to raise the voltage on the trolley wire to 5000, but the design of 5000-volt traction motors would meet with considerable difficulties. The author, therefore, proposes to use the Ward Leonard motor-generator system, the arrangement being shown in Fig. 2. *HM* is the 5000-volt motor of the Ward Leonard system; *LG* is the Leonard generator, and *ED* is the small constant-voltage machine which feeds the excitation winding *I* of the high-tension motor *HM* with low-tension current. *H M A* and *N M A* are circuit-breakers, *A A* is an automatic starter, *A W* a starting resistor, *FS* controller, *RS* reversing switch, *TM* traction motors, *SR* rapid regulator, *I, II, III* excitation windings, and *L* lamps. Data are given on the electric equipment of a motor-car and locomotive with this system together with figures of weight, etc.—*Elek. Zeit*, April 30, 1914.

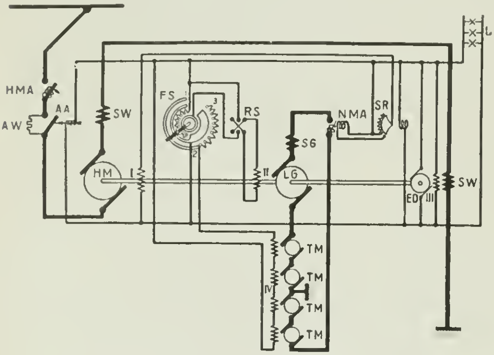


FIG. 2—DIAGRAM FOR WARD LEONARD SYSTEM

Railless Traction.—T. S. Gribble.—A paper read before the (British) Institution of Civil Engineers on comparative economics of tramways and railless electric traction. He submitted evidence that for urban and suburban transportation track-laying has been carried far enough, and in many cases too far, maintaining that wherever overhead wires can be employed railless electric traction affords the best means of extending the tramways. The development of the railways brought about over-crystallization of the population, necessitating the adoption of means for decentralization, such as electric traction, without the heavy burden of permanent way. At the same time this would enable a supply of electricity to be given to sections of the population which at present lack that advantage. The author's final comparisons are shown in Fig. 3. He finds: (1) That with a traffic density represented by a two-and-one-half minute service the cost of working is still in favor of railless electric traction, although only to the extent of about 7 per cent. The cost of construction is, however, about 44 per cent less. (2) That the saving increases inversely with the traffic density, so that with a time interval of thirty minutes the cost of operation is about 36 per cent less and that of construction about 70 per cent less. The opinion that the economy of the "trolley-bus" ceases at a service frequency of about ten minutes is, in the author's opinion, quite unfounded. The tramway cannot serve the public as comprehensively as the "trolley bus." In order to serve the city best, the aim should be to reach the farthest suburb, and to supply the greater frequency of service in the center of the city by means of overlapping services radiating to the suburbs. The curves in the diagram are based upon the following assumptions: Length of route, 1 mile; length of traffic day, fourteen hours; scheduled speed, 7½ miles per hour; number of cars in service, car-mileage per day ÷ 105; number of cars in stock, car-mileage per day ÷ 70; power-house equipment rating, 25 kw × number of cars in service. Cost of power house with plant, 500 lb. × number of cars in service; rolling stock, 750 lb. × number of cars in stock; land and car-sheds, 200 lb. × number of cars in stock; cost of electrical equipment, from £1,000 to £3,000 and of track from £5,000 to £12,000 per mile of route, depending upon the traffic density.—London *Elec. Rev.*, May 1, 1914.

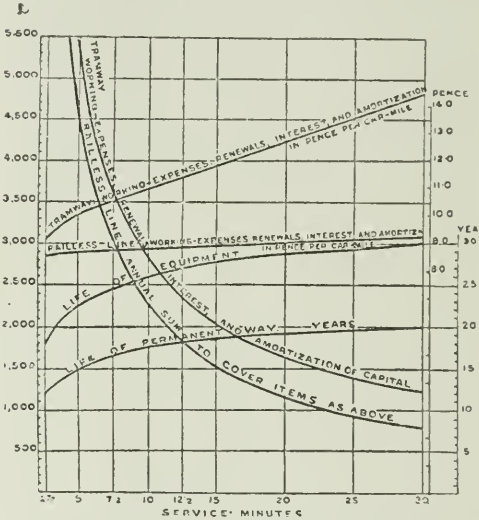


FIG. 3—CURVES SHOWING COMPARISON BETWEEN TRAMWAYS AND RAILLESS TRACTION

Installations, Systems and Appliances

Shanghai.—An article giving statistical data on the great progress which has been made during the last twelve months by the central station at Shanghai. There has been an increase of nearly 2500 hp in motors during the past year, the total aggregate horse-power now connected being over 5300. In addition to this very useful load, a bulk supply is given to two districts which amounts in the aggregate to nearly 6000 hp. Compared with December, 1912, when there were 6870 connections, the total number of consumers is now nearly 11,000. The load-factor has been improved from 23.5 to 30.8 per cent, and the minimum total load observed recently was over 8000 kw. At present over

600 radiators are connected, representing a load of just over 1000 kw. These figures show that the average input per radiator is in the neighborhood of 2 kw. The kilowatt-hours sold or accounted for were nearly 22,000,000, as compared with about 12,000,000 during the previous twelve months. The station introduces electrical vehicles and will add two 5000-kw turbo-alternators to its present plant.—London *Electrician*, May 1, 1914.

Wires, Wiring and Conduits

Calculation of Networks.—Karl Fuchs.—When the problem is to be solved to calculate the voltage drops in the different branches of a network with many branches, it is necessary to solve n linear equations with n unknown quantities. The author shows how the solution of these equations can be facilitated.—*Elek. u. Masch.* (Vienna), April 26, 1914.

Calculation of Alternating-Current Lines.—H. B. Dwight.—The determination of the requisite size of conductor for transmitting a certain amount of electric energy requires considerable calculation and reference to tables of transmission line constants. The author gives a chart for the regulation of alternating-current transmission lines which permits a great saving in calculations. The application of the chart is explained.—London *Electrician*, May 1, 1914.

Switches.—A set of rules for the construction and testing of switches, fuses, regulating resistors and starting resistors for voltages up to 750. This set of rules will be in force beginning July 1, 1915.—*Elek. Zeit.*, April 30, 1914.

Fittings.—A set of rules of the German Association of Electrical Engineers on the construction and testing of fittings, fuses, etc. These rules will be in force beginning July 1, 1915.—*Elek. Zeit.*, April 30, 1914.

Regulations for Mines.—In an appendix to the regulations of the German Association of Electrical Engineers on electric installations wiring rules are given for mines; also a set of symbols to be used in wiring drawings.—*Elek. Zeit.*, April 30, 1914.

Electrophysics and Magnetism

Gas in Vacuum Tubes.—George Winchester.—An account of an investigation of the continued appearance of gas in vacuum tubes. Chemically pure electrodes give off gases in different proportions; for example, of two cathodes having the same weight one may be rich in helium and the other give off comparatively little, or one may give off more hydrogen than the other. Thus, apparently no relation exists between the size of the cathode and the amounts of gases which may be thrown off in a high vacuum when large potentials are applied to the electrodes by means of an induction coil. The explanation of this fact may depend upon the manner in which the gases are occluded in the metal. It seems probable that they are not a part of the metallic molecule in the same sense that the alpha particle is a part of the molecule of radium. Suppose, for instance, that the gaseous atom is simply held in contact with the aluminum atom or molecule by some force of adhesion, and that it is freed by repulsion on account of the very large number of negative electrons applied to the cathode. Then, if one cathode should disintegrate more thoroughly than the other before it was consumed, it would give off the greater amount of gas. The presence or absence of hydrocarbons within the experiment tube has no influence upon the amounts or kinds of gases evolved. So far as the author's experiments have gone there has been no instance when hydrogen could not be obtained if any metal of the cathode remained, with one exception. The fact that helium and neon may be entirely eliminated from the tube shows that they are not disintegration products; if they were, one should be able to generate them as long as he applied high potentials to the electrodes. But the case of hydrogen is different. There is the possibility of its being a disintegration product of the metal in somewhat the same manner as the alpha particle is disintegrated from radium. But while radium disintegrates spontaneously, the hydrogen requires the assistance of a large electric force before it is able to leave the metal.—*Phys. Review*, April, 1914.

Effect of Magnetization on the Opacity of Iron to Roentgen Rays.—A. H. Forman.—In a general way it would seem natural to expect that a change in the molecular arrangement of iron by magnetization, which produces the phenomenon of magneto-striction, should to some extent also effect the opacity of the iron to Roentgen rays. But the results of the author's experiments are negative since they appear to show that no effect is attributable to the magnetization of the iron, with the magnetization in a plane perpendicular to the Roentgen rays and either parallel or perpendicular to the axis of the X-ray tube.—*Phys. Review*, April, 1914.

Electrochemistry and Batteries

Copper Leaching and Electrolytic Precipitation in Chile.—E. A. Cappelen Smith.—His American Electrochemical Society paper in full, with illustrations, on the development of copper leaching and electrolytic precipitation at Chuquicamata, Chile. The ore body is in excess of 200,000,000 tons. The author describes the process which has been developed in an extended experimental investigation at Perth Amboy. It comprises leaching of the ore with a sulphuric-acid solution, elimination of the chlorine from the solution by means of shot copper, and finally electrolyzing the solution, using insoluble anodes of fused magnetite and precipitating copper on ordinary copper cathode starting sheets. The first unit of the plant now in course of erection in Chile has been designed to treat about 10,000 tons of ore per day. The electrolytic refinery will have an output of about 335,000 lb. of copper per day. The generating equipment will consist of a primary station at the coast, using oil-fired boilers driving four steam turbines connected to four 10,000-kw alternating-current generators. The energy will be transmitted 85 miles at 100,000 volts to a substation located at the mill site. The substation for the electrolytic refinery will consist of seven motor-generator sets, each of 2500-kw rating.—*Met. and Chem. Eng'ing*, May, 1914.

Units, Measurements and Instruments

Magnetic Tests for Sheet Iron.—A set of the new rules of the German Association of Electrical Engineers for the testing of sheet iron. These rules will be in force beginning July 1, 1914. For measuring the iron losses and the magnetization a magnetic circuit is to be used which contains only iron of the quality to be tested. The sample should weigh 10 kg (22 lb.) and should be taken from at least four different sheets. The iron is to be tested at 20 deg. C. The iron loss is to be given in watts per kilogram for a pure sine wave of the emf for the maximum values of the magnetic induction = 10,000 and 15,000 c.g.s. units. These figures are called loss figure (Verlustziffer) and are written V_{10} and V_{15} respectively. The "aging coefficient" is the change of the loss figure in percentages for $B = 10,000$ after 600 hours of heating to 100 deg. C. The magnetization is indicated by the values of the induction B at two different field intensities in the iron. These two values are chosen from 25, 50, 100 and 300 amp windings per centimeter. These values are indicated by B_{25}, B_{50}, B_{100} and B_{300}. Figures of specific weight of iron are given; 0.35, 0.5 and 1.0 mm. are standard thicknesses of sheets. The iron strips used for the test should be 500 mm long and 30 mm wide and should be cut one-half parallel to the direction of rolling and the other half perpendicular to the direction of rolling. The Epstein apparatus is used for the tests.—*Elek. Zeit.*, April 30, 1914.

Telegraphy, Telephony and Signals

Variation of Speech by Microphones.—A. BLONDEL AND S. POLAK.—The authors give an account of an oscillographic study of microphones with a view to bringing to the notice of experts the different records obtained of the same sound by different types of microphone. The arrangement of the experiments is shown in Fig. 4. A triple bifilar Blondel oscillograph was employed, the bifilar suspensions, 2 and 3, being used to register the currents in the microphones M_1 and M_2; the third bifilar was hung on an electric tuning fork, giving 200 vibrations per second and permitting the frequency of the waves to be registered. For sounds the authors employed the human singing of vowels, a bell, a special siren, a clock, etc. The microphones were suspended by long wires in front of the source of sound, in identical positions, and the identity of the records was verified by interchanging the microphones and connections. The two bifilars were connected in series with the same microphones, and four oscillograms were taken as follows: One when the current was nil; one with the circuit closed and the current equal to 1/100 amp through the two bifilars and the microphone; one when the vowel *a* was sung before the microphone; one with the vowel *i*. The oscillographs obtained show clearly the effect of the type of microphone. All the oscillograms tend to show that the microphones preserve well the fundamental wave of the note, but alter the higher Helmholtz harmonics characteristic of the vowel. The deformation of the higher harmonics is a fault inherent in all the usual microphones. To explain the reason for this it is natural to attribute it to the resonance of the apparatus and to find out the natural frequency of the microphones. The authors conclude that this investigation shows at least that it is necessary to proceed with caution if one wishes to draw, from theory or practice, conclusions from oscillographic studies of microphones. The microphones can introduce their own oscillations, of a frequency independent of that of the sound of the human voice, every time the membranes or the granules are not sufficiently damped; likewise an excessive damping can suppress certain harmonics. One sees from this point of view the great difference between microphones of similar appearance. Microphones with granules give very many superfluous vibrations. It seems that the better method of recognizing with precision the composition of vowels in telephonic transmission would be the synthetic method, consisting of superimposing a principal emf on the harmonic terms produced by other small alternators, as has been done, for example, by Cahill for the reproduction of the sounds of musical instruments.—London *Electrician*, April 24, 1914.

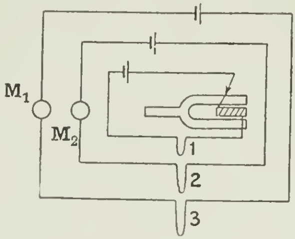


FIG. 4—ARRANGEMENT FOR MICROPHONE EXPERIMENTS

Wireless-Telegraph Recorder.—ALFRED GRADENWITZ.—An illustrated description of the Tauligne wireless-telegraph recorder, which consists of a special electrolytic detector allowing the depth of immersion of a platinum wire electrode to be regulated, a polarized magnetic relay, and a variable-speed Morse recorder. These parts are supplemented by a tuning coil and various accessories.—London *Elec. Review*, April 10, 1914.

Book Review

METAL STATISTICS 1914. Issued by the *American Metal Market and Daily Iron and Steel Report*. New York: The American Metal Market Company. 288 pages. Price, 50 cents.

The additional statistics which the editors of this handbook have included in the seventh annual edition serve to make the 1914 issue a wonderfully handy and complete record of the 1913 metal situation. All the essential statistics of production, consumption, exports, prices and duties for iron, steel, copper and the other staple metals seem to be adequately covered. It was not possible to include final and certified figures for 1913 in all cases; but estimated values are included for the more important items, and these seem to bear out the general conclusions which had been already formed of metal production during the latter half of last year. The 1913 figures for total United States production of ore, pig-iron and steel all go to fresh high levels. Total iron and steel exports for the year are slightly less in tonnage than in 1912, although they have a value of $302,000,000 as against $289,000,000 in the preceding year. The increase of pig-iron production was due to new high records in the earlier part of the year, the figures for the latter six months being over 1,000,000 tons (or 7.5 per cent) less than in the preceding year. Estimated figures for the world's pig-iron production show the United States supplying over 40 per cent of the total. Statistics for the United States Steel Corporation show total earnings of $140,000,000 for 1913, against $108,000,000 for 1912; but figures for unfilled orders for the various months of 1913 indicate a very marked decrease in activity toward the end of the year, October, November and December showing a progressive decline of 40, 44 and 46 per cent as compared with the same months in 1912. The copper production for the entire country showed a decrease of 1.5 per cent over 1912, the total being a trifle under 1,250,000,000 tons. For the first five months 1913 exceeded 1912 by a substantial margin; June and July came out at about the same for the two years, while for the last five months (with the exception of November, which was about even) 1913 production fell considerably below that of 1912. This difference is explained by the tables showing domestic and export consumption, a material falling-off in the home demand occurring in the latter part of the year, with exports running substantially higher than 1912 right through the year. The report of the Copper Producers' Association shows that the deliveries into domestic consumption in December, 1913, were only 37 per cent of their tonnage for December, 1912, while the domestic consumption for the year was 767,000,000 tons against 819,000,000 tons in 1912. The status of electrical manufactures in 1913 (which are responsible for, say, one-half the domestic consumption) will about reflect the conclusion that may be drawn from that ratio. The remaining sections of the handbook provide similar data on tin, lead, spelter, aluminum, antimony and silver, while a good deal of general information on these and other metals is given under a caption of "miscellaneous."

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Electric Fluting Irons

The fluting attachment illustrated in Fig. 1 is for use with an electric iron. The rocker is so constructed that its corrugations draw the fabric into the grooves of the base and press it in such a manner, it is claimed, that there is no danger of tearing. A self-heated electric fluting iron is shown in Fig. 2. The heating unit is contained in the base and is designed to provide heat enough for pressing. This iron is equipped with a quickly detachable connector which permits of rapid removal of the cord from the iron and also allows the user to regulate the heat to the work in hand. Both these devices are being placed on the market by the Simplex Electric Heating Company, Cambridge, Mass.

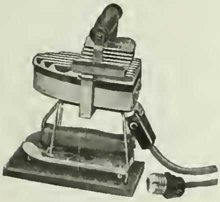


FIG. 1—FLUTING ATTACHMENT

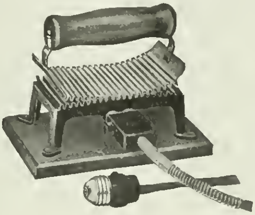
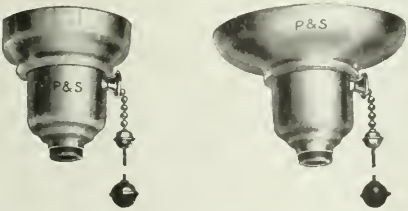


FIG. 2—ELECTRIC FLUTING IRON

Pull-Switch Rosettes

A number of different types of pull-switch rosettes, embodying the so-called "Fluto" interchangeable arrangement, are being placed on the market by Pass & Seymour, Inc., Solvay, N. Y. These rosettes are equipped with a short chain to which is added 10 ft. of black linen cord with a black acorn attached to the end. By means of the cord, eyelets or pulleys can be used so that the switch may be operated at a distance. Various kinds of bases are used for these rosettes, the type of base depending on whether the rosettes are to be used on cleat work, outlet-box work, ordinary concealed wall work, or for taplets, conduit boxes, etc. Two of these rosettes are shown herewith.

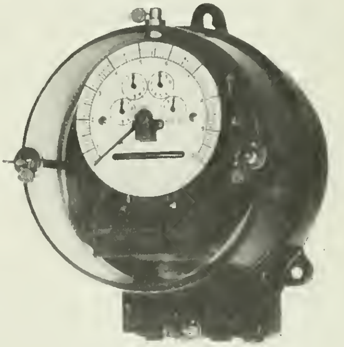


PULL-CHAIN ROSETTES WITH LINEN CORD ATTACHED

Watt-Hour Demand Meter

A meter designed to record both the kilowatt-hours and the maximum kilowatt demand without the use of a clock mechanism is shown herewith. The maximum demand is indicated by a pointer sweeping over a 4-in. dial and the number of watt-hours consumed is recorded on a four-dial counter.

The meter is a combination of an induction watt-hour meter, an induction wattmeter and an escapement form of time element. The instrument has an ordinary watt-hour meter movement, including electromagnet, permanent magnet and aluminum disk. In addition, it has an auxiliary disk sector supported on a jewel-and-ball bearing so that it can move in the air-gap of the electromagnet in such a way that it does not interfere with the accuracy of the main disk, which always rotates at a speed proportional to the load. The rotation of the auxiliary disk is restrained by a spiral spring, making its final deflection proportional to the watts taken. The auxiliary disk with its spring and pointer constitute an indicating wattmeter.



WATT-HOUR DEMAND METER

The shaft of the auxiliary disk is geared to an escapement wheel, and the claw restricting this wheel is oscillated by an eccentric on the main shaft. The auxiliary disk, therefore, advances step by step at a speed determined by the speed of the main watt-hour meter disk, that is, at a speed proportional to the load. It continues to advance until the spring tension balances the torque produced in the auxiliary disk. The demand mechanism is then in equilibrium and the pointer indicates the watts. The auxiliary disk drives the demand pointer.

The maximum demand pointer can be reset instantly by pressing a sealed button on top of the cover. This raises the pawl that holds the pointer in its maximum position, and a light spring returns the pointer to zero or to the position of the auxiliary disk.

This watt-hour demand meter is being made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

China Domes

A dome made of china and designed by manufacturers of art ware and decorative dinner sets for use with electric lamps is now being placed on the market. This dome, which is illustrated herewith, is made of opaque china, a high-grade clay being used in its manufacture. The body of the dome is snowy-white, and the surface, both interior and exterior, is provided with a velvety glaze. The design in the illustration is known as a Byzantine motif and consists of hand-painted filigree-work of coin gold encircling the dome and an artistic centerpiece at the base. The outside rim is finished with a wide band of gold. Domes of this type can be embellished with a variety of decorative colors, and as the colors are burned in the china, the decorations do not deteriorate or become tarnished. Both 16-in. domes with a depth of 5.5 in. and a height from ceiling to base of dome of 38 in. and 12-in. domes with a depth of 8 in. and a height from ceiling to base of dome of 28.5 in. are being made. Two 60-watt lamps, two 150-watt lamps, one 250-watt lamp or one 400-watt lamp can be used with this dome.

OPAQUE-CHINA DOME

The dome described in the foregoing paragraph is being manufactured at the works of the H. R. Wyllie China Company, Huntington, W. Va.

Electrical Features of the Forest Products Show at Chicago

Opening at the Coliseum in Chicago on April 30 and continuing through May 9, the Forest Products Exposition, showing wood in all forms, from sawdust to finished bungalows, contained several features of electrical interest. One of the attractive exhibits, shown in an accompanying illustration, was that of the Northern White Cedar Association, formerly the Northwestern Cedarmen's Association. Straight and sturdy 25-ft. and 30-ft. poles of standard sizes were erected at the corners and in the center of the exhibit. Cross-arms carrying insulators and wire lent a realistic atmosphere to the display. Even the guy wires, of No. 6 steel, were served about the tops of the poles, as though a practical lineman had recently completed his work. The exhibit represented the twenty-eight members of the Northern White Cedar Association, of which Mr. N. E. Boucher, Minneapolis, Minn., is secretary.

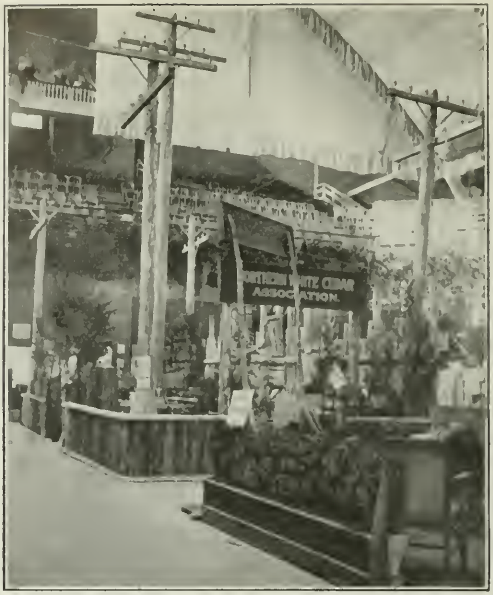


FIG. 1—WHITE-CEDAR POLES AT THE FOREST PRODUCTS SHOW, CHICAGO

As a portion of the exhibit of the cypress producers a large electric sign (Fig. 2) presented a spectacular appearance. The sign, suspended aloft, consisted of a real cypress log, which had been quartered, hollowed out and fastened together again so that it had the appearance of a solid piece of timber. In the side of the log the legend "Cypress—the Wood Eternal," illuminated by electric lamps from the interior, stood out in bold relief and caused the spectator to wonder at the ingenuity with which the light sources were hidden. Closer observation, however, showed the electric circuit coming over the butt of the log and entering through the letter "L."

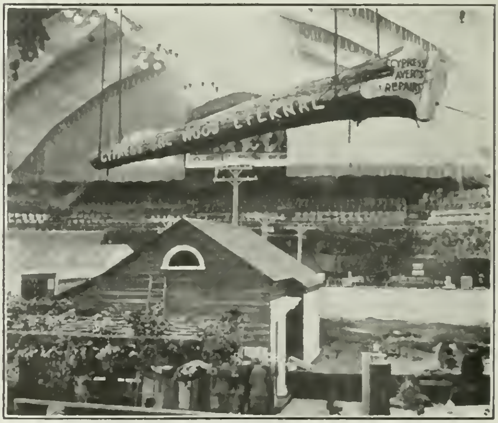


FIG. 2—CYPRESS-LOG DISPLAY AT THE FOREST PRODUCTS SHOW, CHICAGO

Indirect Lighting for Boys' High School, New Orleans

Indirect lighting is used throughout in the illumination of the Boys' High School, New Orleans, La., and in the design of this school building the lighting equipment was considered an integral part of the complete building.

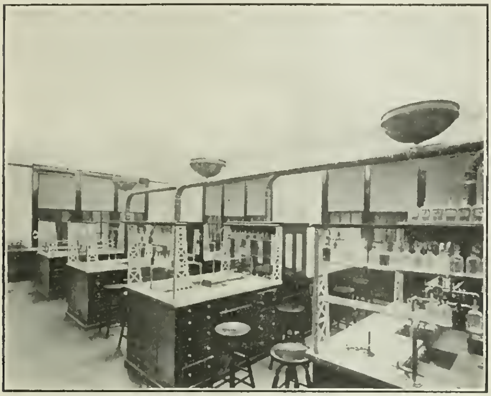


FIG. 1—LIGHTING IN CHEMISTRY LABORATORY

In Fig. 1 is shown the method of illuminating the chemistry laboratory. The room is 25 ft. wide by 41 ft. long and the ceiling is 13 ft. high. Each of the three fixtures used is provided with five 100-watt clear-bulb tungsten lamps suspended 36 in. below the ceiling. The value of watts taken per square foot of floor area is 1.46, and the intensity is 3.4 ft.-candles.

The banking room shown in Fig. 3 is a large class or study room, 75 ft. long by 25 ft. wide, with the ceiling 13 ft. above the floor. In this room five fixtures are each equipped with five 100-watt clear-bulb tungsten lamps, suspended 36 in. from the ceiling. The number of watts per square foot of floor area is 1.40, and the intensity is 3.3 ft.-candles on the working plane.

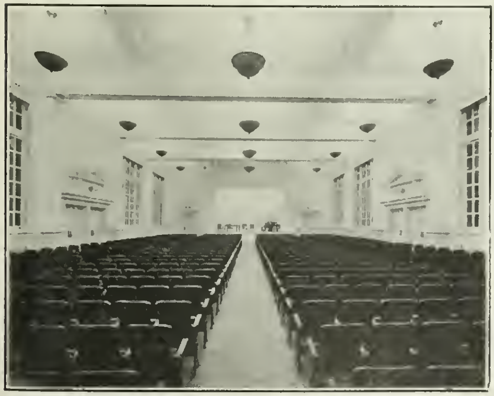


FIG. 2—LIGHTING IN AUDITORIUM

In Fig. 2 is shown the arrangement of the fixtures in the auditorium. This hall is 52 ft. by 73 ft. in size and the height of the ceiling is 26 ft. There are fifteen fixtures arranged in three rows of five units to the row. Each of the center fixtures carries seven 100-watt clear-bulb tungsten lamps and each of those in the outside rows five 60-watt clear-bulb tungsten lamps. The bowls are hung 62 in. from the ceiling. The total area of this auditorium is 3800 sq. ft. and the number of watts used per square foot, therefore, is 1.71. The units are wired so that each set of lamps can be turned on separately. The average horizontal illumination in this auditorium on a plane 36 in. above the floor, when all the equipment is in use, is approximately 4.3 ft.-candles.

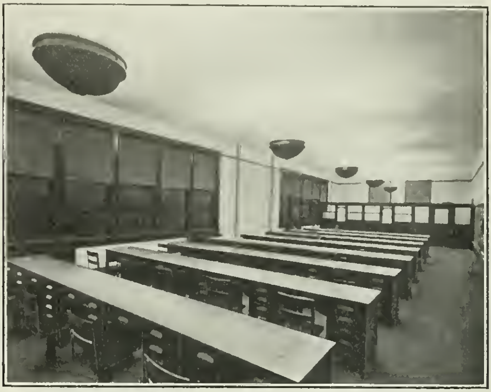


FIG. 3—LIGHTING IN BANKING ROOM

A typical classroom is shown in Fig. 4, the size being 25 ft. by 35 ft. and the height of the ceiling 13 ft. Two fixtures are used, each being equipped with five 100-watt clear-bulb tungsten lamps. The bowls are suspended 42 in. below the ceiling. The total number of watts taken is 1.14 per square foot, giving an intensity at the desk tops of 2.6 ft.-candles.

The fixtures used in this building were supplied by the National X-Ray Reflector Company. They are made of a tough fibrous material called "compone." The reflectors are of one-piece crystal glass plated with silver, which is protected with a green enamel. The designs for the building were prepared by Mr. E. A. Christy, city architect of New Orleans. The attention given in them to the important matter of lighting might well be emulated by all concerned in the erection of school buildings anywhere.

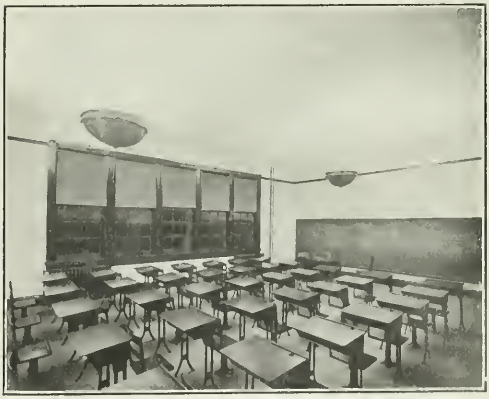


FIG. 4—LIGHTING IN TYPICAL CLASSROOM

Jobber, Dealer and Contractor

Central-Station Co-operation with the Contractors in Texas

The Texas Power & Light Company, which furnishes electric service in thirty-three communities in the Lone Star State, believes thoroughly in co-operating with the contractors and dealers in the localities served by its lines, and to this end the company has made it a rule to do no wiring and to sell no appliances, lamps or supplies, referring its customers in each instance to local dealers and contractors.

CO-OPERATIVE DISPLAY OF THE CENTRAL STATION AND THE ELECTRICAL CONTRACTORS AT WACO, TEX.

Carrying out the same idea of co-operation, the company joined forces with the contractors and dealers of Waco in arranging a really co-operative display booth at the time of the last Waco Cotton Palace. The power company rented the large space shown and also furnished free the services of an attendant and all the electricity and gas required by the apparatus on display.

On their part the contractors and the plumbers (the company supplies gas also in Waco) did all of the installation work for the booth, ran wires and pipes, and furnished from their stocks the appliances exhibited. All identifying marks were removed from the exhibits, and the only place where the dealers' names were shown was on a large painted signboard at the rear of the booth, which listed all those taking part in the exhibition.

Bookkeeping for Electrical Contractors

Bookkeeping, said Mr. W. J. Ball, Moline, Ill., before the recent convention of the Iowa Electrical Contractors' Association at Cedar Rapids, is the art of keeping a systematic and regular record of business and mercantile transactions so that the condition of your business may be known at any time. There are many ways of keeping books, but the detailed extent to which the bookkeeping department of a contractor's business should be carried must necessarily depend upon the amount of business he does, the size of his stock and whether his work is all of one kind. If he is a successful contractor and wishes to branch out a little into handling electric automobile work, motor repairing and fixtures, he should arrange his books so as to know whether each addition to his business is helping the paying end or whether the paying end is carrying along a load that he would better not have added to his business.

Questions to Be Answered

In other words, how much contracting does one do and how much does it cost one to do it? How much fixture business does one do? How much rent does the space occupied by his fixture department cost? How much does it cost to assemble and hang fixtures? These things must be considered as well as others before profit can be added to the job. The books must tell the story. All carry fire insurance and pay money out on profits for this protection, but if one's store and contents burn up to-night, would it be possible to show the insurance adjuster to-morrow morning what the loss is? If books are kept properly, this can be done without difficulty.

Contractors borrow money now and then, if they can, but can they take a nicely prepared financial statement of their business for last year to their banker and convince him from the showing thereon that he ought to be glad to loan them the money? Where books are kept properly and the business warrants the loan there is no trouble in obtaining it ordinarily. Bills should be made out, not with a scratchy old pen, but with a typewriter, because it is much easier to collect a nicely written bill than one that is not. Time should not be spent in collecting for work done, but customers should be educated to bring the money to the office promptly when the bills fall due.

What Books Should Show

If a building is owned, rented or leased, the books should show the value of the improvements installed and a proper amount should be set aside for depreciation. If an automobile is used in the business, its present value should be shown by the books as well as what it costs to keep it running and in repair. A contractor should be able to tell at a glance what his purchases and sales of merchandise are at any time. A record should be kept of labor costs, rent, taxes, insurance, telephone, hauling, light, etc.

Monthly Record as a Spur

A fine feature is a tabulated record of gross business for each month. The Tri-City Electric Company has such a record since the business was started about fifteen years ago. It is looked at often and is the greatest incentive known to make each month better than the corresponding month of the year before. Customers should be made to understand that a desire for business after the price is agreed on is measured only by their promptness in paying for the work. It is foolish to tickle one's self with a lot of old accounts that are outlawed and that no one can collect, because one loses the respect of his customers and has thereby a good start on the road to financial ruin. Customers should understand that credit is the best asset a business can have and that it can only be maintained through their co-operation.

System in All Things

A time-record sheet of workmen should be kept, so that one can find next year whether John Jones worked on a certain day and where. Such a record might be useful in court in case of a lawsuit under the compensation act or by the contractor against a customer. The dates of deliveries and quantities of material sent to jobs should be a matter of record at all times. Catalogs should be filed and indexed because the ability to quote a customer a price without keeping him waiting oftentimes secures his order. If by filing plans one can refer to them easily and can tell a customer the layout of a job done a year ago, it may convince him that attention to details of this kind entitles one to any further business the customer may have to offer.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Biggest Month for Terry Turbines.—In spite of the hard-times reports, the month just passed has been the biggest one in the history of the Terry Steam Turbine Company, Hartford, Conn., both in point of orders and in output.

Electric Brewery Trucks for Milwaukee.—Purchasing four electric trucks from the General Vehicle Company, Inc., the Val Blatz Brewing Company, Milwaukee, will become, perhaps, the first user of the electric truck in the brewery trade in that city. Each of these trucks is of 5 tons capacity and is equipped with sixty cells of type A-12 Edison battery.

Clay-Conduit Business Fair.—The H. B. Camp Company reports its business as being fair. No large installations are being made, but many small orders for additions to existing conduit systems are continually being received. The amount of work being done is not so great as was expected a few months ago. One of the causes suggested for this is the late spring and general inclement weather.

Orders for Lighting Standards for New York City.—The J. L. Mott Iron Works, 118 Fifth Avenue, New York, have received an order for 300 single-unit tungsten-lamp standards from the city of New York. These will be installed in Park Avenue. This company is managing to hold its own in regard to the number of standards sold, and prospects for an increase in the near future appear to be bright.

Reporting Valuation of Properties.—Forstall & Robison, engineers, 84 William Street, New York, state that they are reporting the valuation of several large properties. They deal chiefly with gas companies and incidentally with electric companies when the latter are connected with the former. Mr. Forstall has just returned from a trip to the Middle West, and he reports conditions as he saw them as rather quiet in that section of the country.

New Building for Electrical Manufacturer.—Ground has been broken for the construction of a new factory building to take care of the rapidly growing output of the Robbins & Myers Company, Springfield, Ohio. This building will be immediately south of and adjoining the new shops, which were completed a little less than a year ago. It will be of reinforced concrete, the same type of construction used in the other buildings. The new building will be four stories high, and it will cover a ground area 60 ft. by 265 ft.

Advertising Helps for Selling Electrically Driven Irrigation Apparatus.—In order to increase and facilitate the sales of apparatus for use in irrigation, the Western Electric Company has prepared a number of advertisements, electrotypes of which are supplied to dealers handling this kind of apparatus, for insertion in various newspapers. This is in line with the Western Electric Company's policy in selling other types of apparatus to do more for its customer than supplying the material and to assist him in disposing of the article itself.

Business in Carbons for Arc Lamps Slackening.—A representative of Mr. Hugo Reisinger, 11 Broadway, New York, importer of carbons for arc lamps and carbon brushes, declares that the business in carbons for arc lamps is rather dull. This industry seems to be affected to quite an extent by the new nitrogen-filled lamp. The use of carbons for moving-picture lamps is quite extensive, and the sales in this branch of the business are large, covering orders not only from all parts of this country, but from the South American republics, Mexico and other foreign countries as well. The business in carbon brushes is said to be fair.

European Firm Installing Large Selling Organization in the United States.—The Koerting & Mathiesen Company, of Leipsic, Germany, is preparing to increase its selling organization in the United States, and in addition to the flaming-arc lamps and arc-lamp supplies which it has been selling, it will also have for sale in this country six additional types of arc lamps, watt-hour meters, searchlamps, dynamos and motors. The arc lamps will be for both indoor and outdoor service. The New York branch recently moved into larger quarters at 49 East Twenty-first Street. Later on warehouses will be erected in this country. A complete stock will be on hand about July 1. For some time all shipments will be made through New York; later, however, a branch will be opened in San Francisco, and then shipments will also be made via the Panama Canal through that port.

Prismatic Reflectors for Government Service.—A large number of prismatic reflectors are being supplied to the government for various buildings and warships by the Holophane works of the General Electric Company. The reflectors on the warships require a special hanger, and this company has gone to considerable trouble and expense to develop a satisfactory hanger and reflector for warship usage. Since the advent of the high-efficiency tungsten lamps this company has been busy supplying reflectors for this type of unit. Recently orders were received for 200 Holophane reflectors for use with 750-watt and 1000-watt nitrogen-filled tungsten lamps in the amusement parks of Coney Island, N. Y.

Activity in Construction Work.—Westinghouse, Church, Kerr & Company are doing considerable construction work in the East. Some of this work includes the construction of eight shop and office buildings for the Central Railroad of New Jersey in Jersey City; the revamping of the Pearl Street substation at Hartford for the Hartford Electric Light Company, Hartford, Conn., with a new layout for all the alternating-current switching and an installation for this same company of an outdoor substation and regulator equipment in the Unionville Electric Lighting Company's old plant; the construction of a gas-producer plant and coal-handling apparatus at the Port Alleghany (Pa.) plant of the Mississippi Glass Company; miscellaneous construction work for the Peter Cooper Glue Factory, Brooklyn, N. Y.; and the installation of pipe trenches and tunnels and increasing the capacity of the coal-handling plant of the Winchester Repeating Arms Company, New Haven, Conn.

Manufacturers Bid on Sanitary District Generating Equipment.—With but three manufacturers bidding upon the 4000-kw turbo-generator, condenser and accessory equipment to be installed in the Thirty-ninth Street pumping station of the Sanitary District, Chicago, prices range from \$53,738 to \$56,111. The General Electric Company placed four bids, specifying in each case a different make of condenser. One bid was placed by the Westinghouse Machine Company and two by the Allis-Chalmers Manufacturing Company. Different guarantees account for difference in the two Allis-Chalmers bids. In the General Electric Company's bids the generator specified is operated at 2300 volts, while the other manufacturers specified a 12,000-volt generator. The following table gives the amounts of the bids as they were opened on May 14:

Name of Company	Motor-Driven Accessories	Turbine-Driven Accessories	Condenser
General Electric Co.	$55,100	$56,111	Wheeler Condensing & Engineering
General Electric Co.	53,724	54,146	Worthington
General Electric Co.	55,425	55,906	Wheeler Manufacturing
General Electric Co.	53,738	53,740	Alberger
Westinghouse Machine Co.	56,579	56,579	Westinghouse
Allis-Chalmers Manufacturing Co.	54,113	54,435	Wheeler Manufacturing
Allis-Chalmers Manufacturing Co.	55,397	55,718	Wheeler Manufacturing

Orders for Gas Engines.—Orders which have recently been received by the Bruce-Macbeth Company for its vertical, multi-cylinder gas engine include the following: One 40-hp two-cylinder natural-gas engine for Pietro Elardo, Fredonia, N. Y.; one 60-hp two-cylinder natural-gas engine for the Fairmont Gas Company, Underwood, W. Va.; one 150-hp four-cylinder natural-gas engine for the Willard Storage Battery Company, Cleveland, Ohio, making the seventh engine for this company; one 90-hp four-cylinder natural-gas engine for Ohio University, Athens, Ohio; one 70-hp two-cylinder natural-gas engine for the Wood & Spencer Engineering Company, Cleveland, Ohio; two 50-hp, two-cylinder producer-gas engines for the Alberta Financial Brokers, Ltd., Calgary, Alberta, Canada; two 60-hp two-cylinder producer-gas engines for the village of Warroad, Minn.; one 150-hp natural-gas engine for the village of Caldwell, Ohio; one 70-hp two-cylinder natural-gas engine for the city of Whitesboro, Tex.

Shiras Company Absorbs Chicago Fixture Company.—The Shiras-Chassaing Electric & Manufacturing Company, of 921 Locust Street, St. Louis, announces that it has purchased the plant of the Chicago Gas & Electric Fixture Manufacturing Company. The property of the latter company will be removed to St. Louis. On a four-acre tract in Wellston, St. Louis County, the Shiras-Chassaing company is building a structure 175 ft. long and 100 ft. wide for its general offices and factory. It is expected that about 300 men will be employed soon after June 1. The capital stock of the Shiras-Chassaing Company has been increased to $150,000. Mr. Oliver Shiras remains the president, Mr. Joseph Chassaing, formerly general manager of the Chicago concern, becoming vice-president and general manager of the Shiras-Chassaing Company. The display rooms at 921 Locust Street are being altered and improved. The Chicago Gas & Electric Fixture Manufacturing Company was a well-known concern of Chicago, its office being at 124 North Jefferson Street.

Nitrogen-Filled Series Tungsten-Lamp Bids Opened.—Opening the bids for compensators, with globes and fixtures complete, and nitrogen-filled series tungsten lamps complete, for street lighting, on May 14, officers of the Sanitary District, Chicago, found six companies offering proposals. On compensators and globes the companies' figures differed considerably, but terms as to prices and delivery on the nitrogen-filled lamps were identical in every case. The following table shows how the bids stood:

	Compensators and Globes		Lamps	
Name of Company	First 2000, Each	10,000, Each	First 2000, Each	10,000, Each
Line Material Company	$26.90	$24.90	$4.50	$3.655
Western Electric Company	15.90	15.40	4.50	3.655
General Electric Company	14.50	14.00	4.50	3.655
Westinghouse Lamp Company	10.20	10.05	4.50	3.655
Westinghouse Lamp Company	13.60	13.45	4.50	3.655
Peerless Light Company	....	....	4.50	3.655

NEW YORK METAL MARKET PRICES

	May 12		May 19	
Copper	Bid	Asked	Bid	Asked
Standard spot*	13.50	14.00	13.65	14.00
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	63 3 9		63 7 6	
Prime Lake	14.37½	to 14.50	14.37½	to 14.50
Electrolytic	14.00	to 14.10	14.10	to 14.20
Casting	13.90	to 14.00	13.95	to 14.05
Copper wire base	15.25	to	15.25	to .....
Lead	3.90		3.90	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.15	to 5.25	5.15	to 5.25
Tin, spot	34.37½	to 34.62½	32.87½	to 33.12½
Aluminum:				
Prompt delivery	17.87½	to 18.12½	17.75	to 18.00
Future	17.75	to 18.00	17.75	to 18.00

*OLD METALS

Heavy copper and wire	12.87½	12.87½
Brass, heavy	8.62½	8.62½
Brass, light	7.50	7.50
Lead, heavy	3.90	3.90
Zinc, scrap	4.15	4.15

*COPPER EXPORTS

Total tons to May 5	22,578

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*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Western Power Company.—Mr. F. Lothrop Ames, Boston, has been elected president of the Western Power Company, and Mr. Irving Bonbright a member of the executive committee.

United Railways Investment Company Readjustment.—The following committee has been named to prepare a plan for readjustment of the finances of the United Railways Investment Company: Mason B. Starring, president of the company; Henry Almstedt, Louisville, Ky.; C. H. Bean, Philadelphia, Pa.; Henry J. Bowdoin, Baltimore, Md.; James D. Callery, Pittsburgh, Pa.; Frank R. Ford, Sidney March and F. S. Smithers, New York, N. Y., and Edwards Whitaker, St. Louis, Mo.

Washington Utilities Company Notes.—The Washington Utilities Company has sold $1,500,000 of one-year 5 per cent collateral trust notes dated May 1, 1914, to the Fidelity Trust Company of Baltimore. The notes are being offered for sale on a 6.25 per cent interest basis. They are secured by deposit of 27,500 shares of common stock of the Washington Railway & Electric Company. The issuing company agrees to limit the payment of dividends on its stock during the life of the notes to 2 per cent a year.

British Westinghouse Company Results.—The fourteenth annual report of the British Westinghouse Electric & Manufacturing Company, Ltd., covering the year ended Dec. 31, 1913, shows a gross profit of £223,103. The following deductions were made: Depreciation on works, machinery, plant, etc., £44,100; redemption of 6 per cent prior-lien debentures, £6,728; interest on 6 per cent prior-lien debentures, £13,282; interest on 4 per cent mortgage debenture stock, £49,654; expenses on surplus land and buildings, £2,856; total, £116,610. Net profits for the year were £106,493. Of this amount £50,000 was appropriated for general reserve, £50,000 was paid as dividends of 5 per cent on preference shares, and £6,493 was carried to surplus. The report says that the scheme for the reduction of capital approved by the shareholders has been sanctioned by the court since the last annual general meeting and the accounts are based thereon. The directors report a continued improvement in the business and an increased volume of work. A balance of £66,899 to the credit of profit and loss account as of Dec. 31, 1912, was absorbed in the reduction of capital.

Northern Texas Utilities Company.—The Northern Texas Utilities Company, of Dallas, recently incorporated with a capital stock of $500,000, has acquired the electric-lighting plants at Royse City, Rockwall, Bowie, Garland, Henrietta and Clifton, all towns of 1000 to 3000 population, in the northern section of the State. The company also has franchises for furnishing electric service in the towns of Bellevue, Alvord and Sunset and will later extend its scheme of operations to ten or fifteen other towns in the same vicinity. Garland, Rockwall and Royse are to be tied together with a 13,000-volt or 22,000-volt transmission line, electric service for all three communities being generated in an enlarged plant at Rockwall. Similarly Bowie, Henrietta and other towns of a second group will be interconnected and supplied with energy over a transmission line. Clifton is situated at some distance from the other two groups and will be served from its individual plant. The total population of the communities in which the Northern Texas Utilities Company is to operate numbers 22,000. Among the advantages which it is hoped to secure through centralized generation in large plants is increased efficiency in the use of fuel, as the price of coal is quite high in the section where the company plans to furnish lighting and motor service. An aggressive campaign will be instituted to secure all available "power" business in the territories served. Mr. Hiram Grosman, of Hiram Grosman & Company, investment brokers, Dallas, is president of the North Texas Utilities Company, and Mr. W. C. Woodlief, formerly of Corsicana, is secretary, treasurer and electrical engineer. The directors of the company are Messrs. W. D. Austin, Rockwall, Tex.; C. H. Boedecker, Bowie, Tex.; J. P. Quirk, Minneapolis, Minn.; J. B. Round, New York, and J. J. Mueller, Chicago. The company is capitalized at $500,000, of which $200,000 is preferred stock and $300,000 is common stock.

Business Notes

The Koerting & Mathieson Company, of New York, has moved to new quarters. The address is now 49 East Twenty-first Street.

The Standard Paint Company, of 100 William Street, New York, announces that its New England office is now at 6 Beacon Street, Boston, Mass.

The Railway and Industrial Engineering Company has moved its offices and works to Greensburg, Pa. The office was formerly in Pittsburgh and the factory at Wilkinsburg, Pa.

Edison Storage Battery Supply Company.—Bertram Smith, formerly manager of the Chicago office of the United States Light & Heating Company, has become associated with the Edison Storage Battery Supply Company, of San Francisco, in the capacity of assistant manager.

The Swedish General Electric Company is the new name adopted by Messrs. Kilmer, Pullen & Burnham, Ltd., 1009 Kent Building, Toronto, Can. It was believed that it conveyed a better idea as to the business the company is conducting, that is, that of supplying Swedish generators, motors and other electrical apparatus, for which there is an increasing demand. Frank Pullen is president.

Rialto Engineering & Construction Company.—Fred E. Hummel and A. H. Braunagel have formed a corporation to be known as the Rialto Engineering & Construction Company, with offices in the Rialto Building, San Francisco. Mr. Hummel was formerly associated with the Pacific Gas & Electric Company and the Great Western Power Company, while Mr. Braunagel was manager of what has been known heretofore as the Rialto Electric Company.

The Wiener Machinery Company, 60 Church Street, New York, has been appointed sole representative in the United States and Canada for the Lanz locomobiles and tractors, made by Heinrich Lanz, of Mannheim, Germany. The officers of the Wiener Machinery Company are Felix F. Wiener, president; H. F. Hoevel, vice-president; E. G. Schmeisser, second vice-president; F. H. Scantlebury, sales manager; R. B. Franken, assistant to the president, and E. R. Singer, treasurer. A. Sachsse is mechanical engineer of the company.

New Industrial Companies

The Continental American Specialty Company, of Chicago, Ill., has been chartered with a capital stock of $100,000 to manufacture electrical goods and novelties. The incorporators are K. W. Kemper, G. Cohn and A. J. Alsdorf, of Chicago, Ill.

The Chicago Electric Shoe Shining Machine Company, of Chicago, Ill., has been granted a charter with a capital stock of $2,500 to do a general advertising, hardware and electrical business. The incorporators are E. A. Biggs, E. S. Carr and J. Rigney.

The Victor Lead Storage Battery Company, of Rock Island, Ill., has been incorporated by E. E. Winters, G. E. Brown and Walter E. Snider. The company is capitalized at $100,000 and purposes to manufacture and deal in all kinds of storage batteries.

The Aitken Electric Company, of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 by S. E. Wilson, S. E. McFarland, George R. Aitken, S. M. Aitken and R. M. Zimmerman. The company purposes to do a general electrical contracting and construction business.

The W. J. Snyder Company has filed articles of incorporation under the laws of the State of Delaware with a capital of $100,000 for the purpose of carrying on an electrical and mechanical engineering business and also to manufacture machinery. The incorporators are I. T. Conway, L. A. Brownhill and M. E. Dorsey.

The Electro-Automatic Machine Corporation, of New Rochelle, N. Y., has been incorporated with a capital stock of $250,000 by J. H. Reid, of Ottawa, Canada; F. D. Lincoln, of New Rochelle, and E. E. Sullivan, Newark, N. J. The company proposes to manufacture and deal in electric machines, tools, implements, supplies, etc.

Trade Publications

Ceiling Sockets.—Harvey Hubbell, Inc., Bridgeport, Conn., has issued a leaflet illustrating large base sockets for 3-in., 3¼-in. and 4-in. outlet boxes.

Time Switches.—The Campbell Electric Company, Lynn, Mass., has issued an illustrated leaflet referring to its one-day and eight-day time switches.

Transformers.—The Packard Electric Company, Warren, Ohio, is mailing a leaflet referring to its porcelain-clad bell-ringing transformer. It is suitable for residence doorbells, buzzers and all classes of light signal work.

Cell Switches.—An improved device for end-cell switch control for large central-station batteries is the subject of Bulletin No. 145 published by the Electric Storage Battery Company, Philadelphia, Pa. The device is described and fully illustrated.

Lamps.—Advance information and prices of the new lighting units for 750-watt and 1000-watt tungsten-filament lamps are given in Bulletin No. 108 issued by the Holophane Works of the General Electric Company. Brief illustrated descriptions of these new units are included.

Pulmotor.—The Draeger Oxygen Apparatus Company, 422 First Avenue, Pittsburgh, Pa., has issued a descriptive catalog of the pulmotor, containing instructions for use. The interesting statement is made that this device has been successful in saving more than 500 lives in less than four years.

Construction Tools.—A large folder being distributed by T. J. Cope, 3244 North Fifteenth Street, Philadelphia, Pa., lists his many tools for underground electrical construction. Among those illustrated are the conduit-threading machine, the quick-coupling conduit rod, cable rack, manhole guards and others.

Grinders and Drills.—Portable emery grinders, electric and rope-driven, are described in a small folder recently issued by the Stow Manufacturing Company, Binghamton, N. Y. Several varieties of these grinders are illustrated. Bulletin No. 88 describes and illustrates the Stow two-spindle drill.

Motor Starters.—A large folder issued by the Allen-Bradley Company, Milwaukee, Wis., describes the operating characteristics of its motor starters. A fac-simile blue-print shows their construction. These starters are built in several forms to meet various conditions for starting single-phase and polyphase alternating-current motors.

Automobile Accessories.—An elaborate catalog of 174 pages lists and illustrates the automobile and boat accessories handled by the Wetmore-Savage Company, 76 Pearl Street, Boston, Mass. Practically every requirement of the motorist, repair man and dealer is cataloged. A pocket edition, without illustrations, of automobile and motorboat accessories is also being distributed by the company.

Therapeutic Outfit.—The Dubilier Electric Company, Inc., 80 Fifth Avenue, New York, is sending out Bulletin 100, which refers to its portable X-ray outfits for physicians and dentists. This machine is designed to do fluoroscopic as well as radiographic work on either alternating current or direct current. Some radiographs taken with this outfit are shown, and directions for operating the apparatus are given.

Electric Specialties.—An attractive catalog of eighty-eight pages has been issued by the G & W Specialty Company, 6306 Blackstone Avenue, Chicago, Ill. Its pot-heads of various types are fully described and amply illustrated. Other specialties are also considered, such as its safety line-disconnector, insulating compounds, series cut-outs and similar devices. This catalog of labor-saving appliances will be read with interest by central-station managers.

Electric Incubators.—The Standard Electric Incubator Company, 76 Greenwich Street, New York, has issued an illustrated booklet which gives some interesting information regarding its Standard electric incubators, portable hovers and winter brooders. The "Lo-Glo" incubator automatically regulates the amount of heat reaching the eggs and insures scientific exactness through the entire hatching process. Some excellent results have been reported from the use of this apparatus.

Personal Mention

Mr. Charles G. McAvoy is now associated with the Danville (N. Y.) Gas & Electric Company as superintendent. He formerly held a similar position with the Bellefonte (Pa.) Electric Company.

Mr. Philip Torchio, electrical engineer New York Edison Company, sailed for Europe on the *Imperator*, May 23. Mr. Torchio will spend a great part of his time in Germany and will return to New York June 25.

Mr. C. N. Duffy, vice-president and general manager of the Manila (P. I.) Electric Railroad & Light Company, has been elected president of the Manila City Club, an organization of business men recently formed to boom the Philippines.

Mr. George M. S. Schulz, Surrogate of the Borough of the Bronx, New York City, whose appointment as a member of the Public Service Commission of the First District of New York was announced in the *Electrical World* of April 4, has finally declined the appointment.

Mr. C. M. Clark, of Philadelphia, has been elected president of the Nashville (Tenn.) Railway & Light Company, succeeding Mr. Percy Warner, whose resignation was announced in these columns on May 9, 1914. Mr. Clark will continue as a director and as chairman of the board.

Mr. S. B. Irelan has been appointed manager of the Bartlesville (Okla.) Interurban Railway Company, which operates the electric railway between Bartlesvile and Dewey and also supplies electric-lighting service in Bartlesville. Mr. Irelan was formerly stationed at Fremont, Neb., with H. L. Doherty & Company, who are also the owners of the Bartlesville property.

Mr. F. W. Hoover, vice-president of the Chattanooga (Tenn.) Railway & Light Company, a subsidiary of the Tennessee Railway, Light & Power Company, has been made vice-president and general manager of the Nashville (Tenn.) Railway & Light Company, which is also a subsidiary of the Tennessee company. Mr. Hoover is also general manager of the Tennessee Power Company.

Mr. W. E. Moore, who has been general manager of the West Penn Electric Company and also of the West Penn Traction Company, will in the future have the title of vice-president and general manager. His jurisdiction in general will cover engineering construction and maintenance of way, transportation matters, operation of power plants, purchasing, sale of energy and the securing of new franchises and rights.

Mr. Montague Ferry has been appointed Commissioner of Public Service for the city of Chicago. The work placed in Mr. Ferry's charge results from the combination of several bureaus in the City Hall which are now dealing with public-service corporations and complaints relating to public service. An important part of the work will be the compiling of statistics which may later be valuable in the preparation of rate-regulation ordinances. Mr. Ferry has been connected with the department of gas and electricity of the city of Chicago. He is thirty-three years of age and an engineer by profession. He obtained his collegiate training in Yale University and the Massachusetts Institute of Technology. He has been connected with a number of telephone companies and at one time was in the office of McMeen & Miller, engineers, Chicago. He is an associate of the American Institute of Electrical Engineers and a member of several societies and clubs.

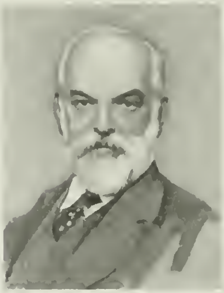
Prof. V. Karapetoff, of the Department of Electrical Engineering, Cornell University, has just completed an extended lecturing tour. On May 9 he spoke before the Eastern Association of Physics Teachers at Springfield, Mass., on the subject of "Some Calculations in the Magnetic Circuit." On May 11 he addressed the engineering students of the Case School of Applied Science, Cleveland, Ohio, on "The Production of Revolving Magnetic Field." On the same day he lectured before the Case School chapter of the Society of Sigma Xi on "The Dielectric Circuit." On May 12 he appeared before the engineering students of Carnegie Institute of Technology, Pittsburgh, and lectured on the subject of "Some Transient Electrical Phenomena." On the evening of the same day Professor Karapetoff delivered a paper before the Pittsburgh Section of the American Institute of Electrical Engineers on "The Preparation and Qualifications of a Teacher in Engineering." On May 13 he addressed the students of the University of Pittsburgh on the subject of "Electrification of Steam Railroads."

Obituary

Mr. Bert Ernest Semple, sales agent for the General Electric Company in its Chicago office, died on May 15, after nearly three months' illness. Born at Keokuk, Ia., in 1874, Mr. Semple received a high school education in Chicago and started to work for the General Electric Company as an arc-lamp repairman in the company's Chicago repair shop in 1894. In 1898 he was made foreman of the shop and in 1908 was transferred to the company's sales organization in the power and mining department, where he worked until overtaken by his last illness. A specialist on heavy-duty motor applications, Mr. Semple had much to do with the steel-mill electrification at Gary and other large plants of similar nature. Mr. Semple was an associate of the American Institute of Electrical Engineers and a member of the American Iron and Steel Institute, the Association of Iron and Steel Electrical Engineers, the Jovian Order, the Mystic Shrine of Medinah Temple and the Chicago Automobile Club. He is survived by a widow, a brother, Frank H. Semple, and a mother.

BERT E. SEMPLE

Robert Kaye Gray, well known in the electrical and telegraph industry of the world and past-president of the (British) Institution of Electrical Engineers, died April 28 and was buried at East Wickham, England, May 2. Robert Gray was born in Scotland, June, 1851, and went to London in 1865, where he entered the University College School and ultimately University College. He was engineer-in-chief of the Silvertown Company, the corporate name of which is the India Rubber, Gutta Percha & Telegraph Works Company, Ltd., and a director of four submarine telegraph companies. His whole career has been connected more or less intimately with the telegraph business. In 1870 he accompanied his father, the late Matthew Gray, to lay the cable from Gravelines to Bordeaux during the Franco-Prussian War. Two years later he acted as electrician-in-chief throughout the expedition for laying the direct Spanish cable from the Lizard to Bilboa and the Marseilles-Algiers cable for the French government. In later years his labors were directed toward developing an extensive manufacturing business, which demanded knowledge far wider than that associated with telegraphy and electric lighting. He was elected president of the Institution of Electrical Engineers in February, 1903, and visited the United States as a delegate to the International Electrical Congress in St. Louis in 1904. He was a member of the Institution of Civil Engineers, of the Institute of Metals, of the Royal Institution and of the Royal Society of Arts. He was instrumental in helping forward the National Physical Laboratory, and two years ago was appointed chairman of the executive committee of the Imperial College of Science.



ROBERT K. GRAY

Construction

New England

BANGOR, MAINE.—The electrical committee has submitted a report to the Council which recommends an appropriation of $2,500 for lighting the rural sections of the city.

MAPLETON, MAINE.—The Mapleton El. Co., recently organized, is building a substation and distributing system to furnish electric service here. Electricity for operating the system will be supplied by the Maine & New Brunswick Co., of Presque Isle, which will extend its transmission line into the village. The overhead line will require 300 cedar poles and 8 miles of wire. Aubrey C. Frost, of Limestone, is engineer in charge. A. E. Floyd is president of the company.

RUTLAND, VT.—The installation of an ornamental lighting system in the business district is under consideration. It is proposed to erect ornamental standards carrying five-lamp clusters. The Rutland Ry., Lt. & Pwr. Co. has the contract for street-lighting.

WATERBURY, VT.—The committee in charge of making investigations in regard to installing a municipal electric-light plant has engaged F. O. Sinclair, of Burlington, to investigate the proposal and prepare estimates of cost of same.

FALL RIVER, MASS.—Bids will be received by the Board of Fire Commissioners, Fall River, Mass., until May 26 for underground cable as follows: For approximately 3000 ft. of 8-conductor, 500 ft. of 6-conductor and 500 ft. of 4-conductor; all to be of No. 14 copper wire, 5/32-in. rubber-insulated, lead-incased cable. W. L. Booth is chairman of board.

MERRIMAC, MASS.—At special town meeting held recently it was voted to appropriate $1,000 to extend the electric-lighting system to the Haverhill line.

WAKEFIELD, MASS.—The municipal light board has signed a contract with the Edison El. Lt. Co. to furnish electricity to operate the municipal electric-light system at 2.68 cents per kw-hr., beginning Sept. 1. The municipal generating plant will be closed down.

WALTHAM, MASS.—The committee on public works has recommended that an engineer be engaged to plan a systematic arrangement of the street lamps in this city.

PROVIDENCE, R. I.—Mayor Gainer has signed the contract with the Narragansett El. Ltg. Co., of Providence, providing for special rates for electricity to operate the 30,000,000-gal. auxiliary pump at the Pettaconsett station. Commissioner of Public Works Slade has awarded the contract for furnishing and installing the pump to the Felber Engineering Corpn.

Middle Atlantic

FARMINGDALE, N. Y.—Bids will be received by Dr. Franklin W. Hooper, secretary board of trustees, 30 Lafayette Avenue, Brooklyn, N. Y., until June 13 for construction, heating, plumbing and electric work for the horticulture and agronomy buildings and director's cottage at the New York State School of Agriculture on Long Island, in Farmingdale. Bids will be received for each division of the work separately and no combination of bids will be considered. Drawings and specifications may be consulted and blank forms of proposal obtained at the office of the secretary, at the office of A. A. Johnson, director, Farmingdale, and at the office of Lewis F. Pilcher, state architect, Capitol, Albany.

ISCHUA, N. Y.—The Village Board has granted the Cattaraugus County Ltg. Co., of Olean, permission to erect transmission lines through the village of Ischua to furnish electricity for lamps and motors here. The company will also furnish electrical service in Franklinville.

LEHIGHTON, PA.—The Mauch Chunk Lt., Ht. & Pwr. Co., of Mauch Chunk, is reported to be negotiating for the property of the Lehighton El. Lt. & Pwr. Co.

PENN YAN, N. Y.—The Board of Electric Light and Water Commissioners will receive bids until June 1 for construction of addition to the power house of the municipal electric plant and water-works system.

ALLENTOWN, PA.—The Council has instructed the Mayor to ask for bids for supplying the several city buildings and pumping station with incandescent lamps for the remainder of the year.

AVOCA, PA.—The Borough Council has granted the Avoca Borough El. Lt. Co. a franchise to operate in this borough and a contract for lighting the streets.

BALDWIN, PA.—Bids will be received by D. S. Smith, secretary of Baldwin Township Public School District, Baldwin, until June 2 as follows: For general contract, plumbing, electrical wiring and heating of the Moore School building. Plans and specifications may be seen at the office of Edwin V. Denick, architect, 1212 House Building, Pittsburgh.

BUTLER, PA.—The City Council has awarded the contract for lighting the entire city by electricity to the Butler Lt., Ht. & Pwr. Co. For several years part of the city has been lighted by gas lamps. Cluster lamps will be used in the business section of the city.

CHAMBERSBURG, PA.—The Borough Council has adopted a resolution to make further improvements to the municipal electric-light plant, to include the installation of an additional 500-kw Fort Wayne turbo-generator, with condenser (Alberger Pump & Condenser Co.) and other accessories, the cost not to exceed $14,000.

HOLTWOOD, PA.—The Pennsylvania Wtr. & Pwr. Co. is reported to have placed orders for the installation of an additional unit with a rating of 16,000 hp at its Holtwood plant. This will increase the output of the plant to 110,000 hp, with provision for the installation of two additional units when required. A transmission line will be erected between the Holtwood plant and Baltimore. The cost of the work is estimated at about $400,000.

LANSDALE, PA.—Bids will be received by the Electric Light Department of the borough of Lansdale until June 1 for furnishing miscellaneous supplies for the municipal electric-light plant, including tungsten lamps, triple-braided copper wire, cross-arms, cross-arm braces, arc-lamp cord, etc. For details see proposal columns. R. S. Landis is chairman.

NESCOPECK, PA.—The Columbia Gas & El. Co. has submitted a proposal to the Council offering to install a street-lighting system consisting of 26 100-watt lamps.

PITTSBURGH, PA.—Bids will be received at the office of the city controller, Pittsburgh, Pa., until May 25, for the installation of an electric wiring system in the new market house in Diamond Square, to be erected by the city of Pittsburgh. Proposal blanks and specifications can be obtained at the office of the director of public works, Room 432, Oliver Building, Pittsburgh.

PITTSBURGH, PA.—Contracts have been awarded by the Duquesne Lt. Co., of Pittsburgh, for an installation of four 15,300-kw (each) turbo-generator sets, and for 20 additional boilers, which will give the plant when completed a total output of 100,000 hp. The Westinghouse El. & Mfg. Co. was awarded the contract for electrical equipment. The cost of the work is estimated at $600,000.

ASBURY PARK, N. J.—The City Council has awarded a contract for lighting the Railroad Square for a period of five years to the Atlantic Coast El. Lt. Co., under which the company will install 12 standards, carrying five-lamp clusters.

JERSEY CITY, N. J.—The Board of City Commissioners is reported to be considering plans for the installation of a refrigerating plant and vacuum-cleaning plant in the new city hospital, to be erected at a cost of $300,000.

MONTCLAIR, N. J.—Bids will be received by Frank J. Taylor, secretary of board of education, Montclair, N. J., until June 4 for construction of new High School building, to be located at Park Street, Chestnut Street and Midland Avenue, Montclair, as follows: (1) For entire work; (2) entire work exclusive of plumbing, heating and ventilation and electric wiring; (3) for all work specified under "plumbing"; (4) for all work specified under "heating and ventilation"; (5) for all work specified under "electric wiring." Drawings, specifications and full information may be obtained from Starrett & Van Vleck, 45 East Seventeenth Street, New York, N. Y., upon deposit of $25, of which $15 will be refunded upon return of above.

NEWARK, N. J. The City Council has awarded the contract for the auxiliary engine and generator for the city hall plant to McGowan & McCabe, of Newark.

NEW BRUNSWICK, N. J.—The Public Service El. Co. has been awarded a three-year contract for the ornamental street-lighting system on Church and Peace Streets. The present lamps are to be replaced with 100-hour flaming arc lamps.

ROCK HALL, MD.—Bonds to the amount of $10,000, it is reported, have been voted for the installation of a municipal electric-light plant.

HUNTINGTON, W. VA.—The Chesapeake & Potomac Tel. Co., 5 Light Street, Baltimore, Md., contemplates the installation of a power plant to furnish power for the Ceredo-Kenova branch.

ROCKY MOUNT, VA.—The capital stock of the Light & Pwr. Co., of Rocky Mount, has been increased from $15,000 to $20,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 2 for furnishing at the various navy yards and naval stations supplies as follows: Schedule 6794—Brooklyn, N. Y., 15,500 ft. 2-in. galvanized steel conduit, 10-in. lengths and ¾ in. I. P. S. Bids will also be received until June 9 as follows: Brooklyn, N. Y., Schedule 6808—6300 admiralty metal condenser tubes, ⅝ in. O. D., 65 mils thick, 13 ft. 2¼ in. long. Norfolk, Va., Schedule 6808—2100 brass, admiralty mixture, seamless drawn evaporator tubes, 2 in. O. D., 5 ft. 10 in. long, 109 mils thick. Boston, Mass., Schedule 6800—6000 lb. galvanized crucible cast-steel wire. Bids will also be received until June 16 for furnishing 2840 7-in. by 1¼-in. batteries and 1440 flashlights without batteries, to be delivered at all yards as per Schedule 6793. Applications for proposals should give the schedule desired by number. T. J. Cowie is paymaster general, United States Navy.

North Central

IONIA, MICH.—Within the next 30 days the Ionia Wtr. Pwr. Co. expects to purchase one 150-kw generator O. S. Wood is secretary and manager.

KALAMAZOO, MICH.—The lighting committee of the City Council has recommended the purchase of 649 ft. of cable, a 30-kw transformer and a motor-generator set for the municipal electric-lighting plant.

LAKE CITY, MICH.—Charles L. Ostrander, owner of the local electric-light and water plant, expects to install a new pump in the near future.

MOUNT CLEMENS, MICH.—The Eastern Michigan Edison Co., of Mount Clemens, is contemplating the installation of an ornamental street-lighting system, to cost about $2,500. The plans provide for the erection of ornamental standards mounted with a 600-cp inverted luminous-arc lamp maintained by underground wires. Armored cable will be used. H. G. Hall is division manager.

PORTLAND, MICH.—Within the next three months the electric light commissioners expect to erect a new transmission line between the power house and substation. T. L. Jenkins is superintendent.

REED CITY, MICH.—The Osceola Lt. & Pwr. Co., of Reed City, expects to purchase within the next three months one 150-kw and one 250-kw, three-phase generator. The company has recently purchased the entire equipment of the steam plant formerly at Frankfort and will soon install the same. B. J. Stall is secretary and treasurer.

SPRINGPORT, MICH.—Within the next 30 days the electric light board expects to purchase six direct-current 220-volt meters. L. E. Landon is chairman of board.

TRAVERSE CITY, MICH.—The Boardman River El. Lt. & Pwr. Co., of Traverse City, contemplates the erection of 2 miles of three-phase, 7200-volt transmission line. W. S. Cook is manager.

BARBERTON, OHIO.—A bond issue of $20,000, recently authorized, has been sold. The city of Barberton, it is understood, will soon let contracts for the construction of an electric light and power system.

CLEVELAND, OHIO.—The Ohio Public Utilities Commission has granted the Cleveland Tel. Co. permission to issue $4,000,000 in notes, of which the proceeds of more than $3,000,000 will be used for refunding purposes and the remainder for improvements and extensions.

COSHOCTON, OHIO.—The Ohio Service Co., of Coshocton, has applied to the Public Utilities Commission for permission to take over the electric-light plant at Canal Dover, the electric and steam plant in New Philadelphia and the electric-lighting plants in Dennison and Uhrichsville, which are now controlled by the County El. Co., of New Philadelphia. In addition to these the company contemplates taking over the new transmission line of the Lafayette Lt. & Pwr. Co. now being erected from the central station in Coshocton to Cambridge, Dennison, Uhrichsville, New Philadelphia and Canal Dover. The plan also includes the purchase of the properties of the New Midland Pwr. & Trac. Co., which operates the electric-lighting, system, ice-manufacturing plant and street railway in Cambridge, and the electric railway extending from Cambridge to Pleasant City.

DAYTON, OHIO.—The residents of North Dayton have petitioned the City Commissioners for the installation of boulevard lamps on Troy Street and a portion of Valley Street.

FINDLAY, OHIO.—The Toledo, Bowling Green & Southern Trac. Co., of Findlay, has submitted a proposal to the City Council offering to forfeit the eleven years its present franchise has to run, pave the center of its tracks and lay 100-lb. rails in place of the present 72-lb. rails, if granted a 25-year franchise and a ten-year contract for street-lighting. The company also offers to install new street lamps.

HAMILTON, OHIO.—Plans are being considered for the installation of a 1000-kw generator and a battery of two boilers in the municipal electric-light plant.

MANSFIELD, OHIO.—Bids will be received by O. Hursh, director of public service, Mansfield, until July 1 for furnishing electric street-lamps for a period of ten years in accordance with specifications on file at the office of the director of public service, Mansfield, and at the office of H. Whitford Jones, consulting engineer, 1303 Citizens' Building, Cleveland, Ohio. For details see proposal columns.

SHREVE, OHIO.—The electric plant of the Gardner El. Lt. & Pwr. Co. was recently damaged by fire.

WEST LIBERTY, OHIO.—The Ohio El. Co. has applied for a 25-year franchise to furnish electricity in West Liberty. C. A. Hartzler, owner of the local electric plant, it is reported, is preparing to give up the business.

WEST MILTON, OHIO.—The Council has awarded the contract for street-lighting to L. A. Pearson, owner of the local electric-light plant, for a period of ten years. The arc-lamps now in use will be replaced by tungsten lamps.

JEFFERSONTOWN, KY.—The Town Council has awarded the contract for the installation of new electric street lamps to H. C. Tafel, of Louisville, Ky.

LEXINGTON, KY.—The merchants have decided to install an ornamental street-lighting system in the business district. The plans provide for the erection of 88 standards carrying high-candle-power lamps. The cost of the installation will be borne by the merchants and the city will maintain the lamps.

ROCHESTER, IND.—The Public Service Commission has authorized the Rochester El. Lt., Ht. & Pwr. Co. to issue $50,000 in bonds, the proceeds to be used in extending a high-tension transmission line to Bourbon and for other improvements.

CHICAGO, ILL.—Bids will be received by John McGillen, clerk of the Sanitary District of Chicago, 910 South Michigan Avenue, Chicago, until May 28 for furnishing supplies, including 4.1-amp, 60-cycle, oil-immersed manhole-type impedance coils, tubular steel poles, arc-lamp windlasses, ornamental pole bases, Chicago pole bases, Chicago base pole seats, 5000-volt multiple-conductor, varnished-cloth, insulated, lead-covered cable. For details see proposal columns.

LANCASTER, ILL.—The Interstate Lt. & Pwr. Co., of Galena, Ill., has closed a 15-year contract with the Lancaster Lt. & Pwr. Co., of Lancaster, Wis., to supply electricity at 33,000 volts, to be distributed in the towns of Lancaster, Bloomington, Fennimore and Boscobel, Wis. The Lancaster company will erect a 17-mile transmision line to connect with the line of the Interstate company at Platteville.

SPRINGFIELD, ILL.—Acting on a petition from the property owners, the City Commissioners have authorized the installation of an ornamental lighting system on Adams Street in the downtown section covering 12 blocks. Ornamental standards carrying one lamp will be used. They will be double-wired and an experiment will be made with the new nitrogen lamps.

SPRINGFIELD, ILL.—The residents of West Grand Place, a suburb of Springfield, having been unable to make a satisfactory agreement for street lighting with the Springfield Lt., Ht. & Pwr. Co. have organized the West Grand Improvement Association and have appointed a committee to investigate the feasibility of establishing an independent electric-light plant. Dr. W. G. Bain is president of the association and William Price secretary.

URBANA, ILL.—The contract for installing the ornamental street-lighting system in Urbana has been awarded to the Caldwell Co.

ALMOND, WIS.—The Almond El. Lt. Co., it is reported, contemplates the construction of a new power house and the installation of two new engines. Improvements are also contemplated to the street-lighting service

POUND, WIS.—The Coleman-Pound Lt. & Pwr. Co. has been granted permission by the Railroad Commission to issue $6,000 in capital stock, the proceeds to be used for the construction of an electric-light plant to supply electricity in the villages of Coleman and Pound.

ROME, WIS.—The Bark River El. Lt. & Pwr. Co., of Rome, is planning to rebuild its hydroelectric plant, which was recently destroyed by fire. The company will soon purchase one 36-in. and one 23-in. turbine with harness and governors, also extend its transmission lines through rural districts, a distance of 12 miles. Connection has been made with the steam plant of the Sullivan Condensed Milk Co., of Sullivan, for emergency purposes. A. A. Lepper is secretary and engineer in charge.

ALEXANDRIA, MINN.—Bids will be received at the office of C. J. Sundblad, city clerk, until June 1 for additions to waterworks system at Alexandria, as follows: (1) Pump house and accessories; (2) reinforced-concrete reservoir, of approximately 300,000-gal. capacity, and accessories, together with pipe line and connection to present system; (3) pump of approximately 400 gal. capacity and a 35-hp to 40-hp motor and accessories with optional bids on same; (4) a drilled well, 16 in., 20 in. or 24 in. in diameter; (5) optional bid for reinforced-concrete dug well and accessories. Plans and specifications are on file in the office of the city clerk, Alexandria, and in the office of J. F. Druar, of the Oscar Claussen Engineering Co., Commercial Building, St. Paul.

BLUE EARTH, MINN.—The Electric Light and Water Works Commission expects to purchase within the next 30 days one motor-driven deep-well pump having a capacity of 250 gal. per minute and to install a new street-lighting system covering about 16 blocks. D. Fitch is superintendent.

ELY, MINN.—Bids will be received by Thomas E. Miller, secretary school board of Independent School District No. 12, St. Louis County, Minn., until June 1 for the construction complete of a 24-room school building as follows: (A) Main building, boiler house, stacks and two subways complete; (B) plumbing; (C) heating and ventilation; (D) electric wiring for both lamps and motors; (E) vacuum cleaning system. Plans and specifications are on file at the office of Thomas E. Miller, secretary of school board, Ely; at the office of C. Howard Parsons, architect, 601 Phoenix Building, Minneapolis, Minn., and at the Builders' Exchange in St. Paul, Minneapolis and Duluth, Minn.

GRAND RAPIDS, MINN.—Within the next three months the Electric Light Commission expects to install a pump having a capacity of 750 gal. per minute, to be driven by a 40-hp, three-phase, 60-cycle motor. F. H. Leonard is superintendent.

HUTCHINSON, MINN.—Bids will be received by F. N. Moore, city clerk, Hutchinson, Minn., until June 10 for the construction of a two-story brick city hall and fire station. Separate bids will be received at the same time for electric wiring, heating and plumbing. Plans and specifications are on file in the office of F. N. Moore, city clerk, Hutchinson, and at the office of C. E. Bell, architect, Security Building, Minneapolis, Minn.

MELROSE, MINN.—Bids will be received by the city of Melrose until May 26 for furnishing one 100-kw, two-phase, 2300-volt (engine-type) generator, directly connected to suitable engine. Specifications are on file in the office of F. J. Weisser, city clerk.

WHITE BEAR LAKE, MINN.—The Village Council has voted to install an ornamental street-lighting system, consisting of 28 standards. Dependent upon the subscriptions of merchants, the initial installation will consist of 40 posts. Electricity for maintaining the lamps will be furnished by the Consumers' Pwr. Co.

BOONE, IA.—The Fort Dodge, Des Moines & Southern R. R. Co., of Boone, is contemplating erecting a transmission line from its plant at Frazier to Jewell, a distance of 40 miles, to furnish electricity to towns along the line. The cost of the line is estimated at $30,000.

DAVENPORT, IA.—The contract for street-lighting has been awarded to the People's Lt. Co. The new contract is for a period of five years and will provide for an increase from 350 lamps to 650 lamps.

DES MOINES, IA.—The Des Moines Ry. & Lt. Co. has changed its name to the Des Moines & Central Iowa El. Co. and increased its capital stock from $500,000 to $1,000,000, the proceeds to be used to build a heating plant in Des Moines and a transmission line from Des Moines to Oskaloosa. The company owns and operates plants in Des Moines, Oskaloosa, Colfax, Valley Junction, New Sharon, Montezuma and Prairie City

WAUCOMA, IA.—At an election held May 12 the proposal to issue $12,000 in bonds to construct a municipal electric-light plant was carried for the second time. The election held early in March was found not legal. It is understood that the Council will soon ask for bids for construction of the dam and installing power plant.

KANSAS CITY, MO.—The Dorn-Cloney Laundry Co., of Kansas City, it is reported, contemplates the erection of a separate power plant, to cost about $10,000. E. Dorn has charge of the plans.

KNOBNOSTER, MO.—The Knobnoster Brick, Tile, Lt. & Pwr. Co., recently incorporated, contemplates furnishing electricity for lighting the city from the plant at its brick and tile plant. James B. Millar is secretary.

ST. LOUIS, MO.—Bids will be received by the Board of Public Improvements until May 26 as follows: Letting 11,225, for generator house for Chain of Rocks filters, Letting 11,226, engine and generators for above, Letting 11,227, motor generator sets for same. Plans and specifications and form of contract may be obtained at the office of the water commissioner, New City Hall, upon deposit of $10, which will be refunded upon return of same.

SULLIVAN, MO.—The Sullivan Ice, El. Lt. & Pwr. Co., recently incorporated, is installing an electric-light plant here. The equipment will consist of three O'Brien boilers, of 175 hp each, 150 lb. pressure; two Corliss engines, one 200-kw General Electric alternating-current generator, switchboard, and three substations, one to be erected at St. Clair, the second at Cuba and the third at Steelville. About 40 miles of pole line will be erected (40 poles per mile); 550 General Electric meters will be used; about 400 incandescent street lamps of 48 cp and about 6000 incandescent lamps of 16 cp will be required for residential lighting. John F. Peterson, of Sullivan, is engineer in charge. R. Zinkman is vice-president.

UNIVERSITY, MO.—The University City Improvement Association is contemplating changing the street-lighting system from gas to electricity. The El. Co. of Missouri, of St. Louis, has offered to furnish 70-cp lamps, mounted on ornamental concrete standards, at $12 each per year, in consideration of a 10-year lighting franchise.

ALEXANDER, S. D.—As yet no definite action has been taken toward the construction of the proposed municipal electric-light plant, and no engineer has been engaged. Reported in the issue of May 9 to have issued $16,000 in bonds for plant. H. M. Schumacher is city auditor.

COLDWATER, KAN.—Within the next two months the Municipal Water & Light Department expects to purchase one 100-hp oil engine and a 75-kw, three-phase, 60-cycle, 2300-volt generator, directly connected, one 25-hp motor and switchboard for above unit. L. A. Baldwin is superintendent.

WICHITA, KAN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 15 for the removal of present elevator and installation complete of a new hoistway, an electric passenger elevator and a new hydraulic lift, etc., in the United States post office, court house at Wichita. For details see proposal columns. O. Wenderoth is supervising architect.

Southern States

GREENVILLE, N. C.—Bids will be received by the Water and Light Commission of Greenville until May 27 for furnishing and installing one 500-kw turbo-alternator, one 500-hp water-tube boiler, one surface condenser, and one open-feed-water heater. General specifications and proposal forms may be obtained from the superintendent at Greenville, and further information from William M. Piatt, engineer, Durham, N. C. H. L. Allen is superintendent.

HERTFORD, N. C.—Bonds to the amount of $12,000 have been voted for the installation of a municipal electric-light plant.

NEWBERRY, S. C.—Plans are being considered by the Commissioners of Public Works for the installation of an ornamental street-lighting system. Present plans provide for the erection of 75 hollow iron posts, 15 ft. high, each to carry three-lamp or four-lamp clusters.

CARROLLTON, GA.—The city of Carrollton is reported to have engaged McCormick & Fahy, engineers, Cherokee Life Building, Rome, Ga., to prepare plans for a municipal electric-light plant.

BINGHAMTON, TENN.—The works, including the power plant, of the America

Car & Foundry Co., at Binghamton were badly damaged by fire recently. It is understood that the plant will be rebuilt at once.

LEBANON, TENN.—The city of Lebanon would consider a proposition to sell an electric-light and water franchise. The city owns the electric distributing system and purchases energy for operating the same. The town has a population of about 5000.

LIVINGSTON, TENN.—The city of Livingston is prepared to grant a franchise for an electric light and power plant. For further information address E. C. Knight, secretary of Chamber of Commerce.

NEWPORT, TENN.—The City Council has granted C. L. Goughnour a franchise to install and operate an electric-light system in Newport. Mr. Goughnour proposes to build a reinforced-concrete dam across the Pigeon River at Hartford, where an electric plant will be erected.

LUVERNE, ALA.—The town of Luverne contemplates the installation of an additional generating unit (consisting of generator and engine, directly connected) and rotary water pumps.

LAUREL, MISS.—Within the next two months the Laurel Ry. & Lt. Co. expects to build an additional fuel room to its power house; also to purchase one 750-kw turbine and material for 1½ miles of overhead trolley line. S. M. Jones is secretary and treasurer.

HELENA, ARK.—The City Council has authorized the installation of 40 additional street lamps.

ARDMORE, OKLA.—The property of the Ardmore Trac. Co. has been taken over by Chicago parties, to be operated under the name of the Ardmore El. Ry. Co. The new owners will make extensive improvements and additions to the system. George S. Cravens is president of the company.

BUFFALO, TEX.—The city of Buffalo has granted Andrew J. Holmes, of Carthage, Tex., a 25-year franchise to install and operate an electric-light plant here.

EL PASO, TEX.—Bids will be received at the office of the Depot Quartermaster, El Paso, until June 3 for construction of and installation of plumbing, heating, electric wiring and fixtures in one set of non-commissioned officers' quarters at Fort Bliss. Plans and specifications may be obtained at the above office upon deposit of $10, to be refunded upon return of same.

GAINESVILLE, TEX.—Contracts, it is reported, have been awarded by the Texas Pwr. & Lt. Co. for the construction of an electric-light plant in Gainesville, to cost about $50,000.

ROCKDALE, TEX.—The city of Rockdale is reported to be contemplating the installation of an ornamental street-lighting system.

Pacific States

EVERETT, WASH.—The Puget Sound Trac., Lt. & Pwr. Co. will install series tungsten lamps to replace the present series inclosed arc-lamps. The contract calls for 27 lamps of 350 cp, 216 of 200 cp, and 295 of 100 cp. No ornamental standards will be used. The cost of the work is estimated at $7,000. The work will be done by the company under the supervision of J. W. Hoover, city engineer.

SEATTLE, WASH.—Plans are being considered by J. D. Ross, superintendent of lighting, for the installation of a lighting system for the alleys in the business district, to cost from $8,000 to $10,000.

SEATTLE, WASH.—A resolution has been introduced into the City Council providing for the installation of cluster lamps on Madison Street, Marion Street and Columbia Street, each from Railroad Avenue to First Avenue.

SEATTLE, WASH.—The Commissioners of King County have granted the Vashon El. Co. a franchise to construct and operate an electric-light and power system on Vashon Island for a period of 50 years. The grant covers 55 roads and 27 additions and specifies that the company must begin work on system in 90 days. Homer H. Edwards is president and E. L. Stiles, of Tacoma, is attorney.

SPOKANE, WASH.—The City Council has granted the Washington Wtr. Pwr. Co., Spokane, a franchise to construct and operate an electric railway upon certain streets in the city.

OAK PARK, CAL.—The installation of an ornamental street-lighting system on Thirty-fifth Street and Sacramento Avenue is under consideration by the Business Men's Association.

RIVERSIDE, CAL. — The Southern Sierras Pwr. Co., of Riverside, has awarded the contract for the erection of its high-tension transmission line from Banning to El Centro, a distance of 131 miles, to the City El. Supply Co., of Riverside. The line will be of aluminum cable and will carry 55,000 volts. The City Supply Co. also has the contract to erect the new section of steel transmission line through Victorville to Oro Grande for the Southern Sierras Pwr. Co. J. W. Finch, of the City Supply Co., will have charge of the work.

SAN FRANCISCO, CAL.—Bids will be received at the office of the Board of Prison Directors, Room 13, Ferry Building, San Francisco, until June 5 for furnishing supplies to San Quentin and Folsom state prisons, consisting of subsistence stores, fuel, oil and electric appliances for jute mill at San Quentin, cement, etc., from July 1, 1914, to June 30, 1915.

VISALIA, CAL.—The State Railroad Commission has granted the Mount Whitney Pwr. Co., of Visalia, permission to issue $500,000, to be sold at 95. Of the proceeds $112,000 will be used for the construction of the Wolverton dam; $75,000 to complete the Keweah plant; new substations as follows: Woodville, $31,000; Rarlimart, $20,500; Goshen, $13,000; Strathmore, $11,500; Terea Bella, $15,000. Expenditures on substations already erected will be made as follows: Tulare, $29,087; Tipton, $53,469; Delano, $20,464; Porterville, $16,337.

CLEAR LAKE, IDAHO.—The Clear Lake Pwr. & Improvement Co. has applied to the Public Service Commission for a franchise to furnish electricity for lamps and motors to residents of Twin Falls County and to erect transmission lines from its plant on Clear Lake, in Gooding County, to Twin Falls County. The power plant of the company is nearly completed. The company was recently incorporated with a capital stock of $750,000. William C. Hazard, of Milwaukee, Wis., is president.

MOAB, UTAH.—Plans are being considered by C. A. Hammond, of Moab, and Joseph W. Christensen, of Fairview, for the installation of an electric-light plant in this city, estimates of cost of which are being prepared by A. V. Richards, of the firm of Caldwell & Richards, engineers, of Salt Lake City.

MONTICELLO, UTAH. — Preliminary surveys and estimates for the installation of an electric-light plant in Monticello, it is reported, have been made by A. V. Richards, of the firm of Caldwell & Richards, engineers, of Salt Lake City.

BAKER, MONT.—Preparations are being made by Ernest Heinrich for the installation of an electric-light plant in Baker. The equipment will include one horizontal tubular boiler (54 in. by 16 ft.), one 10-in. by 30-in. simple Corliss engine, one 50-kva, single-phase, 60-cycle, 2300-volt, 900-r.p.m. generator with switchboard; one carload of 30-ft. and 35-ft. (6-in.-top) poles, 50 meters and 500 25-watt tungsten lamps. Mr. Heinrich will have charge of the work.

MONTE VISTA, COL.—The San Luis Valley Tel. Co., recently incorporated with a capital stock of $1,000,000, proposes to build an independent telephone system in this section of the State. R. G. Breckenridge, of Monte Vista; James D. Pilcher, of Alamosa; Charles A. Gailbreath, of Del Norte, and others are among the incorporators.

PITKIN, COL.—Preliminary surveys, it is reported, are being made for the proposed hydroelectric power plant for the Brant Independent Mining Co. in Pitkin.

Canada

VANCOUVER, B. C.—Property owners in the district between Government and Douglass Streets on Cormorant Street have petitioned the City Council for the installation of cluster lamps. The city engineer has been instructed to prepare plans and estimates for same.

WINNIPEG, MAN.—The fire, water, light and power committee of the City Council has recommended a plan for the extension of the ornamental lighting system on Portage Avenue from Carlton Street to Maryland Street, with underground connections throughout, to cost about $50,000.

CANSO, N. S.—We are informed that the contract for the installation of an electric-lighting system has not yet been awarded. The town is installing a gas producer and engine to drive the plant. S. H. Moffatt is town clerk.

Miscellaneous

PANAMA—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until June 3 for steel derricks complete with operating hoists, electroliers, wrought iron and steel pipes, etc. Blank and general information relating to this circular (No. 853) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is purchasing officer.

New Incorporations

WASHINGTON, ARK.—The Haygood Seminary Lt. & Trac. Co. has been incorporated with a capital stock of $25,000. R. Carter is president.

ST. MARY'S, GA.—The St. Mary's Ice & Lt. Co. has been incorporated with a capital stock of $6,000 by S. C. Townsend, C. S. Johnson, J. F. Hughes and others.

FORT GEORGE, B. C., CAN.—The Northern Interior Lt. & Pwr. Co. has been incorporated with a capital stock of $50,000.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 12, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,096,020. Safety Trolley Wheel: J. A Burton, Covington, Ky. App. filed Aug. 8, 1911. Toggle levers spread the guard plates.

1,096,048. Magneto Generator: J. L. Milton, Tiffin, Ohio. App. filed Oct. 28, 1910. Employs malleable-iron casting in the make-and-break mechanism.

1,096,061. Electro-Pneumatic Control Apparatus: W. M. Scott, Philadelphia, Pa. App. filed Oct. 25, 1910. For disconnecting such portions of a third rail as may become grounded.

1,096,065. Electric Tuning Device; E. G. Stalnaker (minor), Chicago, Ill. App. filed June 21, 1912. For varying inductance and capacity.

1,096,085. Electrolytic Process and Apparatus: C. White, London, England. App. filed Oct. 7, 1913. For removing gaseous anion and restraining same from again being taken up by the electrolyte.

1,096,108. Telephone System: B. G. Jamieson, Chicago, Ill. App. filed Aug. 15, 1911. Particularly for private-branch exchange switchboards.

1,096,109. Circuit Controller: A. A. Kent, Philadelphia, Pa. App. filed Dec. 22, 1906. For internal-combustion engine ignition.

1,096,125. Device for Facilitating the Locomotion of Persons Suffering from Locomotor Ataxia; S. L. Pidot, St. Joseph, Mo. App. filed Oct. 20, 1913. Electrical impulses imparted to the body and controlled by switches on shoes of wearer.

1,096,127. Telephone Receiver: A. Rosenberg, London, Eng. App. filed Jan. 24, 1912. Watch-form receiver for deaf persons.

1,096,136. Electric Signal and Recording System. A. L. Sohn, Los Angeles, Cal. App. filed April 20, 1910. For registering and recording times of arrival and departure of employees of a system.

1,096,138. Electric Connector, J. C. Stearns, Worcester, Mass. App. filed Dec. 22, 1913. Plug connection for auto lamps.

1,096,142. Ethereal Wave Responsive Device, E. Weintraub, Lynn, Mass. App. filed Oct. 27, 1909. Wave responsive element comprising essentially conductive boron.

1,096,151. Spark Indicator, C. D. Bremer and J. L. Moloney, Milwaukee, Wis. App. filed Dec. 30, 1912. Exposed spark-gap for indicating operativeness of sparking circuit.

1,096,153. Telephone Transmitter, E. B. Craft, Hackensack, N. J. App. filed July 9, 1910. Has electrode in the form of a tubular bolt.

1,096,155. Firing Mechanism of Breech-Loading Guns, A. T. Dawson and G. T. Buckham, Westminster, London, Eng. App. filed Aug. 11, 1911. Firing contact mechanism operable from handle of the hand wheel in any position thereof.

1,096,158. Apparatus for Testing Castings, E. I. Dodds, Central Valley, N. Y. App. filed Feb. 11, 1910. By formation of separate comparative magnetic circuits in the casting.

1,096,175. Electric Transmission of Intelligence, I. Kitsee, Philadelphia, Pa. App. filed Oct. 2, 1908. By submarine cable.

1,096,182. Transmission System; D. D. Miller, New York, N. Y. App. filed Oct. 4, 1913. For tapering resistance along a line so that all responsive devices along the line will receive approximately same amount of current.

1,096,205. Electrode Point for Spot-Welding Machines; A. C. Taylor, Warren, Ohio. App. filed Aug. 7, 1911. Has a channel for water circulation between the caps and the tapered electrode points to which the caps are applied.

1,096,215. Signal Device; G. L. Barrett, Springfield, Ohio. App. filed July 29, 1912. Single-stroke signal bell.

1,096,243. Secondary Winding for Induction Motors; T. Hoock, Wilkinsburg, Pa. App. filed June 6, 1911. Ends of conductor bars bent over into overlapped engagement.

1,096,276. Gas Igniter; H. B. Steele, Boston, Mass. App. filed May 10, 1912. For auto-gas lamps; platinum coil held in recess in burner tip.

1,096,277. Gas Controlling and Lighting Mechanism, H. B. Steele, Boston, Mass. App. filed Jan. 2, 1913. Valve construction for lighting and governing auto gas lamps.

1,096,287. Adjustable Mounting of Armatures of Electromagnets; E. B. Craft, New York, N. Y. App. filed May 7, 1908. Armature mounting for polarized bell ringers.

1,096,289. Electric Resistance Unit; O. Dale, New York, and H. A. Frederick, Tuckahoe, N. Y. App. filed Dec. 6, 1911. For heating devices, has reflexed resistance material folded longitudinally to provide for radiation in all directions.

1,096,292. Self-Scoring Target; M. St. Ellis, United States Navy. App. filed May 16, 1913. Sectional target face acted on by impact of bullets to close indicating circuits.

1,096,321. Electric Furnace; A. Scott-Hansen, Christiania, Norway. App. filed Jan. 6, 1914. Currents of gas or air blown toward the flame disk to assume form of truncated cones.

1,096,379. Trolley, C. H. Light, Des Moines, Ia. App. filed May 26, 1913. Trolley carried by laterally movable carriage on upper end of trolley pole.

1,096,390. Osmo Anti-Cathodic Vacuum Regulator for X-Ray Tubes; C. Regaud, Lyons, France. App. filed April 9, 1912. Conducts gas into operative relation to the anticathode.

1,096,411. Arc Lamp; A. Blondell and G. Dobkevitch, Paris, Frnnce. App. filed Jan. 16, 1905. Regulating mechanism for luminous arc lamps.

1,096,413. Alarm Shield; C. J. Coleman, New York, N. Y. App. filed May 25, 1910. Shield over safe door to give alarm when attempt is made to gain access to safe.

1,096,414. Electric Furnace; W. D. Coolidge, Schenectady, N. Y. App. filed Sept. 23, 1908. Tube of alumina wound with coil of platinum.

1,096,421. Pull Chain Guide, E. H. Freeman, Trenton, N. J. App. filed Sept. 1, 1911. Detachable from lamp socket shell.

1,096,422. Cap-and-Shell Fastening for Lamp-Socket Casings, E. H. Freeman, Trenton, N. J. App. filed May 17, 1913. Bayonet slot and slidable latch.

1,096,434. Telephone-Transmitter Cut-Out, A. R. Langdon, Hartford, Conn. App. filed Jan. 8, 1913. Push-button for temporarily cutting transmitter out of circuit.

1,096,440. Lamp; G. C. Lynch, New York, N. Y. App. filed Dec. 31, 1912. Table lamp with swivel connection permitting lateral shifting of the illuminating portion, including the light proper.

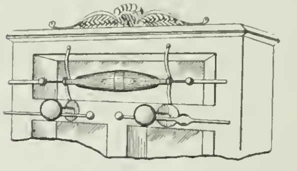
1,096,456. Culinary Article; C. Nelson, Brooklyn, N. Y. App. filed Sept. 8, 1909. Heating attachment for existing non-electric chafing dishes.

1,096,457. Connector Stand; F. J. Ravlin and J. Lofgren, Chicago, Ill. App. filed Jan. 31, 1913. For lamp extensions used in locomotive roundhouse.

1,096,459. Ignition Device; G. B. Reisbach, Milwaukee, Wis. App. filed July 25, 1910. Operated by electromagnets.

1,096,470. Automatic Controller for Electric Circuits; L. Stern, Philadelphia, Pa. App. filed Oct. 29, 1912. High or low water-level indicator.

1,096,475. Electrically Heated Implement; E. C. Van Glahn, New York, N. Y. App. filed Oct. 23, 1913. Soldering iron.



1,096,601—Muffler for Electrostatic Machines

1,096,484. Holding Device for Telephone Receivers; K. H. Atherton, Carson City, Nev., and M. N. Rodgers, Chicago, Ill. App. filed May 24, 1913. Constructed so that when receiver is pulled forward to listening position circuit will be closed in usual way.

1,096,485. Electric Switch; T. E. Barnum, Milwaukee, Wis. App. filed June 29, 1910. Drum controller.

1,096,493. Load-Regulated Governing Device for Fluid Pressure; J. S. Doyle, Mount Vernon, and F. Hedley, Yonkers, N. Y. App. filed Aug. 23, 1912. Braking pressure governed according to load on car.

1,096,498. Automatic Return Hook; H. L. Flanary, Roaringfork, Va. App. filed Sept. 22, 1913. For mine locomotives.

1,096,506. Electric Welding Apparatus; E. E. Haskin, New York, N. Y. App. filed Sept. 20, 1913. For welding heads or ends on tanks.

1,096,526. Pneumatic Tire Trouble Indicator; F. H. Brunig, Kansas City, Mo. App. filed Aug. 29, 1913. Sounds alarm when puncture occurs.

1,096,536. Automatic Synchronizer Indicator for Clocks; E. A. Hummel, St. Paul, Minn. App. filed Aug. 10, 1911. Indicates whether clock was synchronized at the proper time.

1,096,548. Switch Box; C. C. Maison, Cleveland, Ohio. App. filed June 17, 1912. Unit knock-out box adapted to be built up into gangs.

1,096,571. Signal Apparatus for Automobiles, M. C. Stamm, Chicago, Ill. App. filed Nov. 11, 1912. Warning automatically sounded when car turns corner.

1,096,587. Electric Accumulator; M. L. Ashbaugh, Anderson, Ind. App. filed April 12, 1913. Battery element divisible into plurality of superposed parts.

1,096,601. Muffler for Electrostatic Machines; L. C. Charbonneau, Brooklyn, N. Y. App. filed April 27, 1912. Joined conical members inclosing the spark-gap.

1,096,618. Conduit Wire Fishing Reel, G. Fussell, Portland, Ohio. App. filed Jan. 2, 1912. Portable conduit "fishing" device.

1,096,625. Ignition System for Internal-Combustion Engines, A. C. Gundy, Upland, Cal. App. filed June 15, 1912. Uniform period of circuit closure irrespective of engine speed.

1,096,627. Take-Down Apparatus for Handling Glass Cylinders, H. F. Hitner, Mount Vernon, Ohio. App. filed Aug. 18, 1911. Motor control for moving the glass cylinder from the vertical to a horizontal position.

1,096,636. Coated Article, P. McIlroy, Pittsburgh, Pa. App. filed Oct. 16, 1913. Steel pipe conduit with strike coating of copper and zinc and a second coating of zinc.

1,096,676. Telephone Receiver, S. G. Brown, London, England. App. filed March 27, 1911. Has conically formed aluminum diaphragm.

1,096,677. Telephone Transmitter; S. G. Brown, London, England. App. filed Jan. 3, 1912. Has conical light aluminum diaphragm.

1,096,680. Electric Clock, E. E. Clement, Washington, D. C. App. filed May 25, 1909. Provided with hour strike and chime bells.

1,096,681. Time-Control Element for Electric Clocks, E. E. Clement, Washington, D. C. App. filed April 18, 1910. Pendulum construction.

1,096,688. Wear-Resisting Body and Method of Making the Same; C. Dantsizen, Schenectady, N. Y. App. filed Feb. 6, 1912. Die consisting of aluminum oxide sintered in its approximate shape.

1,096,691. Apparatus for Taking Photographs with Röntgen Rays; F. Dessauer, Aschaffenburg, Germany. App. filed Nov. 8, 1909. For effecting an extremely rapid exposure.

1,096,692. Apparatus for Making Instantaneous X-Ray Photographs, F. Dessauer, Frankfort-on-the-Main, Germany. App. filed Nov. 8, 1909. Embodying direct-current transformer and high-capacity condenser.

1,096,699. Connecting Clip for Electrical Conductors; J. G. Elkin, New York, N. Y. App. filed June 11, 1913. Spring-pressed jaws to engage with insulated conductor.

1,096,717. Oscillator for Wireless Transmission, C. D. Herrold, San José, Cal. App. filed April 21, 1913. For producing oscillating currents of high frequency.

1,096,726. Pocket Lantern, W. Knoff, Berlin, Germany. App. filed May 16, 1912. Of pistol shape with slidable cover.

1,096,729. Automatic Block System, H. G. Kurtshals, Somerset, Pa. App. filed Oct. 22, 1912. Apparatus at ends of blocks operated by the visual signals.

1,096,741. Trolley Switch; J. G. Munson, Cedar Rapids, Ia. App. filed March 31, 1913. Automatic switching device for trolley wheels.

1,096,751. Negative Electrode for Alkaline Secondary Batteries, H. P. R. L. Porscke and J. A. E. Achenbach, Hamburg, Germany. App. filed Jan. 7, 1913. Electrolyzes metal-ammonium compound and deposits metal liberated on a finely divided metal mass.

1,096,754. Electric Regulator. F. E. Ricketts, Baltimore, Md. App. filed April 15, 1909. For controlling field of alternating-current generators.

1,096,755. Automatic Electric Regulator; F. E. Ricketts, Baltimore, Md. App. filed July 23, 1910. Automatic switch responsive to voltage of each step of the series of machines.

1,096,765. Method of Collecting Particles Present in an Ionized Medium, W. W. Strong, Mechanicsburg, Pa. App. filed Dec. 28, 1912. For indicating presence of smoke in gases given off by a furnace.

1,096,777. Air-Brake-Control-Valve Mechanism, A. J. Allard, Richmond, Va. App. filed June 2, 1913. Electrically controlled to accomplish gradual application of brakes.

1,096,786. Method of and Apparatus for Producing Filled Precious-Metal Wire, Etc.; F. Kammerer, Pforzheim, Germany. App. filed Dec. 27, 1913. Electrolytic process with mechanical pressure.

1,096,800. Rheostat for Toy Electric Railways; F. Dangel, Nuremberg, Germany. App. filed March 9, 1914. Housed in one of the ties of the track.

11/7

Electrical World

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Duty of the N. E. L. A. to the Public Of the many subjects now receiving attention by members of the National Electric Light Association the most important is doubtless the relations between public service corporations and the public. The time has passed, if it ever existed, when a company could obtain a franchise through personal or political influence and then assume an attitude concerning its duty to the public of "take our service at our price under our conditions or leave it alone." To-day every thinking public utility operator knows that his interests are those of the public he serves and that the dividends of his company depend almost wholly upon the relations which exist between the company and the public. With agitators in many places clamoring for municipal ownership and operation of local utilities, politicians urging various State governments to develop water-powers within the borders of the State, and legislators discussing the acquisition of the railways at the capital by the federal government, it is evident that the attention of the public is being directed forcibly to the public utility business in general. Progressive central-station managers, and especially the members of the National Electric Light Association, know full well that the solution of the numerous problems now confronting the public and the utilities is to be found in the operation of the utilities by private companies under strict regulation by public service commissions. What many such managers have overlooked is the urgent necessity for having the facts involved properly presented to the public rather than given forth in distorted form by the agitators, politicians and interested legislators. In no way could the National Electric Light Association render better service to the country than by keeping the public fully informed concerning the proper conduct of the electric energy supply business under suitable public service commission control. Constructive suggestions to the public and the commissions should be the order of the day in the central-station business rather than counter attacks against ignorant agitators, unsafe politicians and unenlightened legislators.

Politics and Public Utilities Perhaps the present time, when so much energy is devoted to the discussion of all kinds of reforms, political, social and economic, will prove to be opportune for the modest mention of one abuse which should be corrected. This is the manner in which a large proportion of the aldermen and other municipal officials in American cities yield to the pressure of their constituents in asking jobs from the public-utility companies. Of course, only a portion of the requests thus received by utility companies meet with a favorable response, although no doubt polite attention is given to all. However, the practice constitutes a nuisance, to characterize it by no harsher term. The merit system is becoming fairly well established in the public service, and it would seem that the next step should bring about the complete elimination of political spoils from the management of the affairs of public-service corporations. The need for this reform is greater, perhaps, than is generally realized by the public. It will require some degree of moral courage for managers of utilities to stiffen their backs against this insidious attack on efficiency; but no doubt many of the aldermen and other politicians would be secretly grateful if there was an absolute discontinuance of the practice of even occasionally honoring requests for appointment to jobs in privately owned public-service organizations for political reasons. In the states where public utility commissions exist it is probable that this evil will be gradually eliminated, and as it is likely that such commissions will be established in all states before long it is to be hoped that the time is not far distant when this annoying practice will become a thing of the past.

Westinghouse Business Last Year The increase in sales billed by the Westinghouse Electric & Manufacturing Company during the fiscal year ended March 31, 1914, as compared with the previous year, was 9.4 per cent. This was not so large a gain as was shown by the 1913 fiscal year over 1912, 16.9 per cent. It is, however, a material change from the experience of 1912, when the gross sales billed were 10.3 per cent less than in 1911. Carrying the comparison back one year earlier, it is found that the gross sales in 1911 were 30.3 per cent greater than in the fiscal year 1910. These figures present wide fluctuations. The fluctuations, however, follow roughly those that were shown by another of the great electrical manufacturing concerns, the General Electric Company. The business of these two companies is so similar in nature that it is to be expected that they will be affected in about the same degree by changes in the general business situation. Manufacturing industries are always subject to greater fluctuation in volume of business and hence profit than public service industries and most other forms of business. As the industries upon which the electrical manufacturing companies depend for a market increase in stability of earnings, more stability should follow in the manufacturing industries themselves. It is interesting to note that the net manufacturing profit of the Westinghouse company on the sales billed in the last fiscal year was 10.8 per cent of the gross. The annual report as a whole shows wholesome evidences of continued improvement in financial condition, substantial development in gross business and another step in the laying of a better foundation for the future.

Transformers for Changing Frequency

It is well known that when three transformers are connected in primary delta across the three mains of a three-phase supply system any triple-frequency harmonic in the excitation current of the individual primaries will circulate in the delta as a single-phase current of triple frequency. Mr. A. M. Taylor recently read a paper before the Birmingham Section of the British Institution of Electrical Engineers, as abstracted in our Digest, pointing out that, by allowing this triple-harmonic current to circulate through the primary windings of an extra transformer included in the delta, secondary currents taken from the latter will be of triple frequency and single phase. The secondary windings of the three main transformers may then be suppressed, leaving a transformer of four elements which raises the frequency to three times normal and changes the voltage in any desired ratio; so that a three-phase power-transmission system operating at twenty-five cycles per second may deliver single-phase lighting currents at seventy-five cycles per second. This plan may be regarded as adopting and fostering the third harmony. Theoretically, it is capable of being extended to the $3n$th harmonic; so that, as pointed out by Mr. Taylor, it may be possible to generate at 3666 cycles per second, and, by nursing the twenty-seventh harmonic, to throw aside the fundamental parent and utilize the foster-child of 99,000 cycles per second for radiotelegraphic purposes.

A disadvantage at present experienced with the method is that both the efficiency and power-factor of the triple-harmonic secondary system, as referred to the primary fundamental system, are low. That is to say, the forcing of the triple-value harmonic frequency entails an appreciable additional loss, and the magnetizing component of the primary current is also considerably increased. However, so far as radiotelegraphy is concerned, the advantage of a twenty-seven-fold frequency may well permit of accepting markedly low values of efficiency and power-factor.

It is interesting to notice that so far as concerns a simple three-phase circuit such triple-harmonic currents as are known to pulsate unchecked around closed delta connections of transformers are a mere by-product and rather an incubus than a blessing. The incubus becomes the foster-child when it is desired to establish triple-frequency transformation. The change of intent converts it into a blessing. It is an open question whether the efficiency and power-factor of the triple-harmonic nursery method can be raised sufficiently to make it practically serviceable on three-phase transmission systems. The method is, however, an important one to develop, especially in the direction of higher harmonics.

Adjustable-Speed Induction Motors

The ordinary polyphase induction motor with squirrel-cage secondary element behaves in regard to speed very much like the direct-current shunt motor. That is to say, it is essentially a single-speed machine. The single speed is synchronous speed, and the deviation of actual speed below this is a matter of a few per cent. Such a motor is ideal for driving constant-speed machinery but is un-ideal in the extreme for the very common duty of driving machinery at adjustable speeds over a considerable speed range. Various plans have been used for meeting this need. Induction motors with wound secondaries, closed on external adjustable rheostats, permit of a wide range of speed operation at a corresponding loss of efficiency. Multiple-pole groups in the primary winding also permit induction motors to operate at one of two or three speeds, but the plan has not been adopted very widely. In the article by Messrs. Hoeffleur and Misslin, on page 1247 in this issue, is described a method of adjustable-speed operation which has the advantage of maintaining a fairly high efficiency at all working speeds.

The secondary element of the three-phase induction motor described in the article is the rotor, as usual, but the primary element, instead of being a stator and receiving its currents from the line through fixed connections, is mounted on hollow ball-bearings and rotates, so that the machine has two rotors. The primary element receives its line currents through slip-rings of large diameter. Three slip-rings would be sufficient for one set of rotating poles, but, as the machine is arranged to operate with either two poles or four poles in the primary winding, six slip-rings are used. With the primary element at rest, this would permit running at either 1500 r.p.m. or 3000 r.p.m. with fifty-cycle, three-phase current. The primary element is, however, built within the squirrel-cage secondary of a second and auxiliary external induction motor, the primary element of which is a stator arranged to provide either six, eight, twelve or sixteen poles. This auxiliary three-phase motor can be run either forward or backward, thus changing the synchronous speed of the main or internal motor from 1000 to 2000 r.p.m. on the low main speed, or from 2500 to 3500 r.p.m. on the high main speed, and thus affording a total range from 1000 to 3500 r.p.m. in eighteen steps, with an efficiency, according to the curve sheets, of about 90 per cent in a motor delivering from 60 kw to 225 kw. It is hardly to be expected that the expense of telescoping two induction motors into one is likely to be justified for small machines. In the case of large machines, however, the importance of securing adjustability in speed may occasionally warrant the added complexity of structure. The machine is certainly interesting in its behavior and construction.

The Philadelphia Electric System

As in the case of every large city, the electrical supply system of Philadelphia and its environs has been a gradual growth of separate systems consolidated finally into a single organization. As a result of this process of evolution the territory of the Philadelphia Electric Company, with 600 square miles of area to serve, presents characteristics peculiar to its history. At the present time the territory is divided into three general sections. Of these, the metropolitan district receives energy from the main stations, while the lines of the northern district, with a heavy railway load, and those of the territory around Chester, receive energy from auxiliary stations in the immediate vicinity. Besides the three generating plants there are thirty-four substations on the transmission system, and from these the output last year was more than 250,000,000 kw-hr.

From the engineering standpoint the main peculiarity of the Philadelphia system is attributable to the fact that it was equipped some years ago for two-phase distribution, and its underground feeder system has been developed with this particular arrangement in view. The two-phase system as such having now become pretty nearly obsolete, there has existed in Philadelphia the difficult problem of utilizing modern apparatus for the service of its old distributing system, in itself a very effective one and well adapted to its needs. Evidently a great two-phase network cannot readily be changed over for three-phase service, however desirable the latter may be for the transmission service and for long feeders.

Consequently the plant is extremely interesting in that use is made of three-phase-to-two-phase transformers on a very large scale, so that the old generating station, equipped in the main with two-phase turbo-generators, may work harmoniously and interchangeably with the station now under construction, in which will be installed standard three-phase turbo-generators. One of these, as recently described in our columns, is the largest unit of the kind ever constructed, having a full-load output rating of 35,000 kw. The prime mover is a thirteen-stage Curtis turbine, an important feature of the design of which is that it was planned for maximum steam efficiency at a little below full load so as to raise the average efficiency under working conditions. This is a sixty-cycle machine, while to meet the requirements for lower frequency which have been forced upon the supply company a twenty-five-cycle, 30,000-kw, three-phase turbo-generator will operate in the same station. From the new station will be controlled not only these two great units but three of the larger turbo-generator sets now operating in the present station, so that the output actually handled from the plant now built will rise to 119,000 kw—50,000 by sixty-cycle machinery, the rest by twenty-five-cycle units.

Part of the equipment enforced by the great railway load of the station has been an unusually extensive frequency-changing equipment. This is installed in a substation of its own, adjacent to the generating plant, and contains 9000 kw in two synchronous motor-generator sets converting from 6000 volts, sixty-cycle, two-phase, into 13,200 volts, twenty-five-cycle, three-phase, or vice versa. The twenty-five-cycle energy is transmitted to the substations of the Philadelphia Rapid Transit Company, and the station serves also as a reversible means of uniting the generating plants of the two frequencies. This element of differing frequency, always awkward, has appeared in more than one great plant, and the frequency changer has in such cases become a necessity. From the standpoint of the engineer even a more interesting substation is that which feeds energy to the direct-current lighting circuits. This is now operated by 6000-volt, sixty-cycle, two-phase energy, but presently will be shifted to 13,200-volt, sixty-cycle, three-phase, the change being accomplished by two-phase-to-three-phase transformers which feed energy to the synchronous converters for the direct-current service, the two-phase network, and the two-phase supply to the motor-generator sets for arc lighting.

A description of the details of the system would go too far into the minute matters fully discussed in the accompanying article, but throughout the whole runs evidence of great ingenuity in overcoming the difficulties imposed by the past history of the system and in making the somewhat intricate changes in the simplest and most certain manner possible. However, the arc-lighting station is worth some comment, as Philadelphia has the largest remaining equipment, and in fact the largest equipment which has ever existed, of open-arc lamps operated from Brush generators. The station devoted to this work contains thirty-eight motor-generator units, each consisting of a 150-hp, two-phase synchronous motor driving a pair of the largest size 9.6-amp Brush machines.

The importance of the railway load in this plant is another vital feature of its equipment. Nearly one-third of its output goes to traction service. Part of this is furnished at twenty-five cycles and a part is taken at sixty cycles for feeding energy to synchronous converters at this frequency. In addition, twenty-five-cycle, single-phase energy will be used at the rate of several thousand kilowatts for electric service on the Pennsylvania Railroad. Besides all this traction work, there is a particularly heavy motor load in large installations, in many cases requiring the installation of many substations with synchronous converters as well as the ordinary stationary transformers. With a total connected load rapidly approaching 200,000 kw, the system of the Philadelphia Electric Company is one of the greatest in the country.

The Electric Vehicle in Parcel-Post Service

With the anticipated constantly increasing use of parcel-post utilities and the attendant necessity for increased facilities, the government's problem will begin to assume proportions to demand new and radically different practices from those heretofore existing in postal operations. With the obligation which the present administration has assumed for the efficient and satisfactory conduct of this new departure, there is an immediate responsibility for determination in advance upon the ways and means of accomplishment under conditions which will become actualities within a very limited period. That the change taking place is an evolutionary one is indeed fortunate, as any revolutionary conditions would tend to defeat the project in its incipiency. While time is available there should be made an adequate scrutiny of the problems involved, and there should be competent concentration upon their solution. Wherever the government can secure the collaboration of such business genius as has successfully developed other kindred public utilities there should be no hesitation on its part to capitalize immediately the advantages thus presented.

Dependence upon past practices where a different characteristic of service has been rendered will be as futile in this case as it would be in any new commercial enterprise. The method by which the government has in the past secured vehicular service has been under severe question as to its justice, and in turn its severity upon the contractors has naturally resulted in a constantly decreasing efficiency of service, if not at the beginning of the contract period, certainly as the termination approaches. Dependence upon carrier service in the distribution of parcel-post material in large cities cannot be extended very much longer as the increasing human burden is not far from its ultimate maximum. These and other obvious deficiencies are what accentuate the belief that competent counsel alone can insure in advance the development of innovations to meet the new conditions.

The employment of mechanical transportation seems compulsory not only for the handling of the increasing load in transfer service between post office stations and to and from railway terminals but also as a necessary auxiliary to the carrier as a means of increasing his utility for distribution. As in commercial institutions, it will develop that the payroll factor would be the most expensive increase in the cost of operation, and therefore use must be made of means which will increase the radius of the carrier's personal activity. Horse vehicles would accomplish this in a limited way at a cost per unit about 50 per cent lower than that for machine service. The gasoline machine is uncalled for within the limited scope available to its capabilities, and its service, as indicated by the market price, is at least 25 per cent more expensive than that for the electric vehicle. The electric, as the cheapest, most economical and simplest vehicle that could be employed for the service required, will unquestionably be the ultimate choice. In co-operation with the Electric Vehicle Association of America, the public utility corporations furnishing electrical energy for lighting and motor service in every important city in the United States have offered their collective advice and counsel to the government officials responsible for parcel-post activity, and in taking advantage of this the government has excellent insurance of the success of its undertaking.

Objective Photometry

It is well known that the eye is an organ able to transmute a certain kind and portion of radiant power into physiological sensation. From the objective standpoint, the radiant power is merely a rate of displacement of alternating-current energy past a given normal small area, at an assigned point in space, at the rate of so many "abwatts" per square centimeter or ergs per second per square centimeter. Place the eye of a sufficiently sophisticated observer at the point, and the observer reports the sensation of light, assuming that the frequency falls within certain limits, and likewise that the power is within certain limits of intensity, neither too weak nor too strong. What is objectively power density is subjectively luminous flux density. By comparing sensations, the trained observer is able to measure inferentially the luminous flux density at the point of space in question. Owing to the limitation in the precision of comparing optical sensations, the precision of subjective photometry is much less than that which should correspond to objective photometry, if a sufficiently sensitive radiant-power-density measuring instrument could be used instead of the eye.

An interesting paper read recently by Herr Voege before the German Illuminating Engineering Society in Berlin, and reported in the *Elektrotechnische Zeitschrift*, deals with a novel method of attempting objective photometry. Heretofore bolometers and thermoelectric cells have been used, with galvanometers, to measure the incident radiant power, but with only a limited degree of success. Herr Voege describes the use of an Elster-Geitel photoelectric cell as the artificial eye. When an argon-filled glass chamber is equipped with a central platinum wire anode and a cathode layer, of metallic sodium or potassium, on one inside wall, this layer becomes a photoelectrically sensitive surface, when an emf of, say, 100 volts from a small storage battery is impressed upon the anode and cathode of the chamber. High-frequency radiant energy, incident on the chamber, causes electrons to be emitted from the alkali, which are caught by the platinum anode and produce a feeble but readily measurable current in the battery circuit. It is stated that this current is directly proportional to the radiant power density within a very wide range. The cell, like a photographic plate, is most sensitive to violet light and least sensitive to red light; so that in its uncorrected natural state it is able to compare the luminous intensities of two lamps only when having the same color or spectrum distribution. However, Herr Voege reports that he has been able to find tinted light filters, both of liquid and solid form, which, placed in front of the cell, serve to weaken its response to the blue end of the spectrum and raise its response to the red end; so that the shielded cell develops its maximum sensitiveness near wave-length 0.55 μ as does the normal human eye. The curve of the cell's sensibility does not fall off on each side like that of the eye, but sufficiently nearly so for many photometric purposes.

In order to photometer a test lamp, the galvanometer-scale is suitably marked off into "candles," and a standard lamp of known candle-power inside a special reflector, is then brought within such a distance of the shielded cell that the galvanometer indicates the correct candle-power. The reflector and socket are now fixed and the standard lamp replaced by the test lamp. The new galvanometer reading measures the required candle-power. The incandescent lamp is brought up to within about half a meter from the shielded cell, so that the sensitiveness of the latter is not yet all that might be desired. However, it is greatly to be hoped that the new photo-electric cell device may be developed, at the hands of photometrists, into a thoroughly practical instrument.

The Great Southern Transmission Network

It will be startling news to some of our readers that there has quietly grown up in the South what is to-day by far the most extensive interconnected transmission system in the world. That splendid work was being done in the development of the water-powers of the southern Appalachian country has been already made evident, but the linkage of the various networks into what now approximates, and one day will become, a united whole is a comparatively new phase of the situation. Gradually in the South transmission enterprises grew and flourished until there are now seven great systems with a wide ramification of transmission and distribution lines. Of these, six, covering the States of North Carolina, South Carolina, northern Georgia and a large part of Tennessee, are now actually in physical connection through various traffic arrangements.

If the feat were desirable, one could operate a motor in Nashville, Tenn., by energy generated at Rockingham, N. C., over a circuit roughly 1000 miles long. Some day in the near future perhaps it will actually be done, if only as a unique accomplishment in long-distance transmission. The energy would first pass over the lines of the Carolina Power & Light Company at 100,000 volts to a point near Raleigh. Then it would turn westward and pass upon the lines of the Southern Power Company and follow them southwest at the same voltage until it reached the great generating plant at Tallulah Falls. Then it would pass on with unlowered voltage to Atlanta over the lines of the Georgia Railway & Power Company, and thence over another branch of the same system northward to the Tennessee boundary, where it would join the lines of the Tennessee Power Company and be passed on at 66,000 volts to Nashville. A little later, when the line between Nashville and Memphis is completed, the western terminus of the line carrying energy derived from the Cape Fear River, which runs into the Atlantic, would lie on the banks of the Mississippi.

The independent networks have naturally touched elbows and then joined hands. Operating at first in sections quite independent of each other, they have gradually spread out and worked together until actual interchange of energy has become the most natural thing in the world. The main point of the matter is not what has been done but what may be done. At present the local interchange of energy is a mere convenience; the connection exists, but it is not yet ready to be utilized in full. In the first place, the system of the Alabama Power Company will spread out and be connected with those of its neighbors, and then some far-sighted captain of industry must grasp the situation and make the most of it. To-day there are seven neighboring systems, covering five States. They are in a condition comparable with an equal number of large suburban towns in each of which has grown up its own electrical system along various lines of engineering and finance. The task before the great organizer is to unite the systems of the towns or the States into a coherent network capable of gaining all the advantages that lie in such union and of giving better and more extensive service than is possible with the present loose connection of the plants.

A glance at the map tells the story. A few hundred miles of tie line would provide main feeders from Tallulah Falls to Parksville, give an independent connection by way of Augusta between the systems of the Southern Power Company and the Georgia Power Company, and would tie in the lines of the Alabama Power Company at two points, one by way of the Georgia Power Company's lines and the other northward by the Tennessee Power Company system. This plan unites two watersheds, that of the Mississippi Valley and that of the Atlantic, giving all the advantages that come from what one may call the diversity-factor of flow. It would not make much difference at first whether there were actual financial union or not. The main thing is complete interconnection and friendly traffic relations whereby each plant on the system could be utilized to its greatest advantage and the waste of water that takes place through disconnected hydraulic effort could be averted. As a final engineering step, with the energy of five States behind the work, it ought to be possible to block up one of the gorges in the mountains and construct an artificial lake large enough to tide over the dry season and utilize the prodigious rainfall of the southern Appalachians. The country is without natural lakes but there are few districts where natural facilities for impounding the flow could be more easily or cheaply obtained. The work already done brings to view a project of tremendous possibilities.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Detroit Convention of the A. I. E. E.

At the thirty-first annual convention of the American Institute of Electrical Engineers, to be held at Detroit, Mich., from June 22 to 26, the following papers will be presented: "Electric Heating as Applied to Marine Work," by Mr. C. S. McDowell; "The Electrically Driven Gyroscope in Marine Work," by Mr. H. C. Ford; "Direct-Current Motors for Coal and Ore Bridges," by Mr. R. H. McLain; "Method of Keeping Down Peaks on Power Purchased on the Peak Basis," by Mr. T. E. Tynes; "Concatenated Induction Motors for Rolling-Mill Drive," by Mr. William Oschmann; "The Sphere-Gap as Means of Measuring High Voltage," by Mr. F. W. Peek, Jr.; "The Electric Strength of Air," by Messrs. J. B. Whitehead and W. S. Gorton; "Sphere-Gap Discharge Voltages at High Frequencies," by Mr. J. C. Clark and Prof. H. J. Ryan; "Data on High-Tension Transmission Systems," by Mr. Percy H. Thomas, chairman of the engineering data committee; report of the engineering data committee on specifications for high-tension insulators; "Prime Movers," by Messrs. H. G. Stott, W. S. Gorsuch and R. J. S. Pigott; "Voltage Testing of Cables," by Messrs. W. I. Middleton and Chester L. Dawes; "Sterilization of Water by Ultra-Violet Rays," by Mr. M. von Recklinghausen; "Toll Telephone Traffic," by Mr. Frank F. Fowle, and "A High-Speed Printing Telegraph System," by Mr. Carl Kinsley.

On Thursday evening there will take place the presentation of the Edison medal and past-presidents' badges, and President-elect P. M. Lincoln will be introduced. Numerous entertainment features have been arranged for.

Electrical Characteristics of Mexico

Mr. T. D. Smith, of the Willard Storage Battery Company, who spent five years in Mexico, gave an interesting talk, with humorous interludes, relating to the electrical situation in Mexico in addressing the Chicago Jovian League on May 11. Mr. Perry R. Boole presided. Mr. Smith said that when finally the situation in Mexico is cleared up that country will present an immense field for electrical development. Already there are hydroelectric developments of considerable size, the total rating being about 130,000 kw. The frequency used is usually sixty cycles, although the Mexican Light & Power Company, of Mexico City, uses fifty cycles. The greatest demand for electrical energy is in the silver-mining region of the State of Hidalgo. There should be an excellent demand for electric-heating apparatus in a few years. Interior wiring is done largely by the use of lamp cord and is rather primitive. However, some good American-made insulated wire is in place in several of the mines. Many of the electrical fittings imported from continental Europe are of cheap and flimsy construction. According to Mr. Smith's information, there are only two electrical installations in Mexico that meet the requirements of the National Electrical Code.

Arrangements Complete for Philadelphia Convention of National Electric Light Association

All arrangements have been completed for the convention of the National Electric Light Association to be held at the Bellevue-Stratford Hotel, Philadelphia, next week. Meeting rooms large enough to accommodate all who may wish to attend any of the sessions have been secured within the hotel, and inasmuch as there will be three simultaneous sessions during some of the days, the bulletin system of announcing at each session what is going on in other sessions will again be used. On the roof garden of the hotel, exhibits of Class D members will be tastefully arranged, although much of the exhibition space will be used by the exhibitors merely for reception purposes. No change has been made in the special trains from the Pacific Coast, Middle West, Southeast and Pittsburgh, and the officers of the association predict a record-breaking attendance and a most successful meeting. The Philadelphia Electric Company, which will act as the host for the convention, has provided abundant entertainment features for such times as the delegates and guests will not be actually engaged in convention work. The complete program of the convention follows:

General, Executive and Public Policy Sessions

Tuesday, June 2, 10 a. m.

(1) Welcome to the city. (2) Address of President McCall. (3) Announcements. (4) Report of committee on organization of the industry, by Mr. Holton H. Scott. (5) Report of secretary, by Mr. T. C. Martin. (6) Report of insurance expert, by Mr. W. H. Blood, Jr. (7) Report of committee on progress, by Mr. T. C. Martin. (8) Report on the "Question Box," by Mr. S. A. Sewall. (9) Paper, "Safety First," by Mr. Paul Lupke.

Wednesday, June 3, 8 p. m.

(1) Action on report of public policy committee, presented by Mr. Arthur Williams. (2) Presentation of proposed constitutional amendments, by Mr. F. W. Frueauff. (3) Report of treasurer, by Mr. W. F. Wells. (4) Election of nominating committee. (5) Appointment of committee on resolutions. Music.

Wednesday, June 3, 8.45 p. m.

Public Policy Session: (1) Reading of report of public policy committee. (2) Address. (3) Exercises in celebration of the first American Electrical Exhibition and first International Electrical Congress, in Philadelphia, 1884. (4) Music.

Friday, June 5, 10 a. m.

(1) Report of committee on award of Doherty medal. (2) Address, "The Definite Plans of the Society for Electrical Development," by Mr. J. M. Wakeman. (3) Symposium, relations with geographical sections. (4) Report of committee on memorials, by Mr. T. C. Martin. (5) Report of committee on constitutional amendments, by Mr. F. W. Frueauff. (6) Vote on constitutional amendments. (7) Report of committee on resolutions. (8) Report of nominating committee. (9) Election of officers. (10) Adjournment.

Technical Sessions

Tuesday, June 2, 2.30 p. m.

(1) Report of committee on meters, by Mr. P. H. Bartlett. (2) Report of committee on grounding secondaries, by Mr. W. H. Blood, Jr. (3) Report of committee on electric measurements, by Dr. A. E. Kennelly. (4) Foreword, "The Greater Electric Vehicle Problems," by Mr. W. P. Kennedy. (5) Address, "The Electric Vehicle," by Dr. C. P. Steinmetz.

Wednesday, June 3, 10 a. m.

(1) Report of committee on electrical apparatus, by Mr. L. L. Elden. (2) Paper, "Temperature and Its Relation to the Limiting Capacity of Electrical Apparatus," by Mr. F. D. Newbury. (3) Report of committee on underground construction, by Mr. P. Torchio. (4) Report of committee on overhead line construction, by Mr. Thomas Sproule.

Thursday, June 4, 2.30 p. m.

(1) Report of committee on prime movers: (a) steam, by Mr. I. E. Moultrop; (b) hydraulic, by Mr. J. F. Vaughan. (2) Paper, "Selection of Hydraulic Turbines," by Mr. Charles V. Seastone. (3) Report of committee on street lighting, by Mr. J. W. Lieb. (4) Report of committee on accident prevention, by Mr. M. J. Insull.

Commercial Sessions

Tuesday, June 2, 2.30 p. m.

(1) Address of the chairman of the section, by Mr. T. I. Jones. (2) Report of finance committee, by Mr. E. L. Callahan. (3) Report of membership committee, by Mr. J. F. Becker. (4) Report of publications committee, by Mr. Douglass Burnett. (5) Report of committee on education, by Mr. F. C. Henderschott.

Wednesday, June 3, 10 a. m.

(1) Report of committee on rate research, by Mr. E. W. Lloyd. (2) Address. (3) Report of lamp committee, by Mr. F. W. Smith.

Thursday, June 4, 10 a. m.

(1) Report of committee on non-peak and high-load-factor business, by Mr. G. H. Jones. (2) Address, "Age of Co-operation," by Mr. Elbert Hubbard. (3) Report of committee on interurban lighting of highways, by Mr. G. B. Tripp.

Thursday, June 4, 2.30 p. m.

(1) Report of committee on wiring of existing buildings, by Mr. R. S. Hale. (2) Report of committee on electrical merchandising and advertising, by Mr. Parker H. Kemble. (3) Report of nomination committee. (4) Election of officers.

Hydroelectric Sessions

Thursday, June 4, 10 a. m.

(1) Address of chairman of section, by Mr. W. W. Freeman. (2) Report of committee on hydro-progress, by Mr. T. C. Martin. (3) Paper, "The Nature of Electrical Disturbances in Transmission Work," by Mr. D. B. Rushmore. (4) Paper, "The Transmission Systems of the World Operating at and Above 70,000 Volts," by Mr. Selby Haar. (5) Report on permanent methods of measuring water in water-power plants, by Mr. D. W. Mead. (6) Paper, "Water-Power Plant Economics," by Mr. O. B. Coldwell. (7) Illustrated address, "Hydroelectric Work in California," by Mr. John A. Britton.

Thursday, June 4, 2.30 p. m.

Second hydroelectric session held in conjunction with third technical session.

Accounting Sessions

Tuesday, June 2, 2.30 p. m.

(1) Address of the chairman of section, by Mr. H. M. Edwards. (2) Report of library committee, by Mr. C. L. Campbell. (3) Report of "Question Box" committee, by Mr. E. C. Scobell. (4) Paper, "Cost and Statistics," by Mr. T. J. Walsh.

Wednesday, June 3, 10 a. m.

(1) Report of committee on uniform system of accounts, by Mr. J. L. Bailey. (2) Address, "Appraisals," by Dr. D. C. Jackson. (3) Paper, "Variation in Public Service Systems of Accounting," by Mr. E. C. Scobell.

Thursday, June 4, 10 a. m.

(1) Paper, "Accounting for Merchandise Sales," by Mr. H. B. Lohmeyer. (2) Paper, "Suspense Accounts," by Mr. Fred Schmitt. (3) Paper, "Mechanical Sorting and Tabulating Systems," (a) in connection with disbursement accounts, by Mr. F. A. Birch; (b) as applied to inventory of transmission and distribution systems, by Messrs. G. L. Knight and C. V. Woolsey. (5) Paper, "Purchasing, Storing and Accounting of Coal for the New York Edison Company," by Mr. C. R. Lehmann.

Electric Vehicles for Parcel-Post Service

At the meeting of the New York Section of the Electric Vehicle Association of America, May 22, Mr. F. W. Frueauff, chairman of the N. E. L. A. committee on parcel-post co-operation, and Mr. J. H. McGraw, chairman of the committee on parcel-post delivery for the Electric Vehicle Association of America, discussed the work of their respective committees.

When it was suggested, Mr. Frueauff said, that the National Electric Light Association co-operate in the movement to further the use of electric vehicles in parcel-post service, the central-station men were glad of the opportunity to participate. Mr. Frueauff said that his committee had sent letters to 1100 manufacturers, including every central station in the United States in a city with a population of more than 10,000, appealing to their self-interest and urging them to instil into the minds of their Congressional representatives and postal officials the advantages of the electric vehicle.

The committee has not attempted to influence the authorities, he stated, as to how the government shall handle its parcel-post delivery; for that is a matter that the post office alone can determine, but the committee is trying to point out that the use of the electric vehicle for this delivery is the best solution of the problem.

Speaking of the work of the committee on parcel-post delivery, Mr. McGraw said that the number of electric vehicles which could be used in the parcel-post service, if there were the proper disposition and facilities for employing them, may be estimated from the number of parcels now being handled in fifty of the principal cities. There will be at least 600,000,000 parcels handled annually in these cities, or 2,000,000 a day, and assuming that an electric vehicle can handle an average of 200 packages a day, it would require a total of 10,000 vehicles, or an average of 200 machines in each of these cities, to handle the parcels. This, he said, is business worth securing for manufacturers and would bring the central stations in each of the cities an average income of $100 a day, or a total of $1,500,000 annually, assuming an energy consumption of 12.5 kw-hr. daily per vehicle. These figures are not at all surprising when it is considered that the public is buying postage stamps for parcel-post service at the rate of about $25,000,000 per annum. Chicago alone spends $4,000,000 and New

York comes next with $3,000,000 annually. Collection and delivery are said to represent 90 per cent of the traffic in parcel-post transportation; therefore an estimate of 5 per cent of the receipts as the cost of electricity is not unreasonable.

Following the remarks of Mr. Frueauff and Mr. McGraw, Mr. W. P. Kennedy abstracted briefly a paper entitled "The Electric Vehicle in Parcel Post Service for Economy and Reliability," prepared with the idea of educating government officials and others regarding the advantages of the electric vehicle for the delivery of parcels. Mr. Kennedy stated that the representatives in Washington had asked for more operating data, and the committee is now gathering the information desired.

Mr. George Duck, president of the New York Motor Truck Club, declared that the work of the association would be well directed if influence were exerted upon the government to allow the contractors who handle the parcel-post delivery in the various cities fairer compensation for their services. Under existing conditions some of these contractors are just able to cover expenses, while in other instances actual losses have been sustained.

Mr. J. V. Lupo recited some of his experiences in transporting mail in Newark, N. J., and declared that the four-year period usually stipulated is too short for the proper development of an efficient delivery system. He also concurred in the belief of Mr. Duck regarding the inadequacy of the compensation received from the government, and maintained that with the wages now prevalent it is almost impossible to obtain experienced and trustworthy workmen. Mr. Lupo favors the electric vehicle.

Mr. R. L. Lloyd, of Philadelphia, also took part in the discussion.

Growth of the Central-Station Industry in the Central States

Data received from central-station companies in some of the Central States make it possible to estimate fairly closely the present rate of growth of the business in that section of the country. The East North Central group includes Ohio, Michigan, Indiana, Wisconsin and Illinois, and for the first four of these States the available data for March are thoroughly representative. They include figures from the companies operating in sixteen cities of over 50,000 population, which between them generated in March, 1913, over 70 per cent of all the energy produced in those four States. The results are given in Table I.

TABLE I—CENTRAL-STATION DATA FOR FOUR EAST NORTH CENTRAL STATES

	Gross Income from the Sale of Electricity for All Loads			Total Energy Output in Kilowatt-hours of All Stations Subsidiary to the Companies Reporting		
	March, 1914	March, 1913	Per Cent Increase	March, 1914	March, 1913	Per Cent Increase
Ohio	$1,194,618	$1,050,444	13.7	47,599,760	38,883,865	22.5
Michigan	791,049	692,085	14.3	39,639,857	35,681,368	11.0
Wisconsin and Indiana	353,829	326,137	8.5	31,935,583	29,905,643	6.8
Total	$2,339,496	$2,068,666	13.2	119,175,200	104,470,876	14.1

On the basis of output it may be estimated that the Michigan companies included above generate about 62 per cent of all the energy produced in the State, while those of Wisconsin and Indiana are scarcely less representative. For Ohio it may be assumed that more than 90 per cent of the industry is represented, as the returns from this State include the companies operating in Cleveland, Cincinnati, Columbus, Toledo, Dayton, Youngstown, Akron, Springfield and Canton. From the 1912 census figures it is possible to estimate quite closely that in March, 1913, all the central-station companies in the States of Ohio, Michigan, Wisconsin and Indiana sold about 144,243,000 kw-hr. of energy, for which they received a gross income of $3,651,200; and, since the annual expansion-factor of 13.2 for revenue and 14.1 for output obtained by the *Electrical World* may safely be regarded as representative for the whole section, it is possible to compute that, for these four States, gross income increased from $3,651,000 in March, 1913, to $4,125,000 in March, 1914, while energy output increased in the same time from 144,243,000 kw-hr. to 164,700,000 kw-hr. Illinois is the fifth State included in the East North Central group. While authentic data from the properties in that State are not sufficiently numerous to provide an exact index to the rate of their growth, it is thought that the characteristic here is the same as that officially obtained for Ohio and Michigan. On that assumption Table II for the East North Central belt can be presented.

TABLE II—CENTRAL-STATION DATA FOR EAST NORTH CENTRAL BELT

	Gross Income from Sale of Energy		Total Output in Kilowatt-hours	
	March, 1914	March, 1913	March, 1914	March, 1913
Sixteen companies in Ohio, Michigan, Indiana and Wisconsin	$2,339,496	$2,068,666	119,175,200	104,470,876
All central stations in above four States (est.)	4,125,000	3,651,200	164,700,000	144,243,000
All central stations in the East North Central group (est.)	7,340,000	6,492,900	306,000,000	268,163,000

Those who are searching for silver linings to the clouds of business depression should take careful note of the fact that at the present rate of growth (which is in excess of 13 per cent) the central stations in the East North Central States will show a gross income of over $80,000,000 for the year 1914—more than $10,000,000 above the 1913 figures.

Data received from the remainder of the Central States have not been quite so representative as those of the East North Central group, but some idea of the rate of progress in these States may nevertheless be obtained. Within the West North Central group may be included Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska and Kansas. The *Electrical World* has received data for March from many of the major cities in the district named, including St. Louis and St. Joseph, Mo.; Duluth and St. Paul, Minn.; Des Moines, Davenport and Sioux City, Ia., and Omaha and Lincoln, Neb. The rate of growth for the industry in this territory is found to be somewhat more than 25 per cent both on energy output and on gross income. Much of this fine showing is due, however, to the wonderful expansion in business of the St. Louis companies. If the figures for this city are omitted, the resulting coefficient will probably more truly represent the rate of electrical expansion in the West North Central belt. It may be estimated, then, that the urban supply systems in this territory are increasing their output at a rate of 12 per cent per year, for which they are realizing an increase in gross income of from

9 to 10 per cent. It may be of interest to note that the combined output of all the central stations of the West North Central group for March, 1913, was in the neighborhood of 69,000,000 kw-hr., and the gross income from the sale of energy some $2,750,000. For March of this year the figures are probably 77,500,000 kw-hr. and somewhat more than $3,000,000.

In the East South Central group may be included Kentucky, Alabama, Mississippi and Tennessee. Authentic data received from companies in these States cover an output of energy which is little less than one-half of the entire output of the group. Aggregates show that $218,003 of gross income in March, 1913, increased at a rate of 14 per cent to $248,345 in March, 1914, and the energy output of stations from 10,837,745 kw-hr. at a rate of 10.1 per cent to 11,924,325 kw-hr. This shows a healthy rate of expansion which is not greatly less than that established by the last census for the period 1907-1912. For the entire central-station industry in these four States it may be calculated that gross income grew from $705,830 in March, 1913, to $789,000 in March, 1914, and energy output from 22,460,000 kw-hr. to 24,700,000 kw-hr. All available figures from the West South Central States (including Louisiana, Arkansas, Oklahoma and Texas) are in marked contrast with the above flattering returns and indicate a slower rate of expansion in this section of the country for March than in any other of which the *Electrical World* has record. The summary of gross earnings published by the Stone & Webster Management Association for its four principal Texas subsidiaries shows an increase for March, 1914, over March, 1913, of less than 4 per cent; and these companies between them probably handle over 60 per cent of the entire energy output of the State. For Louisiana and Arkansas the returns are a little more favorable, but the available figures for the whole group show only 4.8 per cent increase on gross income and 6.2 per cent on energy output. On a basis of output, these returns cover some 70 per cent of the entire industry of the four States. It may be estimated that for all the central stations in the group the gross income increased from $1,151,700 in March, 1913, to $1,206,000 in March, 1914, and the energy output from 31,542,000 kw-hr. to 33,500,000 kw-hr.

Summarizing the foregoing results, it may be said that the condition of the electrical business in the Central States for March of this year as compared with March of last year is shown fairly accurately by the following rates of increase: East North Central, gross income 13.2, energy output 14.1; West North Central, 9.0 and 12.0; East South Central, 14.0 and 10.1; West South Central, 4.8 and 6.2.

TABLE III—CENTRAL-STATION DATA FOR FOUR GROUPS OF CENTRAL STATES (ESTIMATED)

	Gross Income			Energy Output in Kilowatt-hours		
	March, 1914	March, 1913	Per Cent Rate of Increase	March 1914	March, 1913	Per Cent Rate of Increase
East North Central.	$7,340,000	$6,492,900	13.2	306,000,000	268,163,000	14.1
West North Central.	3,030,000	2,783,000	0.0	77,500,000	69,420,000	12.0
East South Central.	798,000	705,830	14.0	24,700,000	22,460,000	10.1
West South Central.	1,206,000	1,151,700	4.8	33,500,000	31,542,000	6.2
Total..........	12,374,000	$11,133,430	11.2	441,700,000	301,585,000	12.8

Estimated figures for gross income and energy output of all central stations operating in these four groups of Central States will be found in Table III.

It may be remembered that in the *Electrical World* for May 16 a figure of 314,500,000 kw-hr. was given as the probable energy output for March of all the central stations in the Middle Atlantic States (New York, New Jersey and Pennsylvania). Since the March output of the entire country was only 1,240,000,000 kw-hr., it is easy to see that the Middle Atlantic and the East North Central States between them are responsible for about one-half of all the energy generated by the central stations of the United States.

Electric-Vehicle Interests Convene at Boston

The second annual convention of electric-vehicle and central-station interests in New England was held at the Engineers' Club, Boston, Mass., on May 19 and 20. The marketing of the electric vehicle was considered from many angles, and the discussions were among the most prolific of those taking place in any convention of electrical interest in Boston in recent years.

Terminal Freight Congestion

On the evening of May 18 Mr. Fred A. Hortter, car accountant of the Boston & Maine Railroad, read a paper before the New England Section of the Electric Vehicle Association of America in which he set forth the poor load-factor of the city trucking service as at present conducted, discussed the causes of congestion in freight handling, and advocated the organization of a centralized scheme of merchandise transportation to and from railroad terminals as the solution of the problem of rapid and efficient service. The author contended that the use of individual motor trucks represents an improvement in the tools of transportation, but that an organized service must be given before the present troubles of the railroad and the shipper over incoming and outgoing freight will be eliminated. The discussion centered mainly upon the transportation side of the problem, without much reference to electric trucks.

The Electric Vehicle Advancing in Massachusetts

In a brief address of welcome at the opening of the convention President Day Baker of the Electric Motor Car Club, Boston, said that the rate of electric vehicle registration exceeded that of the gasoline cars in Massachusetts in 1913 and that 1000 trucks and passenger cars are now in service in the State. Eighteen makes of commercial and pleasure electric vehicles are now represented in Boston. Conditions in the trade are encouraging, and the public is surely coming to appreciate the attainments of this form of transportation.

Co-operation

Past-president W. H. Blood, Jr., of the Electric Vehicle Association of America, congratulated that body upon the active spirit of its membership and spoke in high terms of the part the manufacturers, central stations, vehicle owners and the technical and lay press are playing in the development of the industry. He paid a well-deserved tribute to the enterprise of the Edison Electric Illuminating Company of Boston in the exploitation of the electric vehicle in New England and in the elimination of its own horse-drawn equipment in favor of "electrics." Favorable rates for charging energy have also been made by the company. Closing, the speaker touched upon the financial interests behind the electric vehicle, considering central stations and allied enterprises, whose investment totaled $500,000,000 recently.

Discussion

A long discussion followed the opening address, the participants being Messrs. D. C. Tiffany, Ohio Electric Car Company, Boston; Converse D. Marsh, Bates Advertising Company, New York; Charles B. Burleigh, General Electric Company, Boston; Col. E. W. M. Bailey, S. R. Bailey & Company, Boston; Day Baker, General Vehicle Company, Cambridge, Mass.; Albert Weatherby, Detroit Electric Motor Car Company, Boston; David W. Beaman, New Bedford Gas & Edison Light Company, New Bedford, Mass.; W. M. Thayer, Hartford (Conn.) Electric Light Company, and S. Fred Smith, Salem (Mass.) Electric Lighting Company. Emphasis was laid upon the need of more co-operation among the smaller central stations in furnishing battery-charging facilities at reasonable rates. A 25-cent rate per kw-hr. at Manchester, Mass., was cited as an insuperable obstacle to a vehicle sale by one of the speakers. Mr. J. S. Codman, S. R. Bailey & Company, Boston, said that this rate was in a measure due to the peculiar situation of the company, which is maintained at a loss by wealthy summer residents and which generates no electricity. He admitted that the price was inordinate and expressed the hope that it might be reduced as a result of the electric-vehicle movement. Another speaker made the point that professional electrical engineers in many cases view the electric vehicle as a toy and do not realize its immense development in the last three or four years. Praise was accorded the Stone & Webster and Tenney companies for their cooperation. Mr. Burleigh urged continual effort to make the small central station realize the value of off-peak charging service, which covers 99 per cent of the battery requirements. Colonel Bailey cited the willingness of central stations to furnish him with charging facilities on his tours around the eastern portion of the country, saying that in Ashtabula, Ohio, a 1200-kw generator was run by the courtesy of the local company to enable an exciter to yield the required service. Colonel Bailey contended that charging should be a simple matter to arrange by use of the exciter bus and emphasized the effectiveness of a boost at a high rate when touring.

Mr. Beaman briefly described a new 60-ft. by 100-ft. garage erected by the New Bedford company to house thirty electric cars, the notable feature being a front of Indiana limestone, used because the structure adjoins the company's office building. Nine "electrics" are used by the company itself to-day. Mr. Thayer outlined the famous battery-exchange-service system in use at Hartford, which has been fully described in the *Electrical World*. There are now fifty-six trucks in service and on order, and the weekly revenue of the company from the battery-exchange service is about $200. The daily mileage, upon which rates are based, is now 1600 and will soon be 2000. The company expended only about $200 in fitting up its charging station, aside from the battery investment, jacks representing this outlay. The labor item is the most important element of expense. Last winter's experience indicated that an average of one and one-half batteries per truck must be carried to give suitable service, this number falling to one and one-third with vehicle charging at night, assuming that the battery is kept on board. With increased business this margin can be cut down.

The Electric Vehicle Association of America

Mr. A. Jackson Marshall, executive secretary of the E. V. A., said that 700 members are now on the list, compared with 400 last fall, and a total of 1000 is anticipated by the Philadelphia convention in October. The growth of geographical sections, of which there are now six, has spread across the country from Boston to San Francisco, and three more sections are about to be added, in Los Angeles, Detroit and Cleveland. Commercial conditions have been bettered by the association, and much first-class co-operative work has been done with the National Electric Light Association, notably in parcel-post developments. Interest in the electric vehicle has been stimulated abroad by the association, and its domestic activities include extensive plans for the education of electric-vehicle salesmen, car owners and others along the lines so successful in the gasoline motor-vehicle industry. Valuable data as to the capacity, location and distance of adjacent charging points are to be printed in the "Automobile Blue Book of America" through the influence of the organization, and it is working hand in hand through committee membership with the standardization representatives of the Society of Automobile Engineers. The latter includes an electric-vehicle committee and is regarded as the leading technical body in the automobile industry. A reduction in the rentals of association electric garage signs from $5 to $1 has been made, and special attention is being given to the improvement of electrical conditions in gasoline garages. Regular publicity items are sent to about 100 newspapers from headquarters.

Electric Garages and Their Service

A paper by Mr. J. C. Bartlett, Philadelphia, described in detail the practice of the Bartlett garage, in which attention to detail, the close inspection of housed cars and a first-class electric livery are noteworthy features. The establishment saved investment cost by locating in the direct-current district, greatly simplifying the necessary charging equipment, which includes twenty-four 35-amp, six 65-amp and three 200-amp circuits, with room for 100 cars in a 70-ft. by 100-ft. house. The author condemned flat-rate storage charges, favoring separate billing for storage, deliveries and energy supplied. This practice improves the handling of cars by owners and insures better charging and maintenance. With the flat rate there is danger of sulphating batteries by neglect on the part of garage attendants. When the author began business a profit of $100 per month was obtained in a small garage handling only a dozen electric cars. By means of rates permitting the building up of garages in various neighborhoods a central station can be of great assistance. The average gasoline garage is a poor place for the electric vehicle, which is so free from repairs that it does not interest the garage owner, and which is often neglected. Continuous mechanical and electrical attendance throughout the daytime is desirable, with competent battery men on duty at night. Special care in sending cars out clean, in informing the owners when repairs are needed, in making minor adjustments, and in keeping thorough records of car movement, is a factor in the success of a commercial electric garage. A thorough monthly inspection, free to the customer, is given.

Utility of the Electric Vehicle

Mr. E. J. Bartlett, Baker Motor Vehicle Company, Cleveland, Ohio, was the author of a paper on the utility of the electric vehicle. He emphasized its advance into the touring field, citing runs by Colonel Bailey and speed tests as instances of the growing possibilities of the machine. The industry is now concerned with a man's car no less than with one appealing to women. In touring, a speed of 22 miles per hour is entirely feasible for many miles, and this is a sufficient average for most services. In the commercial field the speeds are from 7 miles to 13 miles per hour, according to the size of the truck, and these are a third below the gasoline machine speeds, which makes for lower repair bills on the electric balance sheet. The electric vehicle can be counted upon for service 98 per cent of the time, compared with 85 per cent in gasoline and 75 per cent in horse service. The writer said that within a 50-mile daily service the electric vehicle generally can defeat the gasoline outfit on economical grounds. He quoted the following reliability figures from an installation whose service in the recent cold season was performed by electric and gasoline trucks about eighteen months old: Total truck days, 4900, of which 3400 were run by electrics. Troubles reported, 166. Of these, ninety-two were gasoline truck difficulties, and the unit troubles figured two per 100 truck days with the electrics and six per 100 with the gasolines. Of the seventy-four electric vehicle troubles, forty-three were caused by batteries excessively discharged, but no battery gave out before 5 p. m. Loose tires and broken chains were also among the principal causes of service interruption.

Discussion.

Messrs. Burleigh and Marshall discussed the paper, the former emphasizing the need of commercial education among central-station men concerned with the electric vehicle, and the latter the educational work contemplated by the national association.

The Relative Fields of Electric, Gasoline and Horse Trucks

The work of the Massachusetts Institute of Technology in the motor-vehicle field was reviewed by Mr. H. F. Thomson, research assistant in the electrical engineering department. The speaker emphasized the international interest in the investigations. The results have appeared in bulletin form with the exception of the later tabulations and their summary, which will be published in the near future by the Institute. Mr. Thomson gave a few extracts from the forthcoming bulletin which showed that inside a 2-mile radius there is little to choose in expense between horse and electric traction, but outside this range the electric vehicle is superior to other forms of transportation up to the limitations of a single charge of the battery. The limit is about 10 miles radius in parcel delivery and 6 miles in coal delivery. Efforts need to be put on the analysis of labor in delivery service and particularly upon the scientific layout of routes, rather than upon the cost of electricity for charging, since the latter can be doubled with only a small increase in the total operating cost. In a representative case a figured increase in energy cost of from 2 cents to 4 cents per kw-hr. raised the total expenses only 10 per cent. An approximate figure of $2 per 100 miles appears correct for the annual repairs of a 1-ton electric truck, between yearly mileages of 2000 to 10,000. As far as the records indicate, there is less difference in maintenance between electric and gasoline trucks than is generally supposed, but the reliability coefficient of the former is easily 95 per cent as against 75 per cent in the latter.

Discussion

Mr. Royal B. Daggett, Commercial Truck Company of America, Boston, questioned the preliminary figures of the foregoing speaker, suggesting that with the improved handling of electric trucks sure to result from their wider service lower costs are to be expected. He felt that the superiority of industrial electric trucks in factories, etc., hinted the economic possibilities of larger vehicles in short-radius service. The following figures were given by the speaker as representative: Cost of operating a 1-ton electric truck 30 miles per day, $7, compared with $4 for a horse limited to 15 miles service; cost of operating the truck 60 miles per day, with an extra battery, $9.80, compared with $16 for a similar four-horse service. Messrs. Marsh, Baker and L. P. Abel, consulting traction engineer, Boston, also spoke briefly, the last emphasizing the vital necessity of skilful route selection in economical operation. In a case cited by Mr. Abel the delivery cost per case increased from 4.5 cents to 19 cents because the drivers were not versed in the best ways of covering the territory.

Touring by Electric Automobile

Mr. J. S. Codman, Boston, read an interesting paper upon the present status of electric automobile touring, with a comprehensive introduction summarizing the various runs of Colonel Bailey and others within the past few months. The figures showed that, given adequate charging facilities, the electric passenger of the roadster type is perfectly able to traverse the countryside under even adverse road and weather conditions, and that grades and rough highways are not real obstacles. The most important point is the ability to obtain boosting charges, and at present local central stations are very poorly prepared for this, although the engineering and financial difficulties are more imaginary than real. The most recent trip of note by a Bailey electric was a run between Boston and New York on May 14-15, which was accomplished in twenty-three hours, nine minutes, the odometer reading 247.8 miles. On the road the running time was ten hours, fifty-two minutes. At five points boosts or charges were given, the total time thus required being ten hours, twenty-three minutes. The trip was made with a consumption of 3.04 amp-hr. per car-mile.

The author pointed out that the delay entailed by boosting is not serious, since inputs at high rates can be utilized with the modern storage battery, provided that care is taken to avoid gassing. In a case cited the author had boosted a 45-amp Edison battery for one hour at 200 amp, and enough energy was absorbed to enable the car to negotiate the next 50 miles. Too few central stations are prepared to supply direct current of such high value, but it ought to be fairly easy to arrange this by means of connections with the exciter bus, depending upon the instruments carried upon the car if necessary to check the input from the bus in stations not having other suitable instruments. The cost of the necessary wiring and rheostat should be nominal. There are only twenty-eight towns out of more than 300 in Massachusetts where a charging current in excess of 50 amp can be obtained for boosting service.

Discussion

The paper was freely discussed by Messrs. Abel, Marshall, J. W. Cook, of the Electric Storage Battery Company, Boston; P. A. Kelley, of the Philadelphia Storage Battery Company, Boston; F. B. Neely, R. B. Daggett, E. Y. Stimson; Albert Weatherby, and William G. Bee, of the Edison Storage Battery Company, Orange, N. J. The speakers generally agreed that boosting at high rates does not injure the modern battery, whether of the Edison or lead type. The point was made that if a battery has been discharged by 100 amp-hr., the boosting charge can be "put in" at 100 amp, reducing this rate as fast as the meter shows that the cells are being filled. At an indication of 80 amp-hr. out, the boosting rate would be 80 amp, and so on. Mr. Cook said that by charging a lead battery at a constant voltage 90 per cent of the charge could be absorbed in three hours. Fifty per cent would be absorbed in the first hour. In all such work it is necessary to look out for gassing and abnormal temperatures, say, above 110 deg. Fahr. The speakers also cited instances of storage-battery electric-railway cars which gave excellent daily mileage records by boosting the cells at odd times which did not interfere with the schedules. Electric taxicabs are being considered for the Grand Central Station service in New York, on account of their absolute freedom from objectionable fumes.

Recognition of the Electric Vehicle

Mr. Hayden Eames, Standard Electric Company, Cleveland, submitted a paper in which the practical achievements of electric-vehicle service were sketched. The writer commented upon the high economy of the electric vehicle and outlined the value of personal recommendations from users in the electric-vehicle campaign.

Competition, Fair and Unfair

A paper advocating the application of the golden rule to the automobile business was read by Mr. A. V. Shaw, of the Peerless Motor Car Company, Boston. The author attacked the practice of "knocking" one's competitors and their wares and set forth the merits of co-operation, competition and publicity as a slogan for present-day salesmen. The paper was briefly discussed, the burden of the remarks being the benefits of a square deal among rivals.

Analysis of Sales Methods

An open business forum was conducted by Mr. C. D. Marsh, New York, at the closing session. By means of a skeleton diagram, the speaker set forth the fundamental features of business getting by electric-vehicle salesmen and the classification of advertising methods. Various types of reports and records of dealings with prospects were commented upon. An interesting feature was a talk by the leader of the discussion upon the preparation of form letters and various plans by which these can be given individuality.

Discussion

A somewhat rambling discussion followed the remarks of Mr. Marsh. The consensus of opinion was that souvenir programs are about the worst medium of electric-vehicle advertising. Colonel Bailey brought out the point that the sale of an electric roadster to a present car owner is an easier problem for the seller of cars than to market a machine anywhere else. Surprising as it appears, the average speed of the Bailey car on the road exceeds that of the usual gasoline machine. The latter seldom exceeds 19 miles per hour, and that of the former is regularly from 20 to 22 miles per hour. About 50 per cent of these electric roadsters are sold to men. Mr. Marsh, responding to an inquiry, advised spending $250 on newspaper advertising and $750 in circularizing, letters and follow-up work, assuming a yearly appropriation of $1,000 for electric vehicle exploitation by a Boston agency. Mr. Louis D. Gibbs, Boston Edison Company, added a humorous but practical touch to the discussion.

Weak Links in the Chain of Electric-Vehicle Salesmanship

Mr. F. Nelson Carle, manager of publicity for the General Vehicle Company, Long Island City, N. Y., presented a paper filled with concrete evidence of the difficulties besetting the salesman in the electric-truck field. He pointed out that only about 3 per cent of the prospective customers at any one time become early buyers, and even after contracts are signed serious complications often arise through changes in mind on the part of purchasers, modifications of drawings and specifications, insistence upon unusual dimensions and special equipment, and from abuse when the apparatus goes into service. It is no exaggeration to say that the salesman must work on a "prospect" something like one and three-quarters years before he secures his business.

The author contended that among the needs of the industry on its commercial side are a broader knowledge of different trades, with co-operation in different localities along the line of visits from specialists in different industries about to be motorized; better interchange of data bearing on propositions and sales between local offices and headquarters; avoidance of engineering freaks in truck designs and the tabooing of pet scheme of salesmen interested in technical details to the exclusion of sensible engineering solutions of problems; better success in training the purchaser toward accepting standard equipment when possible; the elimination of trade deals and concessions by agents who value their commissions more than the good of the industry, and the paying of more attention, by larger sales forces, to really interested "prospects" in smaller cities and towns. Multiplied sales of standard machines are the prime necessity of the present.

Outings

The entertainment features of the convention included a steak dinner cooked by electricity in the restaurant of the Boston Edison Company at the Massachusetts Avenue garage and an outing and shore dinner at the Relay House, Bass Point, Mass., on the last day of the convention calendar.

Southwestern Convention at Galveston, Tex.

The tenth annual convention of the Southwestern Electrical and Gas Association, held at Galveston, Tex., May 20 to 23, represented a departure from the program arrangement usually adopted by state and sectional associations, in the respect that few formal papers were presented during the various parallel sessions of the four-day meeting, most of the time of the convention being instead devoted to the discussion of practical organization, commercial and operating problems.

As explained by President G. H. Clifford, Fort Worth, Tex., in his opening address, general technical topics are already well covered in the engineering journals and in the transactions of the national scientific and engineering societies, so that state and sectional associations may best profit from the discussion of local subjects, operating problems, and other similar questions of immediate and special application. President Clifford also recommended that the association hold mid-winter meetings in addition to its present annual conventions, a proposal which received unanimous approval.

The attendance at the Galveston meeting numbered 350. The delegates were welcomed to "the Atlantic City of the Southwest" by Mr. Morris Stern of the Galveston Commercial Association. In a witty address Mr. Stern extended a hearty greeting to the utility operators and, in the course of his remarks, urged that legislators, both national and state, cease their destructive attacks on big business organizations, substituting if necessary proper regulation by business men of broad caliber. Mr. W. L. Wood, Jr., Texarkana, Ark., responded to the welcome on behalf of the association.

Membership and Committees

The report presented by Secretary H. S. Cooper, Dallas, Tex., showed the association to have 119 active members and 100 associates, making the largest enrolment in its history. This membership list includes every electric interurban and railway company in Texas, except one, every electric lighting company in cities over 5000, and thirty companies in towns of less than 5000.

President Clifford then announced the following committees: On the president's address—Messrs. R. B. Stichter, Dallas, Tex.; F. G. Murphy, Brownwood, Tex., and J. C. Kennedy, Brenham, Tex. Finance—Mr. J. P. Griffin, Dallas, Tex., chairman. Resolutions—Messrs. C. W. Kellogg, Dallas, Tex.; W. B. Head, Dallas, Tex., and E. J. Emerson, Beaumont, Tex. Nominating committee—Messrs. E. T. Moore, Dallas, Tex.; F. Lege, Jr., Galveston, Tex.; F. R. Slater, Dallas, Tex.; John Carpenter, Corsicana, Tex., and T. T. Malone, Plainview, Tex.

Reducing Energy Consumption of Street Cars

"Economy in the Use of Energy in Street Railway Service" was the title of the paper presented by Mr. George G. Morse, El Paso, Tex., and read in his absence by Mr. C. W. Kellogg, Dallas, Tex. By installing watt-hour meters on the cars and determining "bogey" energy-consumption values for each run with each type of car it was found possible to reduce the energy consumption per car-mile from 2.61 kw-hours to 2.39 kw-hours. The result was a saving of 623,643 kw-hours in two years' operation representing a cash saving of $4,000, said Mr. Kellogg. As the meters cost but $2,400 to install, the investment paid a return of almost 200 per cent. Use of the meters has also enabled car defects, tight brakes, improper wheel gages, etc., to be detected and corrected, and has further resulted in more careful handling of the car equipment by the men.

In the discussion Mr. E. J. Emerson, Beaumont, Tex., reported reducing the energy consumption on his lines from 2.8 kw-hours to 2.02 kw-hours by applying watt-hour meters to the cars. Mr. E. E. Nelson, Fort Worth, Tex., pointed out the advantages of coasting time recorders over the watt-hour meter method, and reported obtaining an immediate saving of 19 per cent of energy through the use of the former device.

Water-Power Transmission and Distribution

At the electric-light session of Thursday morning, Mr. W. L. Wood, Jr., presiding, Mr. H. T. Edgar, of the Stone & Webster Corporation, Boston, Mass., read a paper outlining the extent of energy transmission and distribution from the great Keokuk (Ia.) water-power plant. This development, the largest in the world, is located near the country's center of population and within easy transmission distance of many thriving towns and cities. The water-power thus developed will, the speaker predicted, eventually create an industrial and manufacturing district 100 miles long and 50 miles wide in the Mississippi River region, which will be without an equal in the country.

Central-Station Sales Policies

Secretary Cooper opened the discussion on the sale of appliances by central stations with a citation from the association Question Box, urging electric-service companies to avoid selling devices unless compelled to by apathetic local conditions.

Mr. A. W. Wallace, Jacksonville, Tex., insisted that central stations in communities under 5000 must take appliance sales into their own hands as competent dealers and contractors are rarely found in such places.

Mr. C. W. Kellogg said that at El Paso the central station sells appliances but also furnishes devices to contractors at cost, an arrangement which seems to satisfy the dealers.

Mr. J. C. Kennedy, Brenham, Tex., described his unit outlet system of computing wiring prices. He advised selling apparatus at a reasonable profit, declaring that the customer gives the company no credit for reduced prices.

Mr. J. E. Cowles, Shreveport, La., urged that the central station assume the roll of educator rather than that of merchant.

Mr. W. J. Drury, Dallas, Tex., admitted that in some small communities the central station must sell appliances, but declared that in larger cities the lighting companies will gladly turn this business over to the contractors.

Mr. W. A. Guthrie, San Angelo, Tex., recommended house demonstrations of devices, since the best class of customers, he said, pay by check and seldom enter the electric company's office or display room.

Secretary Cooper also opened the discussion on the sale of lamps by central stations, concluding with advice to the electric company to "stick to its last" and to simplify its business to the furnishing of electric service only.

Mr. F. R. Slater, Dallas, Tex., recommended "commercialization" of the contractor, educating him in business principles.

Mr. C. K. Chapin, Memphis, Tenn., said that the Memphis company delivers, free, all renewals of tungsten lamps, and also installs free of charge the original installation, for which no deposit is required. The cost of this renewal service amounts to 0.5 cent per kw-hour. He advocated the idea of selling not alone electrical energy, but "lighting service" in its broadest sense.

At the accounting session of Thursday morning, Chairman R. G. Carroll, Fort Worth, Tex., delivered an address on the subject of a uniform system of accounting for the public utilities of Texas. He emphasized particularly the need for such a system on the part of the smaller plants, and declared that its adoption would anticipate the state in enforcing unwelcome standard accounting methods.

Developing the Electric Vehicle Load

Mr. C. K. Chapin, chief electrical engineer of the Memphis (Tenn.) Consolidated Gas & Electric Company, on Thursday afternoon presented an interesting analysis of the benefits of electric-vehicle charging loads for central stations and urged the development of this profitable class of business. The Memphis company is unique in operating a service garage for the benefit of its customers. In this garage the various items of energy furnished, washing, delivering, and general inspection of cars, are charged for separately, the garage income per car ranging from $35 to $15 per month, depending on the service desired.

Mr. J. C. Kennedy, Brenham, Tex., reported the successful use of a 2-ton electric truck for ice delivery from his combination plant.

Operating Organization

That the manager of the small central station can with advantage apply to the organization of his own operating staff the same principles employed by the big utility companies was pointed out by Mr. J. C. Kennedy, Brenham, Tex., in his paper of Friday morning. The scheme of organization within the Brenham ice-electric company was illustrated graphically, but the points of greatest importance in any organization, said Mr. Kennedy, are, in their order, the capability, adaptability and congeniality of its individual constituent units.

Principles of Public Policy

"Public Policy of Public Utility Corporations" was the subject of the paper by Mr. F. R. Slater, general superintendent of the Texas Power & Light Company, Dallas, Tex. The average utility customer has very little, if any, concern about franchise rights, public ownership and the other larger problems affecting the industry. But the treatment he receives from the corporation's employees is personal and if they show him courteous consideration the company is given most of the credit. The value of frank and friendly relations with the press as a means of putting the corporation's case fairly before the public was also emphasized. Already there is being established, said Mr. Slater in conclusion, a harmonious spirit of co-operation between the utilities and those whom they serve, and the public is coming to realize that the public-service corporation is an integral and important part of the community and as such is entitled to the same courtesy, fairness and impartiality shown every other business interest.

The draft of a proposed law to make the theft of electricity in Texas punishable by a maximum fine of $25 or imprisonment for six months was presented by a special committee comprising Messrs. H. C. Morris, W. W. Reed, R. C. Brooks and E. C. Bartholomew. Messrs. Kellogg, Hegarty, Cooper, Rathell and Cushman commented briefly on the provisions of the act.

Mr. Homer R. Mitchell, Dallas, followed with an address on the Texas Employers' Insurance Association which was created by the recent Texas employers' liability act to insure employers at cost. The plan is modeled after that of the Massachusetts statute, and the operation of the law, declared Mr. Mitchell, has been attended by savings for both employers and injured employees. Mr. Mitchell was preceded by Mr. W. B. Head, Dallas, who spoke as a member of the insurance board.

"Safety First," the topic with which the session of Friday afternoon was opened, was discussed from the variant viewpoints of a street-railway manager, a claim agent, a lighting-company manager, a gas company executive, and the editor of a city newspaper.

Mr. R. T. Sullivan, Houston, Tex., said that the street-car men have long been exerting every effort in the interests of safety, but declared they yet need more co-operation from the public.

Mr. H. W. Withers, Houston, Tex., pointed out that the claim department may minimize accidents and encourage carefulness by appealing to the employees' sense of humanity, self-protection and company loyalty.

Mr. F. N. Lawton, Wichita Falls, Tex., described a number of practical safety devices in use on his central-station system.

Mr. F. S. Wisely, San Antonio, Tex., spoke for the gas companies, and Mr. H. T. Warner, of the *Houston Post* discussed means of handling that minority of the public which must be kept from harm in spite of itself.

Mr. W. L. Wood, Jr., Texarkana, Tex., made an appeal for better fire-prevention methods in utility properties, through the protection of plants and equipment from hazards both external and internal. Continuous effort and eternal vigilance will be needed to reduce the present astounding fire loss which reaches 1000 miles of buildings each year.

Election of Officers

Saturday's session was given over to business discussion, and the following officers were unanimously elected: President, Mr. D. G. Fisher, Dallas; first vice-president, Mr. W. L. Wood, Jr., Texarkana; second vice-president, Mr. C. W. Kellogg, Jr., Dallas; third vice-president, Mr. F. R. Slater, Dallas; secretary, Mr. H. S. Cooper, Dallas; treasurer, Mr. J. B. Walker, San Angelo.

Mr. D. G. Fisher, the president-elect, is assistant general manager of the Texas Traction Company and the Southern Traction Company, operating interurban electric railways from Dallas to Waco, Corsicana and Denison, Tex. Mr. Fisher served the association for several years as secretary and has since held successively the various vice-presidencies.

Executive committee—Messrs. G. H. Clifford, D. G. Fisher, W. L. Wood, C. W. Kellogg, W. B. Tuttle, D. Daly, F. J. Storm, W. B. Head, H. C. Morris and F. R. Slater.

Advisory committee—Messrs. W. S. Rathell, W. A. Sullivan, F. G. Murphy, E. D. Kelly, A. W. Wallace, F. A. White, E. S. Fletcher, J. W. Carpenter, M. J. Loftus, J. E. Cowles, W. V. Wainwright, W. A. Guthrie, P. A. Rogers, R. Merriwether, R. C. Brooks, J. L. Stevenson, E. J. Emerson and V. W. Berry.

Finance committee—H. S. Potter, G. H. Cushman and C. E. Calder.

The beautiful Hotel Galvez, commanding a superb vista of the Galveston sea wall, beach and Gulf of Mexico, served as headquarters of the convention. An opening reception and ball, a card party, boat rides, fishing expeditions and bathing parties were features of the entertainment program.

On Friday evening the Jovian Order held its parade, rejuvenation and banquet. Visiting Jovians and others were frank in conceding the procession and initiation ceremony to be the most elaborate and handsomely staged of their kind ever attempted anywhere in the United States. Five huge electric trucks carried floats depicting the evolution of the lighting art, the development of electrical inventions, the apotheosis of Jovianism, etc. Not only were the floats themselves elaborately illuminated, but cables from the truck batteries led to 160 banners, each carried by a red-clad marcher and lighted by eight 11-volt, 5-watt sign lamps in series on the 90-volt battery circuits.

PRESIDENT-ELECT D. G. FISHER

The parade, rejuvenation and electrical effects were arranged by the local Jovians led by Messrs. W. R. Phipps, Claude Matthews, K. E. Mason, W. D. Masterson, Max Levy, J. B. Harris and A. E. Kirk. At the banquet which followed the rejuvenation, Past-Jupiter H. B. Kirkland, Pittsburgh, Pa., was toastmaster and there were addresses by Jupiter W. N. Matthews, St. Louis, Mo., and Messrs. W. B. Head, Dallas, Tex.; F. R. Slater, Dallas, Tex., and Max Levy, Galveston, Tex.

Cleveland Electrical Show

The opening ceremony of the Cleveland Electrical Exposition began promptly in the Coliseum at 7 p. m. May 20. Mr. Charles F. Brush, the inventor of the arc lamp, was the principal speaker of the evening. He was introduced by Mr. George S. Millar, president of the Electrical League of Cleveland, which promoted the exposition. Directly following the ceremonies the exposition was formally opened to the public by Mr.

Thomas A. Edison, who from his laboratory in Orange, N. J., closed the Western Union connection, ringing a bell in the Coliseum. In a moment the large hall was flooded with lights of dazzling radiance and rainbow tints.

The general arrangements of decorations and exhibits is such as to allow the beauty of the lighting to be seen from any point in the hall. The two most striking features are the hundreds of semi-indirect lighting bowls, which are constantly changing in color, giving a charming variety of colored lighting, and the runway leading into the exhibit hall, the entire ceiling of which is a blaze of varying colors showing through a diffusing screen and impressing upon those who enter the idea that they are passing under falls of many colored waters.

The exterior lighting is brilliant. Beginning at the main thoroughfare of Cleveland, Euclid Avenue, and extending to the entrance of the Coliseum, the street is roofed with strings of lamps, and at the sides over the curbing are hung 1000-watt gas-filled lamps spaced about 15 ft. apart, making the lighting at night on the street and sidewalks very bright.

The number and variety of the exhibits equal those of any other electrical show held in this country, there being more than 100 different exhibitors.

A. I. E. E. Affairs

At a meeting of the board of directors of the American Institute of Electrical Engineers held on May 19 authority was given to extend the territory of the Portland Section to include Corvallis, Eugene, The Dalles, Astoria and Tillamook, Ore., and Winlock, Wash.

A communication was presented from the library board of the United Engineering Society requesting the appointment of a representative of the Institute upon a joint committee to consider the question of duplication of the exchange of publications and the possibility of retrenchment in the expenses incurred by these duplications. President Mailloux was authorized to appoint this representative.

Past-president John W. Lieb was appointed to represent the Institute at the Cooper Union commencement exercises on May 29, at which a tablet to the memory of Prof. William A. Anthony, a past-president of the Institute, will be dedicated. On Tuesday evening, May 19, members of the board of directors and a few personal friends of Mr. Herman Aaron attended an informal dinner at the Engineers' Club, New York, when a silver service of eight pieces was presented to Mr. Aaron as a token of the appreciation on the part of the Institute of the services rendered by him gratuitously during the ten years he acted as its legal counsel. President Mailloux presided, and the presentation address was made by Mr. J. J. Carty, who is entitled to the credit of obtaining the services of Mr. Aaron ten years ago, at which time Mr. Carty was chairman of the finance committee and a member of the board of directors. Mr. Carty spoke feelingly of the valuable services rendered by Mr. Aaron at the time negotiations were being carried on relative to the proposed gift by Mr. Carnegie to the engineering profession of a suitable building as a home for the principal national engineering societies, and he paid a high tribute to the public service rendered by Mr. Aaron at that time and also as general counsel of the Institute during the entire last decade. After an appropriate response by Mr. Aaron, all present joined in expressing their high opinion of the able, loyal and exceedingly efficient services rendered by Mr. Aaron to the Institute.

Public Service Commission News

New York Commissions

As the New York Public Service Commission, Second District, has approved the consolidation of the Cataract Power & Conduit Company and the Buffalo General Electric Company, Mayor Fuhrmann, of Buffalo, has been asked to approve the merger.

Governor Glynn has appointed Mr. Robert C. Wood to succeed Mr. John E. Eustis as a member of the New York Public Service Commission, First District. Mr. G. M. S. Schulz was appointed to take this office on March 28, but did not qualify. Mr. Wood was formerly a member of the firm of Wood & Havemeyer, bankers and brokers. This firm was dissolved recently.

California Commission

The Railroad Commission of California has rendered a decision authorizing the Downey Light, Power & Water Company to sell its electric system in Los Angeles County to the Southern California Edison Company for $50,938. The selling company has been receiving a rate of 15 cents per kw-hr. for lighting purposes and 6 2/3 cents per kw-hr. for motor service The Southern California Edison Company will reduce the rate for lighting on a sliding scale of from 7 cents per kw-hr. to 2½ cents per kw-hr. and for motor service on a scale of from 6 cents per kw-hr. to 1½ cents per kw-hr.

Ohio Commission

The decision of the Public Utilities Commission of Ohio in the case in which the Bucyrus Light & Power Company appealed from the action of the Bucyrus City Council has been announced.

A number of the principles for which the company contended were recognized by the commission, though some of the values were reduced. For the items of intangible value the commission allowed $14,000, or about 19 per cent of the value of tangible property with the exception of real estate. The company claimed $54,860 for the intangible value, the amount being found by taking certain percentages of a claimed reproductive value of $122,268. The commission pointed out that depreciation had not been taken into consideration by the company in the intangible values, as it had on the value of the tangible property. The items considered under this head are cost of engineering, superintendence, insurance, taxes, legal expenses, interest during construction, financing and development. While the commission recognized the item of financing and development under this head, its opinion of the amount differed widely from that of the company.

In arriving at the valuation of the property the commission took into consideration the appraisals made by the city experts, the company experts and Mr. L. G. White, representative of the commission, and an average was then secured. The reproduction cost was found and from this the depreciation was deducted to obtain the present value of the physical property. As to the amount of depreciation in this case the commission followed the figures of its own representative rather than those of either the company or the city. Mr. White estimated total depreciation at $20,674. The commission suggested that a company should have at least $5,000 working capital. In this case the supplies were counted as part of the working capital and the Bucyrus Light & Power Company was allowed a small sum in addition.

The value of the physical property was placed at $81,000 by the commission, and to this was added the $14,000 for intangible value, making $95,000 to be considered for rate-making purposes.

Current News Notes

Providence (R. I.) Electric Pumping Contract.—The Narragansett Electric Lighting Company, of Providence, R. I., has obtained a seven-year municipal water-pumping contract with a three-year renewal proviso. A 1300-hp synchronous motor driving a centrifugal pump of 13,000,000-gal. capacity will be installed.

* * *

Street Paving as Affecting Electrolysis.—In a recent case before the Public Utilities Commission of Ohio a street-railway company accused of causing damage by the electrolytic action of leaking electricity put in an answer to the effect that the street paving is in such bad condition that it is impossible to maintain proper bonding to prevent electrolysis.

* * *

Turbines in Hauto Plant.—On page 1039 of the *Electrical World* dated May 9, 1914, in an article relating to the Hauto (Pa.) plant of the Lehigh Navigation Electric Company, it was stated that the blading of the steam turbines is "a modification of that used in the Rateau machine as developed by the Allgemeine Elektricitäts Gesellschaft, while the governing parts, impulse nozzles and their wheels are essentially the same as those employed in the Curtis turbine." It should have been stated that these turbines were developed and built in this country and not in Germany. They are of the type that has been standardized by the General Electric Company.

* * *

Electrical Term for Hotel Advertising.—In a recent advertisement in an American newspaper for the Savoy Hotel, London, Eng., use was made of the term "load-factor" to emphasize the advantages of this well-known hostelry. The text in part is as follows: "Have you ever heard the expression 'load-factor'? Do you know what it means? It is used in connection with the supply of electricity. If an installation is able to dispose of its full current during every hour of the twenty-four hours, it is said to have a 'load-factor' of 100 per cent. If it can dispose of it only during twelve hours of the twenty-four and is idle for the remaining twelve hours, it has a 'load-factor' of 50 per cent, and so on." It then goes on to explain why the Savoy Hotel can provide so many conveniences to the public at moderate charges on account of its 100-per cent load-factor.

* * *

The Electrified Defences of Matamoras, Mexico.—During one of the attacks made by the Mexican constitutionalists upon the federal forces in the city of Matamoras, Mexico (which is just opposite Brownsville, Tex.), the defending federal troops intrenched themselves behind a barricade of barbed wire, and then, as an afterthought, their commander hit upon the pleasant scheme of connecting this barbed wire to the lines of the Matamoras electric plant so that a deadly shock would be given persons making contact with it. During a fierce assault on the federal works six or seven constitutionalist soldiers were electrocuted by the wire before the deadly nature of the barricade became known. Withdrawing his infantry for the time being, the rebel general then directed his field guns upon the electric plant with the result of quickly shutting it down. Returning to the assault, the now innocuous barbed-wire entanglement proved only a slight obstacle to the final capture of the city by the constitutionalist forces.

SOCIETY MEETINGS

Annual I. E. S. Convention in Cleveland.—The annual convention of the Illuminating Engineering Society will be held in Cleveland during the week of Sept. 21, 1914.

* * *

Canadian Electrical Association.—The annual convention of the Canadian Electrical Association will be held in Montreal, Que., June 24, 25 and 26 in the rooms of the Canadian Society of Civil Engineers.

* * *

Awards Made in New York Companies' Section N. E. L. A. Contest.—At a meeting of the convention contest committee, New York Companies' Section, N. E. L. A., held in the Consolidated Gas Building, May 25, the following ten contestants were each awarded a prize of $50 to be used to pay the expenses of attending the Philadelphia N. E. L. A. convention: Mr. J. Walker Eaton, the New York Edison Company; Mr. S. H. Cleeland, Jr., the New York Edison Company; Mr. H. J. Garnier, the New York Edison Company; Mr. F. E. Boyland, the New York Edison Company; Mr. G. W. England, New York & Queens Electric Light & Power Company; Messrs. J. Messler, Westchester Lighting Company; R. I. Shannon, United Electric Light & Power Company; E. J. Reilly, the Yonkers Electric Light & Power Company; H. J. Otto, the Yonkers Electric Light & Power Company; E. J. McMahon, the Yonkers Electric Light & Power Company. The contest has been conducted by a committee under the chairmanship of Mr. L. A. Coleman, of the United Electric Light & Power Company, and has been going on since November, 1913. The winning contestants will attend the convention as the unofficial representatives of the New York Companies' Section, N. E. L. A., as well as being the companies' direct representatives.

* * *

Illuminating Engineers Meet in New York Department Store.—The Illuminating Engineering Society, New York Section, held its May 21 meeting in the auditorium of the recently completed Lord & Taylor department store. Mr. Bassett Jones delivered an illustrated lecture on the lighting of the building, describing the illumination of the French salon, concert hall, evening rooms, show windows, etc. He called especial attention to the methods of securing an artificial approach to daylight in certain parts of the store where this light is required. The speaker said that to attempt to illumine an entire store with artificial light approaching that of subdued daylight would be unnecessary and entirely too expensive as too much energy would have to be available at each fixture outlet. Commenting on the types of reflectors and lamp units employed, Mr. Jones declared that the use of concentrated-filament lamps makes the design of reflectors a simple problem. He believes that it is not necessary to design reflectors by theoretical computations, saying that it is simpler and just as effective to form their contours by geometrical construction. After showing that the illumination of a surface depends only on the flux angle and the intensity of the light source, the speaker indicated how a reflector could be designed by geometrical construction. After the lecture Mr. Jones conducted those present through the building showing them the artistically illuminated restaurant and the stage for theatrical gown "try-ons," and demonstrated the operation of the foot, border and drop lamps. Among other innovations shown were the daylight room for the inspection of silks, and the show windows equipped for dressing in the basement. A detailed description of the illumination of this store was published in the May 23 issue of the *Electrical World*.

SYSTEM OF PHILADELPHIA ELECTRIC COMPANY

B Franklin

FROM its three integral but interconnected systems, covering a territory roughly 40 miles long and 15 miles wide, the Philadelphia Electric Company serves 55,000 customers, including many large motor users, and supplies nearly one-half of the total energy requirements of the electric railways operating in its vicinity.

To meet the rapidly increasing demand for its service the company is now preparing to install the largest turbo-generator in the world—a 13,200-volt, three-phase machine rated at 35,000 kw. A corresponding increase in demand a year ago made necessary the raising of the transmission potential from 6000 volts to 13,200 volts, and coincidently the former two-phase system (adopted at the time the Philadelphia company was formed by the unification of a score or more small plants) is also being revised in favor of three-phase transmission to substations. This change, as well as the retention of two-phase, 2400-volt distribution from substations, has brought about many interesting applications of very large Scott-connected transformer banks, which are among the characteristic features of the Philadelphia company's sixty-cycle system. The company also operates from the same plants an extensive twenty-five-cycle system, the principal part of this output being taken by the railways already referred to.

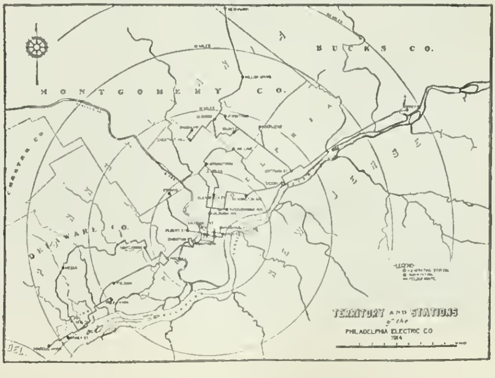
Each of the three geographically distinct systems operated by the company has its own generating station, but tie-lines connect these systems so that a single huge network results.

The power plant for the Philadelphia metropolitan district is situated at Christian Street and the Schuylkill River, but this generating center will shortly be augmented by a new station adjoining the old one.

The lines of the Northern District of the Philadelphia Electric Company include a number of railway substations containing sixty-cycle rotary converters, and are served by the Tacony (Pa.) plant, which has 17,500 kw in steam units.

The region surrounding Chester, Pa., is supplied from the 8500-kw Chester station of the Beacon Light Company, which is a subsidiary of the Philadelphia Electric Company and is operated as part of its system.

In addition to these three generating plants and a "stand-by" emergency generating station, the Philadelphia Electric Company system includes a total of



thirty-four substations. During 1913 the total output of the combined system was 253,000,000 kw-hr., with a maximum peak load of 82,200 kw. The connected load was 150,000 kw, exclusive of 27,000 kw supplied for railway purposes. For the year mentioned the system load-factor was 35.1 per cent, on the basis of a twenty-four-hour day. The company's employees number 2500.

The Philadelphia Electric Company has its own engineering staff, which designs and executes all construction work, both electrical and mechanical, in connection with stations, overhead and underground circuits and even service connections on customers' premises. Not less striking than the number of original practices locally devised and instituted on the company's system is the high degree of standardization achieved in the construction and operation of this extensive system of generating plants, lines and substations.

The World's Largest Turbine Electric Unit—35,000 Kw

In its new "A-2" generating station which the Philadelphia Electric Company is now erecting, adjoining its present Christian Street plant, the "A-1" station, there will be installed during the present year a 35,000-kw steam-turbine set, the largest prime-mover unit ever built. This huge machine was described in the *Electrical World* for May 2 of this year, but a recapitulation of its main features will not be out of place here. It will be of the General Electric horizontal type, will weigh 600 tons, and will measure 63 ft. 2 in. in length, 21 ft. 7 in. in width and 15 ft. 10 in. in height. Its thirteen-stage Curtis-type steam element will operate on steam at 215 lb. pressure and 150 deg. Fahr. superheat.

Exhausting against a back pressure of 1.5 in. of mercury, absolute, this big turbine is expected to deliver 1 kw-hr. for each 11.8 lb. of steam consumed at loadings of about 25,000 kw, while at full rated load 35,000 kw, it will consume about 12.5 lb. of steam per kilowatt-hour. The turbine will be equipped with a 50,000-sq. ft. surface-type condenser, which is being built by the Southwark Foundry & Machine Company of Philadelphia from designs prepared by the Westinghouse Machine Company, Pittsburgh, Pa. The circulating, air and hot-well pumps will all be furnished by the Westinghouse Machine Company. This huge condenser is of unique design and will have its tubes arranged in circular rows eccentrically within the shell. The air will be removed from the center, giving the steam a minimum path through the tubes. Employing the counter-flow principle, the condensate is allowed to trickle down over the hottest tubes and will be removed within a few degrees of exhaust-steam temperature.

The generator element will deliver 13,200-volt, sixty-cycle, three-phase energy, with a current output of 1460 amp per phase at full load and 90 per cent power-factor. The six-pole rotating field is driven at 1200 r.p.m. As designed, the armature will have an internal reactance of 10 per cent. Supported on a bracket on the bearing at the generator end will be a 150-kw, 250-volt, 600-amp shunt-wound exciter, direct-connected to the turbine shaft.

A feature of the construction of this huge machine will be the provision of thermo-electric couples in its windings, which couples will be connected to instruments that will show the attendants the temperatures existing at all times in various parts of the armature. The thermocouples are to be inserted at the bottom of the slots, at the ends of the coils, between the insulation and the windings, and at various other points where the existence of "hot spots" is suspected.

Other Features of the New "A-2" Generating System

In addition to the 35,000-kw, sixty-cycle turbine-alternator above mentioned, there will also be installed in the new "A-2" generating plant a 30,000-kw, 13,200-volt, three-phase turbine set delivering twenty-five-cycle energy. The two-pole rotating element of this unit will be driven at 1500 r.p.m. Besides the internal reactance of 8 per cent for which the machine is de-

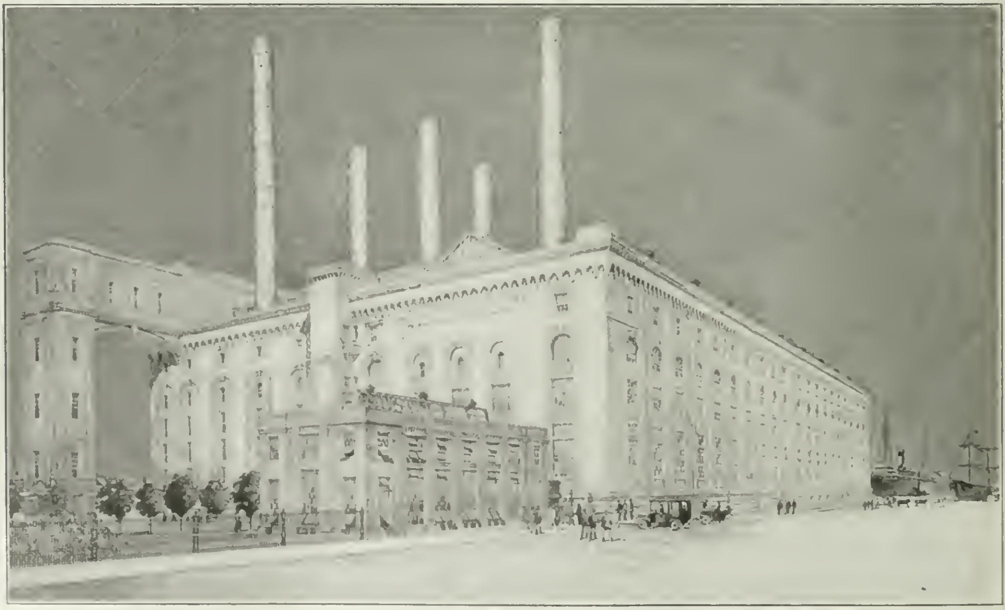
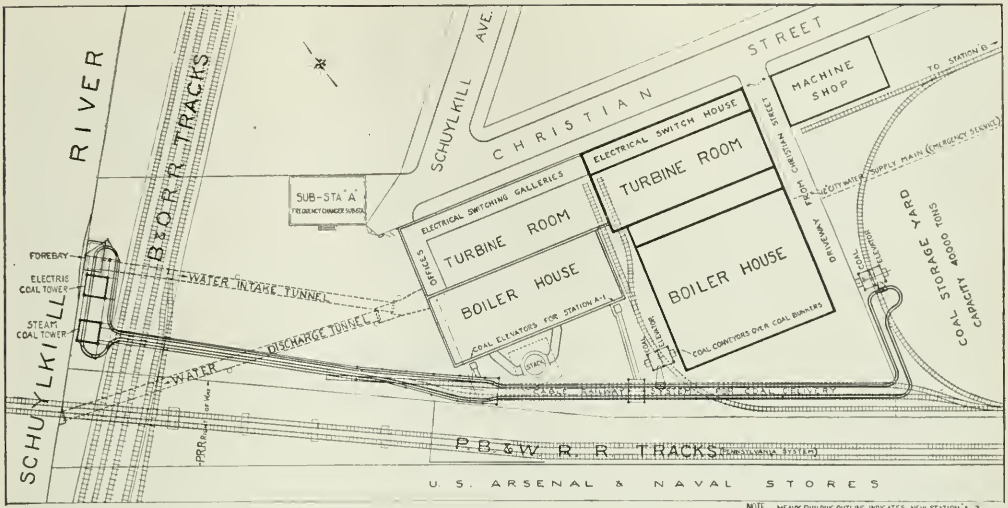


FIG. 1—THE NEW POWER HOUSE OF THE PHILADELPHIA ELECTRIC COMPANY AS IT WILL APPEAR WHEN COMPLETED



NOTE—HEAVY BUILDING OUTLINE INDICATES NEW STATION "A-2"
LIGHT BUILDING OUTLINE INDICATES STATION "A-1"

FIG. 2—LAY-OUT OF THE ENLARGED CHRISTIAN STREET STATION OF THE PHILADELPHIA ELECTRIC COMPANY

signed, 4 per cent will be added by means of external reactance coils, making 12 per cent in all. A similar bracketed-type individual exciter, rated at 110 kw and 250 volts, will be mounted on the end bearing of this machine. An auxiliary 500-kw steam-turbine-driven exciter will be provided for the "A-2" plant and will be of the gear-reduction type of drive.

Separate duplicate sets of unsectionalized high-tension busbars will be installed for each frequency, and provision will be made to control from the "A-2" station three of the turbo sets now operating in Station "A-1," as well as the frequency-changer sets in Substation "A" near by. Although actually containing only the two very large units already described, Station "A-2" will thus effect control of 69,000 kw in twenty-five-cycle apparatus and 50,000-kw in sixty-cycle machines, making a total available rating of 119,000 kw.

Except for these electrical interconnections and for the common condensing-water tunnels, there will be no physical connection between Stations "A-1" and "A-2." The buildings will be entirely separate, and no steam lines will be carried between the sets of boilers in the two stations. The steam equipment for the new station is to comprise twenty Babcock & Wilcox boilers, each rated nominally at 1000 hp and each capable of evaporating 60,000 lb. of water per hour. The boilers will be arranged on a single floor in four rows with one stack serving each row.

New Departures in Sectionalizing

In the design of the control connections for the new station radical departures have been made in the direction of sectionalizing to a degree never before attempted in American practice. Both the twenty-five-cycle and the sixty-cycle systems will be operated with grounded neutrals, and these mid-point connections will be provided with safety interlocks which will automatically prevent the connection of more than one machine of either frequency to ground at the same time. Each of the twenty-two twenty-five-cycle and fourteen sixty-cycle outgoing feeders will be protected with 3 per cent power-limiting reactances inserted directly in the lines. There will also be similar reactances in the tie-lines to Substation "A."

All feeders of both frequencies will be arranged in a group system of original design. Each group will contain two outgoing feeders, and the arrangement of cable connections will be such that no substation will be fed by more than one cable belonging to any one group.

The building for the new station will measure 188 ft. in length by 262 ft. in width, and it will reach a total height of 98 ft.

The Present Christian Street Plant

Although originally designed for and equipped with vertical compound engines of 5000-kw rating, the present Christian Street station now contains steam-turbine units exclusively. As shown in an accompanying illustration, these machines are all of the Curtis-General Electric vertical type. The variety of the units at present installed is best shown by the accompanying table.

PRIME-MOVER UNITS IN STATION "A-1"

Machine No.	Rating, Kva	Machine Voltage	Phase	Frequency, Cycles	Remarks
1	14,000	6,000	2	60	
2	15,000	6,000	2	60	With Scott-connected transformers.
3	12,000	6,000	2	60	
4	7,500	6,000	2	60	
5	7,500	6,000	2	60	With Scott-connected transformers.
6	15,000	6,600	3	25	With "step-up" transformers delivering 13,200 volts.
7	15,000	13,200	3	25	With 5 per cent external reactances.

As prominently shown in Fig. 3, the majority of the turbine units in this plant are equipped with barometric condensers, the exceptions being Nos. 1 and 6, which exhaust into surface condensers mounted in their bases. The circulating-water lines of these surface-type condensers are arranged with complete motor-operated gate valves, all controlled from a central point on the basement gallery. A high-water alarm gives warning in case of failure of the condensate pumps and consequent danger of flooding the condenser.

Features of the Turbine Sets

The 6600-volt output of turbine set No. 6, it will be noted, is stepped up through a set of three 5000-kva single-phase water-cooled transformers to 13,200 volts for transmission purposes. As these transformer units are delta-connected on the low-tension side and have their high-tension windings star-connected, it will be observed that their own winding ratio is approximately one-to-one, although the voltage ratio obtained is two-to-one. No oil switch or other disconnecting feature is inserted between the generator and its compensators, which are treated as extensions of the machine armature itself. These main leads include, however, series transformers which operate ammeters. The generator leads carry 1312 amp per phase and are inclosed in brass piping.

No neutral is brought out from the mid-point of the compensator connections, although the armature windings are star-connected. These compensator units occupy a special fireproof compartment, which is ventilated quite separately from the rest of the station. An underground tank is provided for the rapid withdrawal of the oil in case of fire. A fourth spare compensator is also available in the event of accident to one of the operating units. This No. 6 turbine unit is synchronized and operated from the control gallery like any other generator in the plant, but its leads are connected, with interlocks, to the bus of the nearby railway frequency-changer substation.

Turbine set No. 7, installed within the first half of the present year, illustrates the advance in design and construction which occurred during even the few months separating the erection of these two units. Of the same kilowatt rating as No. 6, its generated potential is directly 13,200 volts without the use of compensators, which is resorted to in the case of No. 6. No. 7 is equipped with 5 per cent external reactances mounted on concrete cores and inserted in the generator leads.

Although turbo sets Nos. 2 and 5 are two-phase units, they are able to deliver energy to the three-phase, sixty-cycle system as well, through the means of Scott-connected transformers. The pair of 7500-kw transformers used with No. 2 has the distinction of being the largest set ever built for this purpose. The units are top-connected, oil-insulated and water-cooled. A similar pair of 3750-kw units serves turbo-generator No. 5. The large Scott-connected transformers for No. 2 contain internal reactance which serves as a power-limiting feature in case of overload or short-circuit.

The boiler house of the Christian Street plant parallels the axis of the turbine room and is double-decked, each floor containing in a double row twenty 630-hp Babcock & Wilcox boiler units with superheaters. Coal is delivered to the overhead bunkers by an inclined in-

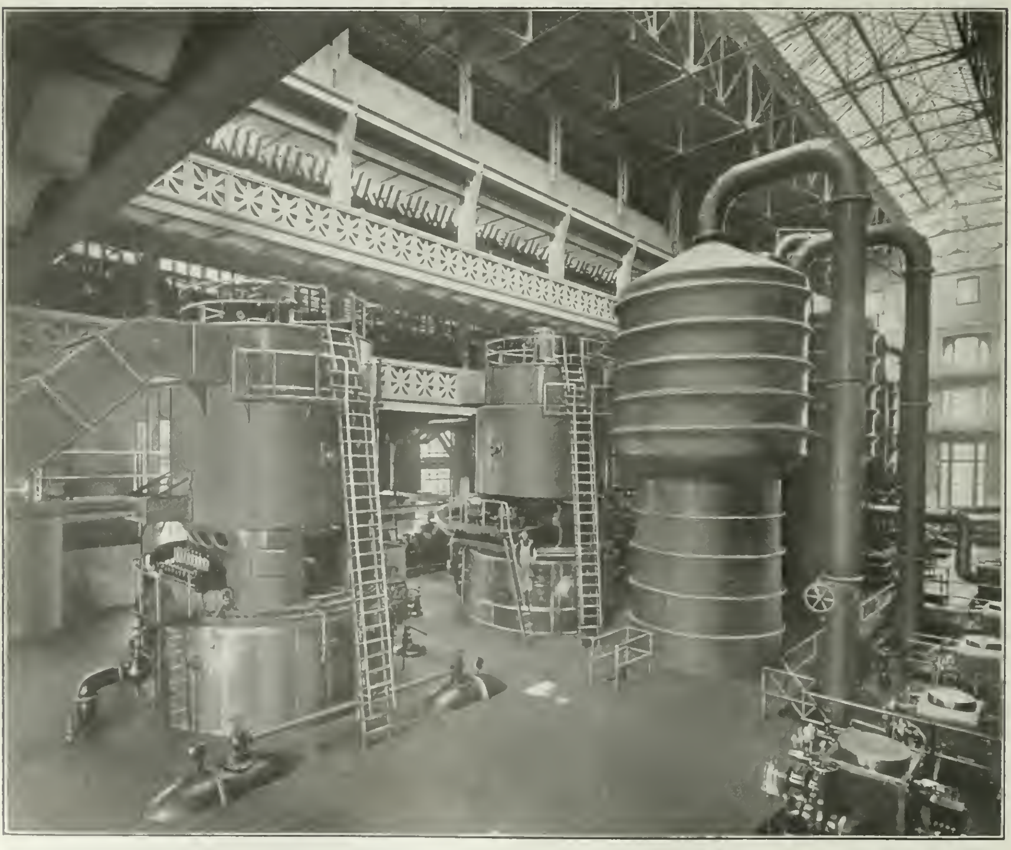


FIG. 3—TURBINE UNITS WITH BAROMETRIC CONDENSERS IN PRESENT CHRISTIAN STREET STATION

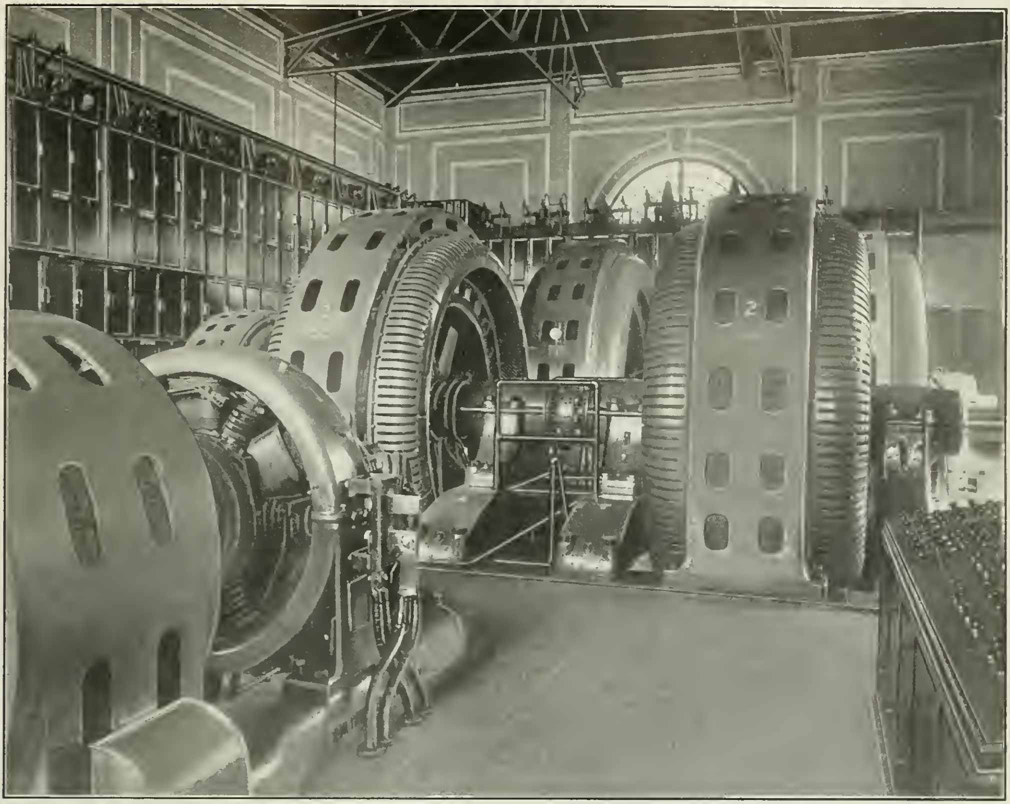


FIG. 4—INTERIOR OF FREQUENCY-CHANGER SUBSTATION SUPPLYING TWENTY-FIVE-CYCLE ENERGY TO RAILWAYS

dustrial railway and system of hoist buckets, which can take its supply either from coal barges on the Schuylkill River or from the tracks of two trunk-line railroads. From the overhead bunkers the fuel is discharged directly to the Taylor underfeed stokers. The present boilers are twenty-four tubes wide and twelve tubes high and are arranged with baffle walls of brick and cast-iron plates. The boilers furnish steam at 200 lb. pressure and 120 deg. Fahr. superheat. The plant is equipped with steam-flow meters, draft gages, efficiency meters, etc.

For the designation of various pipes in the power house the complete color scheme employed is as follows:

	Pipe	Fittings
Turbine step-bearing oil	Red	Black
Oil gravity supply	Yellow	Red
Oil returns	Yellow	Black
Steam lines	Olive green	
Exhaust	Black	
Compressed air	Brown	
Electrical conduit	Blue gray	
Water	Green	

Philadelphia Practice in Bus Layout

In the Christian Street "A-1" station, as well as throughout the system of the Philadelphia Electric Company, duplicate high-tension and exciter buses have been provided, while with the completion of the new "A-2" generating station adjoining the present plant the supply of control energy will be available in triplicate. The duplicate sets of unsectionalized high-tension busbars, which are installed in standard concrete compartments, may be operated singly or together, or also, if desired, separately from different generators, thus giving a flexible bus arrangement.

Throughout the Philadelphia system, it should be noted, all high-tension oil switches, rheostats and auxiliary generator-control equipment are remotely controlled. In the case of certain substations this method of operation is even extended to the control of the oil switches on the outgoing 2400-volt feeder lines.

Generator switches are never made automatic, but a red pilot lamp is arranged with a relay so that the lamp is lighted to indicate overloading. Each phase is provided with a full complement of instruments, including ammeters and voltmeters. All watt-hour meters have their own individual series transformers, which are entirely separate from those serving the relays or other instruments. The outputs of the generating stations are measured by watt-hour meters on the individual generators, no feeders being metered except those supplying station lighting and motor service.

Lamps used for synchronizing are always so connected as to show darkness during the period of synchronism, the rule throughout the system being: "Never throw a switch in the face of a lamp." Each individual generator circuit is provided with its own set of synchronizing lamps in addition to the duplicate standard means of synchronizing provided. Provision is made for "phasing out" feeders after cable repairs.

Experience has shown that inasmuch as all of the feeders carried out of the Christian Street plant are extended underground no lightning-arrester equipment is needed, and none has been installed.

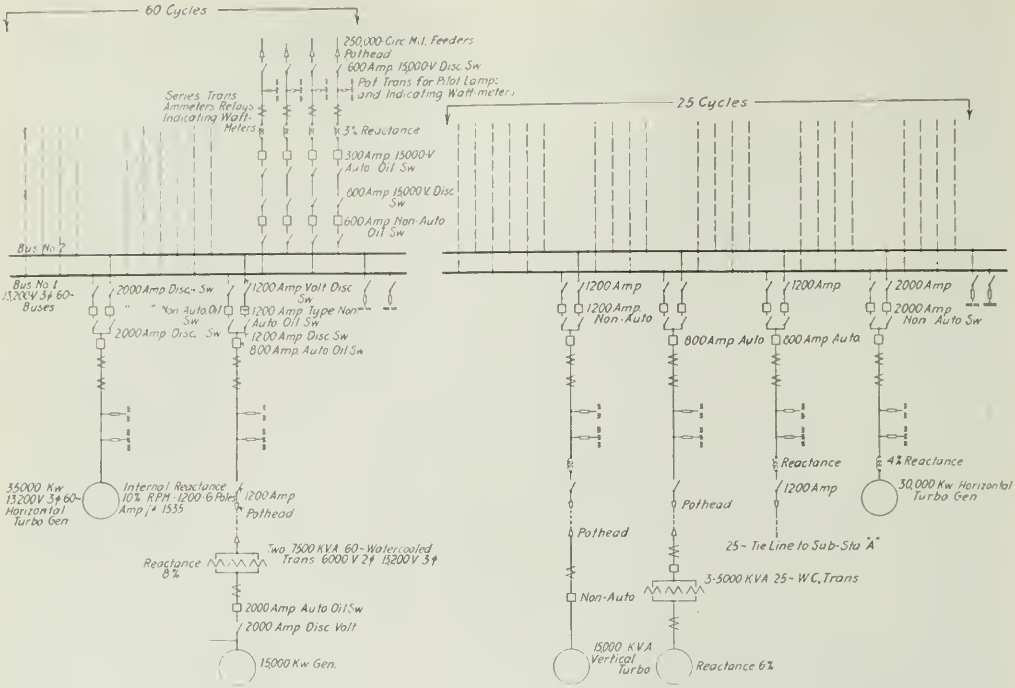

60 Cycles
250,000-Circ Mil. Feeders
Pothead
600 Amp. 15,000-V Disc Sw
Pot Trans for Pilot Lamps and Indicating Watt-meters
Series Trans Ammeters Relays Indicating Watt-Meters
3% Reactance
300 Amp 15000-V Auto Oil Sw
600 Amp 15,000 V. Disc Sw
600 Amp Non-Auto Oil Sw
Bus No 2
Bus No 1 13,200 V 3ϕ 60~ Buses
2000 Amp Disc. Sw
" " Non Auto. Oil Sw
2000 Amp Disc. Sw
1200 Amp Volt Disc Sw
1200 Amp Type Non-Auto Oil Sw
1200 Amp Disc Sw
800 Amp. Auto Oil Sw
35000 Kw 13200 V 3ϕ 60~ Horizontal Turbo Gen
Internal Reactance 10% RPM 1200 6 Poles Amp /ϕ 1535
1200 Amp
Pothead
Two 7500 KVA 60~ Watercooled Trans 6000 V 2ϕ 13,200 V 3ϕ
Reactance 8%
2000 Amp Auto Oil Sw
2000 Amp Disc Volt
15000 Kw Gen.
25 Cycles
1200 Amp
1200 Amp. Non-Auto
800 Amp Auto
1200 Amp
800 Amp Auto
2000 Amp
2000 Amp Non Auto Sw
Reactance
4% Reactance
30,000 Kw Horizontal Turbo Gen
1200 Amp
Pothead
Pothead
25~ Tie Line to Sub-Sta "A"
3-5000 KVA 25~ W.C. Trans
Non-Auto
15,000 KVA Vertical Turbo
Reactance 6%

FIG. 5—CIRCUIT DIAGRAM OF SIXTY-CYCLE AND TWENTY-FIVE-CYCLE BUSES FOR NEW "A-2" STATION

The general grounding practice throughout the Philadelphia system provides separate ground connections for all electrolytic lightning arresters of different voltages, for the neutrals of machines (such grounds being especially designed to carry current in case of emergency), and for the grounding system for the station apparatus. In the last-mentioned ground bus system the buses are laid directly in the concrete of the foundations or compartments, as the case may be. The casing and one side of the secondary of every instrument transformer are also rigidly connected to the station ground bus. Cable sheaths too are solidly grounded.

The various ground connections for the different purposes above described are taken to separate locations in and about the station. Both standard pipe grounds and a special ground box, devised within the company, are employed. In accordance with company practice, pipe grounds must be driven to a minimum depth of 7 ft. and flooded with 4 quarts of saturated salt brine

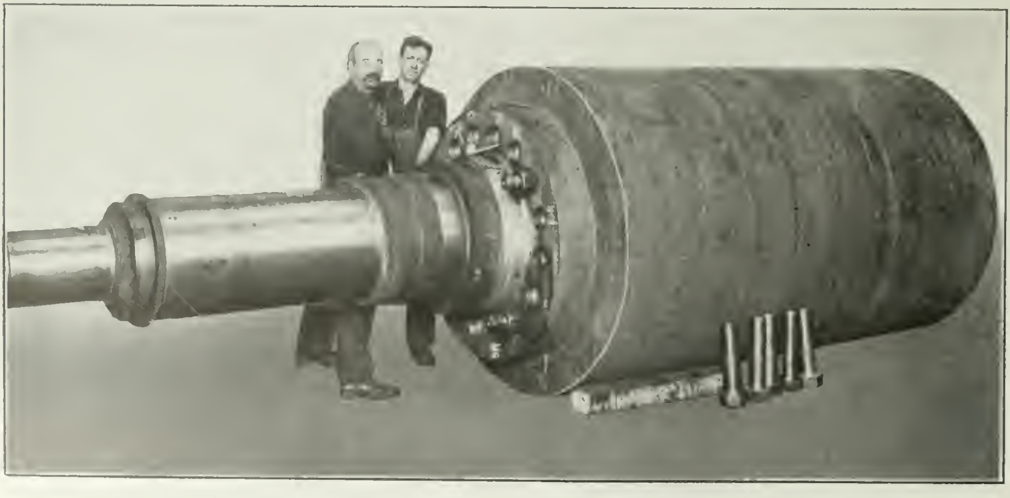


FIG. 6—REVOLVING-FIELD CORE FOR 35,000-KW, SIXTY-CYCLE TURBO-GENERATOR

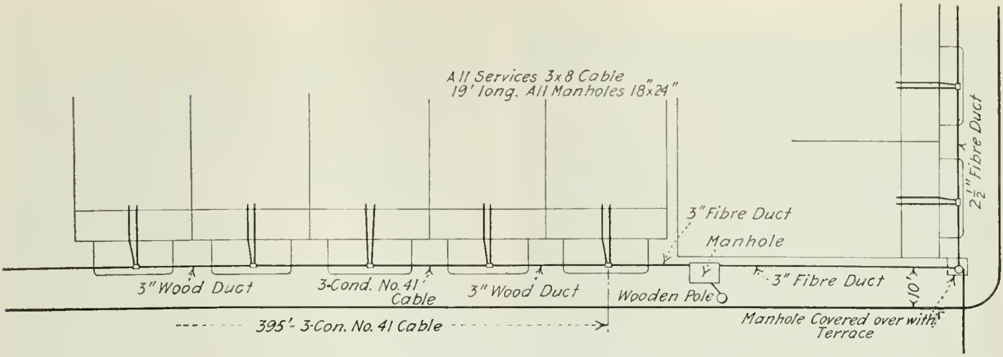


FIG. 7—UNDERGROUND DISTRIBUTION TO DWELLINGS

for each 1½-in. pipe. The ground box above mentioned is made up of a star-shaped casting having openings filled with wire mesh and inclosing a mass of finely divided charcoal mixture of special properties.

Frequency-Changer Substation for Railway Service

On the Christian Street property is also situated Substation "A," a frequency-changer station which was erected in 1911 in the record period of four months to furnish twenty-five-cycle, three-phase energy for the use of the railway company. Its equipment comprises one 6000-kw and one 3000-kw General Electric horizontal four-bearing synchronous motor-generator set arranged with bracket-mounted induction motors for starting. These sets convert 6000-volt, sixty-cycle, two-phase energy into 13,200-volt, twenty-five-cycle, three-phase energy, or vice versa, their twenty-five-cycle output being delivered over underground feeders to substations operated by the Philadelphia Rapid Transit Company. With the transition of the central-station system to three-phase as well as two-phase generation and operation, this substation has thus become a reversible means of tying together the generating systems of the two frequencies. Substation "A" is connected to generating station "A-1" through two tie-lines, each made up of three 2,000,000-circ. mil single-conductor cables.

As shown in an accompanying illustration, the motor-generator sets are of the horizontal four-bearing type. The twenty-five-cycle machines have ten poles and the sixty-cycle machines twenty-four poles, the speed of rotation being 300 r.p.m. To synchronize and parallel such a pair of frequency-changers offers an interesting problem and one to which detailed study has been given by the company engineers. For synchronous indication on the sixty-cycle synchroscope, it may be pointed out, there will be twelve different indications of the twenty-five-cycle pointer, and for the

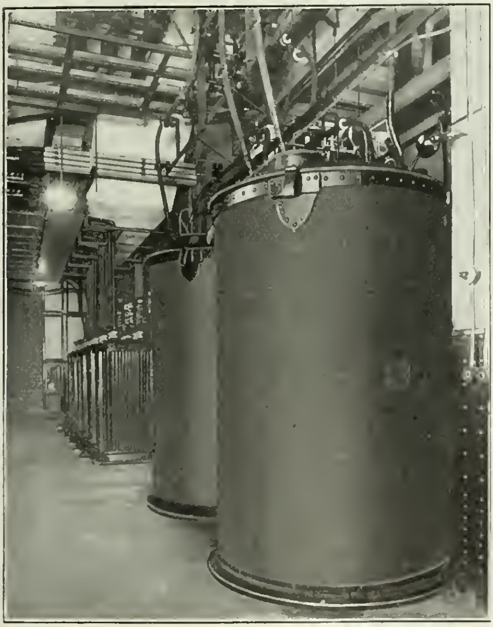


FIG. 8—LARGE SCOTT-CONNECTED TRANSFORMERS FOR TWO-PHASE-THREE-PHASE CONVERSION

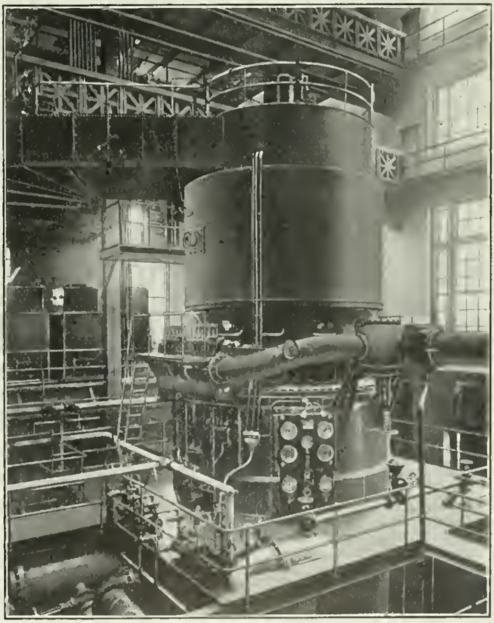


FIG. 9—TURBINE UNIT NO. 6, SHOWING CONTROL EQUIPMENT

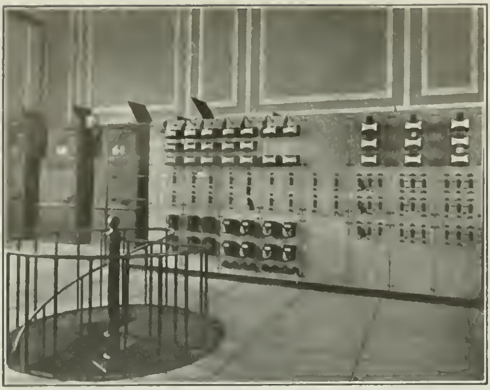


FIG. 10—SUBSTATION "E" SWITCHBOARD AND BANKS OF THREE-TO-TWO-PHASE TRANSFORMERS

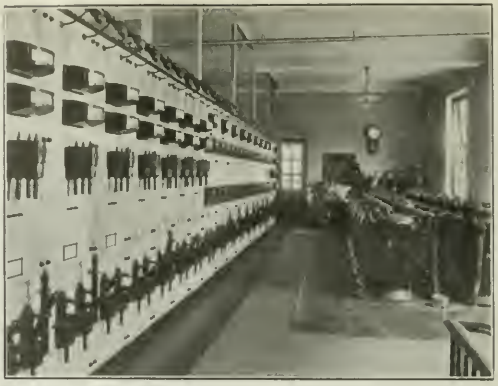


FIG. 12—SWITCHBOARD AND AUTOMATIC REGULATORS IN SUBSTATION "P"

position of synchronism on the twenty-five-cycle instrument there will be five positions of the sixty-cycle pointer. Moreover, in paralleling a loaded machine with an unloaded set the latter's switch must be closed with the synchroscope needle out of synchronism by an amount equal to the lag of the loaded machine.

To enable the non-technical operator to perform these functions properly an ingenious method of synchronizing has been devised employing a small cardboard copy of the synchroscope dial over which is mounted a revolving disk. By making the proper settings on this disk computer, which takes into account variation in load, the position of the synchroscope pointer proper for synchronizing under the particular circumstances can be computed with accuracy.

Synchronous-Booster Rotary-Converter Edison Substation

Representative of the best and most modern substation practice of the Philadelphia Electric Company is its new Substation "E," which furnishes both direct and alternating current to the business and residential districts surrounding its location, at Twentieth and Ludlow Streets.

This substation at present receives 6000-volt, sixty-cycle, two-phase energy, but will later operate on 13,200-volt, three-phase supply of the same frequency. This flexibility of operation is provided by the use of Scott-connected transformers, which will also enable future incoming three-phase energy to be converted into two-phase for distribution, for the continuance of two-phase supply to the motor-generator sets in the adjoining Brush arc-lighting station, "F," and for the rotary-converter equipment feeding the outgoing Edison circuits.

The 110-ft. by 90-ft. steel-and-brick building of Substation "E" also houses a twenty-five-cycle rotary-converter substation operated by the Philadelphia Rapid Transit Company to supply its trolley lines with energy from the electric company's Christian Street generating station.

On the electric company's side the substation equipment comprises two 1500-kw and one 1000-kw Westinghouse sixty-cycle synchronous-booster rotary converters, one 500-kw General Electric three-unit balancer set intended also for battery charging, and two 4000-kw sets of Westinghouse air-blast transformers arranged for three-phase-two-phase conversion. In addition to this apparatus there are now about to be installed two 6000-kva air-blast banks, which will be supplied from the 13,200-volt, three-phase bus and will be used exclusively to furnish two-phase three-wire energy to arc-lighting motor-generator sets in the adjoining substation. Besides their regular 86.6 per cent and 50 per cent taps on the high-tension side, these

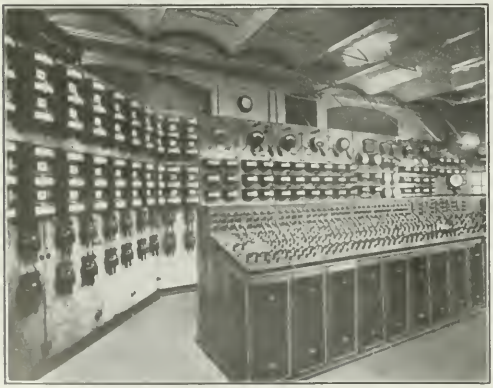


FIG. 11—OPERATING GALLERY, CHRISTIAN STREET STATION

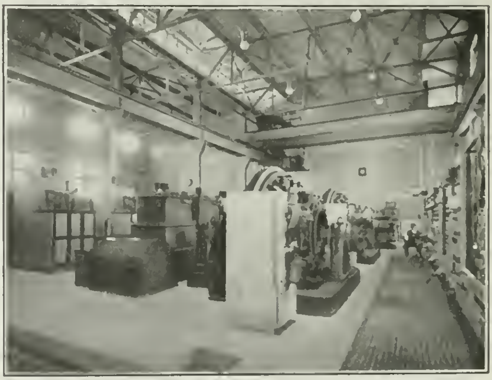


FIG. 13—INTERIOR OF SYNCHRONOUS-BOOSTER, ROTARY-CONVERTER EDISON SUBSTATION

interesting phase-converting units (which are interchangeable as regards "main" and "teaser" relations) are furnished with reduced potential taps on the low-tension side, enabling them to supply two-phase, three-wire synchronous motors of the arc-lighting station. These motors are started at 2400 volts and later thrown over onto the full 5700-volt secondary pressure. Here, as in all the many Scott-transformer connections throughout the system, the main winding invariably preserves the relation of the "A" phase, and the "teaser," of 86.66 per cent winding, is the "C" phase. These air-blast transformers are ventilated under 0.75-ounce air pressure, continuity of operation being assured by an alarm device of local invention which closes contacts and sounds an alarm in event of failure of the air pressure. In the case of the units at Station "E," the air supply comes through a ventilating duct from a fresh-air chamber on the roof and is delivered by duplicate motor-driven blowers. Other air systems are maintained for the rotary-converter transformers, with direct access to the outside air.

The bus structure and oil-switch compartments are of molded concrete with hook-suspended doors of $\frac{3}{8}$-in. asbestos lumber, which easily swing outward in the event of any possible explosion. By the scheme of feeder nomenclature used, the origin, destination and voltage rating of any line are clearly defined in addition to its position. Thus "A-347-E" denotes three-phase feeder No. 347 from Station "A" to Substation "E."

For transfer connections on the incoming feeders General Electric remote-controlled selector oil switches are provided in addition to the main 300-amp, 15,000-volt Westinghouse solenoid-operated units. The former are installed in the basement bus structure and the latter on the main machine floor. The latter switches are provided with inverse-time overload control, for which reverse-energy relays of the wattmeter type serve as the sensitive elements, but in the absence of a potential connection to the relay the protection is of the inverse overload character only. Following standard Philadelphia company practice, the casings of all instrument transformers and one side of their secondary circuits are grounded, care being taken that no fuse, cut-out or other interruptive feature is included in the ground circuit. The features of copper ground bus system set in concrete compartment structure have already been touched upon.

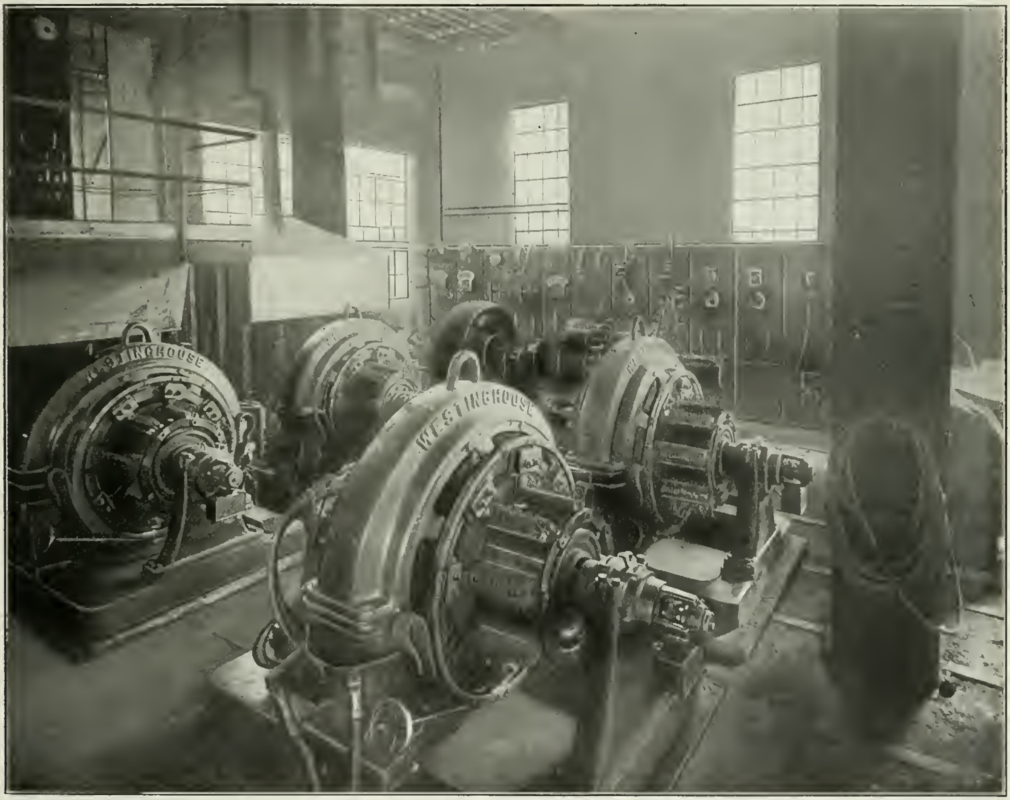


FIG. 14—INDUSTRIAL SUBSTATION SUPPLYING CRAMPS' SHIPYARD

Bridged across one of the phases of each feeder line is a potential transformer, the secondary of which is led to a pilot lamp on the switchboard, which illuminates a ground-glass target bearing the feeder designation of the line which is "alive." The current transformers for the watt-hour meters have no other connections than the coils of these meters, which they serve exclusively. An interesting feature lies in the specially designed form of "current-test" cut-out box connected in circuit between current transformer and meter.

The neutral for the Edison three-wire system is taken from a neutral busbar in turn connected respectively to the mid-points of the transformers serving the 1000-kw "three-wire" rotary converter and the neutrals of the three-unit set, and will ultimately be taken to the mid-point of the emergency storage battery when this is installed. The 1000-kw machine with the three-unit motor-generator set is ample to care for any load unbalancing of this station.

Solenoid-operated direct-current circuit-breakers rated at 10,000 amp are in use in the 250-volt outer conductors of the rotary converters. Protection against reverse current flow is afforded by relays of a special rotating armature type, which exert a very positive mechanical action on the tripping mechanism of the breaker and were designed for this installation. The fuse blocks protecting the outgoing direct-current feeders have projecting lugs cast on one side. Into the socket thus formed a contact plug can be slipped, bridging the fuse block and permitting service to continue uninterrupted while the fuse itself is being removed for inspection or repairs.

The Edison direct-current busbars, which are provided in duplicate sets, are mounted at the rear of the direct-current switchboard and are made up of 6-in. by 0.25-in. hard-drawn copper bars, set vertically with 0.25-in. air spaces for ventilation. The number of laminations is graduated so as to be proportional to the load to be carried by the corresponding section of the switchboard. The busbars may be tied together if necessary by large-capacity lever switches of special design placed behind the switchboard. Machine and battery leads are brought to the central sections of the board and the outgoing feeders are taken off from the ends. The bus conductors are held in alberene-stone insulating blocks, in turn supported by iron framework. All studs from switches, etc., are inclosed in fiber tubes for safety, and similarly all other parts of live conductors are placed in asbestos-lumber inclosures.

The usual pressure-wire equipment is provided for voltage regulation, pilot wires being run back to the station from centers of distribution.

Transformer and Distributing Substation

Attractive architectural outlines characterize the exteriors of the Philadelphia Electric Company power plants and substation buildings. Emphasis is laid on this feature of pleasing appearance, and the external design of the company's buildings is supervised by one of the leading architects of the city.

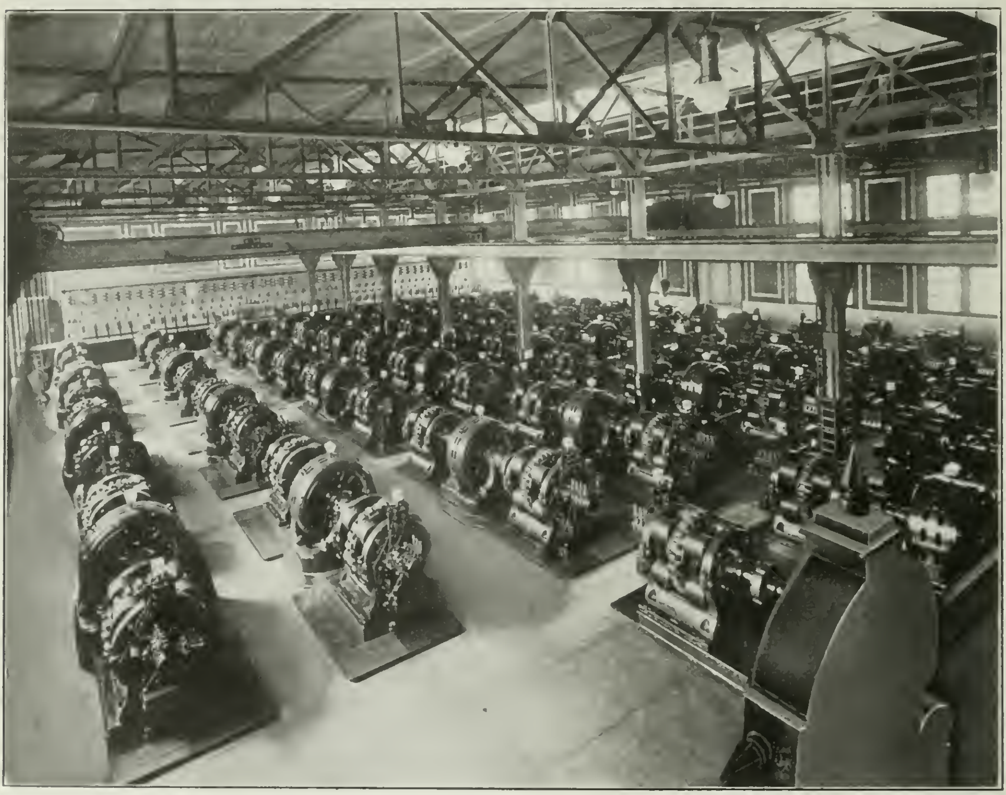


FIG. 15—MOTOR-DRIVEN BRUSH ARC-LIGHTING GENERATORS IN STATION "F"

In point of dignified design, one of the handsome smaller substations of the system is transformer station "P," at Marshall and Noble Streets, which supplies 2400-volt, two-phase, three-wire, sixty-cycle energy to the industrial district in its vicinity. The incoming polyphase feeders are taken through automatic selector oil-break switches to duplicate sets of high-voltage busbars installed in concrete structures. The use of duplicate sets of busbars housed in permanent concrete structures is characteristic of the high standards of station construction maintained by the Philadelphia central-station company.

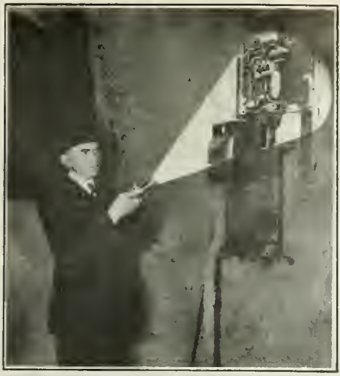


FIG. 16—UNIFORMED METER READER

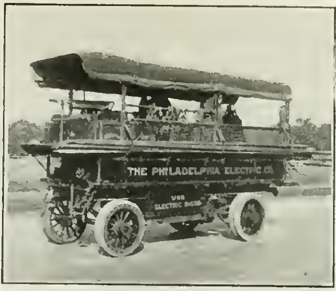


FIG. 17—LINE CONSTRUCTION TRUCK

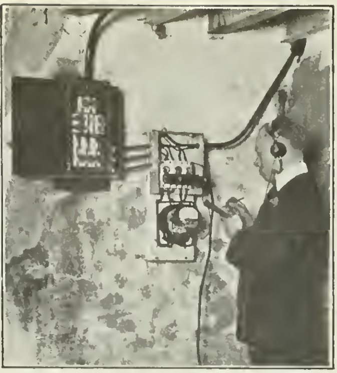


FIG. 18—METER TESTER AT WORK

From the bus-bars lines are taken through automatic oil-switches to the eight 500-kw step-down air-blast transformers which are housed in this station. These units have dial switches on the high-tension side for pressure adjustment, while each of the outgoing 2400-volt, two-phase feeders from the station has its own pair of automatic single-phase induction regulators, the operation of which is controlled through the usual contact-making voltmeter, either in conjunction with a line-drop compensator or according to a prearranged schedule of loads. The regulators are of the General Electric 100-amp and Westinghouse 150-amp types. In addition to the duplicate 2400-volt buses, there is provided a transfer bus connected to the feeder line through a three-pole double-throw oil switch, so that in case of accident to a regulator the corresponding feeder can be energized over the transfer bus from the regulators of some other circuit. The output of the station is metered only on the low-tension side of the transformer. All lines entering and leaving the substation are underground in accordance with progressive practice.

Adjoining the substation is the operator's dwelling, the upper floor of which opens on to the substation roof, where a thriving garden, with vine-covered arbors, hedges and flower boxes, is under cultivation by the station operator. While this is perhaps the only instance where a substation covering supports such a roof garden, the idea of growing trees and grass around the stations of the system is characteristic of the Philadelphia company, by which effort is made to have plant properties as attractive as possible, since it has been found that such beauty has utilitarian value in raising the esprit of the operating staff and inculcating pride in the upkeep of equipment.

Transmission and Distribution Line Construction

For the overhead lines of the Philadelphia system only the best selected chestnut poles are used, and these are purchased under specifications even more rigid than the Class A requirements of the National Electric Light Association. Most of the poles used are 45 ft. and 50 ft. long, and they must measure at least 8 in. in minimum diameter at the top. Stocks are where possible so purchased that poles may lie in the yard about twelve months.

Before being erected the poles receive a brush treatment 2 ft. above and below the ground line with Avenarius carbolineum. Yellow-pine 3.25-in. by 4.25-in. cross-arms are employed exclusively. All service runs are dropped from double arms, no iron arms or spreader brackets being used. For cutting arc-lamp loops into

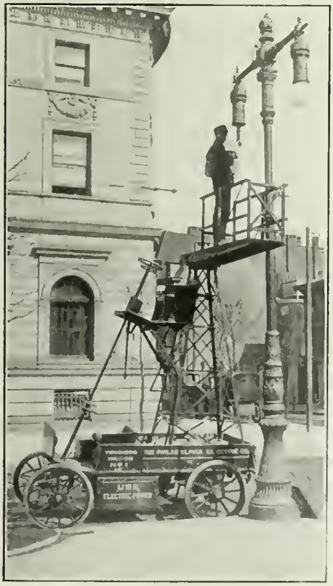


FIG. 19—LAMP-TRIMMERS' TOWER WAGON "ON THE JOB"

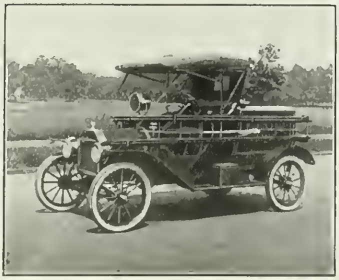


FIG. 20—LIGHT REPAIR WAGON OF OVERHEAD-LINE DEPARTMENT

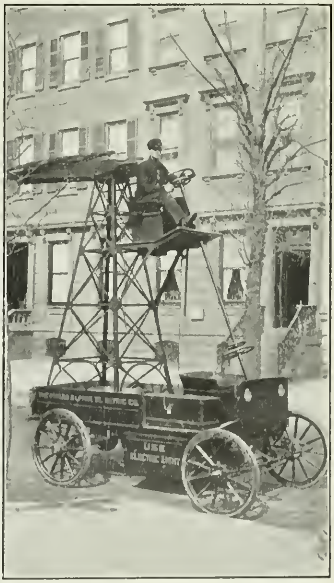


FIG. 21—WAGON BEING DRIVEN BY STORAGE BATTERY

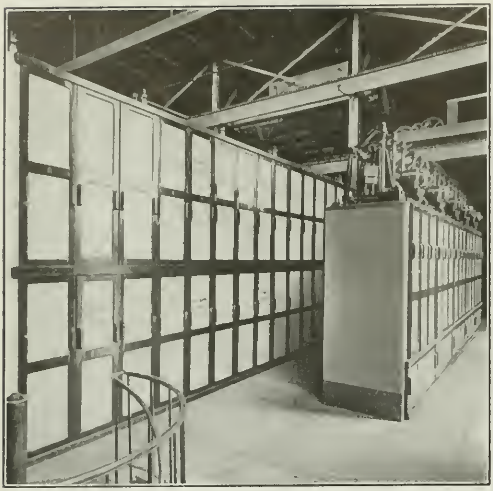


FIG. 22—MAIN AND SELECTOR 13,000-VOLT OIL-SWITCH COMPARTMENT, SUBSTATION B

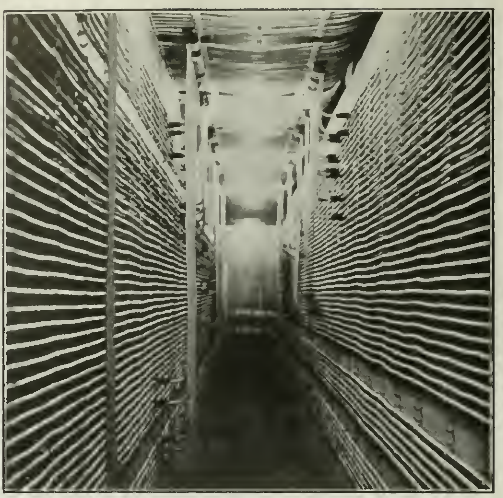


FIG. 24—CABLE VAULT BENEATH ARC-LIGHTING SWITCHBOARD

series circuits transposition insulators are employed, the extra grooves being utilized for tying together and equalizing the strains of the two unbalanced spans.

On poles carrying several three-phase circuits the arrangement is such as to permit the lineman to reach and work on the top wires without endangering himself by coming in contact with the lower circuits.

According to the present practice of the Philadelphia company, transformers are never banked. Branch lines from a given feeder main are always protected by pole switches which facilitate the location and isolation of trouble. Transformers are invariably fused on the primary side and never on their secondary side. The 50-kw size is being standardized as the unit, although the territory supplied by such a transformer varies, of course, inversely as the density, ranging from one block or less in closely built sections to three and four blocks in the suburbs. Lighting and motor services are fed from separate secondary circuits wherever possible, although both classes of lines are kept under close voltage control by automatic feeder regulators installed in the substation and inserted in every line.

A feature of Philadelphia distribution practice has been the method of supplying 220/110-volt, three-wire service to rows of dwellings. Three-pin brackets are affixed to the rear of the houses about the second-story level, and on these are strung the main lines. Thence service taps are run through conduit to the basement, where the company's circuit ends at the inclosed cut-out and meter board.

In West Philadelphia several blocks of residences are already fed underground from manhole transformers energized from nearby poles. The secondary mains are run in fiber-duct conduit laid 24 in. below the surface,

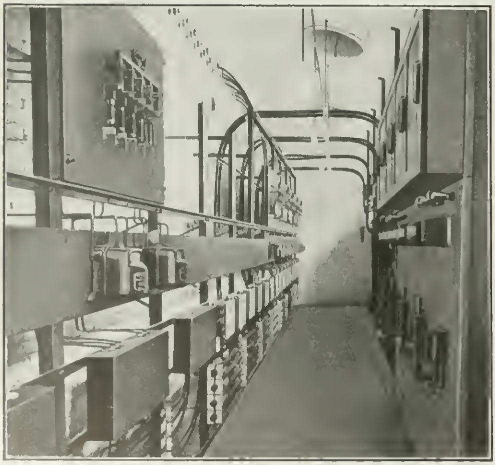


FIG. 23—INDUSTRIAL SUBSTATION, AMERICAN VISCOSE COMPANY

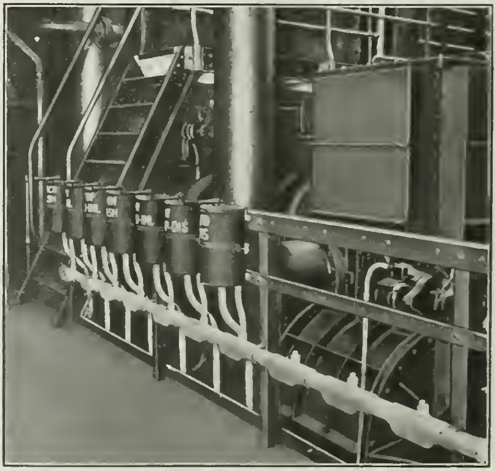


FIG. 25—CONTROLLERS FOR MOTOR-OPERATED VALVES OF SURFACE CONDENSER ON UNIT NO. 6

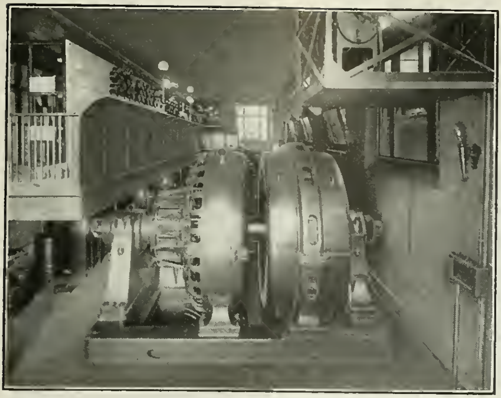


FIG. 26—MOTOR-GENERATOR SETS IN SUBSTATION "Q"

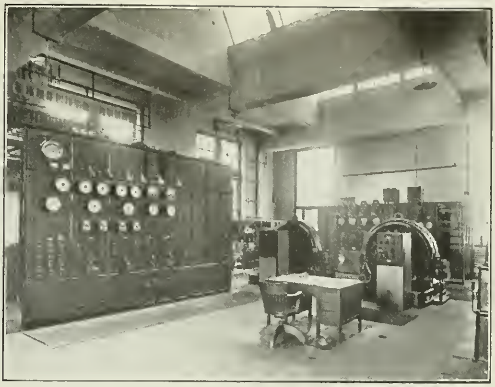


FIG. 28—INTERIOR OF FOLSOM SUBSTATION

and house taps are taken off through wooden junction boxes.

One of the unique vehicles in the service of the line-construction department is a special 6-ton electric truck with a 20-ft. wheelbase, used for transporting poles. The truck measures 31 ft. 6 in. over all and can haul poles up to 90 ft. in length. Each of the four wheels is separately motor-driven, and by steering with both the front and rear wheels the truck can be turned in a radius of 18 ft.

Fully loaded the normal speed is 7 miles per hour, and the forty-two-cell "Exide" batteries have a capacity equivalent to 30 miles of truck travel. Midway of the truck body is a small motor-driven winch which can be used to load and to erect poles. The wagon described was built for the Philadelphia Electric Company by the Commercial Truck Company.

Electric vehicles are largely used as line-construction and repair wagons, replacing horse-drawn teams. Formerly a number of motorcycles were employed for emergency repair work, but these are now being replaced by light four-wheeled gasoline vehicles which are equipped with search-lanterns, extension ladders, fuses, wire and all material necessary to make quick repairs. These vehicles are stationed at various points in the city, under call of the trouble foreman.

Philadelphia's System of Street Lighting

Philadelphia was one of the first cities to adopt arc lamps for street illumination. In the year 1882 the Brush Electric Light Company supplied energy to forty-nine lamps on Chestnut Street, under a special ordinance of Councils, free of charge for one year, to demonstrate the practicability of this form of illumina-

FIG. 27—FEEDER SUPPLYING SUBURBAN RESIDENCE AND STAINED-GLASS STUDIOS

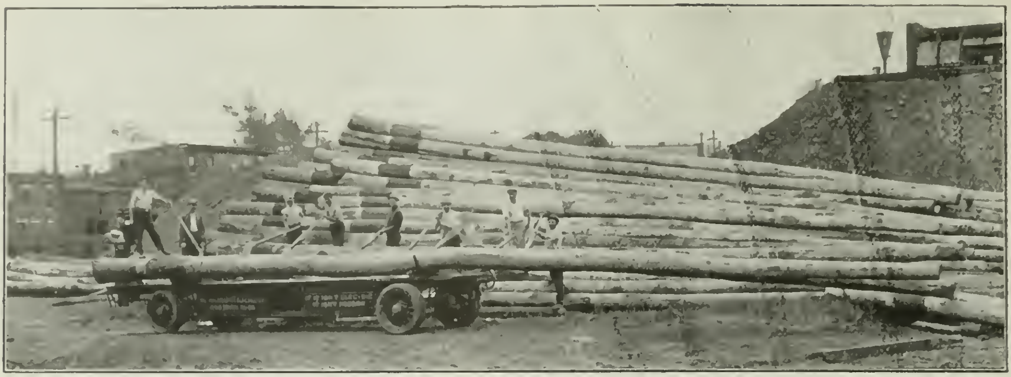


FIG. 29—ELECTRIC POLE TRUCK IN THE POLE YARD

tion, and since that time Philadelphia has been notable for the general excellence of its street lighting over an area of 129 sq. miles. There are now in use over 14,530 arc lamps.

The first lamps used were of the Brush double-pencil carbon type. These lamps had some mechanical defects. On account of rapid development and demand the company was forced to make improvements in the lamps in order to maintain reliable service. This necessitated the equipping of a shop and laboratory to build arc lamps required for extensions and to remodel the older types of lamps. Every new type of lamp worthy of commercial consideration has been tested first in this laboratory and then on the streets, so that this department has kept step with the progress of the art. It has been the policy of the company to test all possible improvements. A few of the types tested were the inclosed, magnetite, flaming, mercury, and finally the nitrogen-filled lamps, this company being the first to erect series nitrogen lamps for street illumination.

Many previous attempts had been made to build a successful broad-carbon lamp, but the engineers of this company were the first to develop a practical lamp of this type. The advantage of the broad-carbon lamp, which was early recognized, was the longer life of the electrodes and consequent reduction in the number of trims. Its chief disadvantage was the serious shadow cast by the lower electrode. In the improved design brought out by the company this disadvantage was eliminated by using an upper electrode of double the thickness of the lower electrode. Both electrodes are 5 in. wide and 8 in. long, the upper electrode being 5/8 in. and the lower carbon 5/16 in. in thickness. The lower electrode always presents a knife edge to the arc, practically eliminating the shadow. The thickness of the upper electrode causes a wider crater and makes an excellent reflector to distribute the light in the lower hemisphere. The stumps from these large electrodes are then sawed to a width of 3 in., pointed at the end and are ready for use in the "pony" broad-electrode lamps, enabling practically the complete consumption of the electrodes. The mechanism of the lamp had to be specially designed on account of the greater weight of the electrode and some varying characteristics. Use is made of a special globe that is self-cleaning.

The lamps are hung with the edge of the electrodes toward the pole, thereby eliminating shadows up and down the street. They are adjusted for 9.6 amp and consume 480 watts per lamp. The life of the electrodes is eighty hours per trim.

Method of Mounting

In the central section of the city the lamps are mounted on ornamental bronze, double-arm posts, placed on the curb and on certain streets, also in the middle of the street on isles of safety. These lamps are known as the "pony" type and utilize the carbon stumps from the standard broad-electrode lamp, their life being

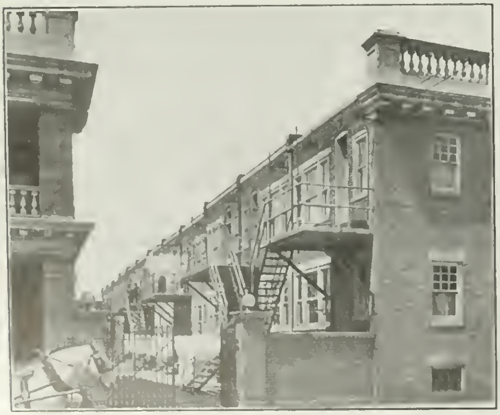


FIG. 30—REAR-BRACKET CONSTRUCTION SERVING ROW OF DWELLINGS

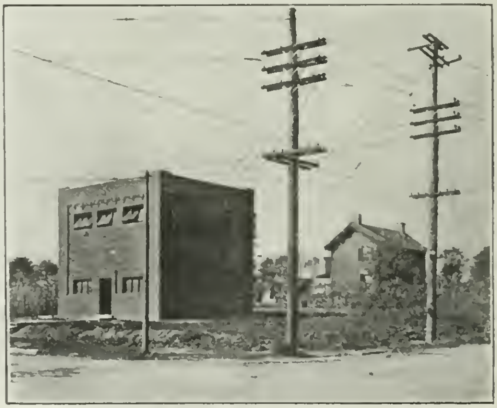


FIG. 31—LIGHTNING-ARRESTER HOUSE AT UNDERGROUND-OVERHEAD JUNCTION NEAR TACONY

somewhat over thirty hours. The total life of a pair of electrodes is thus about 110 hours to 120 hours. The standard broad-electrode lamps are used in the outlying sections of the city, and the "pony" type in the central section.

Of the many details in connection with the maintenance and operation of this large number of street lamps which are novel and have been developed in Philadelphia, mention might be made of the system of trimming and inspecting, which includes the use of special electrically operated tower wagons, the distribution of supplies and the methods of keeping records.

At present experiments are being made with the series-type nitrogen-filled lamp for street lighting. These tests were started about a year ago and very satisfactory results have been obtained. All of the newer types of nitrogen-filled lamps are now in operation.

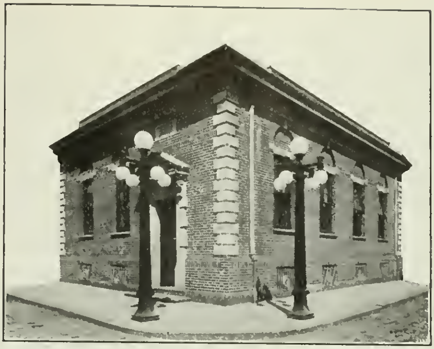


FIG. 33—EXTERIOR OF TRANSFORMER STATION "P"

Motor-Driven Arc-Lighting Generators

What is undoubtedly the largest and most recent Brush-generator station in the world is that supplying energy to the downtown street-lighting circuits of Philadelphia. This interesting substation contains thirty-eight three-unit sets, each comprising a 150-hp, 5500-volt, sixty-cycle, two-phase, three-wire synchronous motor driving through rubber insulating couplings a pair of 120-lamp, 9.6-amp, 6250-volt Brush arc-lighting generators. Excitation for the motors is obtained from the Edison system.

These 5500-volt motors are started with open-field circuits from 2400-volt taps on the windings of the large T-connected transformers in the adjoining substation "E," being afterward thrown to full-pressure running connections. An original arrangement of mechanical interlocks has been devised for the "starting" and "running" switches of each synchronous motor, which positively prevents the two voltages from being brought together. Mounted above the frame of each machine is a pilot lamp which is lighted when the corresponding unit is in service. Inclosing globes of different design are used on the motors and arc generators, so that the attendant may see at a glance what machines are in operation.

An elaborate arc-lighting switchboard permits the interconnection of various machines and lamp circuits by the use of plugs without jumpers. A portable test set which can be rolled along the front of the board enables the current flowing in any line to be read without disturbing the lamps in use. In the substation office there is maintained a complete card catalog showing every lamp fed from the sta-

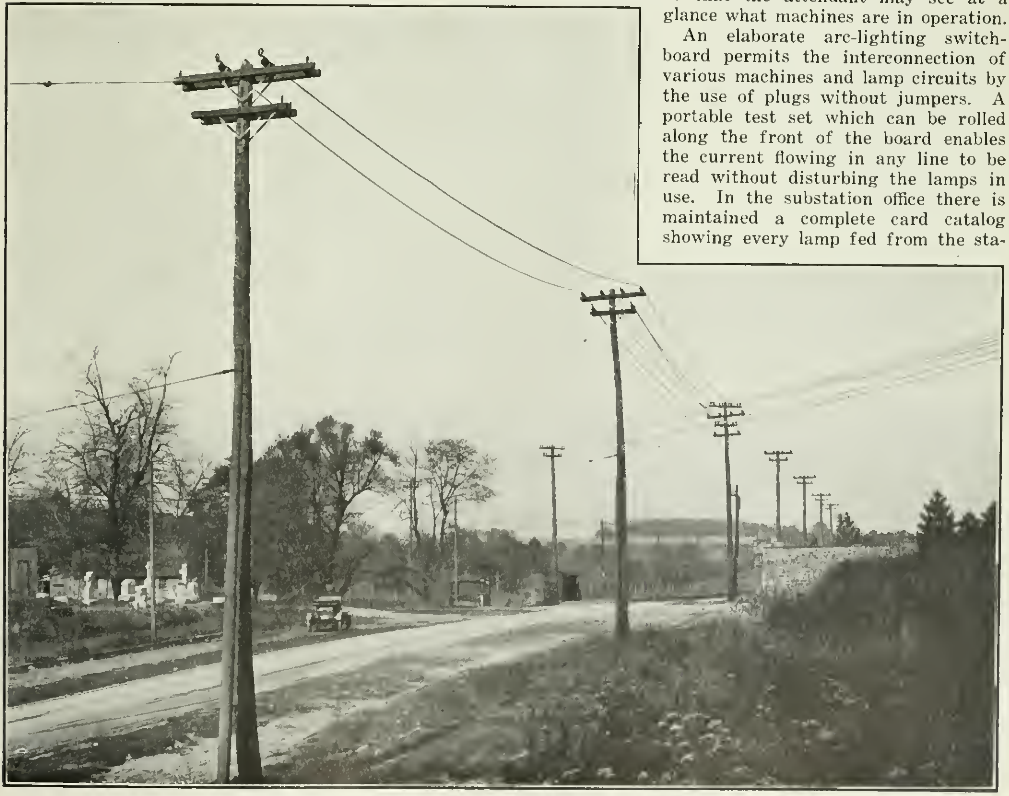


FIG. 32—DOUBLE-CIRCUIT POLE-LINE CONSTRUCTION AND METHOD OF DEAD-ENDING

tion. The cards are filed in racks corresponding to the respective circuits, so that in case of trouble the lamp involved can be located quickly. In the basement are the lamp-circuit feeder cables, which are laid up neatly in racks along the whitened walls, while the connecting lines which appear as vertical drops are tapped onto them without unsymmetrical crosses, the whole making a most flexible arrangement. The synchronous motors of these many motor-generator sets are also used to advantage for power-factor correction during the summer months.

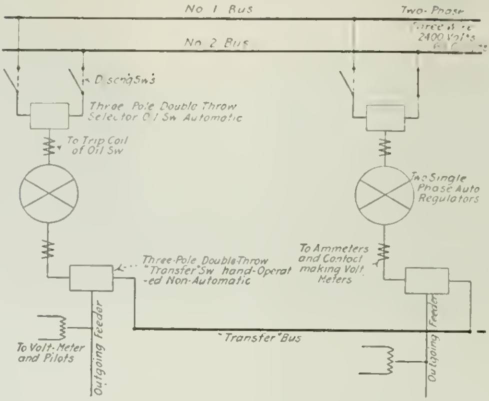

No 1 Bus
Two-Phase
2400 Volts
No 2 Bus
Discng Sw's
Three Pole Double Throw Selector Oil Sw Automatic
To Trip Coil of Oil Sw
Two Single Phase Auto Regulators
Three-Pole Double Throw "Transfer" Sw hand-Operated Non-Automatic
To Ammeters and Contact making Volt Meters
"Transfer" Bus
To Volt-Meter and Pilots
Outgoing Feeder
Outgoing Feeder

FIG. 34—DIAGRAM SHOWING USE OF TRANSFER BUS

Energy Supply to Railways

Exemplifying in fact the central-station idea of centralized energy production, it is interesting to note that approximately one-third of the output of the Philadelphia Electric Company is now sold to the local street-railway company, which in this way obtains about 40 per cent of its present total energy requirements. The Pennsylvania Railroad has also contracted with the electric company for the supply of power to operate its lines now being electrified in the vicinity of Philadelphia.

The Philadelphia Rapid Transit Company, which operates both city and suburban car lines in the district reached by the Philadelphia Electric Company, now purchases about 27,000 kw from the central-station system, taking this energy at a load-factor of about 36 per cent. This energy is metered and sold at transmission potential, the railway company in general furnishing and operating its own transformer and converting equipment. An exception, however, is the northern district, where the central station company has installed its apparatus in existing plants of the railway company. On this system a number of sixty-cycle rotary converters are in satisfactory operation.

The electrification plans of the Pennsylvania Railroad on which work is already actually under way call for the immediate single-phase electrification of its "main line" from the Broad Street station to Paoli, Pa., 20 miles distant, to be followed by the electrification of the Chestnut Hill branch. Under the terms of the contract an initial minimum of 3750 kw of single-phase, twenty-five-cycle power will be required beginning with the fall of 1914. The railroad company will erect a substation adjoining the Christian Street generating plant and will operate its own distribution equipment from that point.

With the extension of the electrification, three-phase energy will be taken, although special provision will be made for variations in load on any leg of the circuit.

Commercial Organization

For the work of the commercial department the territory to which service is supplied by the Philadelphia Electric Company is divided into a number of districts each in charge of a district manager who has his own staff of salesmen. The head of the commercial department is the general agent, and directly under him are divisions which specialize on motor services above 10 hp, electric vehicles, sign lighting, refrigeration and similar work.

Of particular interest is the large growth of the company's motor load during the last few years, and especially during 1913 and the elapsed months of the present year. For 1913 the increase in contracted commercial motor load was 15,000 kw, representing about one-half of the total new business added to the company's lines. This increase is at least four times the rate of growth enjoyed by the company ten years before, when its motor service was a relatively smaller proportion of its total business. By the close of 1914 it is expected that the Philadelphia system will have a total connected load of over 200,000 kw, which is at least double the corresponding figure for 1909, five years ago.

Among the large motor loads recently acquired is the 2000-hp installation of the Girard Point grain elevators of the Pennsylvania Railroad, the largest grain-storage establishment in the world. The elevators, conveyors, loaders, etc., are all operated by electric

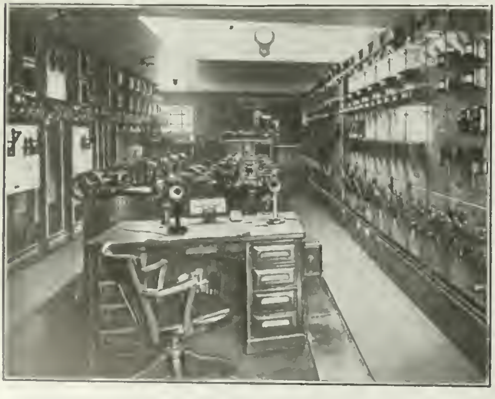


FIG. 35—BANKS OF FEEDER REGULATORS, SUBSTATION "O"

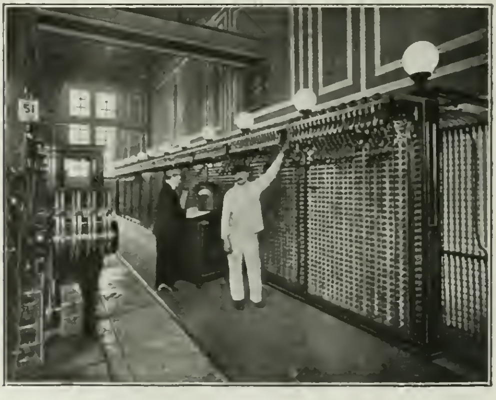


FIG. 36—ARC-LIGHTING SWITCHBOARD

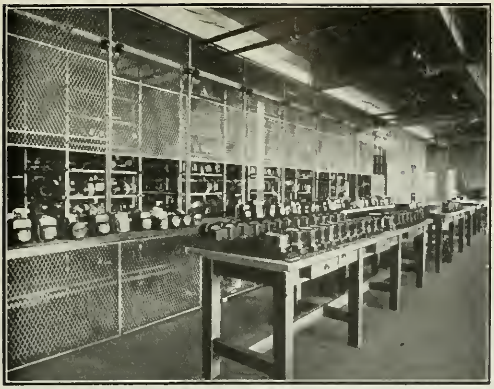


FIG. 37—METER STOREROOM, METER DEPARTMENT

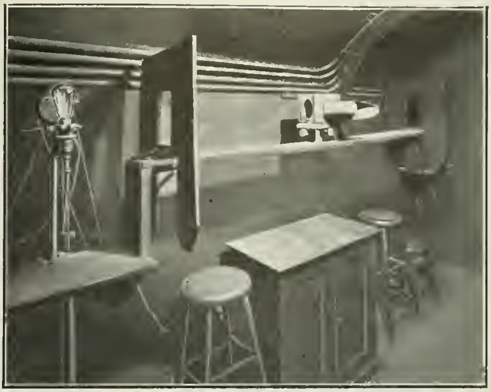


FIG. 39—PHOTOMETER ROOM OF COMMERCIAL DEPARTMENT

motors. Other large motor users served by the company are:

	Hp.
American Viscose Company	1,800
Cramp Ship & Engine Building Company	1,606
Gimbel Brothers	1,600
Philadelphia *Evening Bulletin*	1,500
Pennsylvania Salt Manufacturing Company	1,200
Adams Express Company	1,000
Bell Telephone Company of Philadelphia	1,000
Philadelphia *Inquirer*	1,000
Aberfoyle Manufacturing Company	925
J. G. Brill & Company	800
Chester Paper Company	800
Erben-Harding Company	800
Post office pneumatic tube service	703
Hale & Kilburn	625
Lit Brothers	625
Cresson-Morris Company	500
Standard Roller Bearing Company	500
J. T. Lewis & Company	500

The load requirements of such large consumers usually make necessary the supply of energy at transmission pressure direct to the customer's premises, where a special substation is installed for stepping down the voltage for distribution in the plant. In many cases rotating machines must also be operated to provide direct current. The design of these industrial substations has been a feature of the work of the engineering staff at Philadelphia. In general the simplest possible construction is provided, and every means is taken to insure the safety of the non-technical operator who is usually employed by the customer. In these stations, as elsewhere on the system, the three-meter method of wattmeter connection is employed, the meters being installed preferably on the high-tension side of the transformers where the substation is operated by the customer. When utilizing a room in an existing building, the compartment is usually rendered as nearly fireproof as possible by laying a concrete floor and installing a metal or asbestos-covered ceiling.

Lighting Service

At its main office, corner of Tenth and Chestnut Streets, the Philadelphia Electric Company maintains a handsomely appointed display room. The exhibit on the street floor includes ornamental lamps, heating appliances, etc., and elaborate show-window displays of miscellaneous electrical apparatus. Courteous attendants are on hand to give information, and at the rear of the display room is the cashier's office, so that customers entering to pay bills pass the appliance exhibits.

In the basement is a very complete working exhibit of larger electrical appliances, including motor applications, lighting units and light sources, etc. The commercial department also has here its own complete photometer room, where illumination tests can be conducted for the benefit of customers.

The headquarters of the electric-sign division exhibits a number of illuminated electrical displays. Scat-

FIG. 38—OFFICE OF MEDICAL DIRECTOR, MAIN BUILDING

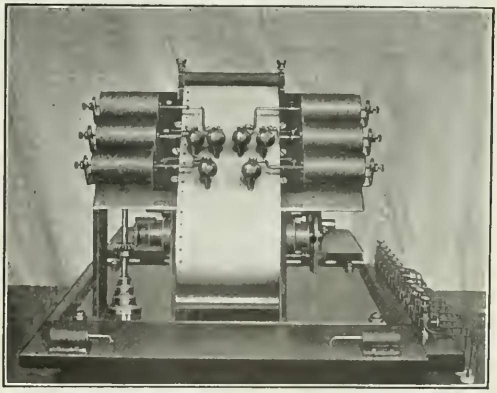


FIG. 40—"ERROMETER" FOR RECORDING METER TESTS

tered over its great area, Philadelphia has one of the largest electric-sign loads in the country. At the present time more than 5000 signs are in operation, representing a connected load of 3100 kw, or 200,000 lamps.

To customers, architects and engineers consulting illuminating-engineering service is offered gratis, trained engineers being retained to design installations, prepare plans, etc.

Wiring of Existing Residences

The company does not do wiring but co-operates with local electrical contractors. To owners of existing unwired residences it offers the benefits of its deferred-payment plan. If the prospective customer prefers not to pay outright for the cost of wiring, the company will secure estimates from several local contractors and submit these for the choice of the customer. When the job is completed the company pays the contractor outright, reimbursing itself in twenty-four monthly instalments collected from the customer with his lighting bills. This deferred-payment offer, of course, covers only the wiring and does not include the fixtures, which must be paid for separately.

As soon as the contract for service is signed the new customer receives a letter from the company the purpose of which is to put the customer in a friendly attitude by showing him that the company stands ready to render various services besides those stipulated in the contract. In part this letter reads as follows:

"It is the earnest desire of this company that none of its customers shall use one kilowatt-hour of electricity more than is absolutely required for proper illumination or efficient motor service. To assist you in these matters we place at your disposal, free of charge, our commercial inspection departments, which are prepared to give you practical advice and suggestions tending to make your lighting or motor installation, as the case may be, one of the highest efficiency.

"We hope you will feel free to call upon us for information regarding anything in connection with the purchase of electricity or the use of the same, so that the cordial relations which we endeavor to maintain with all of our customers will find no exception in your case.

"We inclose a partial list of the various electrical appliances making for economy and convenience in the home or business office. It will be of advantage to you to file this list where you can readily refer to it."

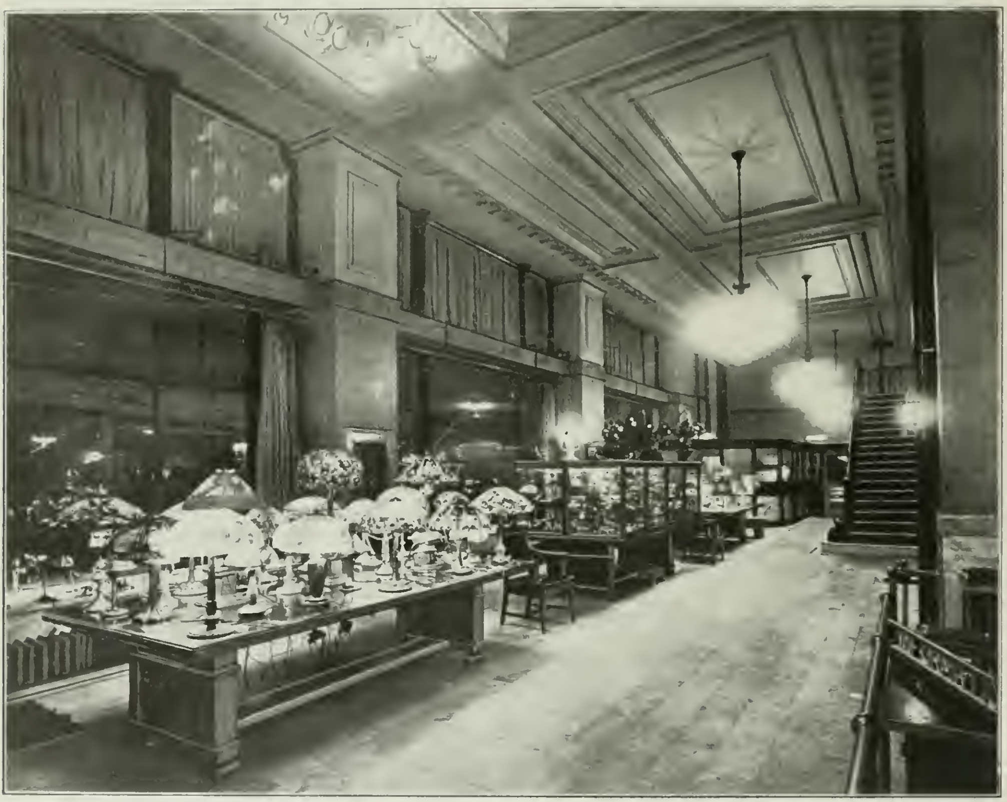


FIG. 41—INTERIOR OF MAIN SHOWROOM, GENERAL OFFICE BUILDING

Besides the usual varied characteristic lighting services, the Philadelphia company has on its lines an unusual proportion of the available church-lighting installations of the city, which it obtained as the result of a recent campaign in this direction.

Graphitized-filament lamps and the few remaining carbon lamps in use are granted free renewals, as are also all tungsten lamps in sizes above 100 watts. For the smaller tungsten sizes a nominal charge is made, which for units below 25 watts rating is the same as the first installation charge. Identification cards are given to customers for use when exchanging lamps, and on these are entered records of the renewals made.

These cards also serve to designate the proper voltage of the lamps to be furnished the customer, since in accordance with the company's engineering practice a constant bus voltage is maintained at substation busbars, the pressure at customers' premises being inversely proportional to the respective distances from the distributing centers.

FIG. 42—APPLIANCE SHOWROOM, GERMANTOWN OFFICE

Publicity and Advertising

For coining the familiar slogan "If it isn't electric it isn't modern," since adopted widely elsewhere, the Philadelphia Electric Company takes credit. This motto is reproduced in window displays and exhibit rooms and on the battery boxes of various electric vehicles and trucks used by the company.

The company makes extensive use of newspaper, program and street-car advertising and of electric signs. It also issues quarterly to its customers an attractive and well-printed twenty-eight-page *Bulletin*, in which are presented interesting general and local electrical news and commercial material. A number of useful booklets have been prepared and widely circulated on household uses of electricity, special lighting applications, etc. These have attracted wide attention and several have already been adopted for national circulation. Folders are inserted with customers' monthly bills. The advertising department also has a lecture bureau, which is prepared to furnish speakers on household electrical topics before women's clubs, social meetings, etc.

Testing of Customers' Meters

The meter department alone employs 350 men, including installers, testers, readers, computers, etc., and has charge of 62,000 watt-hour meters. Of the latter number about 9000 are direct-current meters and the remainder are of the alternating-current type. The department has a completely equipped laboratory occupying four stories of a modern building at 226 South Eleventh Street, the remainder of the building being devoted to other divisions of the meter department.

On their receipt from the manufacturers all meters first receive the usual laboratory inspection and routine test before being placed in stock. Then, after having been installed on the customer's premises, they again have a thorough test, usually within ten days of the time of installing and always before taking the reading for the first bill. Forty testers are employed. In the routine of tests made use of these men are about equally divided, half employing the rotating-standard scheme of test, while the other group check the meter under test against calibrated indicating instruments.

For rotating-standard tests the "eye-and-ear" method, which was originated in Philadelphia, is used exclusively. At each revolution the shaft of the standard meter makes a contact which produces a click in a head telephone, so that while the operator watches the rotation of the tested meter he can check it by sound against the speed of the rotating standard. This permits very close accuracy in comparing rotation speeds and saves much time for the tester.

The "errometer" for comparing the accuracy of different test methods was also devised locally. In this apparatus a paper strip about 4 in. wide is fed by clockwork under six styluses each actuated by an electromagnet which when energized makes a slight "jog" in the corresponding line drawn on the paper. One stylus is included in the circuit from the laboratory clock, a second is controlled by the rotating standard meter, and the others are connected to the meters under test. From a study of the records resulting the accuracy of any method, as well as the skill of the tester, can be determined definitely.

For making alternating-current meter tests at partial power factors a leading potential is employed instead of a lagging current. This reversal of the more common practice results in a considerable reduction of the apparatus necessary for such tests.

Meter testers for the Philadelphia company are recruited from colleges, high schools, trade schools, etc., and are first assigned to work as assistants to the regular testers for periods of one year or eighteen months. Next they are put through practical courses of instruction, which include making repairs in the shop, assembling meters, cleaning parts, etc. After three months of this work the new man takes up his duties as a regular tester, an experienced instructor acting as his assistant for a week or two. When finally declared proficient the graduate is sent out on the simpler jobs as a regular tester, and from time to time he is steadily advanced to special and complaint work. For greater accuracy the results obtained by these testers are occasionally checked without their knowledge either before or after the regular test. The division foreman also drops in unexpectedly at places where his men are at work, visiting each man in this way at least once a month.

In case a meter is found to be in need of repairs no delay is permitted to occur before taking steps to put it into shape. The tester at once summons a repairman and even waits at the place if necessary until the proper repairs are made. In the case of laboratory repairs the shop is so arranged that an experienced

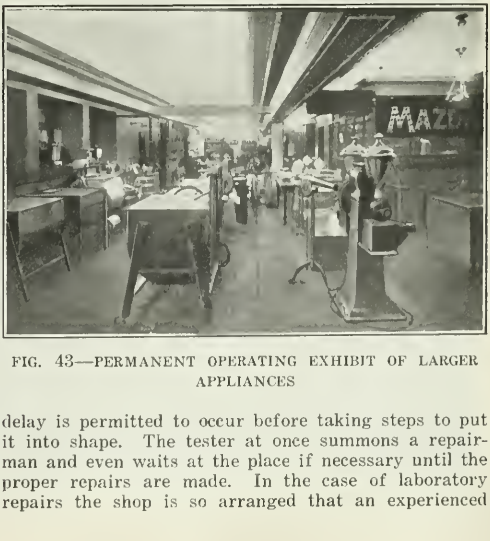


FIG. 43—PERMANENT OPERATING EXHIBIT OF LARGER APPLIANCES

repairman occupies a central bench while the learners work at benches alongside their instructor.

Each meter is designated by an aluminum clip bearing a serial number which also indicates the kind and size of the instrument. The history of each meter on the system is entered on a record card which shows on one side the various locations where the meter has been installed, dates, etc., and on the other the dates of tests, results, etc. All correspondence relating to each customer's meter is also filed in an envelope and deposited in the general meter file.

In addition to the initial laboratory and installation tests before described, each meter also receives routine tests at regular and frequent intervals which range from several months to a year, depending on the type of the instrument.

Meter Installation and Reading Routine

The staff of meter readers numbers twenty-five. These men are all in uniform and follow regular routes over the twenty-four districts into which the system is divided. In this way these inspectors are reading meters practically every weekday of the month, except for two or three days near the close of the month when missed readings are caught up. From month to month the men are assigned to entirely different routes, so that a given inspector will not read the same meter oftener than once a year.

Both a meter record card and customer's record sheet are made out for each customer's meter. The card has dial spaces for twelve months' readings, besides blanks for all necessary information concerning the installation, remarks, etc. By an ingenious system of punches around the edges of the cards, it is possible to detect at a glance when even a single card is misplaced in a group of several hundred cards relating to a given locality.

The inspectors copy down only the pointer positions on the blank dials of the cards, and from these sketches the actual numerical readings are set down by the computers at the meter-department headquarters. The computers then calculate the kilowatt-hours consumed and also make out the gross bill in dollars and cents, based on the customer's rate for service. From this point the bill is handed over to the accounting department, which enters discounts, etc., and attends to rendering the account.

An experienced inspector can read about 175 meters per day, while under special circumstances one man has made a record of 430 readings in a day. For all errors above two during each half-month the reader suffers a reduction in salary of 1/16 cent per hour. While this reduction is very nominal and involves no hardship, its institution has resulted in improved care and accuracy.

During 1913 the Philadelphia meter department

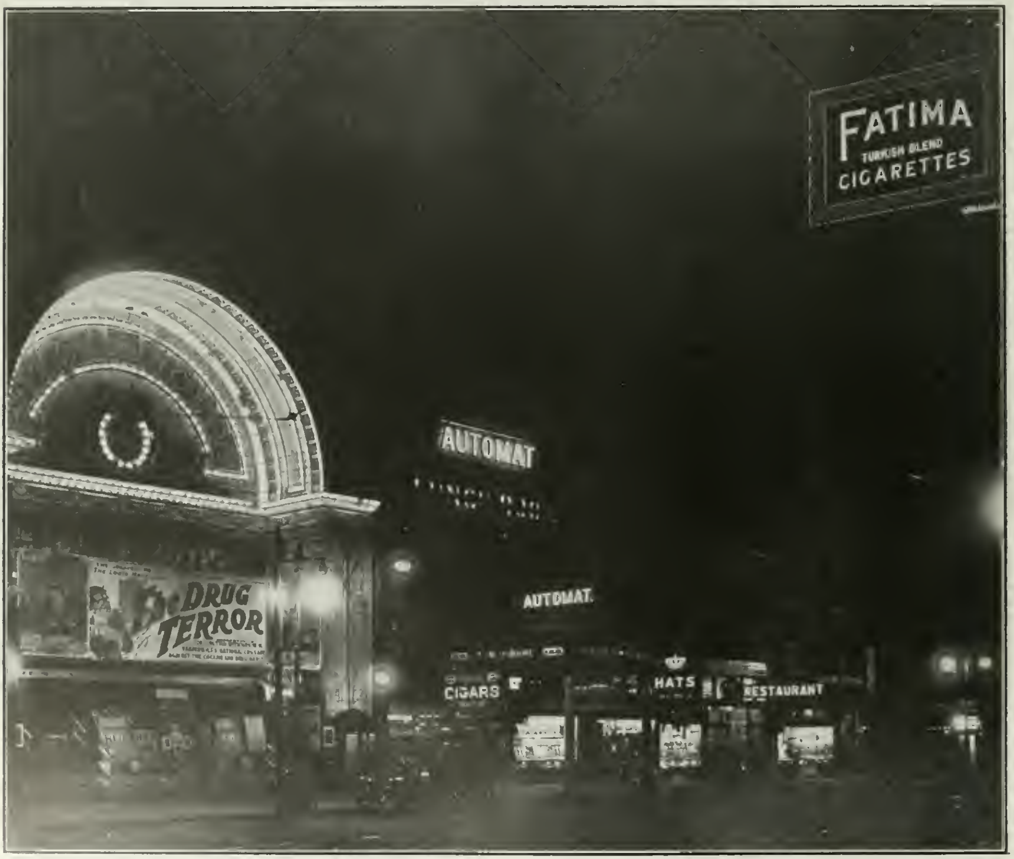


FIG. 44—ELECTRIC SIGNS ON MARKET STREET

made 668,000 meter readings, among which 1400 errors were detected before the bills were sent out. In all 572,000 bills were rendered, and of this number one-half of 1 per cent were returned, although after final investigation less than half of these—that is, 0.22 per cent of the total number rendered—were found to be actually in error.

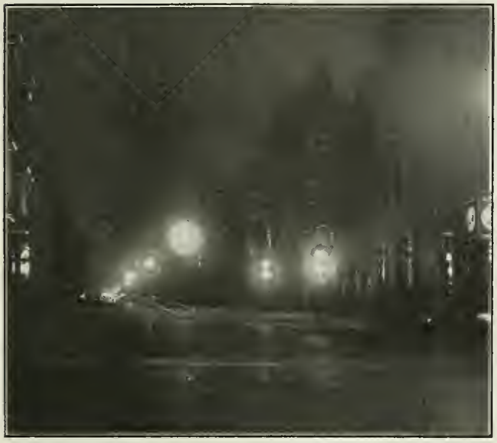


FIG. 45—NITROGEN-FILLED TUNGSTEN STREET LAMPS ON DIAMOND STREET

All meters are mounted on approved inclosed installation boards and in the shop are wired up complete with cut-outs, etc., so that the work of installing on the customer's premises is reduced to a minimum. A regular routine is followed by which an inspector first visits the prospective "job," estimates the material required, and hands in a corresponding requisition. The next day, with all the necessary supplies, one of the installation crews goes to the spot and quickly completes the installation.

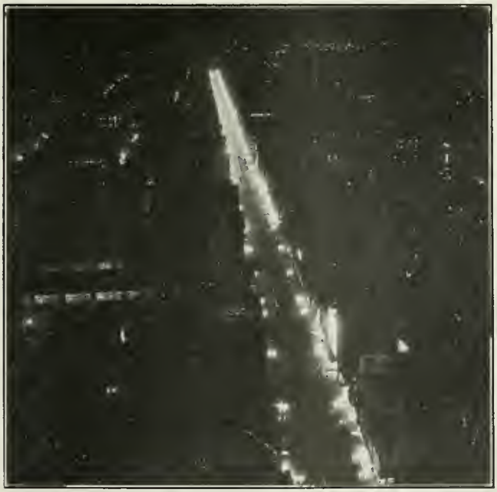


FIG. 46—ILLUMINATION OF WEST MARKET STREET VIEWED FROM CITY HALL TOWER

Modern Accounting Methods

Each month the accounting department tabulates and distributes over the company's 140 operating and construction accounts about 6000 purchase invoices. To simplify this accounting work the vendor is asked to use a standard bill form, a copy of which is sent out with each order by the purchasing agent. After the approval of the purchasing department or other officials concerned has been noted on the bill as rendered, a voucher is made out and the bill itself sent to the tabulating department. Here Hollerith cards are prepared, showing the bill number, date, classification, amount, etc., duplicate green and manila copies being punched separately for verification. At the close of the month all operating expenses, construction charges and other accounts payable can be quickly obtained by running the set of cards through the electrical tabulator, accomplishing a saving of several days' time over addition by hand.

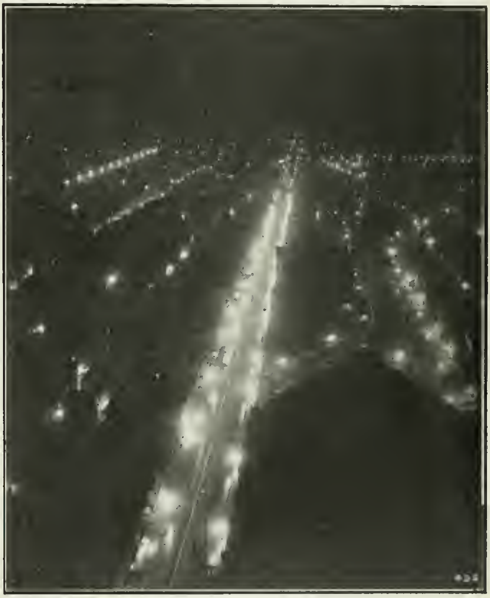


FIG. 47—ILLUMINATION OF STREET IN DOWNTOWN BUSINESS SECTION

For indexing consumers' ledgers use is made of the Rand visible index, which has replaced the file of 120,000 cards formerly required for indexing the company's 60,000 customers classified both under name and under street address. These duplicate card indexes, together with the applicant's credit file, have now been discontinued and are replaced by the visible index cards, which show directly at all times the customer's name, address, ledger folio, meter reading, routes and similar information.

When the overlapping card is raised a full history of the company's entire transactions with the customer is exposed, showing the previous address to which service was furnished to a customer of the same name, the date customer discontinued service, his indebtedness, if any, disposition of account, etc. The cards of discontinued customers are placed in transfer files, where they may be consulted along with the "live" index in the case of new service applications or for any other reason that may arise.

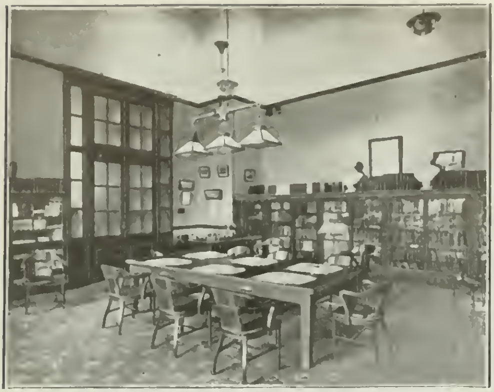


FIG. 48—LIBRARY FOR USE OF COMPANY EMPLOYEES

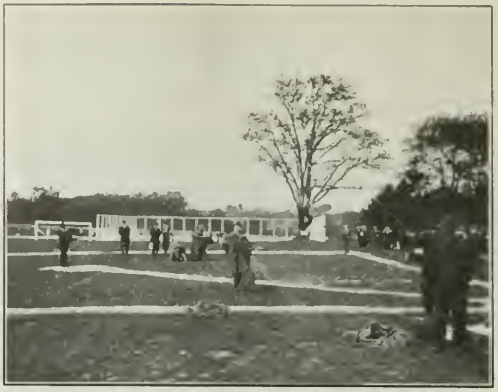


FIG. 49—EMPLOYEES' ATHLETIC FIELD

Employees' Activities and Welfare Work

The active National Electric Light Association company section at Philadelphia now numbers nearly 900 members and exhibits a degree of enthusiasm creditable in the extreme to the parent association. It holds a general section meeting once a month, in addition to which there are monthly sessions of each of the commercial, accounting, meter and engineering branches of the section. Among the section's other activities are a creditable amateur orchestra, and the publication of an excellent and valuable monthly section organ, *Current News*, the cost of which is met directly by company appropriation.

Closely affiliated with the N. E. L. A. section is the Philadelphia Electric Company Athletic Association, which has a 25-acre athletic field at the edge of the city. This field is equipped with tennis courts, baseball diamonds, golf course, grandstand and an attractively appointed field house. Restaurant facilities are also provided at popular prices. Membership fees are apportioned on a classified scale, ranging from family membership with unlimited guest privileges, at $10 a year, down to $1 a year and 50 cents a year for single membership tickets for men and women employees respectively. Boys earning less than $25 a month have the use of the association grounds free. Family membership without guest privileges costs $2 a year.

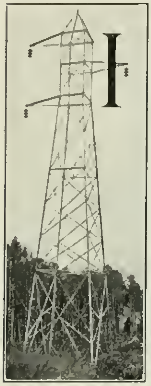
The Beneficial Association is an organization of employees fostered by the company and having as its purpose the payment of sick, accident and death benefits to employees or their beneficiaries. In addition to an entrance fee of $1, each member pays monthly dues amounting to 1 per cent of his monthly earnings. The company also contributes a sum equal to that contributed by the employees. For sick disability a member is allowed one-half of his regular pay for a period not exceeding ten weeks. In case of accident either on duty or off duty the full rate of pay is allowed. The minimum death benefit is usually $750, and this is increased to $1,000 if the member has been for five years in the employ of the company. Members who visit the office of the medical director receive free medical attention and treatment.

Employees who have reached the age of sixty-five and have been fifteen years in the company's employ may retire from active service under the company's service annuity plan, by which they receive from the company an annuity amounting to 2 per cent of their annual earnings for the last ten years multiplied by the number of years of service. For women the age of retirement is sixty years.

The library maintained by the Philadelphia Electric Company at its main office building is open to all employees of the company. It consists of 1275 bound volumes on engineering and commercial subjects, association proceedings, encyclopedias, reports, biographies, bulletins of company sections, of the N. E. L. A., etc. In addition to these bound volumes there are on file a number of pamphlets, clippings, lantern slides, photographs, trade catalogs and bulletins, government publications, etc. The library subscribes for thirty periodicals, which are bound at the end of each year. A card index of important articles appearing in the various periodicals is kept by the librarian, and this index is accessible to all employees.

The officers of the Philadelphia Electric Company are: President, Mr. Joseph B. McCall; vice-president, Mr. W. H. Johnson; second vice-president, Mr. W. C. L. Eglin; treasurer, Mr. H. C. Lucas; secretary, Mr. A. V. R. Coe, and assistant treasurer, Mr. H. R. Kern.

INTERCONNECTED SYSTEMS OF THE SOUTH



In the rapid progress of hydroelectrical development high-tension transmission systems have ceased to be uncommon. The country, especially the West, abounds with them, and yet it is the South which has shown the greatest enterprise in doing the obvious thing in the obvious way by creating a system of transmission systems surpassing anything else in that line ever attempted in this or any other country, until at the present time a high-tension line approximately 1000 miles long stretches from Nashville, Tenn., to Henderson, N. C., tying together the hydroelectric systems of four states. With the completion of the Tallulah Falls station of the Georgia Railway & Power Company the water-powers on both sides of the Appalachian Mountains were virtually combined into one, for there were then actually connected the transmission systems of the Tennessee Power Company, the Chattanooga & Tennessee River Power Company, the Columbus Power Company, the Central Georgia Power Company, the Georgia Railway & Power Company, the Southern Power Company and the Carolina Power & Light Company. In other words, all the great transmission systems of the South, with the exception of the Alabama Power Company, are now interconnected, the lines of this system of systems extending over a wide territory from Nashville, Tenn., as far south as Columbus, Ga., and as far northeast as Roxboro, N. C. Moreover, the lines of the Alabama Power Company are not very far from those of the Georgia Railway & Power Company, and to connect the Alabama system to the others would require only about 50 miles of circuit.

At present these various systems are controlled by separate and distinct syndicates which some day may be welded into one by some master mind. Back of the Tennessee Power Company are the banking houses of E. W. Clark & Company, of Philadelphia, and Hodenpyl, Hardy & Company, of New York. The Bradys own the Chattanooga & Tennessee River Power Company. The Columbus Power Company is a Stone & Webster property, and the fiscal agents of the Central Georgia Power Company are A. B. Leach & Company, of New York. The sponsors of the Alabama Power Company are the Sperlings of London. The Atlanta properties are owned by the Georgia Railway & Power syndicate, while the great system of the Southern Power Company is owned by the Duke family of world-wide tobacco fame. The Carolina Power & Light Company is controlled by the Electric Bond & Share Company, of New York.

The interconnected properties are for the most part new, many of the hydroelectric stations having been placed in operation within a year or so, and few of the stations are over five years old. Numerous advantages obviously follow from the tying-in of the systems, but none of the companies interested has begun to reap the ultimate advantage that would be possible were the systems under a single control. The diversity-factor possibilities are enormous. First, there is a difference in time between Henderson, N. C., and Nashville, Tenn., of about one-half hour, the difference in standard time being one hour, so that on top of the diversity-factor of each single system, which varies considerably in different cities with the industries and customs of the people, the weather conditions, altitude, etc., is the greater time-factor of the interconnected system. Then, too, there is the diversity in stream flow of contiguous rivers and rivers on opposite sides of the mountains.

The Appalachian region is one of enormous rainfall, the largest found in the United States with the exception of a small portion of the Puget Sound district. The aggregate fall from the sources of streams to the sea is large, but unfortunately too gradual to produce powers cheap to develop or free from danger of back water. Another singular peculiarity of the Appalachian region is the absence of lakes, so that from end to end of the main chain there is practically no natural storage whatsoever.

The Fall Line

In considering the water-powers in the Southern Appalachian region it is necessary to take up the important matter of fall line, which throughout that region is well defined, as shown on the map. The streams with but few exceptions fall in gradual descents from their mountain sources to the fall line. This gradual descent includes shoals at various points in the stream where the river may fall as much as 10 ft. in from one-quarter to one-half of a mile of its course. Shoals of from 6 ft.

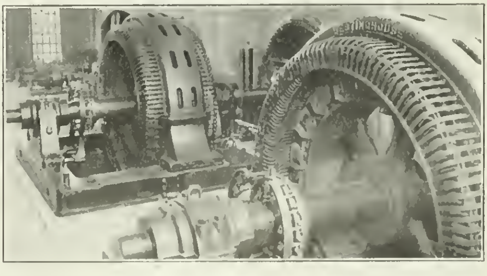


FIG. 1—GOAT ROCK STATION OF COLUMBUS POWER COMPANY

to 10 ft. may be one or two miles apart where the stream flows through a ridge, and thus a succession of shoals may occur. From this it is evident that high heads do not exist as a rule, that flumes and penstocks are little used, and that the form of development which with very few exceptions will be indicated is the building of a dam at the most favorable location on the stream which backs water over a succession of three or four shoals, possibly four to eight miles upstream, and thus secures a head at the point of development usually between the limits of 35 ft. and 50 ft. One advantage in the construction of practically all the water-power developments is the fact that rock, sand and timber, as well as gravel, can usually be obtained in abundant quantities not far from the power-house site.

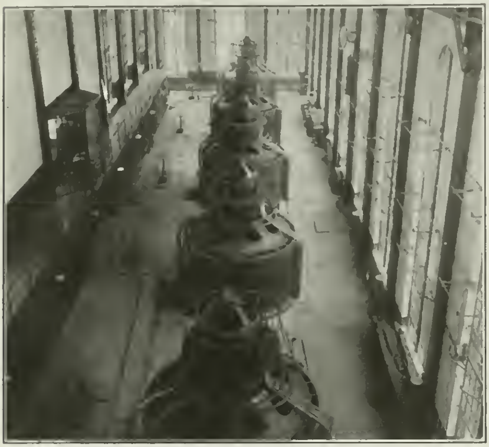


FIG. 2—TALLULAH FALLS PLANT OF GEORGIA RAILWAY & POWER COMPANY

The interconnected high-tension lines of the various systems are for the most part carried on steel towers, with suspension-type insulators, and the trend is more and more toward the outdoor type of substation and switching station. Inasmuch as the greatest operating difficulties incurred by transmission companies are those caused by lightning, all of the lines are protected by overhead ground wires and by lightning arresters of the electrolytic type. The characteristics of the various generating systems are briefly outlined in what follows, for convenience in connection with the accompanying map of the interconnected systems.

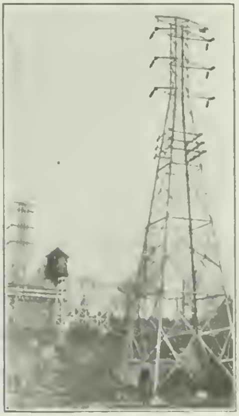


FIG. 3—LINE OF GEORGIA RAILWAY & POWER COMPANY

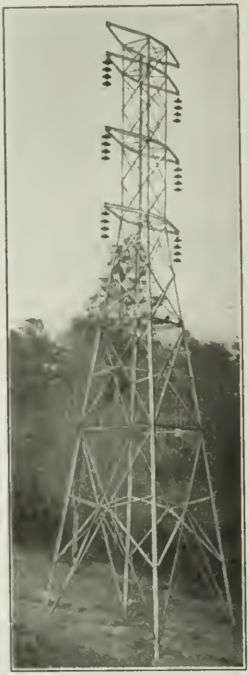


FIG. 4—110,000-VOLT LINE OF GEORGIA RAILWAY & POWER COMPANY

Tennessee Power Company

The Tennessee Power Company has two hydroelectric stations with an aggregate rating of 50,000 hp in operation on the Ocoee River near Parksville, Tenn., where heads of 109 ft. and 250 ft. are available, and owns three other sites on the river where 50,000 hp can be developed. In addition, it proposes to erect an 80,000-hp plant at Rock Island and has six steam stations in opera-

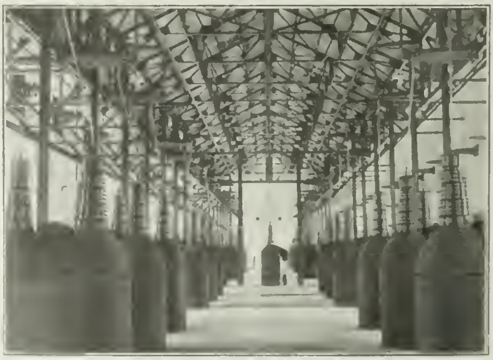


FIG. 5—HIGH-TENSION SWITCH ROOM AT TALLULAH FALLS

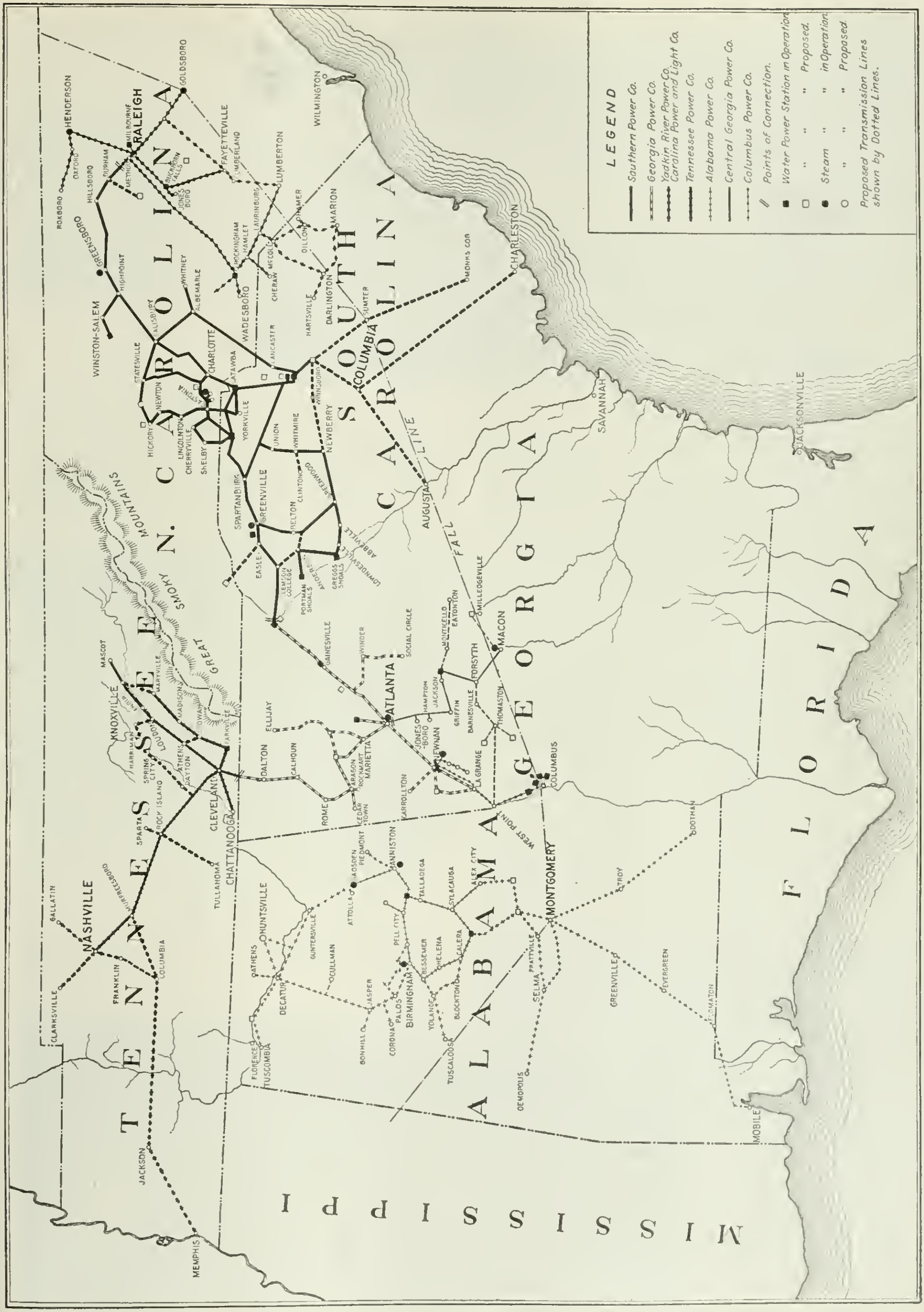


FIG. 6—MAP OF SOUTHERN INTERCONNECTED HIGH-TENSION TRANSMISSION SYSTEMS

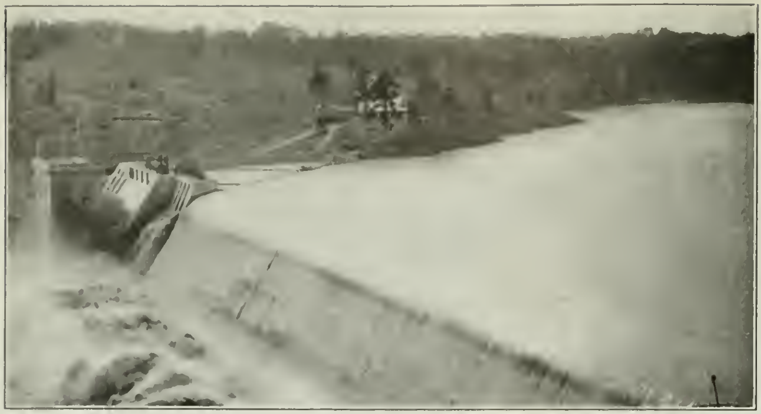


FIG. 7—GOAT ROCK STATION OF COLUMBUS POWER COMPANY ON CHATTAHOOCHEE RIVER

tion with an aggregate rating of 25,000 hp. Substations to the number of fifteen are situated at Cleveland, Athens, Sweetwater, Ludon, Lenoir, Knoxville, Mascot, Etowah, Maryville, Chattanooga, Murfreesboro and Nashville, having an aggregate rating of 57,000 kw. The company has 453 miles of three-phase, sixty-cycle single and double circuit steel-tower lines and wooden-pole lines in operation, designed for 120,000 volts and at present operated at 66,000 volts and equipped with suspension-type insulators. In addition, there are 485 miles of high-tension line proposed, and when the system is complete the lines of the company will extend from the Tennessee-Georgia line to Mascot on the east, Clarksville on the north and Memphis on the west. The circuits of the Tennessee Power Company connect with those of the Georgia Railway & Power Company at the Tennessee-Georgia state line, the company having no transmission line outside of the State of Tennessee. The system of the Tennessee Power Company is tied in with that of the Chattanooga & Tennessee River Power Company at Chattanooga.

Rising in the mountains of northern Georgia, the Ocoee River flows through a region of heavy rainfall in a northwesterly direction to a point near Parksville, Tenn., where it joins the Hiawassee. The river falls some 710 ft. in 26 miles of its course above Parksville, where the first development was made. The second development, which has just recently been completed, is situated 8 miles above Parksville opposite the mouth of Caney Creek. This second development differs from the usual hydroelectric work of the South in that a diversion dam has been built about 12 miles above Parksville, from which water is carried in a flume 4½ miles along the mountain side overlooking the river to the penstock intake situated directly above power house No. 2 at the upper end of Lake Ocoee. This flume is large enough to provide for an ultimate installation of 30,000 brake-hp. It is a wooden structure designed for a waterway, 14 ft. 2 in. wide and 9 ft. 9 in. deep, when carrying the maximum amount of water. Across small ravines the flume is supported on timber trestles, and at five of the ravines steel trestles are provided, the largest of these having a length of 288 ft. and a maximum height of 150 ft. The generators in the second development are rated at 9375 kva, 6600 volts, three-phase, and are directly connected to 10,000-hp horizontal turbines of the inward-flow double-discharge reaction type. A feature of the development is the use of a siphon spillway because the available length of the crest of the concrete spillway dam was not sufficient to discharge 1200 second-ft. of water when acting as an ordinary overflow spillway.

Station No. 2 is equipped with two three-phase transformers, each of the same rating as the generators. These are of the oil-insulated, water-cooled type, wound on the high-tension side for 66,000/120,000 volts, sixty cycles. The transformers are delta-connected on the high-tension side and are at present operated at 66,000 volts. The energy is transmitted from Station No. 2 to Station No. 1 over a double-circuit, single-tower line built on a 1000-ft. right-of-way. The line follows the lake from Parksville to a point about one-third of a mile below Power House No. 2, where it crosses the Ocoee River in a 1300-ft. span at an elevation of about 400 ft. The country being quite mountainous, the spans vary considerably, from 350 ft. to almost five times that length. The steel transmission towers are of the double-circuit type with cross-arms spaced for 120,000 volts.

Chattanooga & Tennessee River Power Company

The Chattanooga & Tennessee River Power Company recently completed a hydroelectric development at Hale's Bar, 33 miles below Chattanooga on the Tennessee River (see *Electrical World*, Nov. 15, 1913). The generating equipment comprises ten three-phase, sixty-cycle, 6600-volt alternators, rated at 3000 kw each,

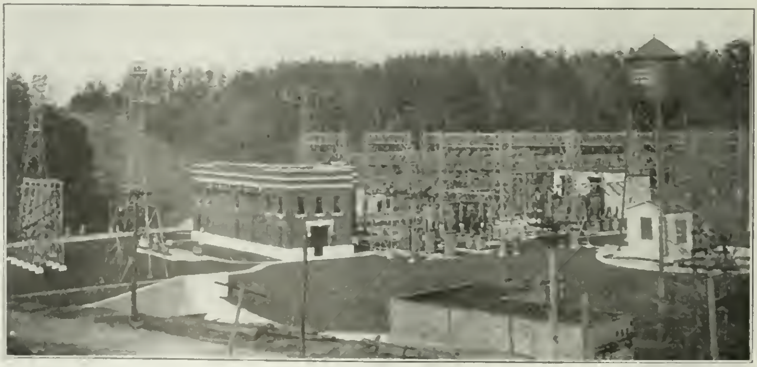


FIG. 8—OUTDOOR SUBSTATION OF GEORGIA RAILWAY & POWER COMPANY AT ATLANTA

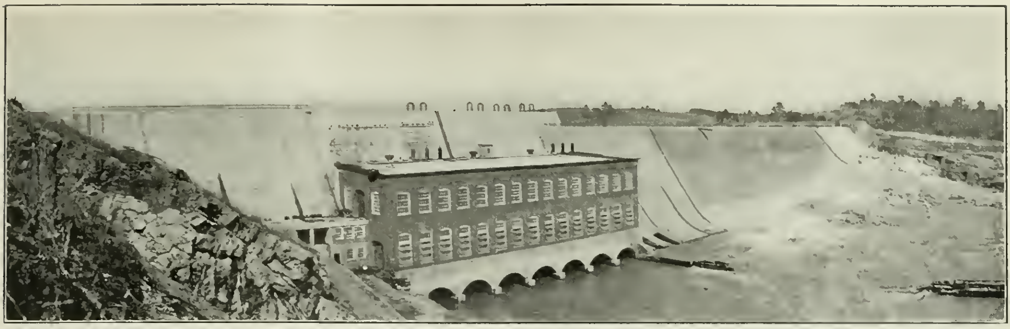


FIG. 9—STATION OF THE CENTRAL GEORGIA POWER COMPANY ON THE OCMULGEE RIVER

driven by three turbines, the two lower ones operating during periods of high head and low flow, while the upper turbine is brought into play when there is more water but less available head. The turbines run at 112 r.p.m., and each unit is capable of delivering 5250 hp under a head of 35 ft. The energy is stepped up in water-cooled, single-phase transformers rated at 3133 kw each and delivering 44,000 volts on the high-tension side. The transmission line consists of No. 000 bare-copper cables on pin insulators, and the line in duplicate is carried on steel towers from Hale's Bar to Chattanooga. A contract has recently been concluded whereby 10,000 kw is taken by the Tennessee Power Company.

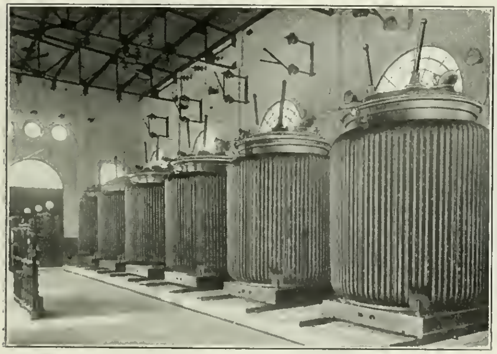


FIG. 10—ATLANTA SUBSTATION OF CENTRAL GEORGIA POWER COMPANY

Columbus Power Company

The Columbus Power Company has three hydroelectric developments on the Chattahoochee River, two at Columbus having an aggregate rating of 7900 kw and one at Goat Rock, 15 miles north of Columbus, having 12,500 kw installed, making the total available 20,400 kw. The City Mills development at Columbus comprises five generators with an aggregate rating of 1000 kw, the head being 10 ft. The North Highlands development has six generators, with an aggregate rating of 6900 kw, and waterwheels operating under a head of 42 ft. The Goat Rock development, where a head of 72 ft. is available, has three generators, two of which are rated at 3750 kw and the other at 5000 kw. Three phase, sixty-cycle energy is generated at 5500 volts and 11,000 volts. Two 4000-kw transformers step up the potential to 66,000 volts for transmission. A 11,000-volt line on wooden poles with pin-type insulators connects the Columbus and Goat Rock properties, and a 60-mile steel-tower line equipped with suspension-type insulators and operating at 66,000 volts extends from Goat Rock at Newnan. There are 18 miles of wooden-pole line operating at 11,000 volts connecting Newnan and Hogansville. Four main substations are connected to the system, one at Columbus rated at 1600 kw, one at West Point rated at 1875 kw, one at La Grange rated at 1875 kw, and the fourth at Newnan rated at 4000 kw. The system operates continuously on a 40 per cent load-factor basis, and auxiliary steam generating apparatus of the capacity of 3000-kw turbo-generators is available. Provision is made for the transfer of 3000 kw between the Columbus Power Company's system and the system of the Georgia Railway & Power Company.

Georgia Railway & Power Company

The Georgia Railway & Power Company's system comprises the great hydroelectric development at Tallulah Falls recently completed (see *Electrical World*, Dec. 20 and 27, 1913), with a present equipment of 50,000 kw and an ultimate equipment of 60,000 kw, sixty-cycle, three-phase, 6600-volt generators driven by turbines designed for an average head of 600 ft.; a 10,500-kw hydroelectric station at Morgan Falls (Bull Sluice) generating 2200-volt, twenty-five-cycle energy; a hydroelectric station at Gainesville (Dunlap), where 2200-kw of two-phase, 440-volt apparatus is installed, and two steam stations in the city of Atlanta with an aggregate rating of 21,500 kw. The company has six main substations in Atlanta (Boulevard), Gainesville,

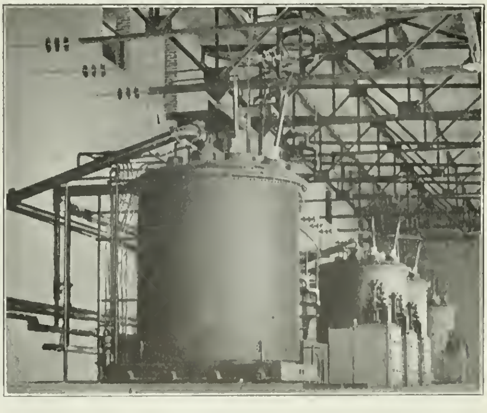


FIG. 11—TRANSFORMER ROOM, CENTRAL GEORGIA POWER COMPANY

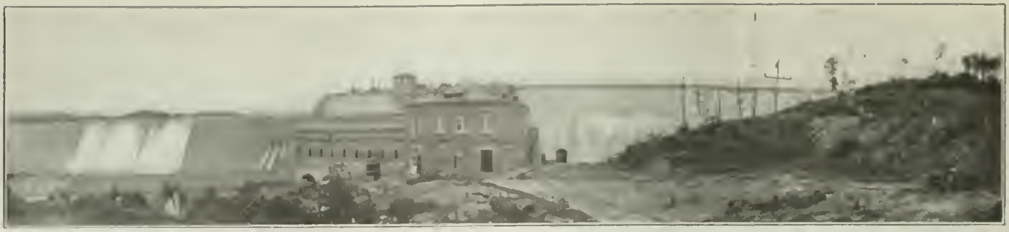


FIG. 12—PANORAMIC VIEW OF NINETY-NINE ISLAND STATION OF SOUTHERN POWER COMPANY ON BROAD RIVER

Newnan, Lindale, Cartersville and Marietta, with a present aggregate rating of 46,500 kw and an ultimate rating of 114,000 kw. It also owns undeveloped water-powers aggregating 140,000 kw. A double-circuit steel-tower line, 87.6 miles long, transmits energy at 110,000 volts between Tallulah Falls and Atlanta; a 42.4 mile tower line with a single circuit transmits 110,000-volt energy from Atlanta to Newnan, and a similar line, 68.6 miles long, carries 110,000-volt energy from Atlanta to Lindale, making 198.6 miles of 110,000-volt steel-tower line equipped with suspension-type insulators. The main line from Atlanta to Tallulah Falls is equipped with No. 0000 copper conductor, and the substations are for the most part of the outdoor type, that at Atlanta being the largest of that type at present in existence. A 66,000-volt wooden-pole transmission line, 62 miles long, extends from Lindale to the Tennessee state line, where connection is made with the Tennessee Power Company's system. There are 28.8 miles of 22,000-volt line connecting the Bull Sluice station with Atlanta and connecting Atlanta with Smyrna. There are also 18.95 miles of 11,000-volt lines in the city of Atlanta. The total mileage of transmission and distribution lines operated by the company is 519.45 miles, 211.1 miles of which is made up of 22,000-volt and 11,000-volt distributing lines. The company receives energy over a 66,000-volt line on steel towers at South Atlanta from the Central Georgia Power Company, and the Tallulah Falls plant is connected with the system of the Southern Power Company at Tallulah Falls.

The Georgia Railway & Power Company operates the electric railways in Atlanta, a direct-current system, an alternating-current system and a steam-heating system. Nearly all of the load is carried by the water-power stations, the steam engines being run only during the heating system and in case of emergency. At each of the steam plants in Atlanta sufficient boilers are kept under steam to pick up about 2500 kw on short notice. In addition, there is a 3000-hp gas engine in the Davis Street station in Atlanta directly connected to a 2000-kw, twenty-five-cycle, three-phase, 6600-volt alternator. This engine can be started and put in service in less than a minute. It is run on illuminating gas supplied by a 16-in. main direct from the gas holder, and besides being available for emergency service, it is also used during periods of low water to tide the system over peak loads.

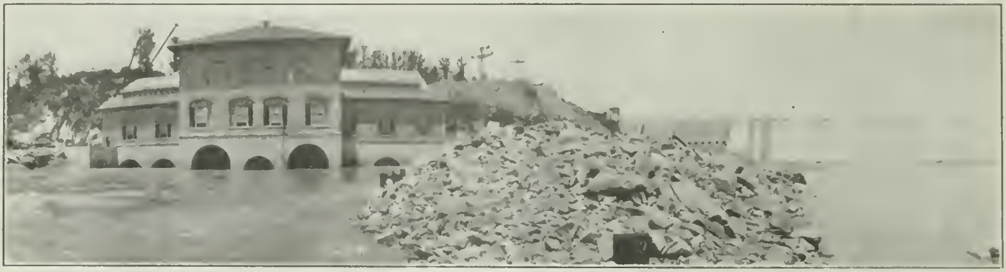


FIG. 13—ROCKY CREEK STATION OF SOUTHERN POWER COMPANY ON CATAWBA RIVER

Central Georgia Power Company

The Central Georgia Power Company operates a 12,000-kw hydroelectric station at Lloyd's Shoals on the Ocmulgee River near Jackson, where a head of 100 ft. is available. The equipment comprises four 2300-volt, sixty-cycle, three-phase, 3000-kw generators, and the energy is stepped up to 66,000 volts for transmission. The most important transmission line is that extending

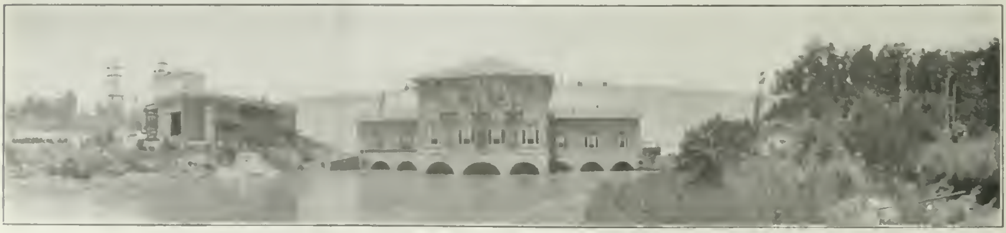


FIG. 14—GREAT FALLS STATION OF SOUTHERN POWER COMPANY ON CATAWBA RIVER

from Griffin to Atlanta, a distance of about 34 miles. The steel towers carry two stranded aluminum circuits, one on each side, over a 150-ft. right-of-way to Atlanta. The company has 226 miles of line on a single-circuit basis, 202 miles of steel towers on a single-circuit basis, and 24 miles of wooden-pole line. One hundred and fifty-six miles of single circuit line are equipped with pin-type insulators, and 70 miles of single-circuit line have insulators of the suspension type. Substations are situated at Atlanta, equipped for 9000 kw; at Hampton, rated at 1100 kw; Griffin, rated at 2250 kw; Jackson, where 900 kw is installed; Monticello, having 900 kw in equipment; Forsyth, rated at 1200 kw; Barnesville, also rated at 1200 kw, and Macon, where 9000 kw is installed. Provision is made for the transfer of 9000 kw between the Central Georgia Power Company's system and that of the Georgia Railway & Power Company at Atlanta. Steam auxiliary equipment up to 5500 hp can be pressed into service whenever required.

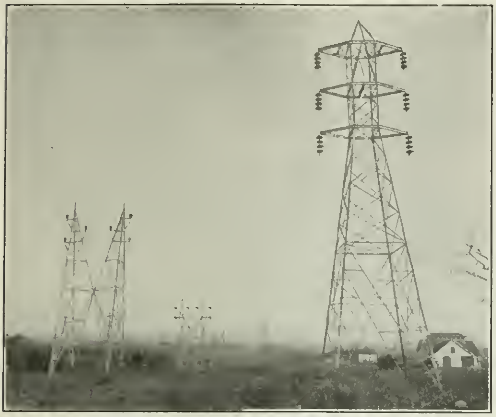


FIG. 15—TRANSMISSION LINES OF SOUTHERN POWER COMPANY

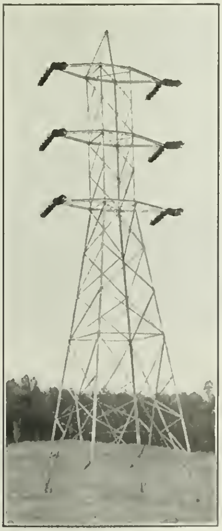


FIG. 16—YADKIN RIVER COMPANY'S TRANSMISSION LINE

Southern Power Company

The Southern Power Company is connected to the Carolina Power & Light Company at a point between Durham and Raleigh, N. C., as indicated on the map, and with the Georgia Railway & Power Company at Tallulah Falls. The location and maximum ratings of the company's various stations are given in the accompanying table.

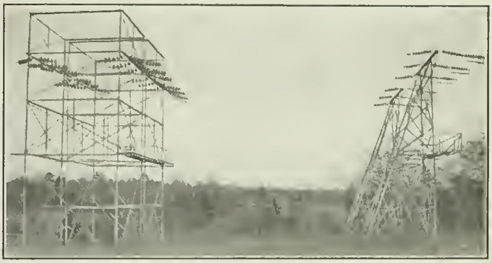


FIG. 17—JUNCTION OF SOUTHERN POWER COMPANY'S AND CAROLINA POWER & LIGHT COMPANY'S LINES

DATA ON SOUTHERN POWER COMPANY'S STATIONS

Location	Maximum Rating	Head, Ft.
Great Falls, S. C.	24,000 kw	72
Rocky Creek, S. C.	24,000 kw	63
Ninety-nine Islands, S. C.	18,000 kw	72
Catawba, S. C.	6,600 kw	25
Lookout Shoals, N. C. (under construction)	24,000 kw	76
Greenville, S. C. (steam)	8,000 kva	..
Greensboro, N. C. (steam)	8,000 kva	..
Mount Holly, N. C. (steam)	8,000 kva	..

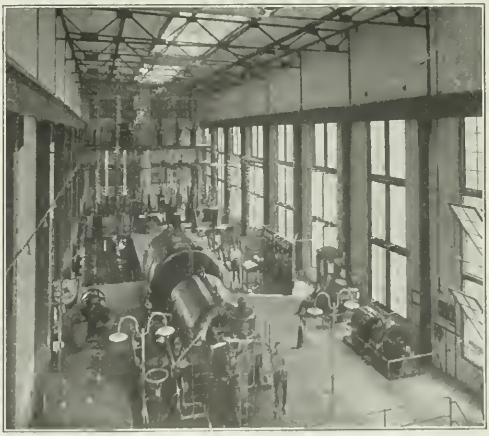


FIG. 18—GREENSBORO STATION OF SOUTHERN COMPANY

Electricity is generated at 2200, 6600 and 11,000 volts, three-phase, sixty-cycle, there being one 8000-kva, 2300-

volt and two 8000-kva, 11,000-volt steam-driven generators, twenty-two 3000-kva, 3000-volt generators, three 7800-kva, 6600-volt generators, four 900-kva and four 750-kva, 11,000-volt generators. The last thirty-three units are of the waterwheel type. There are also connected to the system sixty-five high-voltage transformers having an aggregate rating of 169,400 kva.

The lines of the company cover a territory of 300 miles in a northeasterly and southwesterly direction and 100 miles in a northwesterly and southeasterly direction. The first transmission system of the company was designed for 11,000 volts. With the expansion of the company and its activities, a 44,000-volt transmission system was built, and all of the recent transmission lines erected by the company have been designed for 100,000 volts. All lines are looped in together, and the 11,000-volt, 44,000-volt and 100,000-volt systems are tied together with tie-in transformers. Aluminum and copper are both used for conductors, the size ranging from No. 4 solid copper to No. 000 stranded. By far the greatest amount of the lines are of No. 00 copper stranded and No. 00 equivalent aluminum stranded. This is run on both steel towers and wooden poles with pin-type and suspension-type insulators, depending upon the voltage. There are 103 substations connected to the system, containing 352 transformers with an aggregate rating of 241,162 kva.

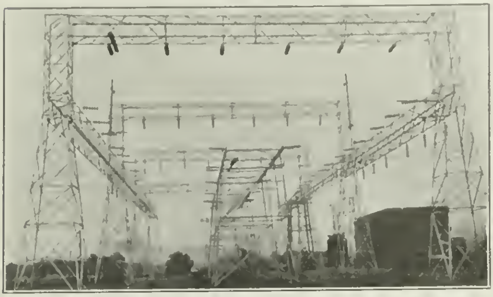


FIG. 19—OUTDOOR STATION OF ALABAMA POWER COMPANY AT ANNISTON

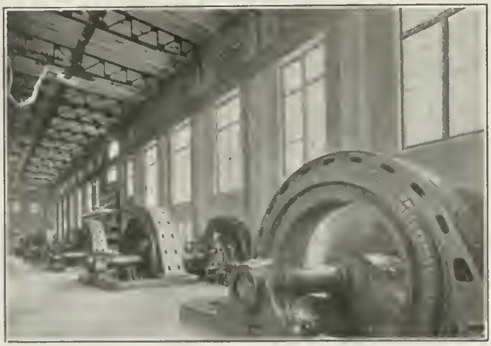


FIG. 20—BLEWETT FALLS STATION OF YADKIN RIVER POWER COMPANY

The circuits of the Southern Power Company are connected on the north with those of the Carolina Power & Light Company with two 00, 100,000-volt lines. The amount of power that can be transferred is limited only by the carrying capacity of these lines, as no transformers are required in order to effect this connection. On the south the Southern Power Company's system is connected with that of the Georgia Railway & Power Company at Tallulah Falls, with two 00, 100,000-volt lines, and the power which can be transferred between the two companies at this point is limited only by the carrying capacity of the lines.

It should be pointed out that the rating of the hydroelectric stations of the Southern Power Company is based upon the continuous rating for the continuous amount of twelve-hour power which the station can generate for eight months in the year. The company maintains three 8000-kva turbo-generator steam plants for emergency and supplementary service. The fires under the boilers are banked, and all three stations can be got under way to feed energy to the lines within fifteen minutes.

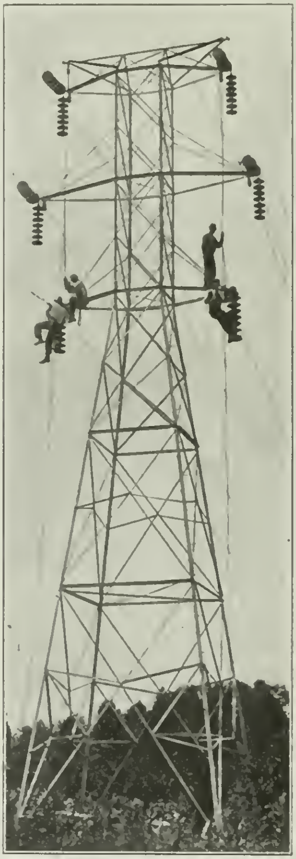


FIG. 21—TRANSMISSION LINE OF ALABAMA POWER COMPANY

On the map are indicated the Portman Shoals generating station, consisting of four 600-kw generators; the Gregg Shoals generating station, equipped with four 500-kw generators, and the Idyls plant, near Winston-Salem, equipped with five 300-kw generators as part of the Southern Power Company's system. These three stations are the property of the Southern Public Utilities Company, as is also the Saluda plant at Greenville, S. C., which contains five generators with a total rating of 2600 kva. The Southern Public Utilities Company has taken over these public utilities, which were formerly owned and operated by the Southern Power Company. These plants are not, however, included in the summary given in the foregoing.

The Carolina Power & Light Company

The Carolina Power & Light Company operates 187.6 miles of high-tension transmission lines, connecting two hydroelectric and three steam stations with the distribution systems in Raleigh, Goldsboro, Henderson, Oxford, Sanford, Jonesboro, Fayetteville, Clayton, Smithfield, Selma, Franklinton, Pine Level and Cumberland. The larger of the hydroelectric plants is at Buckhorn Falls, on the Cape Fear River, and is rated at 3300 hp. The other hydroelectric plant is rated at 530 hp and is situated on the Neuse River near Raleigh. The steam stations comprise a 5000-hp plant at Raleigh, a 950-hp plant at Goldsboro and a 300-hp plant at Henderson. Nine substations are connected to the system, having an aggregate rating of approximately 23,000 hp.

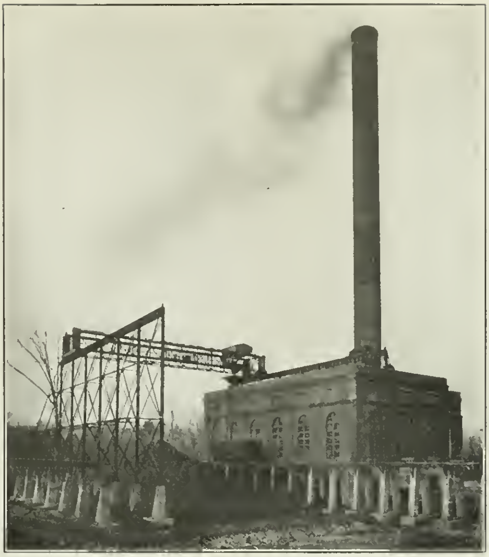


FIG. 22—GADSDEN STATION OF ALABAMA POWER COMPANY

The Carolina Power & Light Company also controls the Yadkin River Power Company, which owns and operates the hydroelectric development on the Yadkin River at Blewett Falls near Rockingham, N. C. This development has an initial rating of 32,000 hp. The company has in operation 185 miles of 100,000-volt transmission lines situated on private right-of-way and 49 miles of distribution lines. Five substations, with an aggregate rating of 4100 hp, are connected to the system, which supplies a number of towns in the Carolinas. The company sells to the Southern Power Company under contract 8000 hp.

Alabama Power Company

The properties owned by the Alabama Power Company include several sites on the Coosa River, one site on the Tallapoosa River, a site on Little River, and sites at Muscle Shoals on the Tennessee River. On these sites approximately 500,000 hp can be developed. The hydroelectric stations of the company at present in operation are located at Lock 12 on the Coosa River, where a head of 68 ft. is available, and at Jackson Shoals, on Choccolocca Creek, where a head of 22 ft. is available. In the Coosa River station, work on which is still under way, there are now four units installed, each rated at 17,500 hp. The Jackson Shoals plant is rated at 2500 hp. Sixty-cycle, three-phase energy is generated at 6600 volts in the Coosa River plant and 2300 volts in the Jackson Shoals plant. The company has at present in operation 180 miles of steel-tower transmission lines equipped with suspension-type insulators and 00 stranded copper cable for transmitting energy at 110,000 volts to four substations over private rights-of-way. The substations are situated at Gadsden, Anniston, Jackson Shoals and Magella near Birmingham. Substations operated at 22,000 volts are in operation at Talladega, Leeds, Lovick, Alexander City, Gadsden and Attalla. The high-tension substations are of the outdoor type. It is the purpose of the company to standardize these as to size and type on 3000, 6000 and 10,000-kva ratings. At present 45,300 kva is installed in the four substations. The company has 25,000 kw of available steam auxiliary apparatus, comprising a 12,500-kw steam turbine station at Gadsden, containing two 6250-kva units, and a 15,000-kw steam turbine and reciprocating engine plant. With the available steam auxiliary of 25,000 kw operating as required and furnishing approximately 7.55 per cent of the total kilowatt-hour output, 62,400 kw of primary power at 50 per cent load-factor can be delivered as soon as another hydroelectric unit is installed. The Anniston substation is a switching station for two 110,000-volt lines which pass through it. The Jackson Shoals substation is also a switching station for three 110,000-volt circuits from the north, south and west. The Magella substation will have an ultimate rating of 67,000 kw.

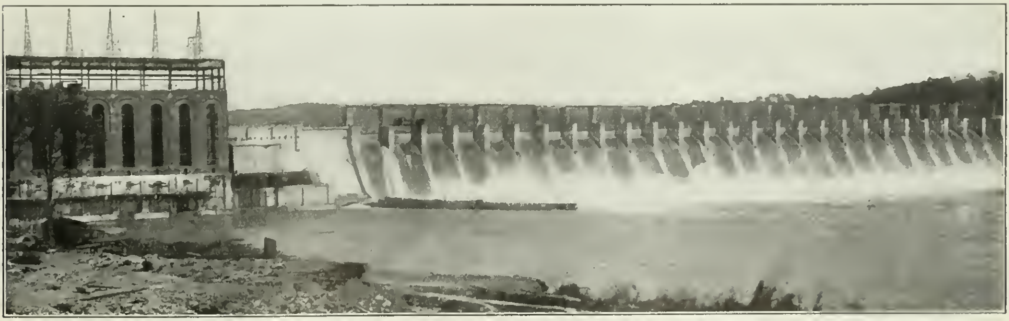


FIG. 23—STATION OF ALABAMA POWER COMPANY AT LOCK 12 ON THE COOSA RIVER

POLE AND TOWER TRANSMISSION LINES

By R. D. Coombs

THE rapid growth of the electric-lighting industry within the last decade has caused an enormous increase in both the number and the length of transmission and distribution lines. From a comparatively unimportant detail of little interest even to the owner, the distribution lines have developed into quite pretentious systems, whose relation to other industries and to the public must be taken into consideration.

The occasional transmission systems of 11,000 volts carried upon wooden-pole lines with spans of 120 ft. have developed into 140,000-volt lines on steel towers, with spans of from 500 ft. to 800 ft., while the light wooden poles supporting a few arc circuits have become in some cases heavy trunk lines.

As is to be expected in a growing industry, no standard has been universally accepted. Moreover, it is impracticable for any one specification or standard of construction to be universally applicable unless such a standard has some elasticity and is interpreted and enforced with intelligence.

In any attempt at standardization it is very necessary to weigh carefully the result, both in cost and in operation, of the adoption of any general mechanical requirement. An assumption appearing innocent and harmless may become very serious if applied to all future construction, through the too common practice of copying or compiling specifications.

The number, size and voltage of the wires and the type of insulation to be used belong to the field of electrical engineering; the subsequent determination of the best method of carrying the conductors across country is purely a question of civil engineering. In the above division of work the terms "electrical" and "civil" are used in their narrow sense, but the division is important as denoting the proper apportioning or departmentizing of the subsequent work. In this age of specialists there is no more reason why the electrician should determine structural details than there is for the structural engineer to decide upon the proper type of insulator. If the layman or worker in another branch of the engineering profession has hesitated to assume authority in electrical matters, the same cannot be said of the average electrical expert in the field of pure construction. This is, no doubt, due to the fact that his brothers in the co-ordinate branch of the pro-

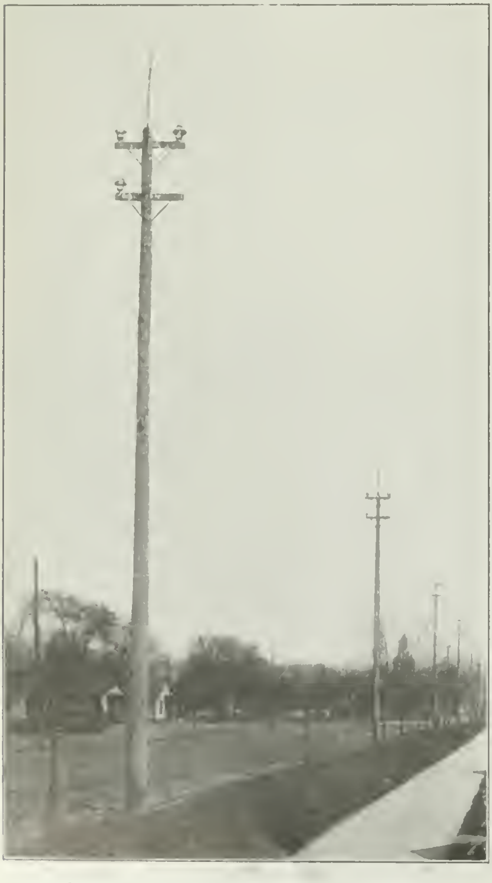


FIG. 1—ONE-CIRCUIT WOODEN POLES, 33,000 VOLTS

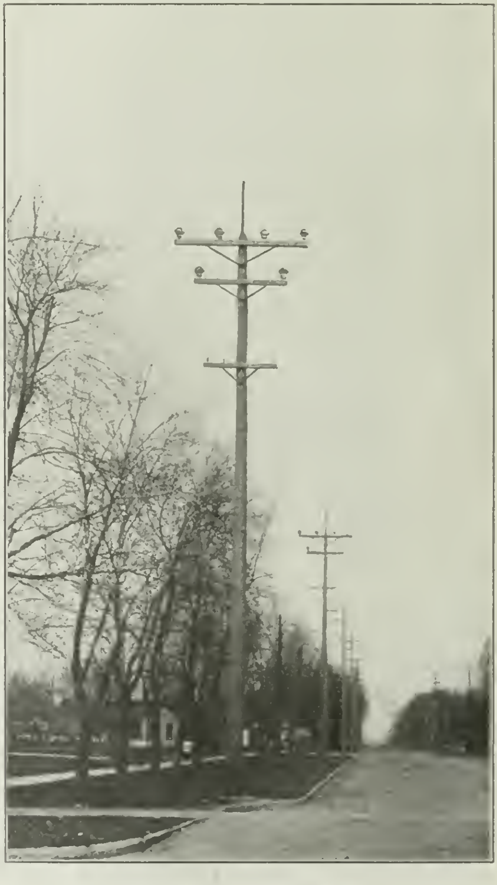


FIG. 2—TWO-CIRCUIT WOODEN POLES, 33,000 VOLTS

fession have done little or nothing to solve the problems properly assignable to the construction engineer.

That this is no imaginary charge is proved by the history of transmission-line construction. Until recent years the rule-of-thumb practices of telephone lines, worthy results of the test of time as many of them are, were followed blindly by those charged with the transmission of electrical energy in large quantities. The natural result is found in the existence of improperly constructed lines and the prevalence of entirely erroneous ideas as to the facts and principles involved. This condition should no longer be permitted to obtain; the electric-lighting industry should advance with some approach to uniformity in all associated lines. If the electrical questions relating to pole and tower lines are being solved with great rapidity, there is incumbent upon some branch of the engineering profession a moral duty to promote proper construction.

It is not the purpose of the writer to deal with purely electrical questions, such as the selection of the size and voltage of the wires as related to the electrical characteristics of the line, or with such very specialized matters as the design of insulators, but with the known laws of mechanics, which have been little changed for ages, and the problem is rather to develop a clear perception of their application to the case in mind.

Type of Line Construction

The type of construction for transmission companies on private rights-of-way may be said to depend on the cost of construction versus the cost of interruptions to service and maintenance. This is also true, though to a less extent, of certain classes of electric lines for railroads.

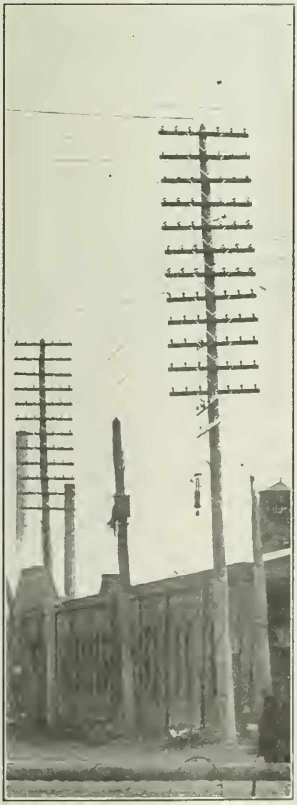


FIG. 3—OVERLOADED WOODEN POLES

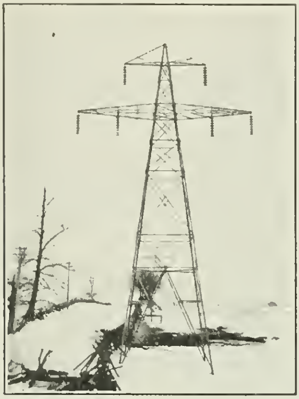


FIG. 4—TWO-CIRCUIT STEEL TOWERS, 110,000 VOLTS

Where the lines of the transmission company are on public property or cross other lines, or when high-tension lines are used by railroads for purposes of electric traction, the cost of failures of construction will be found to exceed the additional cost of good construction.

A decision as to the exact type of line, character of supports and total carrying capacity which will provide the absolute ultimate economy as well as excellence of

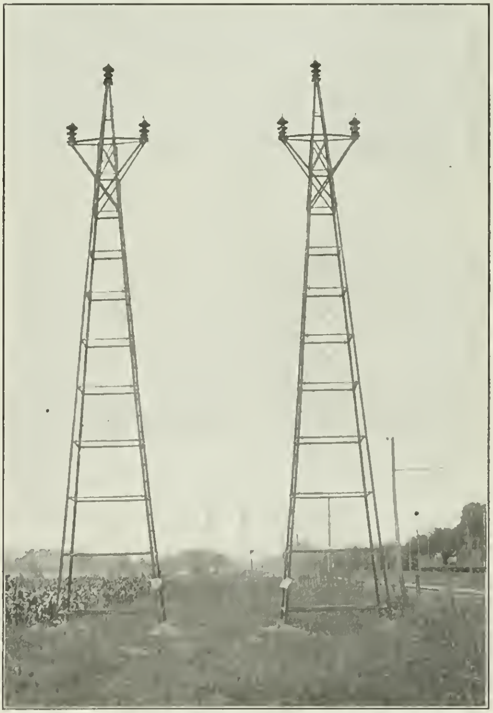


FIG. 5—TWO ONE-CIRCUIT STEEL TOWERS, 60,000 VOLTS

service is perhaps impossible. The best the designer can do is to use good judgment to care for future developments, as well as engineering skill on the immediate construction. The number of years that any line will need to remain in its original location cannot be absolutely foretold. If the line remains in place for a long period of years, will it have any considerable scrap value at the end of that period? If removed, or considerably altered, in a shorter period, the value remaining is scarcely less difficult to determine. Apart from the economic needs of the owner ten or twenty years hence, what may be the effect upon the existence of the line of federal or municipal regulation at some earlier date?

In addition to these considerations, there must also be taken into account the probable future carrying capacity and voltage, the life of the materials, and finally the relative ultimate economy of one or another type of construction as judged by the above conditions.

Carrying Capacity of Supports

Experience, at least with lower voltages, has shown that the desired carrying capacity of the supports to carry additional wires has usually been underestimated. The extremely heavy distribution lines often seen on city streets are not, however, an example of a proper ultimate carrying capacity of the supports but rather of an unwise overloading. Exact maximum limits cannot be set, but the occasional failure of such overloaded lines causes an expenditure which should be a weighty argument for the alternative of more and lighter lines. It is true that two lighter lines will cost more than one heavy line in so far as the actual construction cost is concerned. However, the cost of maintenance and the greater liability of extensive or prolonged interruption to service, if difficult to foretell in terms of money, are not less costly on that account. Many otherwise competent engineers seem to ignore the very real cost in time, money and reputation "saved" by a reduction in the original construction account.

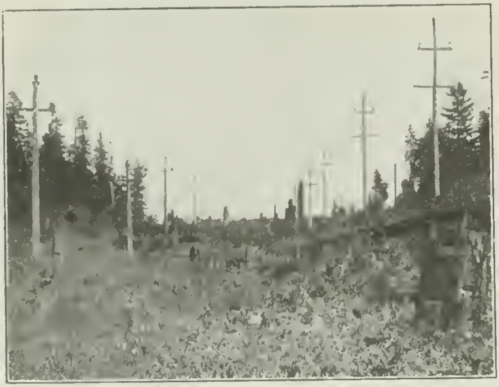


FIG. 6—TWO ONE-CIRCUIT LINES, 55,000 VOLTS

The ordinary wooden-pole lines used for local distribution are subject to more alteration than transmission lines and are affected by conditions not generally applicable to transmission lines, and they are thereby less open to error. In transmission-line construction, on the other hand, the usual decision is whether to provide for one or two, two or four, four or more circuits upon a single line of supports, and in the higher voltages whether to carry one or two circuits.

In the first place, the financial ability or disability of the owner may settle the question without reference to any further considerations whatever. The best may be the cheapest, but it may also be the impossible. Under such circumstances the engineer can only build as well as is practicable with the funds available. Such lines are usually in less populous territory, where the penalties of accident are less severe than in the case of higher grade construction. The natural and entirely proper practice in such a case will be lower supports, longer spans, little future surplus carrying capacity, and lighter structures. It may be noted, however, that proper side clearances, spacing, insulation and guying add but little to the cost compared to the gain in the efficiency of the transmission line.

In what may be called the better grades of construction the number of circuits upon a single support depends very largely upon the location of the line and its present or future voltage. There is quite an important difference between lines upon private rights-of-way and those upon highways or foreign lands. It is not unreasonable to assume that the operating company may utilize any combination of heavily loaded or duplicated lines it chooses upon its own property, though that property will eventually have to be fenced and patrolled. On the other hand, the occupation of highways, etc., by overloaded, or perhaps by any, lines may become subject to criticism. Again, the holding of separated parallel or looped lines has real advantages from the commercial and service standpoint.

Dividing the total number of wires between two or more pole lines cannot be justified as a measure of reducing the cost. Such duplicate lines will always cost more than one heavy line, but the subdivision may be justified on other grounds. In case a different route is given to one line, the maximum security from simultaneous interruption to service is obtained and additional business may be secured, but the cost will be more than that of two lines on one right-of-way and nearly double that of one line of the total current-carrying capacity.

The number of circuits to be carried by a single support depends upon the current-carrying capacity and the continuity of service desired, although to some extent also upon the length of span and the character of the supports. Thus the same weight of conductor, divided between two circuits, affords considerable protection against shutdown with little added cost except for higher poles, larger or more numerous arms, more insulators, etc. The single circuit can, however, be installed with greater spacing and may be used more economically in long spans.

A Frog-Leg Radio Recorder

The nervous and muscular system of the frog has been famous as a sensitive detector of electrical impulses ever since the day of Galvani and his classical observation which led to the discovery of the principle of the electric battery. Very recently, however, C. W. Waggoner, of Morgantown, W. Va., has made some experiments using the same pioneer form of physiological detector for recording the wireless impulses received from the Arlington (Va.) radiotelegraph station. Before the recent meeting of the American Physical Society he exhibited graphs of several inches amplitude recording the one-second impulses of the distant station and showing clearly the gaps marking the ends of one-minute and hourly periods. If anything, said Mr. Waggoner, the nervous system of a freshly killed frog is too sensitive for the best results, and he reported that his own best observations were made with subjects about eighteen hours after preparation.

Adjustable-Speed Polyphase Induction Motor

An eighteen-speed, double-rotor, three-phase motor designed for regulation above synchronous speed. By A. Hoeffleur and M. P. Misslin

ONE of the chief disadvantages of polyphase induction motors consists in the difficulties encountered in obtaining speed regulation without energy loss. To overcome these difficulties a number of methods have already been proposed and practically employed with success, such as speed regulation by means of two induction motors or one induction motor and a commutator motor connected in cascade; changing the number of poles of the induction motors, and the use of three-phase commutator motors. All of these methods of varying the speed of polyphase motors are well known.

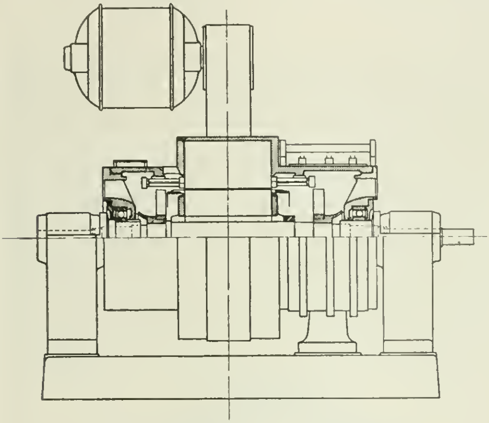


FIG. 1—BELT-CONNECTED MOTOR SET

According to a somewhat less known and little employed method, use is made of two induction motors, of which one—that is, an "auxiliary" motor—drives the inductor of a "main" motor, with variable speed in the same or reverse direction of rotation as its rotor. With this arrangement it is possible to regulate an induction motor also above synchronous speed, whereas all other methods, with the exception of that employing a commutator, allow only a regulation below synchronous speed.

The advantage of the method mentioned above, enabling an asynchronous motor to be run above its synchronous speed, makes this speed-regulation system specially suitable for the drive of all machines demanding very high speeds for their economical operation, such as ventilators, blowers, turbine pumps, etc.

In the new system as actually carried out by the Maschinenfabrik Oerlikon, Switzerland, use is made of machines with pole-changing arrangement for the "main" as well as for the "auxiliary" motor.

Assuming a main motor permitting *n* and an auxiliary motor permitting *m* variations in the number of poles, the new combination will permit the establishment of 2*nm* speed steps. The maximum speed of a standard two-pole induction motor at a frequency of fifty cycles is 3000 r.p.m. With the new "Oerlikon double-rotor" motor it is possible to obtain at this frequency 3750 and more revolutions per minute.

The details of operation of the new method are as follows:

The rotor of a standard four-pole induction motor connected to a fifty-cycle supply system will attain at no-load a speed of 1500 r.p.m. If the stator of this motor, which hereafter may be styled the "main" motor, is made to rotate by means of a suitable device, such as a belt drive or tooth gearing with a ratio of one to four—from an induction motor running at 1000 r.p.m. in such a way that the stator rotates in the same direction as the rotor, the speed of the rotating field of the main motor will be increased by 250 r.p.m.; that is, the speed of the rotating field will be 1750 r.p.m. The rotor of the main motor at no-load will assume synchronous speed with the rotating field; that is, its speed will also be 1750 r.p.m. Both the main and the auxiliary machines operate in this case as motors. The output available at the main motor shaft equals the total watt consumption of both motors less the total of their losses. The auxiliary motor participates in the total output P with an amount equal to $\frac{P \times 250}{1500}$ while the share supplied by the main motor would be

$$P - \left(\frac{P \times 250}{1500}\right)$$

When the auxiliary motor is disconnected from the supply and the stator of the main motor kept stationary by means of a brake, the rotor of the latter motor again assumes a speed of 1500 r.p.m. When the direction of rotation of the auxiliary motor is reversed, so that the stator of the main motor, after releasing the brake and reconnecting the auxiliary motor, rotates again with a speed of 250 r.p.m., but in the opposite direction to that of its rotor, the speed of the rotating field, and therefore also that of the rotor of the main motor, will be decreased from 1500 to 1250 r.p.m. In this case the main motor runs as a motor and the auxiliary motor as a generator.

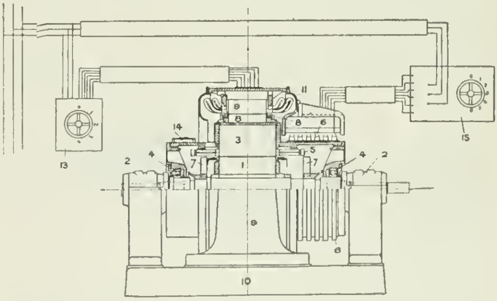


FIG 2—DIRECTLY CONNECTED THREE-PHASE MOTOR SET

Fig. 1 represents schematically a motor set of the kind described. The "stator" (inductor) of the main motor in this instance is driven by belting from the auxiliary motor. When both the main and the auxiliary motors of such a set are built as motors with a pole-changing arrangement, it is possible to obtain a regulation of speed in the ratio of 1 to 4 with twenty-six different steep steps.

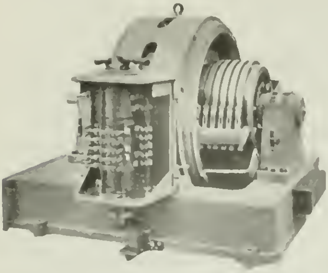


FIG. 3—MOTOR WITH POLE-CHANGER ATTACHED

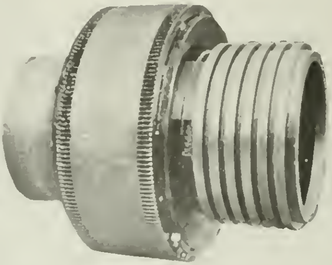


FIG. 4—ROTOR CARRYING INDUCTOR WINDINGS

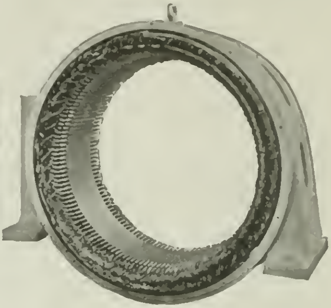


FIG. 6—STATOR OF AUXILIARY MOTOR

By far the simplest arrangement is obtained by directly connecting together the main and the auxiliary motor, as has been effected by the Maschinenfabrik Oerlikon for the three-phase motor set recently built by this firm and represented by Fig. 2.

OPERATING SPECIFICATIONS OF 500-VOLT, FIFTY-CYCLE MOTOR

Speed Steps	Synchronous Speed, R.p.m.	Output, Hp
1	3500	300
2	3375	285
3	3250	280
4	3187	270
5	3000	255
6	2813	240
7	2750	230
8	2625	220
9	2500	210
10	2000	170
11	1875	160
12	1750	150
13	1687	145
14	1500	125
15	1313	110
16	125	100
17	1125	90
18	1000	80

In the following a few constructional dates, test results and illustrations of this motor set will be given.

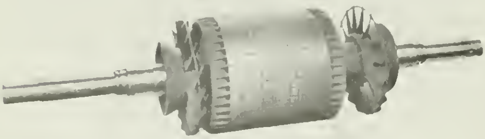


FIG. 5—SQUIRREL-CAGE ROTOR

The operating specifications of this motor, designed for 500 volts and fifty cycles, are given in the accompanying table. This motor will be employed for driving an Oerlikon air-blower, designed for supplying 3 cu. m of air per second, at 3500 r.p.m., at a pressure of 5 m water column, directly coupled with the motor. In order to obtain eighteen speed steps, the main motor with a squirrel-cage rotor has been designed as a two-speed motor, with arrangement for changing from two to four poles. Its synchronous speeds are therefore 1500 and 3000 r.p.m.

The auxiliary motor is a four-speed machine, with two windings and an arrangement for changing from thirty-two to sixteen poles and from twenty-four to twelve poles. The corresponding four synchronous speeds of this motor are accordingly 187, 250, 375 and 500 r.p.m. The rotor of the auxiliary motor is also of the squirrel-cage type, its windings being arranged around the periphery of the rotating inductor (stator) of the main motor.

The combination of the speed steps of the main and the auxiliary motor at the four-pole connection of the former gives the following speeds: 1500 ± 187 r.p.m; 1500 ± 250 r.p.m.; 1500 ± 375 r.p.m., and 1500 ± 500 r.p.m.; that is, a total of eight different speeds.

When running the main motor as a two-pole machine, the speeds obtained will be: 3000 ± 187 r.p.m.; 3000 ± 250 r.p.m.; 3000 ± 375 r.p.m, and 3000 ± 500 r.p.m.; that is, again eight different speeds.

If the auxiliary motor is disconnected and the inductor of the main motor held fast, two additional speeds of 1500 and 3000 r.p.m. are obtained, bringing the total number of speed steps obtainable to eighteen.

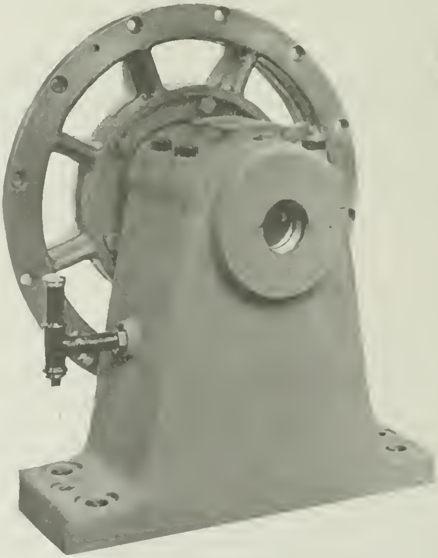


FIG. 7—DOUBLE BEARINGS OF MAIN MOTOR

As will be seen from Fig. 2, the squirrel-cage rotor 1 of the main motor is carried in the two ring-lubricated bearings 2, which are designed for a speed of 3500 r.p.m. The inductor 3 of the main motor is carried by ball bearings 4, resting on the inwardly lengthened main bearings. The ball bearings have been designed for a maximum speed of 500 r.p.m. Six slip-rings 6 are provided for leading the current to the inductor windings 5 and to the device for changing the main motor from two to four poles. The two ventilators 7, fixed on the main shaft, insure efficient ventilation of the main motor. The squirrel-cage rotor 8 of the auxiliary motor is fitted directly on the outer periphery of the inductor 3 of the main motor, whereas the stator 9 of the former is firmly bolted down to the bedplate 10 of the set. The windings 11, equally arranged for pole changing, are led to terminals from which connections 12 are run to the pole-changing switch 13 of the auxiliary motor, fitted close to the stator 9. The pole-changing switch 13 of the auxiliary motor is fitted with a commutating device, permitting the reversing of the direction of rotation of this motor. The commutating device is interlocked with the drum of the pole-changing switch in such a way that the direction of rotation can be reversed only when the primary circuit is open. The starting of the set is effected by means of an auto-transformer 15. This latter is connected to the pole changer for the inductor winding 5 of the main motor.

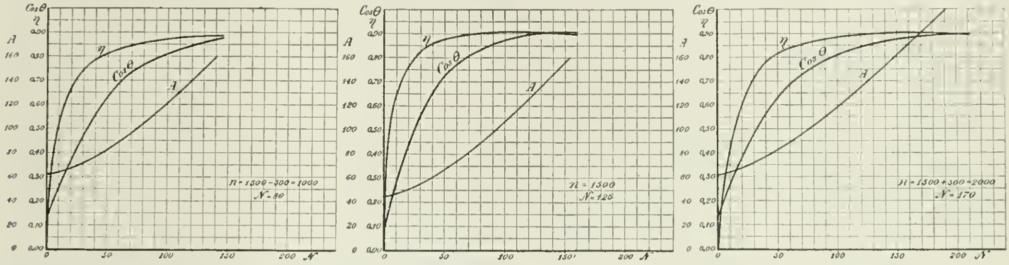


FIG. 8—VALUES OF EFFICIENCIES, POWER-FACTORS AND CURRENTS AS FUNCTIONS OF OUTPUT

The brake 14, serving for holding the inductor 3 of the main motor at the speeds of 1500 and 3000 r.p.m., is operated by the pole changer 13 and automatically released at all other speeds.

Fig. 3 illustrates the complete motor with pole-changer attached, the upper incasement of the slip-rings and the protecting cover of the pole changer having been removed.

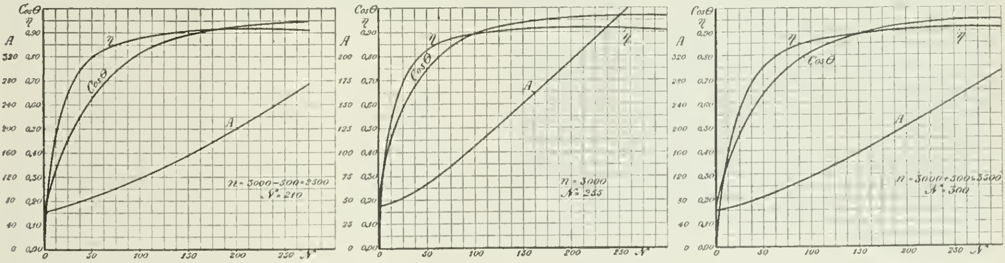


FIG. 9—VALUES OF EFFICIENCIES, POWER-FACTORS AND CURRENTS AS FUNCTIONS OF OUTPUT

Fig. 4 represents the rotor, which carries the inductor windings with the six slip-rings of the main motor and the squirrel-cage rotor of the auxiliary motor, whereas Fig. 5 shows the squirrel-cage rotor of the main motor with its two ventilators.

Fig. 6 illustrates the stator of the auxiliary motor with the two groups of magnet coils. Fig. 7 represents one of the ring-lubricated bearings of the main motor, with ball bearings fitted thereon, which latter carries the inductor of the main motor and the squirrel-cage rotor of the auxiliary motor. These double bearings can easily be dismantled within a quarter of an hour and have given excellent results in actual service.

The starting of the double rotor is effected in the following manner: The auxiliary motor is gradually brought to 187, 250, 375 and 500 r.p.m. by means of the pole changer 13 (Fig. 1), so that its direction of rotation will be reverse to that of the main motor. Then the auto-transformer 15 of the main motor is set on contact 1. In this position the main motor is run as a four-pole machine, receiving only one-third of the normal supply voltage. In about thirty seconds the rotor of the main motor attains the absolute speed of 1500 — 500 = 1000 r.p.m. Then the full supply voltage is applied to the motor by moving the controlling lever of the auto-transformer through position 2 to position 3, which latter is the running position for the four-pole main motor. The maximum starting current is about one-third the normal load current at 3500 r.p.m. The speeds of 1125, 1250, 1313 and 1500 r.p.m. may then be obtained by gradually resetting the handle of the pole changer 13 of the auxiliary motor to the zero—that is, the "off"—position. When restarting the auxiliary motor and running it in the same direction as the four-pole main motor, the speeds of 1687, 1750, 1875 and 2000 r.p.m. will be realized. To increase the motor speed from 2000 to 3000 r.p.m., the controlling lever of the auto-transformer 15 is set on position 4, thereby changing the number of poles of the main motor from four to two and reducing the voltage at the motor terminals to one-third its normal value. In about 50 seconds the motor attains its maximum speed of 3500 r.p.m. The voltage will then again be increased to the normal supply value by moving the lever of the auto-transformer through position 5 to position 6, which latter position is the running position at the maximum speed. The maximum current rush during the starting period equals about the normal full-load current at maximum speed. The intermediate speed steps, 3375, 3250, 3187, 3000, 2813, 2750, 2625 and 2500 r.p.m., can now be obtained by manipulating the pole changer 13 of the auxiliary motor, in the manner described before.

Figs. 8 and 9 give the values of the efficiencies, power-factors and current as functions of the output. Fig. 8 gives these data on three of the lower speed steps—namely, 1000, 1500 and 2000 r.p.m.—resulting from certain combinations of the four-pole main motor with the auxiliary motor. Fig. 9 shows three speed characteristics obtained from the combination of the two-pole main motor and the auxiliary motor. In Fig. 10 the efficiency and power-factor as functions of the speed over the whole range of regulation are shown, assuming the motor running with constant torque.

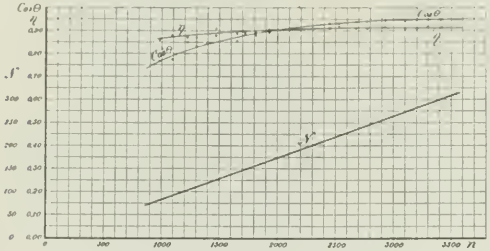


FIG. 10—VALUE OF EFFICIENCY AND POWER-FACTOR AS FUNCTIONS OF SPEED

If the auxiliary machine be built as a slip-ring motor, the speed can be regulated continuously by means of slip resistance. Continuous regulation may also be obtained by employing a commutator machine as the auxiliary motor.

Propagation of Wireless Waves During Solar Eclipse

The eclipse of the sun, Aug. 21, 1914, is expected to present an exceptional opportunity for the study of the propagation of electric waves through air in sunlight and in darkness and across the boundaries of illuminated and unilluminated regions. The eclipse will be total along a strip extending from Greenland across Norway, Sweden, Russia and Persia to the mouths of the Indus. In Russia the duration of totality will be a little more than two minutes.

As pointed out by the committee for radio-telegraphic investigation of the British Association for the Advancement of Science, there are two main points calling for investigation during the eclipse. In the first place, the propagation of signal-bearing waves through air in the umbra and penumbra will probably obey laws different as regards absorption and refraction from those obeyed in illuminated air. In the second place, the strength, frequency and character of natural electric waves and of atmospheric discharges may vary. The variations may occur either because the propagation of natural waves from distant sources is facilitated or impeded by the eclipse or, possibly, because the production of natural electric waves or atmospheric discharges is for some unknown reason affected by the eclipse.

These points have previously been investigated to only a slight extent. The observers of signals during the solar eclipse of April 17, 1912, nearly all agreed that the strength of the signals was greater during the eclipse than an hour before or after. There was only one special observation of strays during the same eclipse, when very pronounced and remarkable variations were recorded during the passage of the shadow-cone across Europe.

To investigate the propagation of signals across the umbra it will be necessary to arrange for wireless-telegraph stations on either side of the central line of the eclipse to transmit signals at intervals while the umbra passes between them. This transit of the umbra occupies about two minutes. It is thus very desirable that the Scandinavian and Russian stations should transmit frequently throughout several minutes before, during and after totality. Stations other than those favored by their proximity to the central line should endeavor to keep a complete record of the variations of signals during the eclipse. Stations in eastern Canada and the United States will probably be affected by the penumbra in the early morning. At Montreal the eclipse (partial) is at its greatest phase at 5.52 a. m. standard time. It is possible that the eclipse may have some influence even when it is invisible.

The investigation of strays is of as great interest as that of signals. So far as is yet known, the natural electric waves reaching wireless-telegraph stations in latitudes higher than 50 deg. appear to travel mostly from the south.

The committee of the British Association will prepare special forms for the collection of data on signals and strays during the eclipse, besides formulating a program of co-operative investigation for stations near the line of totality. Results of this study will afterward be published. Those having the facilities to co-operate in the observations are asked to communicate with the secretary of the committee, Dr. W. Eccles, University College, London, W. C., England.

Exploding Mines by Wireless

In some experiments conducted at Leghorn, Italy, to show the practicability of setting off mines by "wireless," the control apparatus was placed in a small building in a park about 2500 ft. from the two mines to be exploded. These mines themselves were submerged in the sea about 450 ft. from the shore and from 50 ft. to 100 ft. apart. Mr. Manrico Compare, inventor of the control device used, exploded the mines separately with an intervening period of about two seconds. Raised ground, trees, stone fences and buildings obstructed the space between the firing apparatus and the mines, while several wireless stations were in close proximity, but the experiments proved that the destination of the waves could be fixed without interference.

Smoke Prevention by Means of Steam Jets

According to observations recorded by the late Lord Armstrong, steam issuing from an orifice in a boiler is positively charged. Use of this principle for the dispersion of smoke has been the subject of experiments by Mr. G. B. Burnside, of the University of Glasgow, Scotland. In the course of this work aqueous vapor was projected from nozzles placed in the center of a chimney. The steam in its passage through the nozzles was electrified by friction and also partially condensed. In this way a cloud of aqueous vapor, electrically charged, was obtained in the chimney. Each particle of aqueous vapor acted as a center of attraction around which the soot particles congregated and formed groups, which fell down the chimney by gravity. In an experiment with a large school chimney 220 lb. of soot was collected in one month.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

Fourth Anniversary of Electric Shop

To commemorate the fourth anniversary of the opening of its Edison shop, the Edison Electric Illuminating Company, Brooklyn, N. Y., recently sent out attractively engraved invitations to its trade, inviting the people to visit the shop and see the new hot-weather appliances. Heretofore, in demonstrations of this kind, the company has set aside only one day for the event, but this time the entire week beginning May 11 was made available for the purpose. Customers were, therefore, able to examine the various electrical devices more leisurely, and they could repeat their visits and bring their friends with them. The shop was decorated with potted plants and both real and electrically lighted artificial flowers, as shown in the accompanying illustration. Cooks were kept busy preparing various palatable dishes in electrically heated utensils. Music from a cabinet phonograph and an electric piano aided in making a visit to this shop a pleasant experience. In connection with this anniversary celebration the company inaugurated a special sale of electric vacuum cleaners.

INTERIOR VIEW OF EDISON SHOP

The Small Additional Cost of Ice-Making

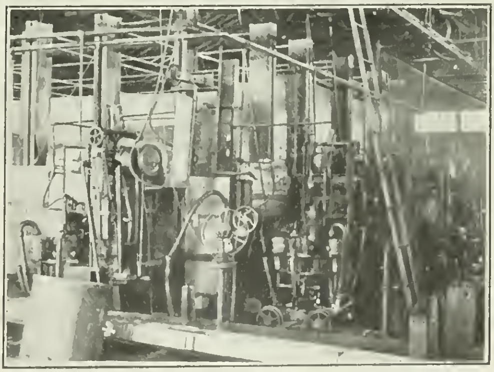
The operator of a small electric-lighting station some years ago added ice-making equipment to his plant and finds that the resulting increase in his total fuel bill has been only about 55 cents for every ton of ice manufactured by his 15-ton refrigerating outfit. During the summer months he had to hire, however, two additional tank men, each at $2 per day, thus introducing an extra labor charge of about 26 cents per ton of ice. Allowing 15 cents per ton for overhead charges and, say, 14 cents for additional expenses, replacements, repairs, etc., made during the year, the total cost of ice-making is brought up to $1.10 per ton for this combination ice-electric station. Ice made under similar conditions in a plant manufacturing ice alone would have cost from $2.25 to $2.75 per ton. The operator above mentioned finds that to operate his delivery system costs about $2 per ton of ice handled. This combination plant can, therefore, deliver to the customer's door at a cost of $3.10 per ton ice for which the purchaser will gladly pay 40 cents to 50 cents per 100 lb., or $8 to $10 per ton. Figures like the above, based on operating experience, indicate some measure of the opportunity awaiting the ice-electric plant.

A Fan-and-Feather Snowstorm

Five pounds of goose feathers, a couple of electric fans and a background set to represent a wintry day were the materials with which an effective electric-fan window display was recently made by Mr. E. A. Booth, new-business manager for the Vicksburg (Miss.) Light & Traction Company. Near the center of the window in crouching posture stood the life-size figure of a man, apparently battling his way through the swirling "snow" which drifted quite realistically about him. Signs reminded passers-by of the cooling effects of electric fans, supplementing the idea already conveyed by the striking window display.

Electricity in Glass Works

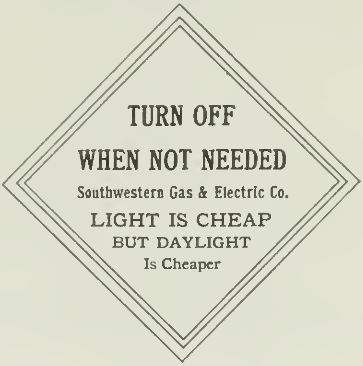
The accompanying illustration shows the plant of the Ball Brothers Glass Company, Wichita Falls, Tex., in which electricity is used exclusively for power purposes despite the low price of natural gas, 9 cents per 1000 cu. ft. The Ball factory makes fruit jars and has a total connected load of 115 hp in individual motor drive, its equipment including one 40-hp, one 25-hp, one 20-hp, three 5-hp and two 7-hp motors. Energy is purchased from the local plant of the Texas Power & Light Company. This glass factory was originally built to be operated electrically and has now been using service for more than a year.



ELECTRICALLY DRIVEN MACHINERY IN GLASS-JAR FACTORY

Discouraging the Waste of Electricity

The Southwestern Gas & Electric Company, Shreveport, La., encourages economy in customers' use of its electric service, and to this end employs cardboard-tag reminders one of which is reproduced herewith. These tags are sent broadcast over the city at intervals of about three months and are intended to be attached to sockets and outlets containing lamps that are sometimes needlessly left turned on. Four or five schoolboys are employed to distribute the tags to the company's customers once a quarter, and each meter setter, meter reader and other employee who comes in contact with the public is also provided with a stock to be handed out to customers, affixed to installations in newly wired houses, etc. Mr. J. E. Cowles, electrical superintendent for the company, reports that the distribution of the tags has had no appreciable effect in reducing the output of the Shreveport system. The generous spirit reflected by the company's action has, however, engendered a feeling of friendliness on the part of the public, who appreciate this evidence of the company's interest in having its consumers "get their money's worth." A direct result has been felt, too, by the reduction of practically one-half in the number of complaints of high bills brought to the company's office.


TURN OFF
WHEN NOT NEEDED
Southwestern Gas & Electric Co.
LIGHT IS CHEAP
BUT DAYLIGHT
Is Cheaper

SOUTHWESTERN GAS & ELECTRIC COMPANY'S "ECONOMY" TAG

No chronic "kicker" can logically complain of his own carelessness when the company's friendly warning hangs before him all the time. The legend on the tag, it will be noted, does not omit an opportunity to remind the reader that "electric light is cheap," even though daylight be cheaper.

A 25-Ton Ice Plant That Is a 38 Per Cent Investment

A Southern town of 3000 population has a combination ice-electric plant, the ice output of which is chiefly shipped to neighboring communities, although there is a large demand for ice in the locality itself. The 25-ton ice-making equipment, including buildings, cost $17,000. It is operated five months in the year with an average gross income of $2,000 per month, or $10,000 for the year. Last season the cost of running the plant, including fuel, ammonia, sawdust, labor and the pro rata of the services of an eighteen-hundred-dollar superintendent, was $3,500, leaving a profit amounting to about 38 per cent on the original investment. A 200-ton storage compartment was recently added and aids the plant in meeting the peaks of demand for ice which come with "hot spells."

Oklahoma Rates and Revenues

Rates, revenues, expenses and other operating data of the seventy-nine central-station plants in the State of Oklahoma, compiled from the official files of the Oklahoma Corporation Commission and supplemented by personal letters and by the McGraw central-station directory, formed the subject of a paper presented before the recent Oklahoma convention by Prof. L. W. W. Morrow of the University of Oklahoma, Norman. These data are reproduced in tabular form on the opposite page.

Oklahoma rates and revenues, as pointed out by the author, are subject to conditions quite different from those in other communities because the state is of recent birth and is in the midst of a tremendous development in population, industries and resources, with resulting demands for an immediate supply of fuel, light and power.

An analysis of the data obtained from the commission's files also reveals a lack of homogeneity in methods of accounting. The larger plants and those controlled by holding companies show marked superiority in accounting methods. Their reports to the commission contain detailed statements of receipts, expenses, interest, depreciation, taxes, etc. A great majority of the smaller companies, however, lump expenses and revenues and omit all mention of taxes, interest on investment, depreciation, allowance, etc.

The rates charged for street lighting, although not reproduced here, show marked variations. The average price for 6.6-amp series arc lamps is $84 per year, and for 100-watt tungsten lamps $25 a year.

A glance at the accompanying fuel statistics shows that coal, oil, gas and wood are used, with coal predominating.

Coal at the mine costs 90 cents to $2.15 per ton, averaging about $1.70. The effect of freight rates is evident in that, although the coal is produced largely in the State, the cost delivered varies from $1.25 to $4.10, with an average of about $2.50 per ton.

Oil varies from 90 cents to $1.70 per barrel delivered and is a state product. Gas varies from 3 cents to 25 cents per 1000 cu. ft., averaging about 8 cents.

The ratio of gross receipts to operating expenses varies from 0.5 to 2.4. Eleven plants are under unity and fifty-eight above, giving a percentage of 18.7 below unity. The ratio is not large in any case, and the general conclusion may be made that the rates are low or expenses high, especially as depreciation and interest on investment are not included in operating expenses.

The data obtainable were too meager regarding interest and depreciation allowance to permit of tabulation. The larger plants and those of the holding companies allowed these percentages, but the large majority did not specify as to these items.

The private and corporation-controlled electric plants of Oklahoma have a total installed rating of 31,912 kw, varying from 30 kw to 6610 kw. The total receipts of fifty-nine plants during 1913 were $2,972,918 and the expenses were $2,058,530, leaving a balance of $914,388, or a ratio of receipts to expenses of 1.45.

The municipal electric plants of Oklahoma have a total installed rating of 6855 kw and range in size from 50 kw to 375 kw.

RATES AND REVENUES OF THE PRIVATELY OWNED CENTRAL STATIONS OF OKLAHOMA.

No.	Location	Name	Bonds	Capital Stock	Gross Receipts	Gross Operating Expenses	Plant Rating, Kw	RATES PER KW-HOUR		FUEL		Receipts per Kw of Plant Rating	Expenses per Kw of Rating	Ratio of Gross Receipts to Gross Expenses
								Residence Lighting, Cents	Motor Service, Cents	Character	Cost Delivered			
1	Ada	Ada Electric & Gas Co.	$75,500	$100,000	$33,048	$21,263	500	12 to 6	8 to 2.5	Coal	$2.90	$66.1	$42.5	1.56
2	Alva	Alva Light & Power Co.	......	20,000	25,205	23,495	365	15 to 7½	10 to 5	Oil	$1.42 bbl	69.1	64.3	1.07
3	Aline	Aline Light & Ice Co.	......	....	....	....	....	15	......	....	......	..	..	...
4	Antlers	Antlers Light & Power Co	......	10,000	4,524	4,792	50	15	......	Coal	$3.15	90.5	95.8	.94
5	Arapaho	Arapaho Light & Water Co.	......	....	.	....	75	......	......	Oil	4½c	......	....	....
6	Ardmore	Ardmore Ice & Power Co	......	250,000	48,831	37,374	905	16 to 8	8 to 5	....	......	54.0	41.2	1.31
7	Atoka	Public Service Corporation	102,000	175,000	19,830	20,296	115	15 to 10	10 to 4.5	Coal	$2 to $3	172.0	174.0	.978
8	Bartlesville	Bartlesville Interurban Ry. Co.	250,000	1,000,000	....	....	1075	......	......	Gas	5c	......	......	......
9	Boley	Boley Light, Power & Mfg. Co.	......	20,000	2,528	2,146	80	10 to 5	......	Oil	5c	31.6	26.8	1.18
10	Broken Arrow	Broken Arrow El. Lt. & Pwr. Co.	2,000	20,000	6,065	5,254	80	15 to 10	6 to 3	Gas	5c	75.8	65.7	1.15
11	Bromide	Bromide Gas & Electric Co.	......	....	....	....	150	.....	......	Coal	$2.10	......	...	.....
12	Caddo	Caddo Power Co.	.....	....	7,200	7,200	50	15	......	Coal	$2.10	124.0	124.0	1.00
13	Chandler	Chandler Electric Co.	.....	5,400	7,319	7,083	120	12 to 6	.....	Gas	.....	60.9	59.0	1.035
14	Checotah	Checotah Water, Light & Ice Co.	10,000	50,000	20,657	17,114	300	15 to 10	10 to 4.5	Coal	$1.95	68.8	57.0	1.21
15	Chickasha	Chickasha Light, Heat & Pwr. Co.	150,000	300,000	43,250	37,920	580	......	5 to 2	Coal	$2.70	74.5	65.3	1.14
16	Chickasha	Chickasha Gas & Electric Co.	200,000	175,000	44,221	33,534	375	8 to 5	7 to 1.5	Water	.....	118.0	89.5	1.31
17	Coalgate	Public Service Corporation	133,000	252,000	3,340	2,631	225	15 to 10	10 to 4.5	Coal	$1.75	14.8	11.7	1.27
18	Collinsville	People's Ice & Light Co.	......	30,000	....	....	185	......	.....	Gas	54c	......	......	......
19	Cushing	Cushing Electric Light & Pwr. Co.	......	15,000	1,600	676	.	10	10 to 5	....	......	......	....	2.36
20	Davis	Davis Electric Light Co.	......	....	3,889	4,000	60	18 to 12	16 to 10	Wood, coal	$2.40	64.7	66.6	.975
21	Duncan	Duncan Electric & Ice Co.	50,000	75,000	14,086	10,670	200	Flat rate $\frac{3}{16}$c; $1.50	14 to 10	Coal	$3.95	70.4	53.3	1.325
22	Durant	Durant Light & Ice Co.	40,000	20,000	44,208	44,667	330	15 to 12	10 to 8	Coal	$2.27	133.3	135.0	.99
23	Dustin	Dustin Light & Power Co.	.....	....	....	....	....	.....	......	Gas	84c	......	.....	...
24	Elk City	Elk City Light & Power Co.	.....	....	....	....	115	15	5 to 2	Coal	$2.60	......	...	.
25	El Reno	El Reno Gas & Electric Co.	272,200	...	82,464	54,355	690	12 to 5	5 to 2	Coal, oil	$3.20-96c	119.0	78.6	1.515
26	Enid	Enid Electric & Gas Co	620,000	939,300	130,846	78,038	1550	15 to 4½	10 to 2.5	Coal	$2.10	83.5	50.3	1.67
27	Eufaula	Pioneer Electric & Power Co.	......	25,000	7,182	6,507	75	15 to 10	84	Buys energy	.....	96.0	87.0	1.10
28	Ft. Towson	Ft. Towson Elec. Light & Pwr. Co.	....	10,000	3,137	2,959	75	15	......	Coal	$3.00	41.8	39.4	1.06
29	Frederick	Foster-Harris Gin & Electric Co.	2,500	10,000	13,643	11,179	100	20 to 10	......	Gas	10.5c	136.4	111.8	1.22
30	Geary	Curtis Brothers Ice & Light Co.	......	....	....	....	....	15c	......	Gas	.....	......	.....	......
31	Guthrie	Public Service Corporation	252,000	425,000	62,177	38,006	1012	15	10 to 3.5	Coal	.....	62.0	38.0	1.635
32	Guymon	Guymon Electric Light & Pwr. Co.	....	40,000		..	75	15	10	Coal	$1.40	...	.....	...
33	Hartshorne	Indianola Ice, Light & Power Co.	20,000	10,000	17,534	11,944	150	15	12 to 8	Coal, oil	$2.75-5½c	117.0	79.5	1.465
34	Hennessey	Hennessey El. Lt., Pwr. & Ice Co.	1,000	25,000	5,851	5,023	115	15 to 10	5 to 3.5	Gas	5c	50.8	43.7	1.165
35	Henryetta	Henryetta Ice & Light Co	10,000	....	7,086	3,689	75	15 to 10	10 to 6	....	......	81.0	49.3	1.65
36	Hobart	Hobart Electric Co.	50,000	50,000	21,488	19,982	340	16 to 2	10 to 3	Coal	$3.11	63.2	58.8	1.08
37	Holdenville	Holdenville Ice & Electric Co.	23,000	50,000	17,797	14,420	225	15 to 10	15 to 7	Coal, oil	$2.75 $1.70	79.0	64.0	1.235
38	Hollis	Hollis Cotton Oil Co.	......	75,000	4,225	..	.	18 to 13	12 to 5	....	......	...	....	...
39	Hugo	Hugo Ice & Light Co.	20,000	50,000	59,832	43,368	360	15 to 8	15 to 8	Coal	$4.10	165.0	120.0	1.38
40	Idabel	Idabel Light & Fuel Co.	.....	....	....	...	..	15 to 9	......	....	.....	...	......	.....
41	Lawton	Lawton Railway & Light Co.	....	40,000	....	....	400	....	6 to 3	Coal	$1.25	......	......	....
42	Lawton	Comanche Light & Power Co.	..	50,000	35,711	31,983	....	15 to 2½	9 to 4	Coal	......	......	..	1.115
43	Lehigh	Public Service Corporation	15,000	25,000	385	556	....	15 to 9	....	Coal	......	..	......	.693
44	McAlester	Choctaw Railway & Lighting Co	391,400	400,000	77,887	33,568	1480	12 to 5	....	Coal	......	52.5	22.6	2.31
45	Madill	Madill Ice, Light & Power Co.	......	...	4,714	4,345	60	12 to 10	..	Gas	25c to 12c	80.0	72.4	1.09
46	Mangum	Mangum Electric Co.	150,000	200,000	30,286	16,268	450	......	4c	Coal, wood	$4.00	67.0	36.0	1.865
47	Millerton	Millerton Electric Light Plant	.....	..	496	859	15	15 to 9	...	...	.	33.0	57.0	.579
48	Muskogee	Muskogee Gas & Electric Co.	1,418,000	2,198,500	495,805	301,557	3400	14 to 2.75	5.5 to 2.2	Coal, oil	..	146.0	88.5	1.645
49	Norman	Norman Milling & Grain Co.	......	125,000	20,972	17,669	350	15 to 6	10 to 6	Coal, oil	..	59.8	50.4	1.186
50	Nowata	Crystal Ice & Power Co	.....	15,000	19,051	7,969	300	11 to 8	6 to 5	Gas	6c	63.5	26.5	2.39
51	Okeene	Okeene Milling Co.	....	10,000	3,493	2,488	60	15 to 12.5	5 to 2.3	Coal	$2.80	58.2	41.5	1.41
52	Oklahoma City	Oklahoma Gas & Electric Co.	2,863,000	2,650,000	1,100,314	740,538	6610	11 to 1.65	.	Gas	10c	167.0	112.0	1.475
53	Okmulgee	Okmulgee Ice & Light Co	40,000	40,000	32,537	17,576	475	15 to 5	6 to 2	Gas	10c	68.6	37.0	1.86
54	Pauls Valley	Washita Electric Power Co.	33,000	250,000	13,977	7,506	375	15	5	Coal	$2.00	37.2	21.4	1.845
55	Perkins	Perkins Electric Light & Pwr. Co.	......	5,000	....	....	30	......	......	Coal	$4.75	......	......	.....
56	Pittsburg	Pittsburg Water & Light Co.	......	10,000	...	....	....	12 to 6	....	....	....	..	....	......
57	Phillips	Public Service Corporation	......	...	..	.	.	12 to 9	9 to 4	....	....	..	..	....
58	Ponca City	Ponca City Electric Light Co	20,000	20,000		.	30	....	....	Coal	$3 to $4	.		.
59	Poteau	Le Flore County Gas & Elec. Co.	250,000	150,000	23,223	12,998	150	10 to 6	.	Gas	3c	154.0	87.0	1.79
60	Pryor	Pryor Ice & Light Co.	......	50,000	....	..	150	15 to 8		Gas	10.5c	.	..	....
61	Ralston	Ralston Elec. Light & Water Wks.	25,000	.	..	..	40	.	.	Oil	4c	....	......	......
62	Sand Springs	Sand Springs Wtr., Lt. & Pwr. Co.	.	50,000	14,792	7,994	.	.	.	....	.	..	..	1.85
63	Sapulpa	Sapulpa Electric Co.	144,000	150,000	39,652	23,975	750	12 to 6	5 to 1.7	Gas	10c	53.0	31.8	1.655
64	Spiro	Spiro Light & Water Works	....	...	.	....	300		.	Coal	$1.75		....	......
65	Stigler	Stigler Light & Power Co.	1,500	15,000	3,422	3,988	75	15 to 5.5	7.5 to 5.5	Coal	$2.50	45.6	53.2	.858
66	Stilwell	Stilwell Water & Light Co.	45,000	15,000	..	.	...	....	......	Coal	$1.65	....	......	.....
67	Sulphur	Sulphur Ice, Light & Power Co.	....	..	11,970	12,125	340	12.5 to 8.5	...	Oil	68c	35.2	35.6	.988
68	Tahlequah	Tahlequah Light & Power Co.	40,000	30,000	11,090	10,248	125	15	5 to 3	Coal	$2.50	88.8	82.0	1.08
69	Talihina	Talihina Light & Power Co	.	5,000			35		..	Coal	$2.10			......
70	Tishomingo	Tishomingo Light & Power Co	...	15,000	2,772	5,470	325	15 to 10	10	Buys energy	.	8.55	16.8	.508
71	Tulsa	Public Service Corporation	784,000	1,325,000	22,430	13,750	2380	11 to 8	5	...	..	9.42	5.8	1.635
72	Vinita	Public Service Corporation	193,000	325,000	3,613	3,064	350	15 to 5	10 to 2.5	Coal	$2.50 to $2.75	10.3	8.75	1.175
73	Waurika	Waurika Ice & Electric Co	6,200	28,300	10,688	9,704	75	15	7.5 to 5	Oil, coal	....	142.0	128.0	1.095
74	Weleetka	Weleetka Light & Power Co	.	50,000	6,800	4,100	75	15	15	Coal	$2.32	90.0	54.8	1.655
75	Westville	Westville Light & Power Co	.	...	2,856	2,780	60	15	12.5	Coal	.	47.6	46.3	1.03
76	Wilburton	Dequan-McConnell Elec. Lt. Co.	..	12,000	12,912	10,184	150	15 to 9	9 to 5	Coal	$2.50	86.2	67.8	1.27
77	Woodward	Woodward Cotton Co	.	55,000	10,909	13,048	100	10 to 8	7 to 4	Coal	$3.70	109.0	130.0	.84
78	Yukon	Yukon Electric Co.		5,000	2,838	2,103	125	15 to 10	......	.		22.6	16.8	1.85
79	Shawnee	Shawnee Gas & Electric Co	776,000	863,000	195,277	165,114	1495	15 to 10	10 to 5	Gas	10c to 25c	130.3	110.3	1.18

Comfort in the Home Afforded by Electricity

Mr. Arthur William Hardigan, of the Western Electric Company, delivered a lecture in the Craftsman Building, New York, on May 12, on home comforts obtained by employing electric labor-saving devices. He called attention to the difficulty of securing servants and pointed out that industrial organizations employing girls pay wages and offer working conditions which make domestic service less desirable. Unless housework is made more attractive by installing labor-saving devices in the home the problem of securing good servants will become still more serious. By employing electric devices work can be performed more efficiently and at less expense than when manual labor is relied on. The speaker recommended that home managers follow the same policy as industrial concerns, by installing labor-saving devices wherever convenience, sanitation, comfort and efficiency can be bettered.

In commenting on the expense of doing household washing, Mr. Hardigan said that in general a laundress must be paid from $1.50 to $1.60 per day besides giving her one or two meals. Assuming that one washing is done each week, the cost would be about $100 a year, or $500 in five years, for labor alone. In addition there is the wear and tear on the goods washed caused by friction on the rubbing board. The speaker said that replacements necessary because of wear during washing cost about $80 per year in a moderate-sized family. The total washing expense, to say nothing of the inconvenience occasioned by having the work manually performed, would therefore amount to about $900 in five years.

When an electrically operated combined washer and wringer is employed hot soapsuds are forced through the mesh of the fabrics without wearing them out. As there is practically no manual labor except that of starting and stopping the machine and transferring the clothes from one place to another, a maid employed for general housework can be utilized to care for the washing.

An electric washer for a family of five costs about $85. Adding 4 per cent compound interest and the cost of supplying energy for operating the machine (at 2 cents per hour), the total washing expense in five years is about $113.85.

Another application of electricity in the home is that of vacuum cleaning. Besides being less laborious than the old method of using a broom, vacuum cleaning is more thorough, more sanitary and less harmful to the fabrics cleaned. Disease germs are liable to be carried into the lungs on dust particles, but these are not spread through the air as when sweeping with a broom. In addition, the furniture and woodwork are not covered with dust and consequently do not have to be wiped off subsequent to cleaning.

Mr. Hardigan cited a case where a 4-ft. by 8-ft. rug received the customary beating, shaking and sweeping necessary with hand cleaning. A vacuum cleaner then used on the supposedly clean rug removed two solid cupfuls of finely powdered dust, thereby showing how ineffective the old method of cleaning is. It costs about 1 cent or 2 cents an hour to operate an ordinary household vacuum cleaner.

The use of electric flatirons was compared with that of the ordinary sadirons heated on a stove. The work of ironing fifty-five pieces for a family of three (man, woman and child) was performed with stove-heated irons in four hours and five minutes. During that time it was necessary to make forty-four trips to the stove to exchange cold irons for hot ones. The same work done with an electric iron required two hours and thirty-five minutes and no exchanging of irons was necessary. Besides saving time and trips to a stove, the electric iron is much more convenient to work with because the heat is radiated in a useful direction and not into the room. In a home where 100 or more pieces of flat work have to be ironed each week it is economical to employ an electric mangle.

Among other appliances recommended for use in a moderate-sized family were exhaust fans for kitchens, motor-driven sewing machines, electric heating pads, toasters, percolators and chafing dishes.

The real work of sewing is eliminated and the operation made a pleasure when sewing machines are motor-driven. Thus equipped, a sewing machine can be operated for about 0.3 cent per hour. Electric heating pads lack the objectionable feature of hot-water bags and furnish gentle, soothing and uniform heat. They may be operated at about 0.5 cent per hour. Toasters permit of making fresh, crisp toast as it is wanted. About twelve slices can be toasted for 1 cent.

Pumping City Water by Electricity

Mr. John M. Bryant, assistant professor of electrical engineering at the University of Illinois, read a short paper entitled "Pumping City Water by Electricity" at the annual meeting of the Illinois Water Supply Association, held at Urbana, Ill. He said that electrical equipment costs about 25 to 50 per cent as much as steam-driven pumping units. It is believed that the cost of the power-plant equipment and buildings of water-works systems represents a little over 15 per cent of the total cost, new, of the entire equipment. Reducing this by 25 per cent will make the first cost something like 11.4 per cent. This will, in turn, affect the cost of operation by 1.7 per cent of the present cost of operation for the steam-driven station.

In relation to cost of operation the author pointed out that the cost of motor repairs is negligible, in comparison with those of steam-driven or gasoline-driven units. The cost of motor attendance may be made very small. There is practically no cost for lubricating oils. The maintenance item of banked boilers to be available in case of fire is done away with. Depreciation is less, as is also interest on investment, as heretofore explained. Electrical energy may be purchased (if available) at a low rate, as the load is a desirable one.

The electric motor is more reliable than the steam or gasoline engine. In order to increase the reliability of the whole system Professor Bryant made these suggestions:

"1. The motors should be placed above all possible flood levels. Although a few cases are known of motor-driven mine pumps operating under water and pumping the mine dry, the insulation is not usually guaranteed to stand such treatment.

"2. Instead of installing one large motor and pump to furnish the total amount of water for the high-pressure service at least two units, and preferably three, should be installed. When installing three units the combined capacity of any two should be able to supply the peak load of the station. This method of design allows the unit or units in operation to run without throttling and at their full capacity.

"3. When the pumping station is situated at some distance from the power plant duplicate pole lines should be installed and over routes widely separated. When the wires pass through city streets a fire in a given quarter may destroy one pole line but service may be maintained over the other line. Repairs may also be made on either line and at any time without interrupting the operation of the station."

Illumination and Wiring

Ornamental Lighting in Pacific Coast Town of 1000 Inhabitants

The town of Cashmere, Wash., is proving itself a progressive community by establishing a street-lighting system that might well elicit the emulation of a much larger place. The installation of its new tungsten street lamps covers 13,000 ft. of street, including the entire business district and the principal parts of the residence section. There are 131 lamps in all and they are spaced from 100 ft. to 125 ft. apart. Each standard is equipped with one 60-cp tungsten lamp, which is inclosed in a 16-in. white globe. In the business district pressed-steel lamp-posts are used. These posts are so designed that two or four globes can be added, making three or four clusters as desired. In the residence district a steel pole is mounted on a concrete base, as shown in Fig. 2. The latter was designed by City Engineer J. M. Crome.

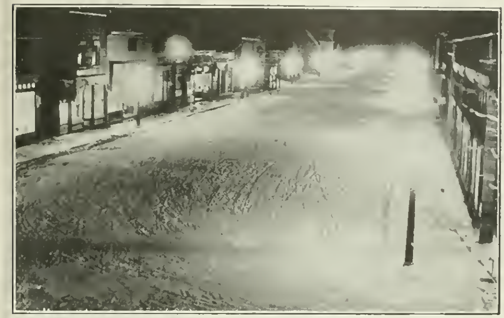


FIG. 1—NIGHT VIEW IN CASHMERE'S PRINCIPAL BUSINESS SECTION

Energy for the lighting of these lamps is obtained from the municipal plant and conveyed through lead-covered cable laid in 0.75-in. iron conduit under the concrete sidewalks. The turning on and off of the energy is accomplished by a Campbell automatic time switch. In order to obtain the maximum ornamental effect, the telephone and transmission-line poles were removed to the alleys wherever possible. The cost of the street-lighting system was approximately $16,500.

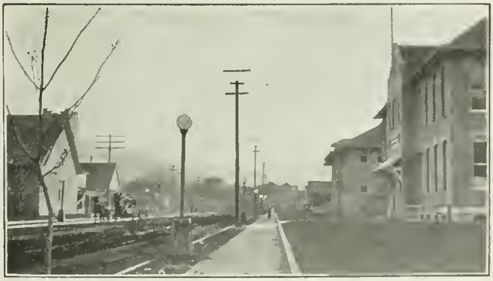


FIG. 2—ORNAMENTAL POSTS USED IN RESIDENTIAL SECTION OF CASHMERE

It may well be doubted whether the lighting system now in operation in Cashmere is excelled by that of any other place of such small size in the whole of the United States.

Nitrogen-Filled Lamps for Interior Lighting

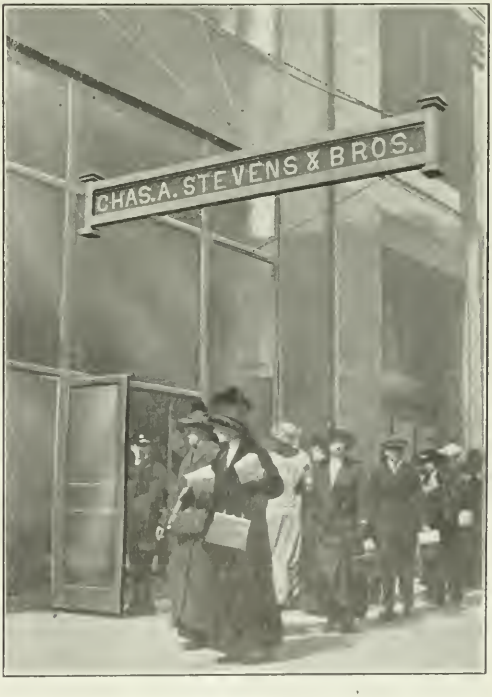
In the new portion of the Fisk Street generating station of the Commonwealth Edison Company of Chicago nitrogen-filled tungsten lamps are used for general interior illumination with success. To illuminate a floor space of 60 ft. by 200 ft. ten 750-watt lamps are used. The lighting units are suspended 50 ft. above the floor in two rows, so that they are about 33 ft. apart. The lamps have to be suspended at the considerable height mentioned in order that the traveling crane may clear them.

Light distribution from side-wall brackets or from posts is open to objection in large generating stations, and the new high-efficiency gas-filled incandescent lamps suspended from the roof structure seem to be well adapted for this purpose. In the Fisk Street installation enameled-steel reflectors are used, and to a large extent local illumination around gages, instruments, valves, etc., seems to be unnecessary.

Outdoor Miniature-Lamp Letter Sign

The sign shown in the accompanying illustration is made up of 6-in. letters illuminated by miniature lamps. It is similar to the indoor signs using 3.5-in. letters; the letters, however, are made of larger glass tubes. The filaments are like those used in the smaller lamps, but when energized are more brilliant. The sign is double-faced and is finished in natural bronze. Plate glass is placed over the lettering to make the sign weatherproof.

This sign was installed by the Federal Sign System (Electric), Chicago, Ill.



OUTDOOR SIGN ILLUMINATED BY MINIATURE LAMPS, FORMING 6-IN. LETTERS

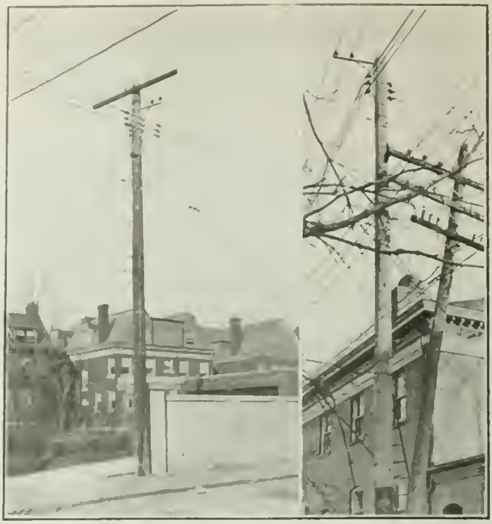
Reducing the Cost of Line Construction

Comparative tests conducted in St. Louis, Mo., seem to show that the cost of overhead distribution line construction may be reduced to nearly one-third its former value by the use of a combination primary-secondary distribution rack. In addition to the economic record shown, the distribution rack has the further advantage of presenting a neat and finished appearance on the poles. For this reason the alley between Westmoreland and Portland Places, exclusive residence districts in St. Louis, was selected as the site for the experimental line. The site of the experimental standard line was in another part of the city. In all fairness it should be said that the standard line was built on a street free from trees and obstructions, under more favorable conditions than was the bracket line, where there were alley fences to be climbed and carefully kept lawns had to be avoided. Equal numbers of secondary services were installed on each line, making the necessary labor as nearly identical as possible.

DATA ON COST OF BUILDING DISTRIBUTION SYSTEM

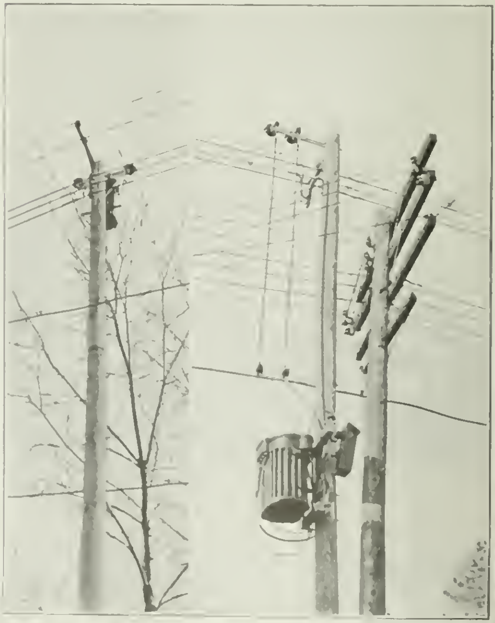
STANDARD PRIMARY-ARM CONSTRUCTION	
Material:	No. of Pieces
Primary arms	15
24-in. cross-arm braces	30
0.625-in. by 12-in. machine bolts	15
0.625-in. by 5-in. lag screws	15
Pins	30
Clamps	15
Square washers	30
Labor:	Hours
Seven piece, one and one-half hours each	10.50
Automobile	1.50
STANDARD SECONDARY-ARM CONSTRUCTION	
Material:	No. of Pieces
Secondary arms	15
24-in. bracer	30
0.625-in. by 14-in. machine bolts	15
0.625-in. by 5-in. lag screws	15
Pins	60
Through-point spreaders	30
Malleable pole-back brackets	15
2-in. by 0.25-in. lag screws	60
Labor:	Hours
Seven piece, one and three-quarter hours each	12.25
Automobile	1.75
Extra team to haul arms	21.00
Driver	21.00
MATERIAL AND LABOR TO APPLY ON COST OF LEAD AND OIL PAINT	
Material:	Amount
White lead in oil, 1 lb	10.0
Boiled linseed oil, gal	1.5
Turpentine, gal.	0.5
Japan drier, pt.	0.25
Dry red mineral, lb.	4.33
Labor:	Hours
One man painting	2.5
Two men fitting up	5.0
Total cost	$116.13
COMBINATION DISTRIBUTION RACK CONSTRUCTION	
Material:	Number of Pieces
Brackets complete	1
0.625-in. by 12-in. machine bolts	30
Square washers	30
0.375-in. by 2-in. machine bolts	15
Western Union pins	30
Labor	Hours
Three men, two hours each	6.0
Automobile	2.0
Total cost	$45.24

As will be noted from data in the accompanying tables, the cost of building the standard primary-secondary distribution system, inclusive of material, labor, painting, extra haulage and overhead charges, was $116.13. For the competing line using distribution-rack construction the cost was $45.24, no charge being included for extra haulage, as the crew were able to carry all material in the gang automobile. These figures show that the standard construction really cost two and one-half times as much as the distribution-rack construction, although the former was built under the more favorable conditions. Data in the accompanying tables show what material was used and give total costs.



FIGS. 1 AND 2—COMBINATION PRIMARY AND SECONDARY DISTRIBUTION BRACKET

The distribution racks, which will be marketed by W. N. Matthews & Brother, of St. Louis, consist of a



FIGS. 3 AND 4—METHODS OF HANGING TRANSFORMER WHERE BRACKETS ARE USED

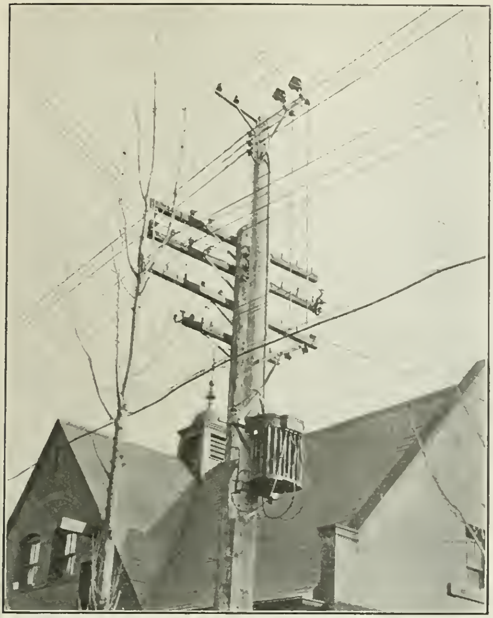


FIG. 5—TRANSFORMER INSTALLATION

combination of a channel-iron primary arm, a malleable-iron secondary rack with three pins integral therewith, and a transformer bar iron rack, all held together by one stud bolt, the horizontal or primary line arm being braced by means of a channel strut set in the right angle at 30 deg. to the horizontal member. Western Union type pins are used to support the primary line, while the secondary pins are cast integral with the vertical channel. Two through-bolt suspension has been used in St. Louis, but a single stud bolt with a lag screw in the lower hole may be utilized satisfactorily. Two views of the distribution rack are shown in Figs. 1 and 2.

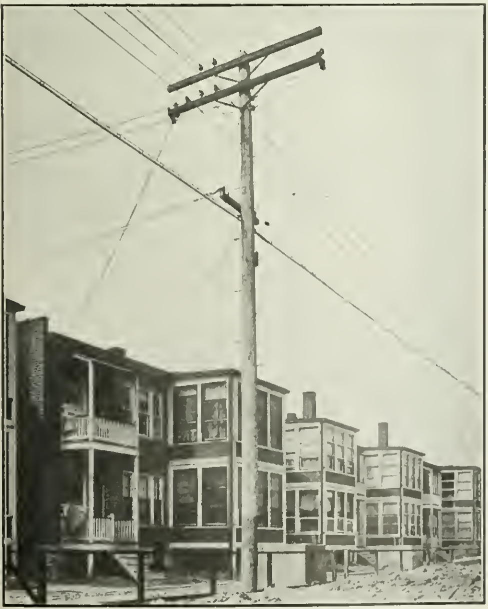


FIG. 6—TYPE OF CONSTRUCTION ON COMPETING LINE

For mounting transformers where distribution-rack construction is used a special hanger (Fig. 3) has been designed. In this illustration are shown the primary taps leading to fuse plugs mounted on pins at the extremities of the triangular bar-iron transformer support. No additional pole bolts are needed, as the 0.625-in. stud bolt fastening the top of the distribution rack is also used to carry the transformer hanger, the nut being backed off and a hole in the horizontal bar of the triangular iron piece being slipped over the bolt. A lag screw driven into a hole at the lower apex of the triangle prevents motion in any direction. Fig. 4 shows another method of hanging a transformer at a lower point on the pole and also shows some of the older type of construction which is being replaced by the improved design.

Fig. 6 shows a pole of identical construction with those put up in the standard line built for comparison with the distribution rack, the only difference being that the other line was built in a private alley instead of on an open street.

Recent Telephone Patents

To Mr. Homer J. Roberts, of Evanston, Ill., a patent has been granted for a circuit and key arrangement for introducing party-line ringing. Here the special keys for party-line operation are arranged in a master set for each position, the group being wired in multiple to all the cord pairs of the position. Connection to each cord pair is effected through a key individual to that cord pair and having a locking position. The patent has been assigned to the Homer Roberts Telephone Company.

Combined Telephone and Recording Systems

A combined telephone, fire-alarm and watchman's recording system has been patented by Mr. L. W. Miller, of Rochester, N. Y., and is assigned to the National Police Signal Company. The watchman on his rounds leaves the usual record on the clock system by removing the receiver from the hook. The clock is then cut out and the call extended to the switchboard. The operator can check with the watchman. If the watchman leaves the receiver off the hook but closes the door of the box at any station, this latter action restores the circuits. The fire alarm is of the usual manual type and is operated by breaking a glass and pressing a switch. The operator sets a return signal for the sender.

An entirely different kind of recording system is that of Mr. C. J. Gustafson, of Aberdeen, S. D. He provides a phonograph arrangement for a telephone first to advise the calling party of the condition of affairs and then to record any reply or replies. This apparatus is intended for use during the absence of the owner.

Muffler to Fit User's Face

A muffler comprises the invention of Mr. A. Dare, Philadelphia, Pa. This is a cone of special contour to fit the face of the user. An air vent of special construction is the feature of novelty. This is a sort of hollow button which screws into the side wall of the muffler. A partition is arranged so that two confronting relief passages are formed, the actual outlet being through a saw slit.

Letters to the Editors

Power Bond Election in Los Angeles

To the Editors of the Electrical World:

SIRS: In the issue of the *Electrical World* of May 9 appeared a news item, under the heading "Power Bond Election in Los Angeles," containing certain statements from "a telegram to the *Electrical World* on May 7," which form altogether a one-sided representation of conditions here. Exception must be taken to the statement attributed to Mr. J. A. Lighthipe, that "the plant of the city cannot be finished for the amount estimated." Mr. Lighthipe no doubt made such a claim and submitted figures in support of his claim, but the City Council of Los Angeles employed three independent and competent electrical engineers—Prof. C. L. Cory, of the State University; Dr. George L. Hoxie, consulting engineer of New York City, and Mr. C. W. Koiner, manager of the Pasadena Municipal Plant—in November last to make estimates and report regarding installation and operating costs of an appropriate and modern electrical distribution system for the city of Los Angeles, which report shows that the statements of the city's engineers are conservative, while the claims of the local electrical companies are about 50 per cent in excess of such figures.

The statement that the writer "admits the insufficiency of the estimate" is in error, if it is intended to refer to the estimate for completing the generating works, and is wholly misleading if it refers to the estimate for providing a system for the distribution of the city's electrical energy. This is shown by the accompanying report addressed to the Los Angeles Board of Public Works, upon request, during the bond campaign, and signed by Mr. William Mulholland, supervising engineer; Mr. E. F. Scattergood, chief electrical engineer; Profs. W. F. Durand, O. H. Ensign and Harris J. Ryan, board of consulting engineers. This report was called for by a citizens' publicity organization, "the people's power bond committee," and was desired because of the misrepresentations of the local electrical companies in their talks and literature, and it contains a brief statement of the whole situation, which should be convincing as being prepared and signed by four engineers, every one excepting the writer being of national reputation.

While it is correct that "entire pages for advertisements" were used in the daily newspapers, as stated in your issue of May 9, it should have been made plain that this activity was displayed by the electric companies and not by the people's power bond committee. It should have been stated that the people's power bond committee was made up of 100 representative citizens, men and women, appointed by and representing many of the most prominent civic bodies and clubs in the city, including, among others, the Chamber of Commerce, the Friday Morning Club (women's), the Municipal League, the Central Labor Council and the City Club.

For eighteen months the municipality has attempted to work out an agreement with the private interests in order to enable the city to realize proper benefits from its aqueduct development and the municipal distribution of the same, by the utilization of the existing distributing systems. The city offered to lease all of the existing systems for a period of five years, in order to give the companies ample time in which to adjust their affairs, and to purchase, at the end of the lease, at a rental and price to be fixed by the State Railroad Commission. The electric companies having refused to enter into such an arrangement as to lease and purchase, the city is now undertaking to acquire the property by condemnation, the price to be fixed by the State Railroad Commission, in accordance with the State law.

E. F. SCATTERGOOD,
Chief Electrical Engineer,
Bureau of Los Angeles Aqueduct Power.

Los Angeles.

[The report referred to is printed in full below.—Eds.]

LOS ANGELES, CAL., May 4, 1914.

To the Honorable Board of Public Works, Los Angeles, Cal.

GENTLEMEN: The following is presented in response to your request for a statement by your engineers of the Bureau of the Los Angeles Aqueduct Power:

Power Fund Expenditures to Date.—The proceeds derived from the bond issue of $3,500,000 have been expended as follows:

Waterways leading to San Francisquito Power Plant No. 1	$480,000
Waterways leading to San Francisquito Power Plant No. 2	1,304,000
Hydraulic and electric machinery and equipment for Plant No. 1 and receiving substation, of 37,500-hp capacity	766,000
Construction work on same	624,000
Transmission line surveys, rights-of-way and equipment	326,000
	$3,500,000

Completion of Generating System.—Of the proposed $6,500,000 bond issue, $1,250,000 will complete the generating works now under construction for delivering the 37,500 hp at a central substation in the city and will be used for such purpose in the following amounts:

Waterways leading to the No. 1 and No. 2 plants	$315,000
Generating Plant No. 1 and receiving substation	480,000
Transmission lines and rights-of-way	455,000
	$1,250,000

Acquisition of Distributing System.—The remainder of the proposed bonds, $5,250,000, will be used to provide a system for the distribution of the city's power. The city attorneys advise, and the Council has declared in favor of, acquiring existing distributing properties by condemnation, at prices fixed by the State Railroad Commission. Such a policy would insure to the companies a fair compensation for their properties, and though the cost would be greater than that of installing an independent system, it would eventually eliminate all competition and thus enable the city to realize greater benefits in rates and profits.

It is impossible to know what values the State Railroad Commission would fix, but the proposed bonds should unquestionably provide for proper street lighting throughout the city and for the acquisition of the complete distributing system of the Southern California Edison Company, which would serve the city's immediate purposes better than either of the other two systems.

This would insure to the city 55 per cent of the total business immediately upon the issuance of the distributing bonds, would insure reduced rates alike to all classes of consumers in every part of the city, would eliminate taxes for power bonds, and would yield a large annual net profit from the start, which could be applied to interest payments on aqueduct bonds, thus further reducing taxes, or to the extension of the electric system.

Under such circumstances the acquisition of the other systems, as needed, to cover the whole city, whether by bonds or surplus, or both, would be wholly taken care of by the business, without one dollar of additional taxation.

Net Profit from Sale to Companies.—Should the power companies contract to purchase the full output of the city's 37,500-hp plant at 0.65 cent per kw-hr. (which is the highest price ever suggested by them), the annual net profit to the city would be but $130,000. Furthermore, the wording of the companies' proposition is such as not to guarantee to the city that they will take any power whatever.

Net Profit from Municipal Distribution.—The yearly net profit to the city from the distribution and sale by the city of the power from this same plant, at present rates, for domestic and commercial light and power and street lighting would be $1,300,000. Or, should the city distribute and sell the same at rates averaging 10 per cent less than those proposed by the city's Board of Public Utilities for the coming year, an annual net profit of $750,000 would be realized. In either case the combined benefits in rates and profits would be the same.

Equal net profits and benefits are shown by the special board of electrical engineers employed by the Council in November last. Respectfully submitted,

Wm. Mulholland, *Supervising Engineer.*
E. F. Scattergood, *Chief Electrical Engineer.*
W. F. Durand, O. H. Ensign, Harris J. Ryan,
Consulting Board of Engineers.

Co-operation Essential in Conciliation

To the Editors of the Electrical World:

Sirs:—In his letter relative to "The Attitude of Conciliation," which appeared in the *Electrical World* April 25, Mr. S. M. Kennedy brought out some very good points with reference to relations between public utility companies of to-day and their patrons. There are certain other suggestions of value which would aid materially in producing courteous treatment of the public by employees which he did not bring forward in his letter.

No doubt the attitude of conciliation on the part of corporation employees will accomplish wonderful results toward gaining the confidence of the public in general; but, as "charity begins at home," why not broaden the scope of this attitude so as to make it applicable among employees in their dealings with each other?

The attitude of conciliation as applied to employees dealing one with another may be compared to the advancement of the electrical science of present-day lighting. By reflection, indirect lighting produces a soft, mellow light, evenly diffused, which is pleasing to the eye and does not produce the glare found with direct lighting. So a spirit of co-operation and courteous treatment among superiors and subordinates in public utility companies reflects a certain influence which is productive of true conciliation, "the kind that flows from the heart," in their dealings with the public and commands public confidence.

The success of any enterprise depends largely on the personnel of the organization and the amount of co-operative spirit existing among the individuals composing the operative force of the enterprise. Perfect harmony should exist in the organization of utility companies in order that a harmonious influence may exist between employees and the public. Courtesy practised in ever-day transactions soon becomes a habit which is far-reaching in its influence toward gaining public confidence. Therefore, in answer to Mr. Kennedy's question as to "how to spread the gospel of conciliation among company employees," the writer suggests that, by precept and example, they be permeated with courteous cheerfulness and thereby impressed with the knowledge of what the word "conciliation" stands for and its importance to them and the organization of which they are a part.

There is another phase of importance which should not be overlooked in discussing "the attitude of conciliation." The burden of responsibility for existing conditions should not be shifted too heavily on the shoulders of those employees alone who are in direct contact with the public. Certain influences are exerted by the dealings between executive departments of utility companies and individuals who officially represent the public which also have an important bearing on the situation.

An attitude of conciliation on the part of company officials which is not reciprocated by public officials becomes monotonous and is not productive of the harmonious relations which should exist between the companies and the public, whose interests are mutual.

Utility officials, as a rule, are always conciliatory in their treatment of their patrons, but self-preservation and respect sometimes require that they assume a defensive attitude toward public officials, who, in their eagerness to gain political advantage, are apt to confound the meaning of the word "conciliation" with that of "humiliation." It is just as essential that a spirit of co-operation exist between private and public officials as it is for employees to maintain an attitude of courtesy in their dealings with the public; in either event a discord upsets the melody of conciliation. It is the writer's opinion that co-operation is the keynote to be sounded in attuning harmonious relations between the public utility companies of to-day and the public in general.

Redondo Beach, Cal. J. M. Long.

Economics of Power-Factor Adjustment

To the Editors of the Electrical World:

Sirs:—The proposal of Mr. H. B. Dwight in the *Electrical World* of March 28, 1914, for improvement of the power-factor deserves the fullest consideration. Difficulties might be encountered when attempting to reduce his plans to practice, however, since the user is not anxious to buy expensive synchronous motors, phase advancers, compensators, etc., and to take care of their maintenance and attendance. Three-phase commutator motors, which are used to a considerable extent in Germany, have a better power-factor, but are more expensive, than induction motors of the same rated output, and they are inferior to direct-current motors with respect to speed regulation.

The author's proposal that, instead of paying for real consumption in kilowatt-hours, the consumer should pay for his complex consumption in kilovolt-ampere-hours—as proposed, for instance, by Arno and Benischke—is also objectionable in practice. Attention has been called repeatedly to the great industrial importance of improving the mean power-factor evaluated with respect to time. This goal can best be reached by the use of the synchronous motor. The problem will be solved in practice, however, only when the construction of the synchronous machine has been simplified.

Above all things it would be necessary for the synchronizing operation, starting and regulation to constant power-factor to be independent of the attendant; that is, automatic. That this goal can be reached in practice is obvious from an article on "The Attendantless Rotor Converter Substation at Detroit" in the *Electrical World*, June 28, 1913. Attention should be directed also to articles on "Combined Synchronous and Induction Motor Loads," by Messrs. H. L. Wallau, *Electrical World*, Nov. 22, 1913, and G. W. Meyer, *Electrical World*, Feb. 14, 1914.

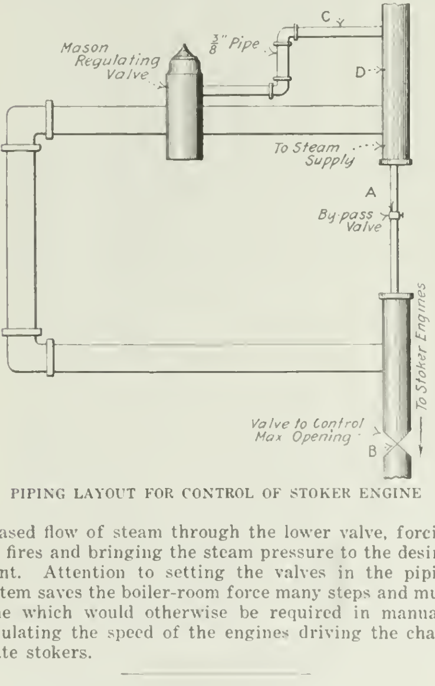
Zwickau, Germany. Gustav W. Meyer.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Regulating Valve Controls Stoker-Engine Speed

An ingenious piping layout, including a regulating valve, has been constructed in the power station of the Springfield (Ill.) Light, Heat & Power Company for controlling the speed of the stoker engines and hence maintaining practically constant steam pressure. Referring to the accompanying diagram, the valve *A* is set to allow the flow of enough steam to produce the minimum desired speed of the stoker engines. Likewise, the valve *B* is set to control the maximum speed of these engines. As the steam pressure in the supply main *D* increases the variation is transmitted to the diaphragm of the regulating valve by means of the small 0.375-in. pipe shown in the sketch. This change in pressure tends to close the valve reducing the flow of steam to the engines. On the other hand, if the steam pressure falls the regulating valve allows an increased flow of steam through the lower valve, forcing the fires and bringing the steam pressure to the desired point. Attention to setting the valves in the piping system saves the boiler-room force many steps and much time which would otherwise be required in manually regulating the speed of the engines driving the chain-grate stokers.



PIPING LAYOUT FOR CONTROL OF STOKER ENGINE

Elevator Limit Switches

Good chemists are not expected to know much about freight elevators, motors and such things; if they did, they probably, and logically, would not be such good chemists. The air-gap and bottom of an induction motor were found to be full of "babbitt." Under the assumption that a chemist should know babbitt from solder, the repair shop would have sent him a set of rotor bearings and let it go at that; but this repair shop was not taking any chances with a motor that it had recommended. When the inspector got there the motor had been disassembled, and a glance at the bearings revealed that they were all right, but the stator coils were lined with a bright metal which proved to be about all of the silver solder that the rotor connections ever had in them. The sum total of the information forthcoming was to the effect that the rotor "sparked when she was running," though the elevator "never had been overloaded." It later developed that owing to the absence of any limit switch to limit the upward travel of the elevator a green operator had, about a week before, tried to run the elevator through the roof. Failing in this, the roof being too strong, he became scared and jumped off, leaving the motor to hum and buzz until its fuses blew, but too late to save the solder. The elevator now has a very nice four-dollar limit switch, and it should be pointed out that hoists of all kinds should have limit switches, as much to guard against the effects of controllers getting stuck as against the effects of careless operation.

A Differential Relay for Heavy Work

By Harry E. Dey

Some time ago the writer had occasion to use a differential relay that involved unusual requirements inasmuch as it had to be very sensitive, operating upon a small fraction of 1 per cent of change in current, and was used for closing and opening a pilot motor circuit (0.0825 hp) every few seconds, the motor running in two directions.

A prominent electrical instrument manufacturer had previously reported that he could provide nothing, either special or from stock, to fulfil the conditions, as the design of his instruments necessitated that the spring should be a conductor, while the current requirements involved were too great for this service. Upon further investigation the writer came to the conclusion that it was necessary for him to design some device to be made in the shop. Before entering upon a description of the device built it may be well to give a general idea of the purpose for which it was intended.

A 40-hp motor of special design and construction was installed on a United States cruiser for steering purposes. This motor was controlled for speed, direction and stoppage by means of a field rheostat only. Mounted on a standard on the bridge of the ship was a bronze case which contained a small high-resistance rheostat (*a* in Fig. 1), which was operated by means of a hand wheel *b*, the shaft of which passed through the case. A line wire was connected to the contacting finger, which was normally at the center of the commutating arc, thus giving equal resistance to each side. Down in the steering room a duplicate of this rheostat *c* was connected with the finger of the steering-motor field rheostat in a manner to cause them to move together. The differential relay was also installed in the steering room. Two wires connected the extremes of the arc of one rheostat to corresponding points of the other rheostat, the coils *d* of the differential relay being inserted in the circuits between the two rheostats in such a manner that the two windings opposed one another.

If the helmsman desired to turn the rudder, say, 5 deg. to starboard, he would turn the hand wheel until the index to which it was geared pointed to 5 deg. starboard. This would upset the equilibrium of the relay circuit, causing its pendulum to swing over to starboard and close the pilot-motor circuit. The latter would immediately operate, moving the arm of the field rheostat to a position that would cause the steering motor to run in the proper direction to carry the rudder to starboard. The pilot motor, besides changing the field rheostat, drove the contacting finger of the relay rheostat to a position which would neutralize the change of resistances in the rheostat on the bridge. This again balanced the two circuits, allowing the relay pendulum to swing to the center and thus break the pilot-motor circuit. If the pilot motor overran from momentum, the relay would become unbalanced and thus swing over to the other side and reverse the motor. The overrun would be so short, however, that the motor would not have enough momentum on the return to pass over, consequently no brake was required. The net result was, therefore, a slight overrun, a rebound and a dead stop.

When the steering motor operates, in addition to moving the rudder, it drives, through a chain of gearing, the field rheostat body in the base of the machine. This rheostat body is driven in the same direction that the contact finger was moved, so that by the time the rudder has reached the end of its 5-deg. travel the relative positions of the finger and the body are unchanged from what they were before the helmsman acted. An overrun of the steering motor from momentum acts in a similar manner to that with the pilot motor, unbalancing the field rheostat and causing the motor to rebound with an easy elastic movement and to stop at the point required. It was interesting to watch this motor with its slow elastic movements for small changes and quick rotation for the greater rudder movements.

Connections of the Relay

The relay, as illustrated herewith, is made from a brass spool 4 in. long and with heads 4 in. in diameter; the hole is 1.75 in. in diameter. After providing the proper insulation the spool was wound with two parallel insulated wires separated by a coarse thread. The four terminals were brought out to binding posts, which were later connected to the circuit in such a manner that the currents oppose one another. This causes a high difference of potential between the adjacent wires near their terminals, consequently extreme care is required in the winding. Each layer should be especially well insulated from the layer beneath. This parallel winding provides an absolutely accurate balance that can never be secured by winding the two circuits in separate coils. A brass shell slipped over the spool completes the metal housing. A hard-rubber plate is attached to one of the heads, for holding the binding posts, and the whole is fastened to a base plate by lugs as seen in Fig. 2.

Another brass spool was made to provide a snug fit in the first spool when forced in with its axis at right angles to the former. It is held from endwise movement by means of rods suspended from the binding-post plate which is mounted on top of the main spool. This spool is wound with a single insulated wire of a resistance sufficient to take care of the full line voltage, for it is connected directly across the circuit. A wide deep groove is cut across each head of this spool, extending lengthwise of the main spool. A soft-iron core, having considerable clearance within the hole of the spool, is mounted upon pivots at the center, the clearance permitting a slight rocking motion up and down. This core is shouldered and threaded at the ends. An elliptically shaped ring is sprung over the ends of the core, when assembling, and held in place by thin iron nuts, the latter also serving as pole pieces.

It will be noted that none of the wires has any motion, and also that the iron core is traversed by a constant number of magnetic lines regardless of the balanced or unbalanced condition of the differential coils. In other words, it is equivalent to a permanent bar magnet, the only object of the winding being to obtain additional strength of magnetism. Owing to this fixed magnetism there is no magnetic lag and consequent loss of sensitiveness, as would be the case were the changing magnetism of a piece of iron depended on. With this design the slightest unbalancing of the currents of the outside spool is at once manifested.

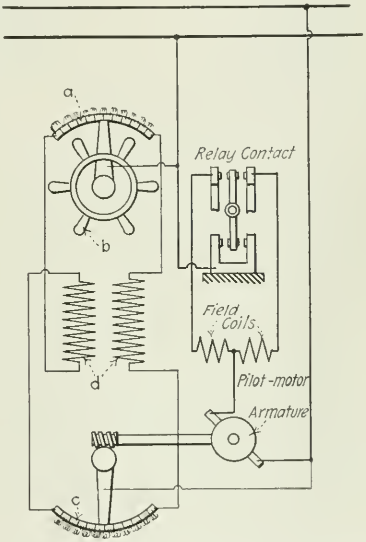


FIG. 1—CONTROL CIRCUITS FOR ELECTRIC STEERING

A pendulum rod is attached to the lower part of the elliptical ring, while a ball serves as a counterbalance at the top. The lower end of the rod is turned off to form a shoulder and to provide a bearing for a bar about 1 in. long loosely mounted thereon. This bar is provided with platinum contacts, four in number, set upon opposite sides of its two ends. Corresponding contacts are set upon brackets mounted upon the base of the instrument. Two of these latter contacts are electrically identical, being attached to a bracket common to both. The double-contact bracket is connected directly to the line while the single contacts are led to the pilot motor. The contact bar acts as a bridge between the double-contact bracket and one or the other single contacts, thus obviating any flexible connections between moving parts and also providing a double series break when opening the circuit. This greatly reduces the arc and also acts as a safeguard against sticking, for if one side did stick there would still be enough hinge action to allow the other side to open the circuit.

One problem that caused considerable difficulty was that of obtaining a spring to bring the pendulum to its neutral or center position and which would at the same time be practically frictionless. Another desirable feature in the spring was to have it decrease its pulling power as it left the neutral point so that by the time the contacts were reached there would be very little pull remaining, and thus the electrical contacts would be proportionately improved. These requirements are directly opposed to the principle of action of any mechanical spring, but the happy thought finally struck the writer of using a permanent steel magnet for a spring. The magnet included both the important elements of being frictionless and having the pull decrease with the distance moved, besides being easy to adjust by filing off the small wire used as an armature. The device as finally built consisted of a specially designed magnet, cut out of sheet tool-steel and hardened, of the form shown in Fig. 2. It will be noted that the pole pieces are sharply pointed, like the teeth of a saw, and are separated by about 0.25 in. The magnet is fastened to the insulating block in a position that will permit the pendulum to swing between the pole pieces without touching them. The pendulum at this point is drilled to receive a small iron wire, which passes through and is pointed at both ends. It is made short enough to afford a liberal clearance when passing between the poles. In operation the poles draw the iron wire, and hence the pendulum, to the exact center and hold it there with all the force desired. This magnetic spring completely solved the problem and it appears that there may be other cases where it might be used to advantage.

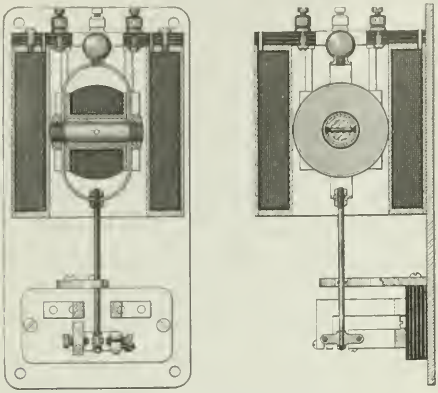


FIG. 2—CONSTRUCTION OF DIFFERENTIAL RELAY FOR HEAVY WORK

Before the sea trials the writer feared that the pendulum might vibrate, owing to the rolling and pitching of the ship and the vibration of the machinery, and thus keep up a continuous "seesawing" of the steering, for the magnetic spring had to be made quite weak in order to preserve the sensitiveness of the relay. But, as usually happens, the expected difficulty did not come to pass, and in the worst of seas the pendulum never wavered.

The Pilot Motor

Another problem that came up in this steering device was that of reversing the pilot motor without the complication of a pole-changing switch on the relay. This was accomplished by providing the field with two sets of windings. Two terminals, one from each winding and of opposite signs, were joined together to one of the commutator brushes (see Fig. 1). Of the other two terminals, one was connected to one of the relay contact points and the other to the remaining contact. The other commutator brush was connected to the line. The resultant operation was that when the relay closed one circuit it sent the current through one set of field coils and thence through the armature in series. When the circuit was closed through the other contact the current passed through the other field coil in the reverse direction, which reversed the field, and thence through the armature in the same direction as formerly. This gives a reversing motor with only a single contact required for each direction. There are many cases where a control of this kind can be made to fit in to advantage.

The motor used was of standard manufacture and of the fan-motor type, but its builders refused to take any responsibility if they provided it with two fields. The writer lost patience with their ultra-conservatism, had the old field coils removed and replaced them with new ones of enameled wire. The saving in space due to using this enamel conductor in place of the former cotton-covered wire permitted almost as many ampere-turns for each coil as there were in the original windings. The motor never gave the slightest trouble. Without any external resistance it was thrown on, back and forth, every few seconds, for periods sometimes extending over several days.

Conversion of a Single-Phase Generator Into a Motor

Can a 45-kw, 2200/1100-volt, 133-cycle, single-phase, 1200-r.p.m. generator be converted into a motor? If so, what speed and power can be obtained? P. T. O

Any generator may be operated as a motor, but when designed for single-phase operation it is usually necessary either to change its internal construction or to provide some external means of bringing it up to speed. If the generator is of the revolving-field type, it would not be difficult to make three-phase taps on the stator winding and bring the motor up to speed with "split-phase" current. In general it is preferable to accelerate the motor to synchronous speed by some external source, using either a directly connected or a belt-drive motor. At 133 cycles the machine will run at 1200 r.p.m. and develop about 35 hp. At lower frequencies the speed and operating voltage will be correspondingly decreased and the permissible load reduced proportionately.

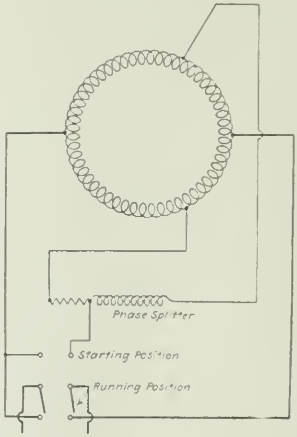


DIAGRAM SHOWING WIRING SCHEME FOR CONVERTING A SINGLE-PHASE GENERATOR INTO A MOTOR

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Static Transformers for the Simultaneous Changing of Frequency and Pressure of Alternating Current.—A. M. Taylor.—An illustrated paper read before the Birmingham Section of the (British) Institution of Electrical Engineers. The author first mentions the frequency changers of Joly, Vallauri and Spinelli. The principle of the present author's arrangement is shown in Fig. 1. In this the connections are shown that would obtain if the arrangement were single-phase. Consider first what would happen in the choking coil if the primary winding of the working transformer were short-circuited, which condition would exist if the saturated choking coil were connected directly to the supply mains. The wave-form of the current which would then flow is shown by curve *C* in Fig. 1. It will be seen at once that if the current took this form the portion of the curve marked *R* would be that on which the rate of change of current was very rapid; and, in consequence, if the current undergoing this change could be passed through the primary coil of a transformer winding, on an unsaturated core, so that the flux virtually followed the current wave, the emf in the secondary-coil windings on the core of this transformer would have the wave-form marked *D* at the bottom of the figure. This, however, would leave a large period of the fundamental cycle in which no useful work was being done in the secondary coil of the transformer, and it would be an unsatisfactory arrangement. Another disadvantage would be that the half-waves of the emf would not be exactly symmetrical, because the ascending and descending sides of the peak of the current are not exactly symmetrical about the axis. If, however, the arrangement is repeated on the three phases as shown in Fig. 2, these two difficulties disappear, the blank spaces being filled in by the impulses received from the other phases, and the dissymmetry of the positive and negative half-waves of emf being nullified by corresponding impulses from other phases, in the manner indicated by Fig. 3. A further investigation of the wave-form obtained in the secondary circuit (Fig. 3) shows that at any instant only two out of three transformers are active, and the question then arises whether it is expedient to couple the secondary

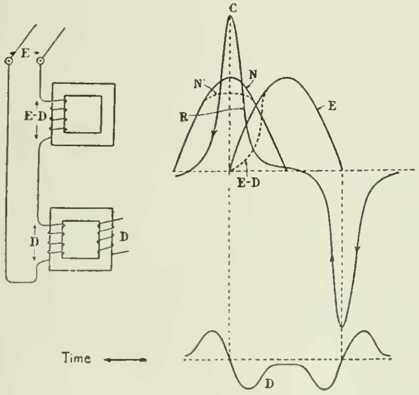


FIG. 1—PRINCIPLE OF TAYLOR'S ARRANGEMENT

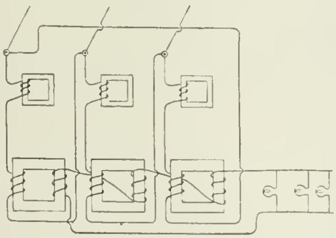


FIG. 2—CONNECTIONS OF FREQUENCY CHANGER

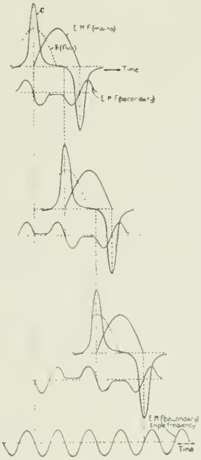


FIG. 3—COMBINING THREE PHASES TO FORM SINGLE PHASE

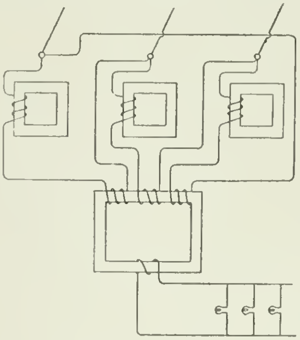


FIG. 4—PRESENT FORM OF ARRANGEMENT

coils in series or in parallel. The author decided that it would be better to couple them in parallel than in series. It is desirable to avoid difficulties with the idle current in the third phase by having a single winding in the secondary, and by employing a common magnetized core, which is magnetized by the three primary currents having peaked wave-forms as received from their respective choking coils. This is shown in Fig. 4. The application of this frequency changer to wireless telegraphy is also discussed. In an appendix the author shows how the power-factor, which is only of the order of 0.2, can be compensated for. One use of the apparatus would be the conversion of three-phase current on systems having a frequency of twenty-five cycles per second to single-phase triple-frequency currents having a frequency of seventy-five cycles for lighting work. At the meeting Mr. Taylor performed an interesting experiment to show the reversibility of the apparatus, which consisted in passing through a special transformer a current received at seventy-five cycles and obtaining from the said transformer a current of twenty-five cycles.—London *Electrician*, May 8, 1914.

Air Filters.—O. Gerold.—An illustrated description of details of construction of air filters built by a German company for removing the dust from the air for cooling turbo-generators.—*Elek. Zeit.*, May 7, 1914.

Lamps and Lighting

Street-Lighting Specifications.—Jacques Abady.—The author deals with the subject of street lighting in relation to the standard specification proposed by the joint committee of the Institution of Electrical Engineers, Institution of Gas Engineers, Institution of Municipal and County Engineers and the Illuminating Engineering Society, as given in a paper read last year by A. P. Trotter before the last-named society. A number of clauses are here proposed, and it is suggested that the necessary photometric measurements should depend upon rays making 20 deg. and 50 deg. respectively with the horizontal, the candle-power of the former to be at least 15 per cent greater than that of the latter.—London *Electrician*, May 8, 1914.

Street-Lighting Specifications.—An editorial commenting on Abady's article (mentioned in preceding abstract). The committee had arrived at the conclusion that the only quantity that needed specification was the minimum horizontal illumination observed upon a plane 3 ft. 3 in. above the surface of the street. Abady was one of the keenest opponents of the suggested clauses at the time of the discussion. The writer agrees entirely with Abady when he says that one of the objects of such a specification should be to allow fair competition by all systems of illumination. There is, however, some difficulty in securing this desirable end. The difficulties become less when dealing with illumination rather than candle-power, but Abady objects to an illumination standard. The editor thinks that the recommendation of the joint committee was strong, but did not go far enough, and that the ratio of maximum to minimum illumination cannot be wholly neglected. As against the measurement of minimum illumination, Abady prefers to measure the candle-power along the 20-deg. and 50-deg. rays from the horizontal, and he suggests that the former should be 15 per cent greater than the latter, as it is the more important. In this respect it is thought that Abady does not go far enough. If candle-power measurements are to be made in place of illumination measurements, then the 20-deg. ray should have a much greater relative importance. The aim of the street lamp should be to throw the illumination as far as possible into that region which is situated about midway between the lamps. From this point of view it would be better to take the 15-deg. ray instead of the 20-deg. ray. Considering that the ray with the smaller angle would generally have to travel more than twice as far as the ray with the larger angle, it would not be too much to suggest that the 15-deg. ray should, preferably, have double the candle-power of the 50-deg. ray, instead of an excess of merely 15 per cent.—London *Electrician*, May 8, 1914.

Low Candle-Power Half-Watt Lamp.—R. Ziegenberg.—By means of small transformers, nitrogen-filled tungsten lamps consuming half a watt per candle-power can be applied in low-candle-power units for alternating-current supply networks. A German company brings half-watt lamps of the following sizes on the market in spherical form:

Diameter	Candle-Power	Volts
70 mm (2¾ in.)	50	14
80 mm (3⅛ in.)	100	14
100 mm (3 15/16 in.)	200	25
120 mm (4¾ in.)	400	50

The transformer is either built directly into the fitting of a single lamp or one transformer is used to supply energy to several lamps near together. Since the lamp consumes 0.5 watt per candle, and the efficiency of the transformer even in the smallest sizes is between 88 and 97 per cent, the practical specific consumption of the lamp is 0.6 watt per candle. If the cost of electrical energy is 10 cents per kw-hr. it is estimated that for 1000 hours of burning a saving of 40 per cent is obtainable with a 50-cp lamp and a saving of 45 per cent with a 100-cp lamp, taking into consideration the cost of renewal of the lamps and the amortization of the transformers.—*Zeit. f. Beleucht.*, April 30, 1914.

"Reflex Light Tubes."—By inclosing tube lamps in a long cylindrical glass tube and inserting also a metallic reflector within the outside glass tube a good illumination for special purposes is available, especially for indirect illumination of ceilings.—*Zeit. f. Beleucht.*, April 30, 1914.

Objective Photometer.—Voege.—His complete paper, with illustrations, presented before the German Illuminating Engineering Society, on the use of the photo-electric cell for an objective photometer, as described in the Digest last week.—*Zeit. f. Beleucht.*, April 20, 1914.

Traction

Subway in Buenos Aires.—E. E. Wachsmann.—On Dec. 1, 1913, a subway line from Plaza de Mayo to Plaza Once de Setiembre was opened. It is the first part of a rapid-transit system which has been designed in connection with the street railway network and which is to be completed during the next few years. In the subway the current is supplied from an overhead wire because the extensions are to be built as street railways on the trolley system. The direct-current system is used with 1100 volts on the trolley wire. The length of the subway is 4 km (2.5 miles).—*Elek. Zeit.*, May 7, 1914.

Installations, Systems and Appliances

Electric Heating and Cooking.—J. W. Hame.—His presidential address before the "Point Fives" on various details of electric heating and cooking apparatus. As to the difference of opinion among users of cookers whether heating from the sides or heating from the top and bottom is preferable, the author has a personal leaning toward the latter method. He doubts whether it is a wise policy to increase the cost of electric cooking apparatus by the addition of glass windows in the doors and the supply of thermometers. The cookers should be provided with some much more prominent indicating device than the small opening of the switch with the "on" and "off." Illuminated glass disks or other illuminating or conspicuous indicating devices to show what is being used are most necessary when using electric cookers. He mentions several British makes of heating and cooking apparatus which he has found particularly useful. As regards metallic utensils, in his experience the cast-iron kettles and pans with the bottoms turned or ground flat have proved the best, taking into consideration the cost of the utensils. In a test which he recently made as to the time taken to boil water, twice as much time was required to boil water in a utensil which had been in use on a coal fire as to boil a similar quantity of water in a cast-iron kettle with a ground bottom. The two utensils were heated on the same hot-plate, and both were started cold. When wiring houses it is desirable to include as much wiring as possible for wall sockets and plugs, and no opportunity should be missed in persuading new consumers to have a circuit run around the rooms which are most frequently used, the wires being run under or on the surface of the skirting board. There was a long and extended discussion. J. W. Beauchamp and W. G. Pickvance advocated the use of thermometers. P. Rycroft thought that the electric iron was the best introduction to other uses of electricity. W. Travis thought that it was a hardship that British electrical supply engineers must pay for their experience; he suggested a central association or bureau of research. W. S. Pickvance and S. T. Allen thought that it is most desirable for each central-station engineer to test personally various types of ovens under actual conditions. R. S. Downe said that the cooking business will be greater than the motor-service business. The possibilities are enormous because of the non-combustive action of electrical operations. F. Farndon approved of the system recently adopted by Seabrook, that is, in making a nominal charge for hire and slightly increasing the charge for energy, with a view to bringing the total hire to a figure approximating the present standard rental. The additional price per kw-hr. would, however, appear to be an arbitrary figure, depending entirely on the class of district and individual consumption. A. H. Seabrook remarked, in connection with the position of the heating elements, that he saw no reason why side heating should not be standardized. Cast-iron pots with turned bottoms proved the best for hot-plate heating. He emphasized the necessity of fixing to each cooker either a rapid boiler or a separately heated kettle for small quantities of water required quickly. Either of these heaters would supply hot water at a quicker rate than is obtainable by gas.—London *Electrician*, May 8, 1914.

Electrochemistry and Batteries

Electrically Melted Ferromanganese.—An article giving the results from practice in three European steel plants where a molten supply of ferromanganese is kept at hand at the converter plant, the ferromanganese being molten in an electric furnace. The first plant to take up this practice in this country has been the Illinois Steel Company, which at its converter plant at Joliet, Ill., employs a 4-ton Héroult furnace to keep on hand a supply of molten ferromanganese from which 150 lb. is taken every seven minutes. The three European plants from which figures are given in this article employ induction furnaces for melting the ferromanganese, and from the results obtained an estimate of the energy requirements and savings to be expected in new installations is made. It is stated to be safe to figure on a saving of 30 per cent in weight of ferromanganese and an energy consumption of 675 kw-hr. per metric ton of ferromanganese for a 3-ton furnace in regular operation. Other metallurgical advantages of the use of molten ferromanganese resulting in a better quality of the steel are pointed out.—*Met. and Chem. Eng'ing*, May, 1914.

Units, Measurements and Instruments

Electrometer.—An illustrated description of a new electrometer devised by Szilard for the measurement of radio-activity, as shown in Figs. 5 and 6. The movable system of the electrometer is a fine stiff needle with a piece of wire bent into circular form *A*. This piece of wire *A* can move into the interior of the charged system *S*. A directing force is exerted upon the needle *A* by means of the spiral spring *R*, the tension of which may be adjusted by means of the screw *V*. The system *S*, which is electrically charged, consists of two segments arranged parallel, one above the other, as shown in Fig. 6, this being charged through the rod *G*. The influence effect of the segments *S* upon the circular bent wire *A* at the end of the needle produces the deflection of the needle. Since the needle is not charged the scale may be placed directly below it. The sensitiveness is about 5 volts per degree of the dial.

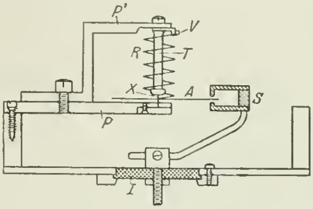


FIG. 5—SECTIONAL VIEW OF ELECTROMETER

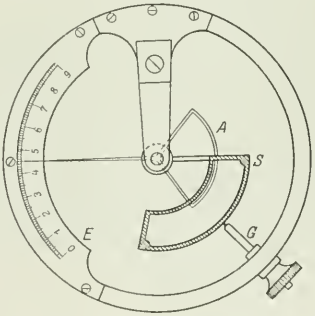


FIG. 6—TOP VIEW OF ELECTROMETER

If the electrometer is equipped with a micrometer, it is easy to estimate the one-hundredth of a degree, that is, 0.05 volts. The mean capacity of the apparatus is 2.5 electrostatic units.—*Elek. Zeit.*, May 7, 1914.

Telegraphy, Telephony and Signals

Telephone Cable.—W. J. Hillyer.—An article on the new London-Birmingham-Liverpool telephone cable. The route length between London and Birmingham is 110 miles, and that between Birmingham and Liverpool is 90 miles. Stoneware multi-way ducts of 3⅜ in. internal diameter are being used to form the conduits. The air-space paper-core cable contains two 300-lb., fourteen 200-lb., twelve 150-lb. and twenty-four 100-lb. loops made up in multiple twin four-wire core formation. All the loops will be loaded at the outset, as will also twelve superposed circuits formed. Tables are given for the electrical constants of the line itself and of the loading coils. The loading spaces are 2½ miles.—

From *Post Office Elec. Eng. Jour.*; abstracted in London *Electrician*, April 24, 1914.

Automatic Switchboard Telephone Systems.—W. Lee Campbell.—The paper describes a telephone-traffic recording machine by means of which not only the number of calls for a given period, but also the average duration of each call, is mechanically registered on a moving tape. The observations recorded here were taken on an automatic telephone system. The graphical record shows the exact duration of each connection, the number of connections made during a given interval, and the number of simultaneous connections in service at each instant. By means of these records it is possible to study the relative efficiency of small and large junction groups and the average time of calls, and these observations permit the switches and junctions to be so arranged that the calls will be evenly distributed among the junctions in each group.—London *Electrician*, April 24, 1914.

Wireless Telegraphy.—H. Parodi.—A mathematical article on Eccles' theory of wireless telegraphy. The passage of an electromagnetic wave through an ionized atmosphere results in an increase in the speed of propagation. In an atmosphere in which the ionization is distributed the electromagnetic rays are refracted and the degree of refraction is the greater the smaller the frequency of the vibration. From this fundamental fact Eccles draws important conclusions on the effect of the frequency in wireless telegraphy transmission.—*La Lumière Elec.*, April 11 and 18, 1914.

Miscellaneous

Kinematograph Projector.—One of the great objections to the use of the kinematograph for educational purposes has been the inability of the lecturer to stop the film at any particular place in order to point out to his class any special features or printed matter, etc., on the film. With the ordinary type of projector this proceeding would cause the film to catch fire, or the gelatine to melt in the case of a non-inflammable film. The heat from the lantern is easily sufficient to bring this about if the film is stopped in the gate for more than the fraction of a second necessary to project the picture under normal conditions. By means of Kamm's kinematograph projector, a demonstration of which was given at the Regent Street Polytechnic, London, recently, it is claimed that any particular picture can be projected as a lantern slide at the will of the lecturer. This result is attained by means of a special form of shutter, situated behind and in close proximity to the film, and a special driving mechanism for the film. The shutter is formed of two or more fan-shaped sectors, which, when revolving at high speed, cause a powerful cooling draft to blow continuously on the film; also, as the shutter is placed between the film and the lantern, it intercepts directly a large amount of heat which, in the ordinary type of projector, with the shutter in front, falls directly onto the gate. A clutch operates the feeding mechanism of the film, and when it is desired to stop the film the clutch can be thrown out and the film comes to rest. This clutch may be operated from a distance by means of an electromagnet. To start the film again it is necessary only to throw in the clutch, but it is desirable to start the film by hand in order to save the wear on the clutch as far as possible.—London *Electrician*, April 10, 1914.

Patents.—C. L. Clarke.—The first part of a serial on patents from the standpoint of the technical and practical man in the field of engineering.—*Gen. Elec. Rev.*, May, 1914.

Protection Against Lightning.—The rules of the German Association of Electrical Engineers on the erection of lightning rods have been supplemented by four appendices dealing with the protection of factory smokestacks, churches, windmills and reinforced-concrete structures.—*Elek. Zeit.*, April 30, 1914.

German Association of Electrical Engineers.—The twenty-second annual meeting is to be held from May 24 to May 28 in Magdeburg.—*Elek. Zeit.*, April 30, 1914.

Book Reviews

Allgemeine Elektrotechnik Hochschul-Vorlesungen. By P. Janet. Vol. I. Leipzig, Germany: B. G. Teubner. Paper, 280 pages, illus. Price, 7 marks.

This book is a German translation of Prof. Paul Janet's work. As a class book for students of elementary electricity, it seems interesting and suggestive. In reviewing a book of this character by a French author one cannot resist the temptation to indulge in a comparison with the master treatise of Mascart and Joubert, which is so well known and clear. It is rather difficult to do justice in a review to a book which has passed through a double translation. There can be no question that the book will be of great interest to German readers, but it can hardly be expected that the American reader will take the trouble to study the German translation while the French original is accessible.

Halsey's Handbook for Machine Designers and Draftsmen. By F. A. Halsey. New York: McGraw-Hill Book Company, Inc. 500 pages, 700 illus. Price, $5.

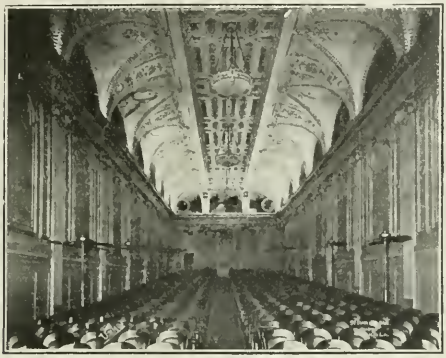
This volume marks a departure from conventional methods adopted in the preparation or compilation of what is usually referred to as a handbook. The dimensions of the book are such as to remove it utterly from the class of more or less bulky publications commonly referred to as pocket-books. It is essentially a book for the office desk, but the title "handbook" correctly indicates the nature of its contents. Admitting that the book is not of a conveniently portable size, the advantages of the large page are many and obvious, the chief of these being the possibility of presenting diagrams or charts on a large scale, thus greatly enhancing their value. A great deal of the material has been gathered from the pages of the *American Machinist*, but care has been exercised in the selection of the articles worthy of a permanent place in this compilation. All such information as one expects to find in a reference book on machine design is to be found within the covers of this book, and in addition there are sections on hydraulics, steam boilers, the steam engine, and compressed air, which are here mentioned to indicate the comprehensive nature of Mr. Halsey's work. An important and commendable feature of the book is the completeness of the section containing mathematical tables. This includes all that the designer or mechanical engineer is likely to require. It contains tables of hyperbolic functions in addition to common logarithms and anti-logarithms. Although the repetition of such tables in the various handbooks or "pocket-books" may seem to involve much unnecessary work, yet no reference book for the use of engineers, whether designers or draftsmen, can be considered complete without them. The design and arrangement of the book are such that it can be kept continuously "up to date" by the dropping of old matter and the introduction of new material as subsequent editions may be called for. Both author and publisher are to be congratulated on the excellence of this exceptional work.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed
Manufactured Products of Interest to Electrical Readers

Indirect Lighting for New Orleans Theater

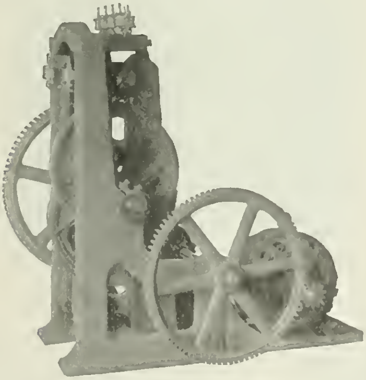
The system of lighting in the Trianon Theater, New Orleans, La., has recently been changed from direct to indirect. The lamps are in Frink reflectors placed in the coves behind the cornice. Tubular lamps of the linolite type, measuring about 1 ft. in length and 1 in. in diameter, are used. This indirect-lighting installation was made by the New Orleans branch of the H. W. Johns-Manville Company.



INDIRECT-LIGHTING UNITS IN NEW ORLEANS THEATER

Non-Pulsating Pump

The pistons of the pump shown in the accompanying illustration are not operated from a crank shaft as in the ordinary type of reciprocating pump but by cams. The cams are keyed to the main shaft, and each transmits its motion to its piston by means of a sliding yoke, rollers being used to minimize friction between the cam and the yoke. The manufacturers claim that this construction keeps the load on the piston more uniform than that where the piston passes through a cycle and runs from full load to a complete stop and back again as in the crank-shaft pump. Hence there is said to be no pulsation, and there is less strain on the pump; high efficiency, therefore, results, owing to the absence of backlash when gears and other parts of the pump have become worn.

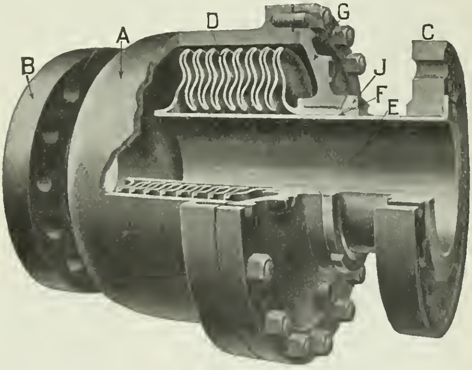


ELECTRICALLY OPERATED NON-PULSATING PUMP

The manufacturers guarantee an efficiency of 80 per cent for the pump. The Liutweiler Pumping Engine Company, Cleveland, Ohio, manufactures this pump, and electric motors made by the Westinghouse Electric & Manufacturing Company are used for the drive.

High-Pressure Steel Expansion Joint

The high-pressure steel expansion joint illustrated herewith is being placed on the market by the Alberger Pump & Condenser Company, New York. In this expansion joint use is made of a nest of circular disks stamped from steel plates with a high elastic limit welded together to form a flexible bellows, which absorbs the movement of the pipe line.

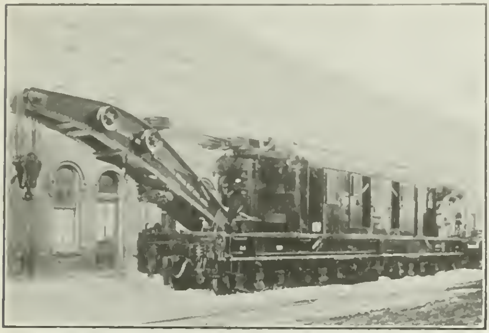


STEEL EXPANSION JOINT FOR HIGH-PRESSURE SERVICE

As shown in the illustration, one end of the nest is welded to the steel tube *E* and the other end to the steel sleeve *F*, the latter being held in place by the locknut *J*. Leakage between the sleeve *F* and the casing head *G* and the casing *A* is prevented by special gaskets. Only the outside of the bellows is under steam pressure, and therefore no condensation can collect within the disks themselves. The working portion of the joint is protected from outside injury by the cast-iron casing *A* and the casing head *G*, which are designed to withstand pressures up to 200 lb. per square inch. To safeguard the expansion joint against excessive movement, the flange *C* will strike the locknut *J* when the maximum lineal movement for which the joint is designed is employed.

100-Ton Tunnel Crane Operating on Storage-Battery or Third-Rail Energy

A double-end electric wrecking car with two independent 100-ton cranes at each end has been constructed recently for operation in the Grand Central Terminal yard, New York. While being adapted to use on the main line of the electrical division of the New York Central Railroad, it is specially designed for underground clearances existing in tunnels. The equipment possesses the functions of a crane with many of those of a high-powered electric locomotive.



CRANE MECHANISM FOR ELECTRIC WRECKER

Storage-battery energy may be used for intermittent and emergency service, when the third rail is deenergized or when cable connections cannot be made with a feeder line. The battery, which consists of 230 cells, has a rating of 75 amp for eight hours, with maximum discharge rate of 350 amp for two hours. A complete testing and charging outfit is installed in order that the battery may be charged wherever a connection can be made with a feeder circuit.

The electrical equipment is noteworthy, not only on account of the power it develops, but because of its flexibility of operation. Six motors with a total rating of 1100 hp operate the equipment, four motors rated at 200 hp each being used for propelling, and two of 150 hp each for hoisting and operating the crane machinery. The propelling motors are directly connected to the axles of the compound trucks, two at each end of the car. They are arranged so that all four or only the two at each end may be operated simultaneously. They are capable of operating satisfactorily on voltages between 300 volts and 750 volts.

During a trial test conducted by the railroad company the crane propelled itself at a rate of 34 miles an hour while hauling an 80-ton rolling load. Satisfactory operation is also possible by using only the two motors at each end of the car, the resulting speeds being about 60 per cent of those obtained when four motors are used.

Standing on a solid foundation and braced with outriggers, the wrecker is capable of lifting the following loads: 100 tons at 24 ft. 2 in. radius straight ahead or 6 ft. 6 in. either side of the center; 100 tons at 22 ft. radius straight ahead or 12 ft. either side of the center, and 100 tons at 13 ft. 8 in. swinging through 180 deg. Without using outriggers the following loads can be hoisted: 50 tons at 24 ft. 2 in. straight ahead and 25 tons at 13 ft. 8 in. swinging through 180 deg.

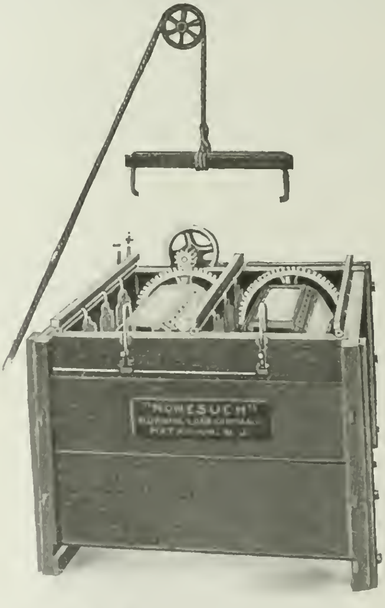
The wrecking car was designed and built by the Industrial Works, Bay City, Mich., from specifications prepared by a committee consisting of Messrs. H. A. Currie, assistant electrical engineer; B. J. Buell, wrecking master, and C. H. Quereau, superintendent electrical construction, New York Central & Hudson River Railroad.

Electroplating Machine

A machine for electroplating small articles in quantities with nickel, brass, copper, zinc, etc., has been designed and is being placed on the market by the Munning-Loeb Company, Matawan, N. J. With this apparatus the work is subjected to a tumbling action, and by the time the deposit reaches the desired thickness it is said to receive a good polish.

The tank is made of 2-in. clear cypress, which is painted both on the inside and outside with a special paint impervious to the action of ordinary solutions. The tank is also lined with a semi-flexible composition. The material to be electroplated is placed in a compartment consisting of two strong hexagonal end pieces of mahogany connected by mahogany staves. Five of the sides of the octahedron thus formed are covered by removable canvas panels the edges of which are corded so that they can easily be slipped in and out of the grooves in the staves, and the sixth is closed by a perforated mahogany cover. It is through the latter opening that the pieces to be plated are passed within. The plating compartment is rotated by a gear wheel meshing with a pinion attached to the pulley shaft. These gears are not in the electrical circuit, and therefore no deposit can take place on them.

The cathode connection consists of a copper busbar attached to a conductor which passes over the edge of the tank and terminates in a bearing which conveys the energy through a copper journal to a swinging chain or rod embedded in the work. This rod does not revolve with the barrel, but remains in contact with the work and falls continually to the bottom of the cylinder with the articles and does not interfere with their rolling.



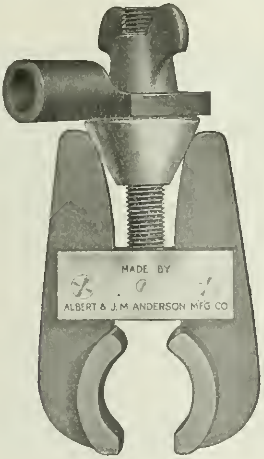
DOUBLE-COMPARTMENT ELECTROPLATING MACHINE

The anode connections are heavy copper or brass tubes upon which the anodes are hung. These run along the upper edge of each side of the tank on a single-compartment machine. In a double-compartment machine, shown herewith, an additional or third rod is provided, running across the center of the tank upon which the flat anodes are hung with hooks. These rods are covered by wooden strips which serve the double purpose of keeping the anode rods clean and acting as supports for the draining tray. In the single-compartment machine six curved anodes are used, three being placed on each side of the compartment and curving around underneath it. In the double-compartment machine six curved and three straight anodes are employed, the latter being hung between the two compartments.

Alligator-Jaw Testing Clamp

In the operation of a large central station the cost of testing the customers' watt-hour meters is an item of considerable expense. This is especially the case in connection with large installations where the meters must be tested without interrupting the service and where the current must be shunted from the meter. Of the many protective devices now being utilized for testing and shunting meters without danger of interrupting the service or injuring the employees, the testing clamp shown herewith will meet the requirements of any installation, the manufacturers claim, and reduce the time of shunting to a minimum.

The clamp is made on the alligator-jaw principle and is operated from the front, thereby making the possibility of a short-circuit small. It is rugged in construction, being made entirely of brass and bronze. Although weighing only 0.5 lb., the device can grip a cable or flat bar up to 1.125 in. thick, and when provided with proper conductors can carry 600 amp. The clamp can be put in place by hand, no wrench or screwdriver being necessary, and it is so designed as not to scratch or mar the switch blade or bus. It can be removed easily from the flexible conductor, and it is well adapted for use in motor tests or for making any temporary connection in construction work. This clamp is being placed on the market by the Albert & J. M. Anderson Manufacturing Company, Boston, Mass.



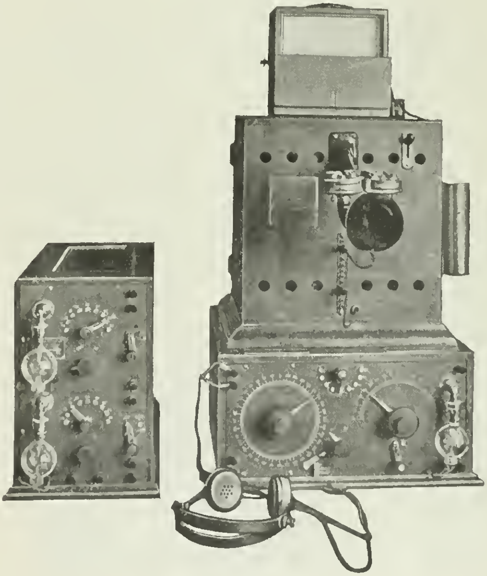
ALLIGATOR-JAW TESTING CLAMP

Radiotelephony for Railroads

On account of the success that attended the wireless-telegraph installations on the Delaware, Lackawanna & Western Railroad during the nine-day paralysis of its wires in last February's blizzard the officials of that system have been investigating the possibilities of the radiotelegraph and radiotelephone on their moving trains.

Wireless-telephone apparatus was recently installed at Scranton, Pa., and on one of the through fast trains. The Scranton installation, though hurriedly made, was able on its second trial to maintain clear voice transmission to this train as far as to Stroudsburg, Pa., a distance of 53 miles, the train running at 60 miles per hour. The antenna at Scranton is 300 ft. long and 150 ft. high; that on the train extends over the four forward cars only, the station being in the second car from the locomotive. On account of train noises it is necessary to use an amplifier and a detector. A two-step amplifier, giving from fifty to sixty times amplification, is used on the train. The generator is directly connected to a steam turbine in the baggage coach, which is supplied with steam from the steam-heating pipes beneath the car. At the Scranton station 125-volt direct current is used.

The present apparatus is of only 1-kw rating, but no difficulty has been had in telephoning from Scranton to Binghamton, a distance of 67 miles, over rough wooded and mountainous country. The officials of the Delaware, Lackawanna & Western Railroad purpose to make permanent installations on two of their fast-train equipments for facilitating dispatcher's service and especially for the convenience of the public.



RADIOTELEPHONY APPARATUS

In the radiotelephone equipment described a De Forest transmitter, an Audion amplifier and an Audion detector were used. These devices were built by the Radio Telephone & Telegraph Company, 309 Broadway, New York, which also made the installation at Scranton and on the Delaware, Lackawanna & Western train described above.

Electric Cooking Utensils

An electric tureen, illustrated in Fig. 1, is offered for sale by the Simplex Electric Heating Company, Cambridge, Mass. The device is made in either nickel-plated or copper finish. Its capacity is four pints. It is well adapted to the heating of canned soups and other prepared foodstuffs. This tureen is equipped with a quick-detachable connector. A 6-ft. silk cord with lamp socket attachment is also provided.

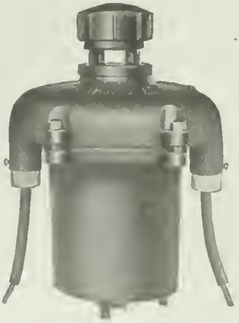
ELECTRIC EGG BOILER

ELECTRIC TUREEN

The electric egg boiler shown in Fig. 2 is a compact device that will boil from one to six eggs conveniently held in a removable rack. The boiler is so constructed that eggs can be prepared in various forms; it can also be utilized as a small tureen if desired. This utensil is double-tin-lined and can be easily kept clean.

Oil-Fuse Cutouts

Oil-fuse cutouts for high-tension work have been designed by the D & W Fuse Company, Providence, R. I. In these cutouts the fusible element is placed under a heavy body of special oil. The terminals are so arranged that on the blowing of the fuse they are forcibly thrown apart and the oil is interposed between them, thus preventing the formation of an arc. The cutout is provided with a venting system which avoids the accumulation of pressure within the casing and also the blowing out of any considerable quantity of oil. The oil container is equipped with a plug outlet at the bottom which permits the drawing off the oil when necessary. The cutouts are provided with flexible cable terminals to which the line terminals can be soldered. The fuse links are made of an alloy of low melting point and high conductivity. These cutouts are made in three sizes, rated at 50 amp, 100 amp and 200 amp respectively.


OIL-FUSE CUTOUT

Electric Vehicle Call

A vehicle-call system operated from a special form of pedestal switchboard rather than from the usual panel in the wall has recently been installed in the department store of James McCreery & Company, New York. The pedestal switchboard is in the center of the lobby, where it is in plain view of patrons of the department store.

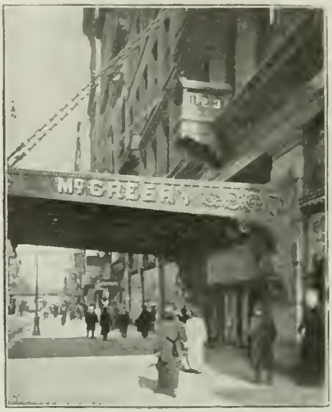


FIG. 1—ANNUNCIATOR OUTSIDE OF NEW YORK DEPARTMENT STORE

The method of operating the switchboard, which was designed by the Western Electric Company, New York, is simple. When shoppers arrive at the store they receive a numbered check from the carriage man stationed at the curb. This check is kept in the possession of the customer so long as he or she remains in the store. When the patron is about to leave, the check is handed to the operator, who moves the switch levers on the dial face of the pedestal to numbers corresponding to those on the check. The numbers are reproduced on both sides of the vehicle-call annunciator on the outside of the building. For night service a lever switch is provided on the switchboard for lighting a bank of lamps which illuminate the numbers.

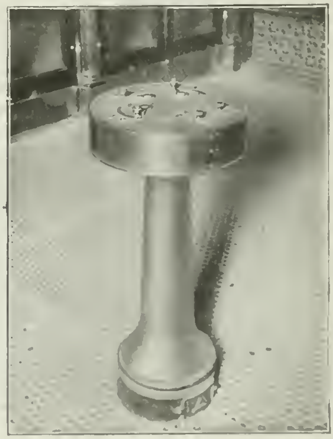


FIG. 2—PEDESTAL SWITCHBOARD

Street Hoods for Nitrogen-Filled Tungsten Lamp

The street hoods illustrated herewith are designed for use with the new nitrogen-filled tungsten lamps as well as the old types of incandescent lamps. In Fig. 1 is shown a one-piece fluted street hood, the body of which consists of an iron canopy and a porcelain housing with clips for holding the 20-in. reflector. The canopy is ventilated by means of arches around the lower edge. These arches do not allow moisture to penetrate inside the housing; cool air, however, can circulate through the porcelain body, thus preventing the overheating of the metal parts of the socket as well as the neck of the lamp. In Fig. 2 is shown a one-piece fluted street-hood body with a 24-in. reflector designed for large-sized lamps. The outer glove has a 1.5-in. hole in the bottom.

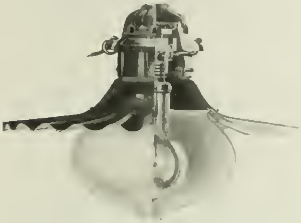


FIG. 1—ONE-PIECE FLUTED STREET HOOD BODY WITH 24-IN. REFLECTOR

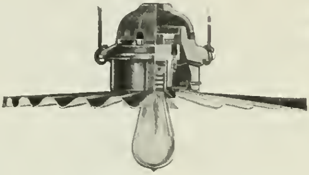
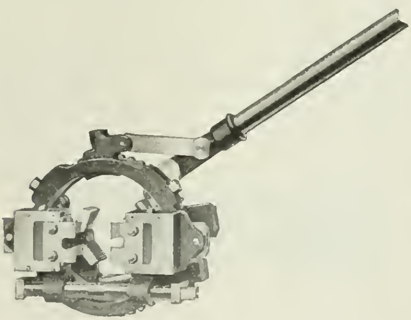


FIG. 2—ONE-PIECE FLUTED STREET HOOD BODY WITH 20-IN. REFLECTOR

These tungsten-lamp fixtures are being placed on the market by the George Cutter Company, South Bend, Ind.

Pipe Cutter

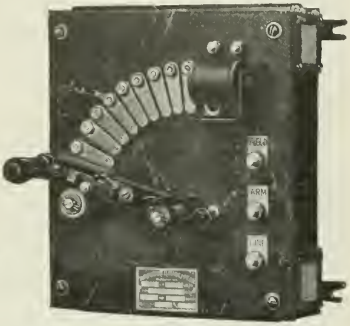
A 2.5-in. to 4-in. pipe cutter designed to cut pipe square without any burrs is being placed on the market by the Borden Company, Warren, Ohio. This cutter is provided with an automatic feed. Use is made of a peculiarly shaped knife with which the cut is so regulated that a very thin section of the pipe is cut out. The pipe is accordingly not depressed and the end of the pipe is left clean and square without any burrs. The manufacturers claim that this cutter will not split the pipe and that it is easy to start a threading die after cutting the pipe with this tool. This pipe cutter, which is illustrated herewith, is operated by a ratchet and can be used in any position. It is a development of smaller cutters which have been put out by the same company.



PIPE CUTTER

Casing for Starting Rheostats

The Independent Electric Manufacturing Company of Milwaukee, Wis., is placing on the market a casing for starting rheostats and controllers. The casing in which the resistor units are mounted is of cast iron, and in the sides of the box, at the top and the bottom, are four large ventilating openings. These openings are covered with heavy non-corroding screens of fine mesh which allow free passage of air into the box and which are said to prevent any sparks or flames emanating from the box in case of a burn-out of the units. The principle on which this prevention is based is the same as that with safety lamps. There are no external openings in the bottom plate of the box, so that should a burn-out occur the molten parts dropping to the bottom of the box cannot fall to the floor. This box has been approved by the Underwriters' Laboratories.



CAST-IRON CASING FOR STARTING RHEOSTAT

Electric Sprinkler Truck

A 5-ton electric sprinkler truck with a 1200-gal. tank is shown in the accompanying illustration. The tank is 160 in. long and has an inside diameter of 51 in. An air compartment is provided in the forward end of the truck. This compartment is 36 in. long and its volume is 25 per cent that of the tank. The holding capacity of the air tank is 65 lb. The total weight of the tank is 3600 lb. The tank is equipped with air-pressure and

ELECTRIC SPRINKLER TRUCK

water-pressure gages and a pop safety valve is provided in the by-pass connecting the water space with the air chamber. The water discharge is controlled through lever gate valves which are operated by hand levers at the driver's seat. The two flusher nozzles can be worked together or independently of each other. The tank is mounted on five 4-in. oak benches. The battery box is under the seat as shown. This electric sprinkler is being made by the General Motors Truck Company, Pontiac, Mich.

Reverse-Power Relay

A reverse-power relay for direct-current circuits designed primarily for use with shunt trip circuit-breakers is being manufactured by the Roller-Smith Company, 203 Broadway, New York. The instrument is equipped with a platinum contact attached to the instrument needle, which contact co-operates with a similar contact carried by an adjustable pilot needle. The pilot needle can be set at any point between zero and full load. The circuit established on engagement of the contacts energizes an electromagnet contained in a rectangular casing below the instrument and mounted on the same slate base as shown in the accompanying illustration. The electromagnet establishes whatever external circuit closure the relay is to effect. Being of the separate shunt type, the dimensions of this relay are independent of the volume of current or size of the breaker to be controlled. The relay can be mounted on the board or as far away as desired, only four small wires being used for the connections.

REVERSE-POWER RELAY

Series-Multiple Transformer for Street Lighting and Farm Service

A transformer designed to operate with its primary coil connected in series with high-voltage series circuits and its secondary winding available for constant current at low voltage has been brought out by the Kuhlman Electric Company, Elkhart, Ind. For applying this transformer to a 7000-volt, 7.5-amp series-lighting circuit the secondary has been designed so that a high-efficiency gas-filled tungsten lamp may be operated from it satisfactorily. The manufacturer states that the insulation resistance between the primary and secondary windings is designed to withstand 30,000 volts. Since the interruption of local lamp circuits does not interfere with the primary series circuit the greater reliability of this system is pointed out. Transformers of this type which have been in operation in Chicago parks for some time are said to operate with current variation not exceeding approximately 3 per cent.

In designing these transformers for farm service the company has taken into consideration the fact that line construction for this type of service must be inexpensive, and the use of a series-multiple transformer allows a single line wire to replace the pair of wires necessary where multiple transformers are employed.

Metallized Graphite

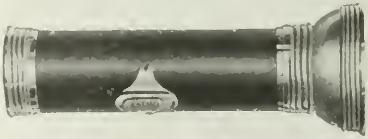
Metallized graphite, known as "graphalloy," is a product consisting of graphite impregnated with molten metal. In the manufacture of this material the molten metal is forced into the pores of graphite blocks or rods by means of high air pressures. The material is utilized quite extensively for bearings on light-duty machinery operating at high speeds, such as loose pulleys, fans, small motors, trolley-wheel bushings, etc. It is also employed for other classes of service such as in bushings for escalators, bushings for tackle blocks, bearings for windmills, etc.

The basic element of graphalloy is pure graphite, which is said to be the most efficient solid lubricant known. The object of the metallic impregnation is to solidify the product so that it can be machined into bearings or bushings of any desired form which will have requisite strength and durability. Different metals and alloys are used for combining with the graphite according to the class of service needed. For example, with trolley-wheel bushings bronze is used; with packing rings for steam turbines, which are required to withstand high temperatures of live steam, copper or bronze is employed, and for electrical purposes, such as brushes for slip-ring alternators, motors, rotary convertors, low-voltage direct-current generators, etc., use is made of copper or copper alloys. This graphalloy is said to have a high compressive strength and can be machined to accurate dimensions. The material can also be tapped and threaded.

The Graphite Metallizing Corporation, Yonkers, N. Y., is placing this material on the market.

Contact for Flash-Lamp Case

An improved contact for its flash-lamp cases has been developed by the Beacon Miniature Electric Company, 110B Duane St., New York. This contact consists of a double locking device. In opening the circuit, the outer slide moving along the plate is locked on the plate and a pressure of the finger is required to move it out of place. In closing the circuit the slide is moved along the plate in the opposite direction to a point where it is locked, pressure being necessary to move it out of place. This contact, it is said, eliminates the possibility of accidentally closing the circuit on placing the flash-lamp in one's pocket.



FLASHING-LAMP CASE WITH DOUBLE-LOCKING CONTACT

Large High-Voltage Testing Transformers

Two testing transformers are shown in the accompanying illustration, with a normal rating of 360,000 volts for continuous service and 500,000 volts for short periods. These transformers were recently furnished to the Inawashiro Hydroelectric Power Company of Japan. One unit is to be installed in the generating station on the Nippashi River at the outlet of Lake Inawashiro, about 145 miles from Tokio, and the other in the receiving substation at Tokio. They will be used for testing transmission lines and apparatus in these stations.

360,000-VOLT TESTING TRANSFORMERS

The features of interest in the design of these transformers are the arrangement of the windings to give distributed static fields, the use of condenser terminals to give distributed stresses from terminals to ground, and the terminal "hat" to distribute stresses from the terminal tip to ground. The transformers are 19 ft. high from the base to the top of the terminal, and the tanks are 9 ft. high and 9 ft. in diameter. One high-tension terminal of each transformer is grounded to the core and case, the other being brought out as shown in the illustration. By connecting the cases of the two transformers, 1,000,000 volts can be developed between the two high-tension terminals.

These transformers are similar in construction to the 500,000-volt testing transformer described in the *Electrical World* of March 16, 1912. They were built by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Shipping Box for Non-Metallic Flexible Conduit

A corrugated box has been designed by the Tubular Woven Fabric Company, Pawtucket, R. I., for shipping its non-metallic flexible conduit known as "duraduct." Heretofore this conduit has been shipped in loose coils. With a shipping case the material is handled safely and can be rehandled, the manufacturers declare, with a minimum of expense. The package also permits the advantageous stocking of the conduit, and each container can be marked so that the contents may be ascertained at a glance.

Three-Oven Range

A three-oven electric range designed to serve the needs of twenty people is shown in the illustration herewith. It is constructed of sheet metal and aluminum, no castings being used. The ovens are heavily insulated and are said to retain practically all the heat generated. The only wires entering the stove are the feed wires for the ovens. All wiring is contained in a metal box underneath the hood. An automatic thermostat, controlling each heating element and adjustable at will for any degree of heat required, is placed beneath the hood. The adjustment of this thermostat is made by a knob and pointer which are attached to a dial.

When the desired temperature is reached the thermostat automatically cuts off the energy supply, and then as the oven gradually cools the heating unit is automatically put in circuit again and the oven is brought back to the predetermined temperature.

The stove is 64 in. high, 51 in. wide and 25 in. deep. The two outside ovens are equipped with one heating unit each. The middle oven is provided with a unit in the bottom and one in the top for broiling, toasting, etc. The two outside ovens are 11.5 in. by 11.5 in. by 18 in. The middle oven is 12.5 in. by 13.625 in. by 21 in. Each heater is connected with a pilot lamp. Three receptacles are provided for surface cooking or the attaching of any electrical appliance. Condensation is carried to a drip pan by means of troughs and pipes. The stove is equipped with a porcelain-lined broiler pan and five wire grates. It is enameled in gray with nickel trimmings.

THREE-OVEN ELECTRIC RANGE WHICH WILL COOK FOR TWENTY PEOPLE

The Olston Electric Stove Company, Los Angeles, Cal., is placing the range described in the above paragraphs on the market.

Jobber, Dealer and Contractor

Buying Advertising Space from Contractors

In perhaps no other city are the relations of the contractor and the central station more amicable than those existing in Cleveland, and the reason for the real coöperative efforts being put forth in that Ohio city may perhaps be found in the fact that both the contractors and central stations are doing just a little more than their share to make each endeavor a success. In advertising electric service the Cleveland Electric Illuminating Company has recently begun to purchase a portion of the contractors' windows, paying for the space according to its advertising value. The illuminating company places electrically lighted advertising transparencies in the windows, allowing the contractor to display whatever electrical apparatus he chooses. Energy for illuminating the transparent sign is supplied from a separate circuit and is paid for by the illuminating company.

New Building of the Northwestern Electric Equipment Company

By alertness and progressive methods the Northwestern Electric Equipment Company, of St. Paul, Minn., has been able to build up a business now typified by a new building which is a credit to the electrical interests of that city. The structure is seven stories high and is at 174-178 East Sixth Street, in the center of the wholesale district. The building is of reinforced-concrete construction and provides for 60,000 sq. ft. of floor space. The accompanying illustrations show various interior views. Office illumination is accomplished by means of indirect lighting, while direct illumination is used in the remainer of the building. All the interiors in the entire building received two coats of white paint to give maximum light reflection. Three electric elevators are used, energy being obtained for all requirements from the central-station mains.

The demonstrating rooms are found on the first floor, and here are shown electrical appliances in large variety, the devices sold being both for industrial and domestic requirements. The building is one of the largest in the Mississippi Valley devoted to the exclusive needs of an electrical jobbing house. It is equipped with modern facilities for carrying on the work of the company and the other activities of the concern.

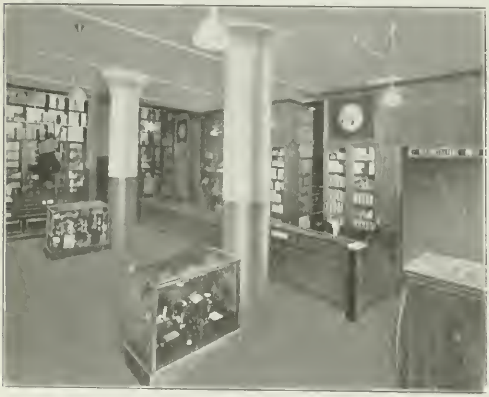


FIG. 1—CITY SALES DEPARTMENT

Established by Mr. Frank B. Thompson, the president of the company, in 1900, as the Thompson Electric Company (the name being changed in 1903), the Northwestern Electric Equipment Company has come into prominence for its up-to-date merchandising methods in handling electrical supplies of all kinds. The business of 1913 was nearly $1,250,000. The officers of the company have managed not only to make a success of their business but to accumulate a large stock of personal popularity. In addition to President Thompson, they include Vice-president James M. Whalen, Secretary and Manager Albert J. Anderson and Manager of Sales J. M. Hannaford, Jr.

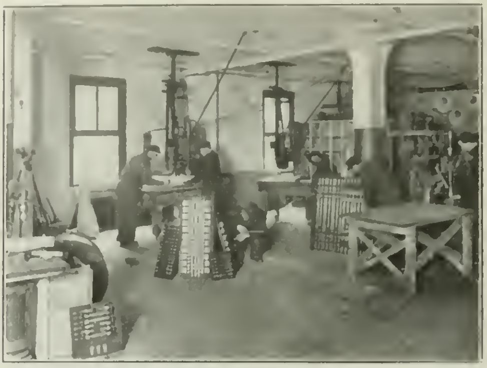


FIG. 2—A CORNER OF THE PANELBOARD SHOP

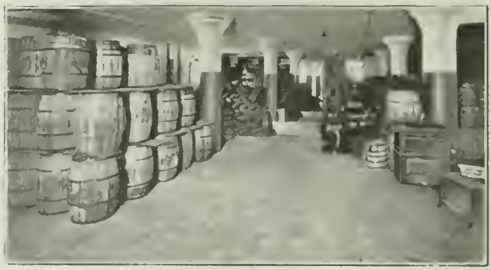


FIG. 3—VIEW OF THE STOCKROOM

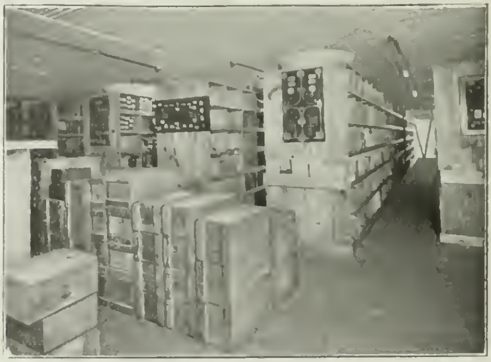


FIG. 4—WIRING DEVICES IN STOCK

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Chicago Railway Exhibit.—The Permanent Railway Supply Exhibit, of Chicago, which until recently was housed at 900 South Michigan Avenue, has been removed to 14 East Jackson Boulevard.

Spring Works Keeping Busy.—The business of the Cary Spring Works, 240 West Twenty-ninth Street, New York, is good. A large amount of the work being done by this company is for the Western Electric Company for use on telephones.

Business in Automobile Accessories Good.—In spite of the recent slump in the automobile business, the Roller-Smith Company, 203 Broadway, New York, manufacturer of electric accessories for automobiles, is finding business good. One reason for this, it is declared, is the increasing number of gasoline cars using electric starters and electric lighting systems.

More Capital for Electric Stove Company.—The capitalization of the Copeman Electric Stove Company, Flint, Mich., has been increased. For the past year this company has been rather inactive, pending the development of its new all-steel ranges, which supplant its old wooden automatic stoves. The company is now in the field for new business with new designs of ranges and accessories.

Orders from Foreign Countries for Transmission-Line Accessories.—The Clark Electric & Manufacturing Company, 149 Broadway, New York, has received orders from Australia, Japan, Spain and South America for its insulator clamps and its seamless splicing sleeves. The latter is used to join two wires or cables. The joint is made by running two conductor ends into and through the oval sleeve and then with special tools twisting in opposite directions at each end of the sleeve. No solder is used.

Storage Battery Company Enlarges Its Service Depot.—The New York Service Depot of the Philadelphia Storage Battery Company has been removed to larger quarters. The plant now occupies the entire ground floor at 651-655 West Forty-third Street. Modern equipment has been installed. The plant is devoted exclusively to the construction, repair, recharging and sale of storage batteries and supplies. The depot is in charge of Mr. Walter L. Thompson, the New York sales agent of the company, with offices at 1789 Broadway.

Line Material Company Moves Into New Plant.—The Line Material Company, South Milwaukee, Wis., has moved into a new plant, which was made necessary on account of the growth of the business in the past few years. The floor area is about 35,000 sq. ft. and is occupied by the machine shop, forge, galvanizing plant, assembling shop, engineering department and office. The foundry is in the same building that was in use before the construction of the new plant. Two acres of land adjoining the company's old property has been purchased also to provide for possible extensions in the future.

Equipment for Power Stations.—The Empire District Electric Company, Joplin, Mo., has arranged to install in its Scammon, Weir City, Columbus and Kansas substations considerable new electrical apparatus, which comprises two 300-kw synchronous converters, one 210-kva frequency-changer set, three 500-kva water-cooled transformers, six 110-kva and three 75-kva transformers, switchboards and accessories. The Eastern Michigan Power Company, Jackson, Mich., recently ordered three additional 900-kva transformers. The Rogue River Public Service Corporation, Grant's Pass, Ore., has purchased a 750-kw alternating-current generator. The above equipment is to be furnished by the General Electric Company.

Montana Power in Anaconda Copper Company Mine.—In the annual report of the Anaconda Copper Mining Company for the year 1913 Mr. B. B. Thayer, the president, says that the service rendered by the Montana Power Company in furnishing electric power to the mines, reduction works and railroad was very satisfactory. While in most districts it would be somewhat hazardous, he said, to rely upon electric power alone without steam reserve plants for use in pumping and hoisting operations, the number of hydroelectric power plants and interlocking transmission lines established by the Montana Power Company make it practically safe in the Butte district, and in fact throughout the district which is served by that company.

Holtzer-Cabot Electric Company Starts Work on New Factory.—Construction was begun on May 21 upon a new five-story concrete factory building on Amory Street, Roxbury, Mass., by the Holtzer-Cabot Electric Company, of Brookline, Mass., manufacturer of electric motors, telephones, sundries and automobile accessories, the ground being broken by President C. W. Holtzer. The company is one of the oldest electrical manufacturers in the country, dating from 1875, when eight or ten employees were on the payroll. There are now over 800 employees, and the force will be increased when the new establishment is occupied about Jan. 1, 1915. The four existing plants of the company in Brookline and Boston will be united in the new building, which will easily house 1000 employees.

Small New York Contracting Firm Busy.—The New York Electric Installation Company, 43 West Twenty-seventh Street, New York, a firm capitalized at $10,000, is doing approximately 100 per cent more work this year than it did last year. Its business last year amounted to about $40,000. One of the installations this company is working upon is that for the Commercial Acetylene Company, Bound Brook, N. J. Sixty motors ranging from 2 hp to 50 hp in rating are being installed. The method of making this installation is interesting, no competitive bids having been sought by the acetylene company. The electric company is virtually an employee of the acetylene company and gets a commission for products bought and the labor necessary. In the purchase of equipment it advises where and how to buy.

Imitating Coal Fire by Means of Electricity.—An imitation coal fire is being manufactured by William H. Hoops & Company, 531 South Wabash Avenue, Chicago, Ill. The grate consists of an ordinary-sized coal-grate basket with a wire lining on which are placed ruby, amber and dark-ruby glass and sometimes a few pieces of genuine coal. Under the wire frame there is a system of wires and incandescent lamps. Sometimes a yellow light, sometimes a clear light and sometimes a red light is used. The effect when placed in the fireplace is said to be a very good imitation of a real coal fire. This company is also handling an "electric fire log" which is made abroad. The material used in the manufacture of this electric log is a secret combination of glass and other ingredients. It is used extensively in Europe and on ocean steamships. No heat comes from these logs, but when lighted they make a good imitation of real glowing logs.

Solderless Connectors for Substation Equipment.—In the new Jay Street substation of the Edison Electric Illuminating Company of Brooklyn, N. Y., solderless connectors manufactured by Dossert & Company, 242 West Forty-first Street, New York, are being used to a large extent. All leads, for instance, both top and bottom, to the disconnecting switches are connected by solderless plugs; all connections of primary and secondary leads and all delta connections to the transformers are with solderless lugs and cable taps; all connections from the switchboard to the copper, from the copper to the 1,000,000-circ. mil leads, and from the leads to the rotaries, are by solderless connectors, and all leads to the switch studs of the "K" and "H-3" oil switches are connected by solderless stud connectors. Outgoing direct-current feeders, main high-tension bus, starting bus, outgoing neutral, etc., in this substation are also connected with solderless connectors.

Aluminum Business Improving.—The amount of business being done by the Aluminum Company of America is reported to be increasing. Aluminum conductors are being supplied to Western companies chiefly for extensions to existing transmission lines.

Electric Stove Company Increasing Capacity.—The Olston Electric Stove Company, Los Angeles, Cal., recently enlarged its plant. It is now turning out 650 ranges a month, which are made in three types. The three-oven range is the latest development. This stove, the manufacturers claim, has a capacity for serving twenty persons.

Iron Works Increase Property Holdings.—The Murray Iron Works Company of Burlington, Ia., has bought the property formerly occupied by the McCosh Iron & Steel Works. This property adjoins the Corliss engine works of this company and gives it about ten contiguous acres in the heart of the town. This is besides the foundry property in West Burlington.

Topeka Electrical Supply House Changes Ownership.—Messrs. H. S. Lee and C. W. Sears are the new owners of the Tucker Electric Company's stock and plant at Topeka, Kan., purchasing the establishment at a sale of receivers recently. The business will be continued by the new owners, the style being changed to indicate the transfer of ownership. Both men formerly were with the Eagle Electric Company, and both continued with the Tucker Electric Company when the latter took over the old concern.

Insulating Paints and Varnishes for Foreign Countries.—The Standard Paint Company, 100 William Street, New York, is said to be doing considerable business in Japan, Australia and South America. The business in this country is also good, that in the East, it is said, being somewhat better than that in the West. A cement-floor filler and cement-floor finish recently brought out by this company is reported to be meeting with considerable success. These compounds neutralize the free alkali, forming what is known as calcium resinate, which, it is said, not only seals up the alkali but results in a firmer bonding of the coating of paint to the cement surface. These cement-floor finishes are in demand for power houses and generating rooms, because the grit arising from unfinished cement-floor surfaces has a tendency to cause heating and sparking of the machinery and thus produce unnecessary wear on the moving parts.

Washing-Machine Selling Methods.—The Hurley Machine Company uses a method of selling its "Thor" washing machines which adapts itself very well to this industry. Letters are written to prospective customers explaining the advantages of the Thor washer and stating that in the course of a few days a representative of the company will call them up over the telephone. If the "prospect" appears interested, a salesman is sent to see him and describe more fully what has been told by letter and telephone. The results of this selling method are said to be neither sudden nor spasmodic, but a steady sowing of the seeds of suggestion finally brings many sales. Liberal terms are allowed on all machines. A fifteen-day trial free of charge is given to any one who can give satisfactory references. Mr. J. H. Clingenpeel, of the New York office, states that approximately 90 per cent of the machines delivered thus on trial are finally sold. Of interest in connection with the Hurley company's selling campaign is the fact that none of its salesmen is paid on a commission basis; they are all salaried men. Demonstrations are continually being made in all the branch stores of this company.

Sales Contest of Hobart Manufacturing Company.—During March and April the Hobart Manufacturing Company, Troy, Ohio, inaugurated a selling contest among its salesmen, of whom there are about a hundred in different sections of the country. A prize of $100 was offered to the salesman having the largest number of sales, $75 to the man with the second largest and $50 to the man with the third largest. Besides this, a section prize of $100 and a five-dollar hat to each member was offered for first man and $50 for second. Five sections were represented, with headquarters in New York, Philadelphia, San Francisco, Boston and Chicago. The New York section won the first prize with a total number of sales for the two months amounting to about $43,000. The Philadelphia section was second. The Hobart company manufactures electric coffee mills, meat choppers and grinders, cake mixers, etc., which are sold chiefly to grocers, butchers, hotels, etc. The company makes its own direct-current motors but buys its alternating-current motors from the Emerson Electric Manufacturing Company and the Western Electric Company.

New Equipment for Industrial Plants.—The Aluminum Company of America, Pittsburgh, Pa., will place in operation in its new plant at Massena, N. Y., eighteen 2500-kw rotary converters and nine 5000-kw water-cooled transformers. The Cyclops Iron Works, San Francisco, Cal., has recently ordered two 15-hp, four 30-hp and four 37-hp induction motors. The Crucible Steel Company, Milwaukee, Wis., intends to install soon one 500-kva and three 10-kva transformers. The John A. Roebling's Sons Company, Trenton, N. J., recently purchased fifteen 20-hp motors and starters. The Riter-Conley Manufacturing Company, Pittsburgh, Pa., has ordered seven small motors and six motors of 10-hp and ten of 25-hp rating. The Oldbury Electrical Chemical Company, Niagara Falls, N. Y., will place in operation in its plant a 500-kw rotary converter, three 175-kva transformers and a switchboard. The Lakeland Phosphate Company, Lakeland, Fla., will add to its power facilities electric apparatus consisting of a 937-kva alternating-current generator with a 35-kw turbo-exciter and a 35-kw motor-generator exciter set, a switchboard and accessories. The Portland Flouring Mills Company, Portland, Ore., has arranged to install in one of its subsidiary mills—the Puget Sound Milling Company, Tacoma, Wash.—a 500-hp induction motor with starting-compensator panel and two 100-kva transformers. The Standard Portland Cement Company, Leeds, Ala., will install four 75-hp induction motors in its plant. Spencer Kellogg & Sons, Inc., Buffalo, N. Y., manufacturers of linseed oil, will add to their electric-drive equipment a 1000-hp induction motor and a switchboard. The Excelsior Shoe Company, Portsmouth, Ohio, will install for electric drive a number of 2-hp and 3-hp motors and eighteen 5-hp motors. The Western Glass Company, Streator, Ill., will add to its electric-drive equipment two 200-hp induction motors and controllers. The Newport Mill Company, Newport, Tenn., will install a 25-hp, a 35-hp and a 75-hp induction motor in its plant. The Borden Condensed Milk Company, Elgin, Ill., will place in operation in its plant a new 150-kw alternating-current generator, eight 5-hp motors, a switchboard and accessories. The J. C. Hubinger Brothers Company, Keokuk, Ia., manufacturer of oils and dexterine, has arranged to install in its plant a 1270-hp synchronous motor with an 18-kw exciter, one 50-hp induction motor, two 100-hp induction motors and one 150-hp induction motor, with switchboard apparatus. The Western Brick Company, Danville, Ill., will install a 7.5-hp, a 35-hp and a 150-hp induction motor with compensators in its plant. The above equipment is to be furnished by the General Electric Company.

NEW YORK METAL MARKET PRICES

	May 19		May 25	
Copper	Bid	Asked	Bid	Asked
Standard spot*	13.65	14.00	13.70	14.12½
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	63 7 6		63 2 6	
Prime Lake	14.37½	to 14.50	14.37½	to 14.50
Electrolytic	14.10	to 14.20	14.10	to 14.20
Casting	13.95	to 14.05	13.95	to 14.05
Copper wire base	15.25	to	15.25	to ....
Lead	3.90		3.90	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.15	to 5.25	5.10	to 5.20
Tin, spot	32.87½	to 33.12½	33.10	to 33.30
Aluminum:				
Prompt delivery	17.75	to 18.00	17.75	to 18.00
Future	17.75	to 18.00	17.75	to 18.00

*OLD METALS

Heavy copper and wire	12.87½	12.87½
Brass, heavy	8.62½	8.62½
Brass, light	7.50	7.50
Lead, heavy	3.90	3.90
Zinc, scrap	4.15	4.15

*COPPER EXPORTS

Total tons to May 25 27,878

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Amalgamated Copper Company Annual Report.—In the annual report of the Amalgamated Copper Company for the calendar year 1913 Mr. John D. Ryan, the president, says that the market for copper metal during the year was a reasonably good one, notwithstanding the fact that in the last quarter the domestic consumption fell off materially. Domestic consumption averaged in the six months commencing with November but 77 per cent of the rate of consumption during the year 1913 and but 73 per cent of that during the year 1912. The exports during this period of six months were sufficient not only to absorb the surplus left over after the domestic consumers were supplied but also to reduce the stock in the hands of producers in this country from 105,000,000 lb. at the end of 1912 to 70,000,000 lb. on May 1, 1914. The total stocks in Europe and the United States, which were 370,000,000 lb. at the end of 1909, had been reduced to 122,000,000 lb. on May 1, 1914. The prices obtained during the first four months of the year 1914 have not been as good as the average for the years 1913 and 1912, but, taking into consideration the very sharp falling off in domestic business during the last few months, Mr. Ryan concludes that even with domestic consumption below the normal, the future for the metal market is one of great promise.

Increasing Activity of Westinghouse Electric & Manufacturing Company.—Some of the figures of the annual report of the Westinghouse Electric & Manufacturing Company for the year ended March 31, 1914, were published in the *Electrical World* of last week. Supplementary information is published herewith. Property and plant are valued on the balance sheet at $20,054,595. The decrease of $412,649 in this item is due to the fact that the charges for depreciation of buildings and equipment exceeded the amount charged to capital account for additions to plant. Mr. Guy E. Tripp, chairman of the board of directors, says that it is a matter of considerable satisfaction that the company was able to show a large increase in sales billed during the year on the one hand and an actual net decrease in the property and plant account on the other. Patents, charters and franchises are valued at $6,128,239. During the year the balance of $1,540,000 of a total of $3,500,000 debenture certificates issued by the company in 1898 was retired. The situation regarding the foreign companies was explained in detail by Mr. Tripp. The latest advices from the liquidator of the Russian company indicate that in addition to the balance due the Westinghouse Electric & Manufacturing Company for cash advances there will be realized an amount sufficient to pay the greater part of the present book value of the investment in the debentures of the Russian company. At the annual meeting of shareholders of the British Westinghouse Electric & Manufacturing Company, Ltd., on April 6, 1914, a dividend of 5 per cent on the preference shares, the first since 1904, was declared out of the results of the 1913 operations. It is expected that this rate will be maintained as the company has now accumulated an ample cash working capital. The reduction in the book value of the investment in the shares of the Traction & Power Securities Company, Ltd., of London, is due to the repayment in cash of £2 per share on the par value of £10 per share. This company also paid a cash dividend of approximately 3½ per cent out of its income for the year 1913. The total of the investments in traction and power companies has been reduced during the year almost $2,000,000. This is partly due to depreciation but chiefly to the sale during the year of the investment in the securities of the Niagara, Lockport & Ontario Power Company. This sale resulted in a net profit over the book value at which these securities were carried as of March 31, 1913, certain depreciations having been made in previous years. Since the close of the fiscal year the directors have approved the sale of the investment in the bonds and in the majority of the capital stock of the Scranton & Wilkes-Barre Traction Corporation. The notes of the Security Investment Company, to which reference was made in the report for the previous year, have been depreciated to the nominal value of $1. The amount of the depreciation was charged against surplus. The reserve for notes and accounts receivable was again increased during the year. A decrease in the value of the working and trading assets as compared with the previous year is due to the decrease in volume of unfilled orders on hand. The book values have been verified by inventories which were valued at purchase prices or manufacturing costs or less. A small increase in the total of $7,066,864, other assets, is due to deferred charges, incidental to the renewal on Aug. 1 last of $3,250,000 of a total of $4,000,000 collateral notes due on that date. The balance of this expense will be charged off when the notes are paid on Aug. 1, 1914. The five-year notes, aggregating $429,500, issued to creditors under the plan for the discharge of the receivers in 1908, matured Jan. 1, 1914, and were paid. Collateral notes aggregating $3,500,000, placed during the previous year, were paid in full during the current year. An additional collateral loan of $1,250,000 was placed during the year and will be paid at maturity on June 29, 1914. The issue of three-year 6 per cent collateral notes due Aug. 1, 1913, was renewed to the extent of $3,250,000 for two years. The payment of the notes aggregating $4,500,000 will be made from the proceeds of sales of securities and therefore will not deplete the working cash capital of the company. Their payment will return to the treasury a large amount of surplus securities pledged thereunder and will leave outstanding but one issue of collateral notes, the ten-year 5 per cent notes due Oct. 1, 1917, amounting to $2,720,000. The surplus as of March 31, 1913, was $7,348,522. This was increased by the net income for the year and various items to a gross surplus of $12,002,305. By charges for 7 per cent dividends on the preferred stock and 4 per cent dividends on the common stock and miscellaneous charges aggregating $370,686 the gross surplus was reduced to $9,945,719. Against this there were charged depreciations and adjustments of investments and other assets amounting to $2,286,589, leaving a balance sheet surplus as of March 31, 1913, of $7,659,130. The book values of the investments of the company stood at the close of the year at the $22,104,481 as compared with $23,882,860 at the close of the previous fiscal year, or a decrease of $1,778,379.

Augusta-Aiken Corporation Earnings.—Gross earnings of the Augusta-Aiken Railway & Electric Corporation and subsidiary companies for the year ended Dec. 31, 1913, amounted to $725,073 as compared with $662,591 in the preceding year. Operating expenses, including taxes, amounted to $403,084 as compared with $369,438. Net earnings from operation were $321,989 in 1913 and $293,153 in 1912. Interest and sinking fund charges were $205,170 last year as compared with $193,211 in the previous year. The surplus was $116,819 in 1913 and $99,942 in 1912. Dividends of 6 per cent, or $90,000, were paid on the preferred stock in each year, leaving a surplus of $26,819 in 1913 and $9,942 in 1912. In comparison with the increase of 9.4 per cent in gross earnings from all sources, gross electric earnings increased 18.9 per cent with an increase in expenses of 23.4 per cent. F. Q. Brown, the president, says that expenses were higher in 1913 owing to an increase in wages of employees in the transportation department, an active new-business campaign in the lighting department, which resulted in a large increase in electric light and power sales, and the generation of a much larger output of energy to take care of new customers, which necessitated the use of the steam plant for a greater part of the time, the total available water-power supply from the city canal having been used. In addition to the expenditures for maintenance, $94,321 was expended for construction work, of which over one-half was for connecting and serving new customers in the electric department and $11,873 was for an addition to the switchboard to control the apparatus of both city plants in connection with the hydroelecric power from the Georgia-Carolina Power Company. The new hydroelectric development of the Georgia-Carolina Power Company, a subsidiary of the company, was formally dedicated on Feb. 17, 1914. The relations of the company with the city authorities, its own employees, and the public generally are, in the opinion of the officials, entirely satisfactory. With the materially improved business and financial conditions now existing throughout the South, and with a plentiful supply of energy at an economical price for industrial expansion, the officials look forward hopefully to the future growth of Augusta and the properties of the company.

Business Notes

The Olston Electric Stove Company, of Los Angeles, Cal., announces that J. K. Tennant is now manager of the company.

K. McLennan & Company, of Chicago, Ill., have removed their office from 431 South Dearborn Street to 412 South Fifth Avenue.

The Multi-Refillable Fuse Company, of Chicago, Ill., has moved to larger quarters. The new address is 723 West Fulton Street.

The Railway & Industrial Engineering Company has moved its factory and main offices from Pittsburgh to Greensburg, Pa.

The Electric Products Company, of Cleveland, Ohio, announces that O. P. Smith has been appointed manager of its Chicago office.

Lloyd Donaldson, electrical engineer and contractor, has moved from 221 South Tenth Street to 305 North Ninth Street, Boise, Idaho.

The Connecticut Telephone & Electric Company, of Meriden, Conn., announces that W. J. Johnston, of Chicago, Ill., has joined its sales force.

W. N. Matthews & Brother, of St. Louis, announce that James R. Kearney, formerly of the Western Electric Company, will be their special representative.

Hubbard & Company, of Pittsburgh, Pa., announce that Victor L. Crawford, formerly traveling salesman for W. N. Mathews & Brother, is now representing them.

Meirowsky Brothers have moved to 106 Broadway, Jersey City, N. J., where they have about ten times as much space as they had at their former quarters in New York.

The United States Equipment Company, of Chicago, Ill., announces that its offices have been moved to the Continental and Commercial Building, 208 La Salle Street, Chicago.

The Pittsburgh High Voltage Insulator Company, of Derry, Pa., has changed the address of its Los Angeles office from 120 South Los Angeles Street to 757 South Los Angeles Street.

The Robbins & Myers Company, of Springfield, Ohio, has removed its Philadelphia office from the Bailey Building, Room 206, to the Bellevue Court Building, Room 606, 1418 Walnut Street.

M. B. Wheeler has opened an office at 1015 Union National Bank Building, Houston, Tex., as electrical manufacturers' agent. Mr. Wheeler says that "Everything electrical" is his slogan.

The Goodsell Packing Company, of 31 West Lake Street, Chicago, Ill., a new corporation, is to handle various kinds of packing known as "Goodsell" packing. B. W. Goodsell is president and manager.

The Menominee Electric Manufacturing Company, of Menominee, Mich., announces that the Bressan-Young Company, 6 Church Street, New York, has been appointed its Eastern representative.

Harvey Deschere & Company have moved their main office, formerly at 50 Church Street, New York, to the works at 1507 Garden Street, Hoboken, N. J., where the office and works will be combined.

Baeuerle & Morris, of Philadelphia, Pa., announce that the interests of the late Alfred P. Morris have been purchased by Sydney S. Morris and that the business will be continued under the old firm name.

W. G. Watson & Company.—W. G. Watson, of the firm bearing his name at Sydney, Australia, is visiting the United States for the purpose of establishing business relations with manufacturers of electrical supplies.

J. Ed. Erickson, formerly with Thomas G. Grier in Chicago, and more recently with the Erner Electric Company, of Cleveland, has formed a connection with the Western Conduit Company, of Youngstown, Ohio.

William C. Tregoning has established an office and laboratory at 813 Prospect Avenue S. E., Cleveland, Ohio. Mr. Tregoning was formerly president and general manager of the Tregoning Electric Manufacturing Company.

The United States Light & Heating Company, of Niagara Falls, N. Y., announces that a sales office has been established in Washington, D. C., in the Evans Building, 1420 New York Avenue, with W. G. Davis in charge.

Electrical Engineers' Equipment Company, designer and builder of power-plant appliances, has moved to 711 West Meridian Street, Chicago. J. C. Farrar & Company, Los Angeles, Cal., have been appointed its Pacific Coast agents.

The Cutler-Hammer Manufacturing Company announces that Paul W. Jones has been transferred from its New York factory to the sales engineering department, with headquarters in the Farmers' Bank Building, Pittsburgh, Pa.

The Sun Electric Company, Burrage, Mass., manufactures sockets, fuse plugs, cut-outs, switches, etc. G. B. Levy is the president of this new concern, S. O. Reinstein is vice-president, J. Nelson is treasurer, and Frank Langford is secretary and manager.

The L. E. Myers Company of Illinois has transferred its business to the L. E. Myers Company of Delaware. The new company is capitalized at $250,000. The offices of the company will be maintained at Chicago at the same address as that of the old company.

The Buffalo Foundry & Machine Company, of Buffalo, N. Y., is no longer being represented by H. E. Jacoby in New York City and vicinity. This company is now handling direct all inquiries covering vacuum apparatus, castings, patterns and machine work.

The Electric Products Company, of Cleveland, Ohio, announces that J. Preston Lyons has been elected secretary of the company with headquarters at Cleveland. Mr. Lyons has been manager successively of the company's offices at Mobile, Ala.; Buffalo, N. Y., and Chicago, Ill.

Charles Eshleman, general sales manager of the Adams-Bagnall Electric Company, Cleveland, Ohio, has left that company to become vice-president and sales manager of the Union Metal Manufacturing Company, of Canton, Ohio, which is preparing to double the capacity of its plant in that city on account of its rapidly increasing business.

The Alaska-Washington Purchasing Bureau, of Seattle, Wash., has been organized for the purpose of representing firms and individuals in purchasing and forwarding stocks and supplies of every description. E. C. Gaumintz, formerly purchasing agent for the Puget Sound Traction, Light & Power Company, is the purchasing agent of this company.

The Santo Manufacturing Company, of Philadelphia, Pa., announces that it has purchased the patents and manufacturing facilities of the Keller Manufacturing Company. A. H. Boyd, who has been manager of the Philadelphia office of the Fort Wayne Electric Works, has resigned his position to become general manager and treasurer of this company.

New Industrial Companies

The Court Electric Company, of Boston, Mass., has been incorporated with a capital stock of $20,000. The directors are William P. St. George, president; John V. Quinlan, of Brookline, treasurer, and J. J. Gaffney.

The Rupp-Skeldon Motor Company, of Toledo, Ohio, has been incorporated with a capital stock of $50,000 to manufacture and deal in electric motors. The incorporators are Robert G. Young, James Nye, James Greenwald and B. W. Johnson.

The Amo Manufacturing Company, of New York, N. Y., has been incorporated by Herman Frieder, H. G. Wear and F. W. Schmidt, 159 Jewett Avenue, Jersey City, N. J. The company is capitalized at $5,000 and proposes to manufacture and deal in electrical novelties.

The National Electric Distributer Corporation has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $500,000 and proposes to manufacture and deal in machinery to generate electricity. The incorporators are H. E. Latter, W. J. Maloney and O. Reichard, of Wilmington, Del.

The Stephens Gas-Electric Chandelier Company, of Kansas City, Mo., has been granted a charter with a capital stock of $20,000. The incorporators are S. S. Stephens, W. C. Chapman and E. G. Stephens.

The Miami Electrical Supply Company, of Peru, Ind., has been chartered with a capital stock of $10,000 to manufacture and deal in electrical supplies. The directors are E. Trautman, John Bethel and Samuel Fowden.

The MacLewee Electric Company, of Trenton, N. J., has been incorporated by W. S. MacLewee, H. M. Hartman and F. R. Brace, of Trenton, N. J. The company is capitalized at $100,000 and proposes to manufacture electrical appliances, etc.

The Universal Sign & Letter Company, of Brooklyn, N. Y., has been incorporated by H. A. Jourdan, E. Breuer and L. Cohen, of Brooklyn, N. Y. The company is capitalized at $50,000 and purposes to manufacture and deal in electric signs and novelties.

The Willis Mitchel Company, of New York, N. Y., has been incorporated by A. B. Britton, J. J. Jansen, Jr., and W. P. Powell, of New York, N. Y. The company is capitalized at $100,000 and purposes to install light, heat and power systems and deal in machinery, etc.

The Columbian Electric Vehicle Company has filed articles of incorporation with a capital stock of $300,000 under the laws of the State of Delaware. The company purposes to manufacture vehicles of all kinds. The incorporators are W. M. Pyle, G. G. Stiegler and L. W. E. McCarthy, of Wilmington, Del.

Trade Publications

Fans.—A pocket edition of its 1914 fan catalog has been issued by the Sprague Electric Works of the General Electric Company.

Fans.—Westinghouse 56-in. ceiling and column fans are illustrated and described in Folder 4282, issued by the Westinghouse Electric & Manufacturing Company.

Outdoor Substations.—An illustrated flier showing several types of modern outdoor high-tension substations is being distributed by the Delta-Star Electric Company, 617 West Jackson Boulevard, Chicago, Ill.

Motors.—Direct-current motors, types C and D, are discussed in Bulletin No. 41,010 issued by the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York. Their application to various purposes is well illustrated.

Automobiles.—The handsome catalog of the Anderson Electric Car Company, Detroit, Mich., shows some splendid new models of the "Detroit Electric" car. Specifications of each car are given, as well as a description of some of the principal parts of the automobile.

Crane Motors.—Leaflet 2364 of the Westinghouse Electric & Manufacturing Company describes its direct-current crane motors. These motors are designed for severe intermittent, varying-speed service where high starting torque is required. Detailed views of the motors are given and the more important features of construction described.

Household Electric Iron.—Folder 4281 describes the household and travelers' iron manufactured by the Westinghouse Electric & Manufacturing Company. On the front page is a picture of the cutout representing "Dorothy" ironing. This device is furnished to dealers and central stations by the company for use in their selling campaigns.

Motor-Driven Pumps.—Section 3082, a publication of the Westinghouse Electric & Manufacturing Company, describes various kinds of electrically driven pumps. The booklet is freely illustrated. Tables are given showing the frictional heat in wrought-iron pipe, horse-power for pumping, standard dimensions of pipe and atmospheric pressures, equivalent heads and suction lifts.

Laundry Machinery.—The Westinghouse Electric & Manufacturing Company has recently issued Section 3164, which covers motor-driven laundry machinery. It describes the qualifications necessary for motor drive in laundry work. A number of installations are also described, showing the amount of power required for the various machines and also the monthly energy consumption of the different plants.

Map of Mexico.—The Central Electric Company, 320 South Fifth Avenue, Chicago, Ill., is sending out to the electrical trade a map of Mexico showing the position of the United States forts along the Mexican border and the position of the United States fleet in Mexican waters. In the lower left-hand corner of the map, following brief reference to the company being "first in service," are mentioned a few of its specialties.

Lighting Fixtures.—A handsome and instructive catalog illustrating and describing "ideal lighting" has just been issued by the Central Electric Company, 326 South Fifth Avenue, Chicago. Eighteen of the fixture units shown may be equipped with the new high-efficiency tungsten lamps. The illustrations in the catalog show a decidedly attractive line of fixtures ranging from plain Doric designs to the ornate Louis XVI styles.

Lamp Standards.—A booklet of forty pages bearing the imprint of the King Foundry Company, St. Joseph, Mo., contains "A Story of Modern Merchandising." It tells in an interesting manner of the development of light as an aid in selling merchandise as well as an important factor in building up retail sections. It leads up to the story of what the "King White Way" is, and describes the structure, designs and other features of its ornamental poles. Almost any of the classic types of standards and fixtures illustrated would add beauty to a city thoroughfare.

Electric Toaster.—The title of a recent publication of the Copeman Electric Stove Company, Flint, Mich.—"The Toaster That Turns the Toast"—will attract attention. A distinctive feature of this toaster is a knob which controls the tray on which the bread rests. By the turn of a knob the bread can be toasted first on one side and then on the other without handling it and without burning the fingers. The booklet contains illustrations of suggested window displays for dealers and other advertising helps, and attached to one of its pages is a well-prepared smaller booklet (size 3½ in. by 5½ in.) for distribution to consumers.

Chandeliers and Other Fixtures.—A new and distinctive catalog is that of the Beardslee Chandelier Manufacturing Company, 216-220 South Jefferson Street, Chicago, illustrating and describing the varied chandeliers and other lighting fixtures of this house. The book contains about 220 pages, 10 in. by 13.5 in. in size. It is handsomely and profusely illustrated, one plate in colors showing the tints for art glass referred to in the catalog. The manufacturer makes the point that all chandeliers ordered from this catalog in the finishes listed will be shipped in twenty-four hours. Prices are given, and the book forms a valuable reference work for engineers, architects, contractors, dealers and others interested in lighting fixtures.

Locomobiles.—A 112-page catalog has been issued by Heinrich Lanz, Mannheim, Germany, in which are described and fully illustrated the portable and semi-portable self-contained engines made in the works of Herr Lanz. Some interesting interior views of the Lanz shops are followed by comprehensive descriptions of the various types of engines made by this firm, and expert opinions and test reports are also given. Pictures of some industrial plants and central stations in Europe which are driven by Lanz semi-portable engines lend interest to the catalog. An attractive cover incloses the well-arranged reading matter. The Wiener Machinery Company, 50 Church Street, New York, is sole representative of the Lanz products in the United States.

Marine Service Equipment.—Four pamphlets have recently been published by the Westinghouse Machine Company, East Pittsburgh, Pa., with the general title "Application of the Westinghouse Machine Company's Products to Marine Service." Each part of the equipment is treated in a separate publication, under the following heads: "Steam Turbine," "Reduction Gear and Dynamometer," "Bridge Control" and "Condensers and Auxiliaries." A fifth pamphlet gives a description of the Westinghouse gear and dynamometer for marine service. The publications contain much useful information on the electric propulsion of ships and the application of Westinghouse machinery to this purpose. The excellent illustrations make an effective accompaniment to the text.

Personal Mention

Mr. J. H. Ward, formerly of Tottenham, Ont., has been placed in charge of the electric-light plant at Acton, Ont.

Mr. Thomas Henry, for many years chief engineer of the Interurban Electric Company of West Toronto, Ont., has been appointed electrical inspector for the city of Toronto.

Mr. J. C. Grimes, who was formerly connected with the municipal light and water system at Grove, Okla., is now superintendent of the Harrison (Okla.) Gas & Electric Light Company.

Mr. J. Morris has been appointed engineer in charge of the municipal electric light and water-works plant at Newmarket, Ont., succeeding Mr. W. O'Hara, resigned. Mr. Morris was formerly at Mount Forest.

Mr. A. H. Ford has resigned as president of the Birmingham (Ala.) Railway, Light & Power Company, effective June 1, to become vice-president and general manager of the Cumberland County Power & Light Company, of Portland, Maine.

Mr. A. H. Robbins, formerly electrical engineer for the Electric Light & Power Company of Abington and Rockland, North Abington, Mass., has accepted a position as consulting engineer, specializing in electrical engineering, with the General Engineering & Construction Company of New York.

Mr. George Kidd has been appointed general manager of the British Columbia Electric Railway Company, Ltd., of Vancouver, B. C., to succeed Mr. R. H. Sperling, whose promotion as assistant to the chairman of the board in London was noted in these columns on April 25, 1914. Mr. Kidd was formerly secretary of the company in London, and since he has been located at the Vancouver office has filled the position of comptroller.

Mr. Allen B. Gates, until recently testing engineer of the Sanitary District of Chicago, has been promoted to the position of operating engineer. Mr. Gates is a graduate of Purdue University in electrical engineering, class of 1909, and took post-graduate work at the University of Illinois. For four years he has been connected with the District, in Electrical Engineer Ellicott's department. He has made an excellent record.

Mr. J. S. Pevear, vice-president of the New Orleans (La.) Railway & Light Company, has been elected president of the Birmingham (Ala.) Railway, Light & Power Company as successor to Mr. H. S. Ford, who resigned to accept the position of general manager of the Cumberland County Power & Light Company, of Portland, Maine, as announced elsewhere in these columns. The Birmingham company is a subsidiary of the American Cities Company.

Mr. E. C. Gaumnitz has resigned as purchasing agent of the Puget Sound Traction, Light & Power Company, Seattle, Wash. Mr. Gaumnitz was born in St. Cloud, Minn., on Feb. 24, 1882. He went to Seattle with his parents in 1890, and was educated in the public schools. Mr. Gaumnitz entered the employ of the Western Union Telegraph Company about 1896 and remained in its employ until 1899, when he accepted a position in the office of the general superintendent of the Seattle Electric Company.

Mr. Samuel G. McMeen, of Columbus, Ohio, has accepted the presidency of the Ohio State Telephone Company, soon to be formed, it is said, by the consolidation of the United States Telephone Company, the Cuyahoga Telephone Company and other independent concerns, to compete with the American Telephone & Telegraph Company an dits subsidiary companies. Mr. McMeen is a member of the firm of McMeen & Miller, of Chicago, and is president of the Columbus Railway & Light Company.

Mr. Robert Colgate Wood was nominated on May 19 by Governor Glynn as a member of the Public Service Commission for the First District of New York to succeed Mr. John E. Eustis, whose term expired on Feb. 1. Mr. Wood is forty-four years old. He was graduated from Harvard University and has lived at Riverdale in the Borough of the Bronx practically all his life. After leaving Harvard Mr. Wood engaged in the banking and brokerage business with Mr. J. Craig Havemeyer. He was one of the organizers and a director of the New York City Interborough Railway, a crosstown surface line in the Bronx which served as a feeder to the subway and elevated lines. The company is now included as part of the system of the Third Avenue Railway.

Mr. Samuel G. Neiler, who has been nominated as chairman of the Chicago Section of the American Society of Mechanical Engineers, is one of Chicago's prominent engineers. Mr. Neiler has had a wide experience and takes high rank as an authority on details of power-plant service, particularly steam piping and high-pressure hydraulic transmission work for industrial plants. He is president of the engineering firm of Neiler, Rich & Company. In addition to his membership in the American Society of Mechanical Engineers, Mr. Neiler is a fellow of the American Institute of Electrical Engineers and a member of Franklin Institute, the Illuminating Engineering Society, the American Society of Heating and Ventilating Engineers, the National Electric Light Association, the American Association for the Advancement of Science, the New York Railroad Club and the (British) Institution of Electrical Engineers. He was a special student in the mechanical engineering course in Massachusetts Institute of Technology, class of 1888. He took post-graduate work at the University of Minnesota and from 1889 to 1892 was connected with the Thomson-Houston Electric Company at Lynn and Boston. He was responsible for much of the work done in the early development of the search-lantern projector, and he is said also to have done the first real work in the standardization of methods of pole-line construction. From 1892 to 1894 Mr. Neiler was assistant electrical engineer of the World's Columbian Exposition in Chicago. He designed much of the special equipment, laid out a large portion of the work and was directly in charge of all detail construction. It is difficult at this time to realize the almost entire lack of precedent for much of the electric-service work that was undertaken on the exposition grounds. Mr. Neiler's engineering resourcefulness and ingenuity were brought out at the Chicago World's Fair, and he introduced many original ideas in the electric service of that extensive and beautiful exposition. He wrote the report for the electrical engineering department of the exposition. From 1894 to the present time Mr. Neiler has been in professional practice in Chicago. At the Louisiana Purchase Exposition of 1904 he was a member of the jury of awards on steam engines and chairman of the condenser committee. He has designed a large number of plants and equipments, nearly all of them distinguished by originality of execution in adapting means to ends.

SAMUEL G. NEILER

Obituary

George Millard, of Burlington, Ia., secretary of the Citizens' Water Company and for many years connected with the Murray Iron Works Company, died May 4.

W. M. Sheehan, president and treasurer of W. M. Sheehan & Company, electrical engineers and contractors of New York, died at his residence in Newark, N. J., May 23. Mr. Sheehan had been identified with the electrical industry for more than thirty years and was one of the first employees of the Thomson-Houston Company of Lynn, Mass., In 1883 he went to Newburgh, N. Y., in the interest of the Thomson-Houston Company and soon afterward became superintendent of the Newburgh Light, Heat & Power Company. For several years he was identified with the Hyer-Sheehan Electric Motor Company, and with the firm of Sheehan & Hewett, of Newburgh. For fifteen years past Mr. Sheehan had been actively engaged in business in New York City and for several years had been the managing director of the Suffolk Light, Heat & Power Company of Southampton, N. Y.

Construction

New England

GUILFORD, MAINE.—The Greenville Lt. & Pwr. Co., of Greenville, has applied to the Board of Selectmen for a franchise to supply electricity for lamps and motors in Guilford.

MANCHESTER, N. H.—Preparations are being made by the Manchester Trac., Lt. & Pwr. Co. to place all its electric wires in the business district underground, at a cost of about $125,000, to be completed in five years.

MIRROR LAKE, N. H.—Plans are being considered to secure electrical service for this part of Tuftonboro from the municipal electric-light plant in Wolfeboro, which already has erected a transmission line to the Tuftonboro line.

FITCHBURG, MASS.—The Fitchburg Gas & El. Lt. Co. has acquired the public lighting franchise in Ashby and Townsend.

MELROSE, MASS.—The Board of Aldermen has approved the contract with the Malden El. Co. for the installation of an ornamental street-lighting system on Main Street.

TOWNSEND, MASS.—The Fitchburg Gas & El. Co., of Fitchburg, is reported to have acquired control of the public lighting franchise owned by U. S. Adams & Co., of Townsend.

WEST SPRINGFIELD, MASS. — The electric distributing system in West Springfield, together with a franchise for a period of ten years for supplying electricity to the town and residents, has been sold by the Board of Selectmen to the United El. Lt. Co.,of Springfield, for $21,000 ($12,000 for system and $9,000 for franchise). The terms agreed upon assure the placing of the wires underground on Main Street and on Park Avenue as far as Elm Street.

PROVIDENCE, R. I.—Plans are being considered by the City Council for the eventual installation of about 7000 of the new nitrogen incandescent street lamps in the outlying sections of the city, to replace the present carbon incandescent lamps.

WARWICK, R. I.—The Narragansett El. Ltg. Co., of Providence, is planning to replace the 32-cp incandescent street lamps now in use with 50-cp lamps. It is understood that a few of the 350-cp nitrogen lamps will be installed. Arthur B. Lisle is general manager.

Middle Atlantic

ALBANY, N. Y.—Bids will be received by the trustees of public buildings, Executive Chamber of the State Capitol, Albany, until June 10, for electric wiring and fixture hoists in the Assembly chamber of the State Capitol, Albany. Drawings and specifications may be consulted and blank forms of proposal obtained at the office of Lewis F. Pilcher, State architect, Capitol, Albany.

BUFFALO, N. Y.—The New York & Buffalo Steamship Co., recently organized with a capital stock of $3,500,000, proposes to operate 30 electrically driven vessels on the State Barge Canal. Charles W. Morse, of New York, is interested in the company.

NEW YORK, N. Y.—The Bureau of Franchises of the Board of Estimate has reported in favor of granting the application of the Yonkers El. Lt. & Pwr. Co., the Westchester Ltg. Co., the New York Edison Co. and the United El. Lt. & Pwr. Co. for permission to maintain an electric transmission line along the Catskill Aqueduct lands in Westchester County.

NEW YORK, N. Y.—Bids will be received by the Board of Water Supply, twenty-second floor, Municipal Building, Park Row, Center and Chambers Streets, New York, until June 9, on Contract 148, for the construction of the portion of the Catskill Aqueduct telephone system extending from Croton Lake to the northern boundary line of the city of New York, a distance of approximately 28 miles. The pole line has been built under another contract. Pamphlets containing information for bidders and contract drawings can be obtained at the office of the secretary, twenty-second floor, Municipal Building, upon deposit of $10 for each pamphlet. W. Bruce Cobb is secretary.

NEW YORK, N. Y.—The Public Service Commission has authorized the Long Island Ltg. Co., of New York, to issue $90,000 in bonds and $35,000 in capital stock, the proceeds to be used for new construction and improvements to its transmission system. A new 1250-kw turbo-generator set, new coal-handling apparatus and a 300-hp boiler will be installed at the Northport plant, and the docks at Northport will be lengthened 50 ft. Improvements will be made at Brentwood, Islip, Amityville, Ronkonkoma and Sayville. The distribution lines of the company will be increased 12 miles and 250 additional services to consumer installed. The company supplies electricity in Northport, Centerport, Kings Park, Amityville and other towns on Long Island.

WEEDSPORT, N. Y.—At an election held recently the proposal to issue $18,000 for a municipal electric-light plant was carried. It is proposed to secure electricity to operate the system from the Empire Gas & El. Co., of Geneva, which distributes Niagara power in this section of the State.

ARENDTSVILLE, PA.—The Borough Council has entered into a contract with R. B. Myers for lighting the streets of the borough with electricity. The service will be furnished from the plant in the mill owned by Mr. Myers.

NEW CASTLE, PA.—William Wray, manager of the McDougal & Wray Theater, it is reported, is contemplating the installation of a private electric plant.

PHILADELPHIA, PA.—Plans and specifications have been completed and bids are being taken for a power house to be erected at Fortieth and Spruce Streets for the Thomas W. Evans Museum and Institute Society. John T. Windrim is architect.

PHILADELPHIA, PA.—Sub-bids are being asked by Braun & Stewart, of Philadelphia, contractors, for construction of power house for the North Philadelphia station of the Pennsylvania R. R. Co. William Cookman, Broad Street Station, is architect.

PHILADELPHIA, PA. — An ordinance appropriating $60,000 for the construction of a new heating and power plant for the Home for the Indigent at Holmesburg, a suburb of Philadelphia, has been signed by Mayor Rudolph Blankenburg. Plans, it is reported, will soon be completed and bids for construction of the plant will be asked in about 30 days.

PHILADELPHIA, PA.—Bids will be received by A. F. Hammond, superintendent of supplies, at the office of the Board of Public Education, Room 392, City Hall, Philadelphia, until June 9, for lighting fixtures for the following school buildings: William Cullen Bryant, Sixtieth Street and Cedar Avenue; James Martin, Richmond and Ontario Streets, and Overbrook, Sixty-second Street and Lebanon Avenue; also for program clocks and window shade carriers. Specifications, etc., can be obtained at the office of the superintendent of supplies, Room 392, City Hall.

PITTSBURGH, PA.—Bids will be received at the office of the secretary, board of education of Pittsburgh, 725 Fulton Building, Pittsburgh, until June 9 for furnishing electrical supplies.

YORK, PA.—The Merchants' El. Lt., Ht. & Pwr. Co. and the Edison Lt. & Pwr. Co., of York, it is reported, have decided to consolidate. A number of prominent business men, it is stated, will form a company and establish another electric-light plant.

BURLINGTON, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 17 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Burlington, N. J. Drawings and specifications may be secured at the above office or from the custodian of site. O. Wenderoth is supervising architect.

HAMBURG, N. J.—The Hardyston Township committee is preparing plans for the installation of a street-lighting system in Hamburg.

RAHWAY, N. J.—We are informed that the matter of establishing a municipal electric-light plant has been postponed indefinitely. C. H. Lambert is city clerk.

BRUNSWICK, MD.—The Town Council has granted the Harper's Ferry El. Lt. & Pwr. Co., of Harpers Ferry, W. Va., a 20-year franchise to furnish electricity in Brunswick.

CUMBERLAND, MD.—The Edison El. Illg. Co., of Cumberland, has awarded to the Wright, Richardson Co., of Cumberland, a contract for the construction of new power house and the erection of 1½ miles of transmission line. The new plant will have an output of 6500 hp. George W. Eyler is electrical engineer.

CLIFTON FORGE, VA.—The Virginia Western El. Co., of Clifton Forge, it is reported, is contemplating the erection of a transmission line from Clifton Forge to Ronceverte, W. Va.

ROCKY MOUNT, VA.—The Light & Pwr. Co., of Rocky Mount, has increased its capital stock from $15,000 to $20,000.

WILLIAMSBURG, VA.—The Bryant Lumber Co., it is reported, will install a 100-hp generating unit (directly connected) to furnish electricity for lamps and motors in Williamsburg. R. M. Bryant, of Franklin, is secretary.

WASHINGTON, D. C.—Bids will be received by the Engineer Department, Washington Barracks, D. C., until June 12 for furnishing motor-driven centrifugal pumps. Further information may be obtained on application to Lt.-Col. Joseph E. Kuhn.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Room 509, District Building, Washington, until June 1 for furnishing cast-iron lamp-posts for use in the Electrical Department. Specifications and form of proposal may be obtained from the purchasing office, Room 320, District Building, Washington.

WASHINGTON, D. C.—Bids will be received at the office of the superintendent, United States Capitol Building and Grounds, Washington, D. C., until June 1 for installing at Columbia Hospital for Women, Pennsylvania Avenue, two electric passenger elevators, one electric service elevator, six electric dumbwaiters, one hydraulic sidewalk elevator and the mechanical equipment for same. Further information may be obtained upon application to Elliott Woods, superintendent.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 16 to be delivered at the various navy yards and naval stations the following supplies: Newport, R. I., Schedule 6832—three electric furnaces. Narragansett Bay, R. I., Schedule 6835—for installing underground telephone system as shown on drawing 646-13. Brooklyn, N. Y., Schedule 6839—one 110-hp induction motor, type A, class I, 2200 volts, three-phase, 60 cycles; Schedule 6830—6000 ft. interior-communication plain 4-conductor and 10-conductor cable, 148,000 ft. flexible, double, plain, insulated conductor for portables, 2000 ft. solid, cotton-covered, rubber-insulated wire for ignition circuits for combustion engines, 54,700 ft. galvanized, soft-steel, leaded and armored twin-conductor wire; Schedule 6829—30,000 ft. solid, single, rubber-insulated lighting and power wire. Annapolis, Md., Schedule 6831—one motor-driven, 40-in. by 60-in. non-reversing, suction, dry-room tumbler. Boston, Mass., Schedule 6827—annual supply galvanized, crucible wire, cast-steel, annual supply annealed and galvanized, crucible cast-steel wire, annual supply plow-steel wire. Norfolk, Va., Schedule 6834—one motor-driven 24-in. chucking and bar combination lathe, one motor-driven 30-in. screw-cutting rapid-reduction lathe, two motor-driven, combined vertical and horizontal milling machines. Bids will also be received until June 23 as follows: Mare Island, Cal., Schedule 6824—one motor-driven hydraulic test pump. Bids will also be received at the same place until June 23 as follows: Mare Island, Cal., Schedule 6824—two motor-driven portable bench drills; Schedule 6813—one motor-driven combination saw and dado machine. Bids will also be received until June 30 for 10 radio sets (2-kw and 5-kw) for ship installation, to be delivered at the Brooklyn navy yard as per Schedule 6811. Applications for proposals should designate the schedule desired by number.

North Central

ALBION, MICH.—The Commonwealth Pwr. Co., it is reported, contemplates the installation of a new tungsten street-lighting system in Albion.

BATTLE CREEK, MICH.—Efforts are again being made to extend the ornamental lighting system on West Main Street to Washington Street and on Washington Street to the Sanitarium Annex.

GLADSTONE, MICH.—The electric light commission expects to purchase within the next eight months poles, wire, etc., for a 2-mile extension. The commission also contemplates the installation of either magnetite-arc lamps or series tungsten lamps to replace the 48 series-arc lamps now in use. G. A. Frogner is superintendent.

THREE RIVERS, MICH.—The Middle West Utilities Co., of Chicago, Ill., has purchased the controlling interest in the Three Rivers Lt. & Pwr. Co. T. L. Arnold is treasurer and manager.

BRADFORD, OHIO.—The installation of a small electric-light plant, to cost $2,000, is under consideration.

CAMBRIDGE, OHIO.—The New Midland Pwr. & Trac. Co., of Cambridge, has purchased a site on the B. & O. road, near the plant of the Guernsey Earthenware Co., on which it will erect a substation to transform energy taken from the high-tension transmission line from Coshocton for distribution in Cambridge.

CINCINNATI, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 8 for repairs to the heating system, etc., in the United States custom house in Cincinnati, Ohio. For details see proposal columns.

CLEVELAND, OHIO.—The Cleveland El. Illg. Co. has taken out a permit for the construction of an addition to the engine room to its power plant at 712 East Seventieth Street, to cost about $7,000.

COLUMBUS, OHIO.—Arrangements, it is reported, have been made for financing a company to build a large central station at Floodwood, Ohio, in the Hocking Valley coal fields, from which electricity would be transmitted to towns and coal mines within a radius of 75 miles. Close & Co., of London, Eng., are said to be interested with other English capitalists in the project. F. C. Elliott, of Chicago, Ill., as trustee, will carry the plant through the construction stage. Herman Gamper, formerly superintendent of the municipal plant at Columbus, is engineer in charge.

LORAIN, OHIO.—The City Council has appointed a special committee, consisting of Mayor J. J. Pollock, Service Director Lewis and Council President George Alleman to make investigations and report on the feasibility of installing a municipal electric-light plant.

LOVELAND, OHIO.—The receiver of the Loveland El., Ice & Wtr. Co. has obtained authority from the court to dispose of the property of the company, including power and ice plants, which will be sold at auction on June 6. The estimated value of the property is placed at $75,000.

NORWALK, OHIO.—The City Council, it is reported, will soon call an election to submit the proposal to issue $120,000 in bonds for the installation of a municipal electric-lighting system to the voters.

YOUNGSTOWN, OHIO.—Bonds to the amount of $1,000,000, it is reported, will be issued by the Mahoning Valley Street Railways system, controlled by the Republic Ry. & Lt. Co., to finance improvements in its plants and railways within the next year.

WINCHESTER, KY.—George E. Tomilson, of Winchester, it is reported, is expecting to purchase one 75-kw to 100-kw, three-phase, 60-cycle, 220-volt generator and 20 motors, from 5 hp to 20 hp.

EAST CHICAGO, IND.—The Public Service Commission has granted the Northern Indiana Gas & El. Co., of East Chicago, $1,020,000 in bonds and $282,000 in notes, the proceeds to be used for the construction of a new plant in East Chicago.

JEFFERSONVILLE, IND.—The City Council is considering the question of establishing a municipal electric-light plant in Jeffersonville.

KOKOMO, IND.—Within the next three months the Indiana Rys. & Lt. Co., of Kokomo, expects to erect approximately 35 miles of transmission and distribution lines and transformers to supply electricity to rural districts and small towns. P. H. Palmer is assistant general manager and electrical engineer.

WINAMAC, IND.—The Town Council is considering a proposal submitted by Mr. Marvin, civil engineer, of Frankfort, for the installation of a power plant in Winamac.

AVON, ILL.—Within the next two months the Avon Milling & Mfg. Co. expects to purchase a 40-kw, 50-kw or 60-kw, 250-volt direct-current generating unit (directly connected) and one carload of 25-ft., 6-in.-top poles; also electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc. George A. Tompkins is secretary and treasurer.

LOCKPORT, ILL.—The Public Ser. Co. of Northern Illinois, of Chicago, which, it is reported, has taken over the municipal electric-lighting system, is contemplating rebuilding the entire lighting system.

ROCK FALLS, ILL.—The Illinois Northern Utilities Co., of Chicago, is reported to have purchased the electric power franchise owned by Paul Dillon in Rock Falls. The company, it is expected, will extend its transmission lines into Rock Falls immediately.

ROCK ISLAND, ILL.—The People's Pwr. Co., of Rock Island, is planning to install a new street-lighting system consisting of 200 4-amp magnetite-arc lamps and 450 tungsten lamps of 100 cp, maintained by overhead wires, to cost about $30,000. Contracts have been placed for material. F. W. Reimers is general manager.

SPRINGFIELD, ILL.—Plans for a new fire-alarm system for the city have been submitted to the City Commissioners by Fred Spears, city electrician, to replace the present system. The plans provide for the installation of 150 boxes, at a cost of $30,000.

STERLING, ILL.—Bids are being asked by the city of Sterling for a boulevard lighting system, consisting of 82 posts, 8600 ft. of cable, transformer, etc. For specifications address Mayor A. J. Platt.

HUMBIRD, WIS.—The installation of an electric-light system in Humbird is under consideration. It is proposed to ask the Chippewa Valley Lt. & Pwr. Co., of Chippewa, to extend its service here.

MANITOWOC, WIS.—The cost of a new building and improvements for the municipal electric light and power plant is estimated at about $60,000.

ANOKA, MINN.—Within the next five months the city of Anoka expects to purchase material for distribution system, including poles, underground conduit, wire and meters. John Palmer is city manager.

AURORA, MINN.—The Village Council has decided to call an election to submit the proposal to issue $35,000 in bonds, of which $20,000 will be used for extensions and improvements to the municipal electric-light plant and $15,000 for the water-works system.

NEW YORK MILLS, MINN.—The installation of an electric-light plant in New York Mills is under consideration by the Council.

ST. JAMES, MINN.—Bids will be received until June 12 at the office of the Board of Education, St. James, Minn., for erection of an addition to the present high school building. Separate proposals to be submitted on general construction, heating and ventilating, plumbing and electric work. Plans and specifications are on file at the Minneapolis Builders' Exchange; copies may be obtained at the office of F. E. Halden, architect, Kasota Building, Minneapolis, upon deposit of $25, to be refunded upon return of plans. J. K. Sonnesyn is president of board.

ST. PAUL, MINN.—Extensive improvements will be made to the properties of the Consumers' Pwr. Co., a subsidiary of the Northern States Pwr. Co., during the current year. The Coon Rapids hydroelectric development on the Mississippi River is nearing completion and the initial unit of 21,000 hp will be in operation about Aug. I. The plant when completed will have an output of 10,500 hp. A high-tension transmission line from St. Paul to near Northfield, a distance of 33 miles, will be erected to connect the hydraulic systems of the Faribault and Mankato systems. In addition to these there will be a number of extensions to transmission and distributing systems.

STAPLES, MINN.—Within the next four months the Board of Public Works expects to purchase water-softener outfit for water used in boilers at the municipal electric-light plant and an 8-in. by 12-in. boiler-feed pump. F. W. Findsen is secretary of light and water commission.

TWO HARBORS, MINN.—The city of Two Harbors is expecting to purchase coal loading and screening equipment for the municipal electric-light plant. A. Omtvedt is city clerk.

ALLISON, IA.—A franchise has been granted to the Hampton El. Lt. & Pwr. Co., of Hampton, to furnish electricity here for a period of 25 years. The company will extend its transmission line from Hampton to Allison.

DUBUQUE, IA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 2 for changes in plumbing, conduit and wiring system and lighting fixtures in the United States custom house and post office at Dubuque, Ia. For details see proposal columns. O. Wenderoth is supervising architect.

ESTHERVILLE, IA.—Plans are being prepared for extensions to water-works system and remodeling the municipal electric-light plant. J. F. Druar, of the Oscar Claussen Engineering Co., Commercial Building, St. Paul, Minn., is engineer in charge.

MASON CITY, IA.—All three franchises asked by the People's Gas & El. Co., controlled by the United Lt. & Rys. Co., were carried at an election held recently.

MILFORD, IA.—Preparations are being made for the installation of an electric-light and power plant in Milford. Electricity for operating the system will be obtained from the plant at Spirit Lake. Ralph Rodgers, of Milford, is engineer in charge. Messrs. Rassmussen and Nelson are interested in the project.

SAC CITY, IA.—The Sac City El. Co. is reported to have awarded a contract for the erection of a new generating plant.

WIOTA, IA.—The installation of an electric-lighting system in Wiota is under consideration.

HERMANN, MO.—The Hermann El. Lt. Co. expects to purchase within the next two months a 100-hp water-tube boiler.

PARNELL, MO.—Application has been made to the Council by the Grant City El. Lt. & Pwr. Co., of Grant City, for a franchise to furnish electricity in Parnell.

CHURCH'S FERRY, N. D.—The Commercial Club is considering the question of securing an electric-lighting system for the town.

HANKINSON, N. D.—The Otter Tail Co., of Fergus Falls, Minn., has purchased the property of the Phillips-Carlton El. Co., of Hankinson, and will extend its transmission line from Fairmont, N. D., to supply energy here. Other improvements will be made to the local system, involving a total expenditure of about $150,000.

BROOKINGS, S. D.—Extensions and improvements to the municipal electric-light plant, involving an expenditure of about $10,000 are under consideration.

EUREKA, KAN.—At an election held May 19 the citizens voted to grant R. M. Wilson, owner of the local electric-light plant, a 20-year electric-light franchise.

SHADY BEND, KAN.—The Shady Bend Milling & Pwr. Co. is expecting to erect within the next six months a transmission line to Beverly, a distance of 2½ miles, and will purchase material for same.

VALLEY FALLS, KAN.—The City Council, it is reported, has adopted resolutions providing for improvements to the electric-light plant. It is understood that new equipment, including engines and generators, will be purchased.

Southern States

WASHINGTON, N. C.—Bids will be received by the committee on improvements of the city of Washington until June 17 for mechanical and electrical equipment and for improvements to the electric-light plant as follows: Water-tube boilers, 400-kw engine-driven or turbine-driven generating units, exciters, switchboard, condensers and steam and centrifugal pumps. The construction work consists of buildings, foundations, concrete coagulating basin and filter tubs, filter plant, reservoir and radial brick chimney, and laying about 2½ miles of cast-iron pipe. Specifications and plans are on file in the office of the superintendent, Washington. Specifications, form of proposal and contract and plans will be mailed upon application to Gilbert C. White, of Charlotte, N. C., engineer, for which a deposit of $5 will be required for the specifications and form of proposal and contract and $5 for plans, which will be refunded upon return of same. H. B. Charles is superintendent.

LANDRUM, S. C.—The Tyron Ltg. Co., it is reported, contemplates the construction of an electric-light plant in Landrum.

McBEE, S. C.—A dam is being erected on Cedar Creek preparatory to installing an electric power plant, which will furnish electricity in McBee, Bethune and Big Springs Hotel. M. L. McCoy, of McBee, is interested in the project.

McPHERSON, GA.—Bids will be received at the office of the quartermaster, Fort McPherson, Ga., until June 10 for remodeling electric-lighting system. Major L. F. Garrard is quartermaster.

ATLANTIC BEACH, FLA.—The proprietors of the Atlantic Beach Hotel, it is reported, contemplate making improvements to the hotel, changing the lighting system from direct to alternating current, to install an ornamental street-lighting system, covering about 1 mile and to furnish electricity for street-lighting and for about 85 cottages; also to make improvements to engine house and probably to install Ball engines. H. M. Stanford is manager.

AVON PARK, FLA.—The Town Council has granted L. O. Feagin a franchise to construct and operate an electric-light plant and water-works system in Avon Park.

GULFPORT, FLA.—Application has been made to the City Council by F. J. Davenport and others for a franchise to install and operate electric-light, gas and water plants in Gulfport.

LAKELAND, FLA.—The city of Lakeland, it is reported, will vote on the proposal to issue $70,000 for additions to water and light plant, and $25,000 for extensions to distribution of light and water systems.

LEESBURG, FLA.—Rufus Vinsant, of Ashland, Ky., Dr. Collier, of West Liberty, Ky., and others are reported to have acquired Stone Mountain, and propose to erect a clubhouse, six residences, install water-works, electric-light plant, etc.

TAMPA, FLA.—The Tampa El. Co., it is reported, will install six boilers (equipped with automatic stokers) in the West Jackson Street power house and erect radial chimney 200 ft. high, at a cost of about $200,000.

WINTER HAVEN, FLA.—The Winter Haven Wtr., Ice & Lt. Co., it is reported, contemplates the installation of new machinery in its plant, including a 300-hp engine, two 6-in. pumps and extensions to its electric distributing lines and water mains. N. F. Boyd is manager.

HALLS, TENN.—Bids will be received by the city of Halls until June 1 for one 150-hp boiler, one 50-kva and one 75-kva generator, each to be directly connected to automatic high-speed engine, and installation of street-lighting system complete, including switchboard. R. C. Huston, Exchange Building, Memphis, Tenn., is consulting engineer. B. M. Archer is Mayor.

ASHFORD, ALA.—The proposal to issue $8,000 in bonds for the installation of a municipal electric-light plant will be submitted to the voters on June 8.

MONTGOMERY, ALA.—The Alabama Trac. Co. has applied to the City Commissioners for a 30-year franchise to construct and operate an electric street railway on certain streets of the city.

GREENVILLE, MISS.—The Delta Lt. & Trac. Co., recently organized, has acquired the property of the Delta El. Lt., Pwr. & Mfg. Co., of Greenville, operating electric-light plant and street railway (10 miles) and equipment; Riverside Transmission Co., operating transmission line from Greenville to Arkansas and Mississippi points; Chicot Lt. & Pwr. Co., furnishing electricity in Chicot County, Arkansas, and Lake Village Lt. & Pwr. Co., of Lake Village, Ark. The Delta Lt. & Trac. Co. contemplates improvements to the systems. Frank Robertshaw, of Greenville, is president; Ralph Claggett, secretary and general manager, and E. J. Lenz, superintendent, all of Greenville.

JONESBORO, ARK.—Arrangements are being made to rebuild the electric plant of the State Agricultural College, recently destroyed by fire. New equipment will be purchased consisting of two tubular bricked-in boilers (one 125-hp and one 120-hp), one 30-kw, 110-220-volt direct-current generator and engine or turbine, directly connected. Switchboard equipment will be purchased later. V. C. Kays, of Jonesboro, is engineer in charge.

DELHI, LA.—The town of Delhi has granted E. Scott, of Rayville, a franchise to construct an electric-light plant here.

MELVILLE, LA.—At an election held May 12 the proposal to issue bonds for the installation of a municipal electric-light plant was carried. Anderson Offut, 439 Carondelet Street, New Orleans, is consulting engineer.

NEW ORLEANS, LA.—Bids will be received at the office of the lighthouse inspector, New Orleans, until June 18 for furnishing and installing an electric plant for the completion of the tender *Camellia*. Blank proposals and particulars may be obtained by addressing light-house inspector at New Orleans.

JET, OKLA.—At an election held recently the proposal to install an electric-lighting system in Jet was carried.

WILBURTON, OKLA.—The City Council is considering the installation of municipal electric-lighting and water systems in Wilburton.

AUSTIN, TEX.—The Austin St. Ry. Co. is reported to be contemplating building an addition to its power house, at a cost of about $2,000.

PHARR, TEX.—The Pharr Ice, Lt. & Pwr. Co., recently organized with a capital stock of $40,000, it is reported, will erect an electric light and power plant and ice factory. S. R. Gathrop is one of the incorporators.

SANGER, TEX.—The installation of an electric-light plant is under consideration. C. P. Dodson is reported interested in the project.

Pacific States

KELSO, WASH.—The Kelso Wtr. Co., recently incorporated with a capital stock of $30,000, it is reported, will take over the plant of the Independent El. Co. The incorporators are: E. W. Hall, of Portland, Ore.; B. M. Atkins, of Kelso, and B. Yates, of Vancouver, Wash. The headquarters of the company will be in Vancouver.

LEAVENWORTH, WASH.—The Cashmere Wtr. Co., of Cashmere, has applied to the City Council for a franchise to distribute electricity for lamps and motors in Leavenworth. The company proposes to build a hydroelectric plant near Cashmere and supply energy to the entire Wenatchee Valley.

NORTH YAKIMA, WASH.—The Central Htg. Co. has petitioned the City Council for a franchise to furnish electricity for lamps and motors in addition to its heating service in North Yakima. If granted a franchise, the company proposes to build a plant, at a cost of $100,000.

RIDGEFIELD, WASH.—J. H. Cunningham, of Portland, Ore., has applied to the City Council for a franchise to furnish electricity and water in Ridgefield.

SEATTLE, WASH.—Plans prepared by Daniel Huntington, city architect, for the power station of the auxiliary steam plant on Lake Union, to cost $50,000, for the city lighting system, have been approved by the Board of Public Works. The plant complete will cost about $350,000.

SEATTLE, WASH.—The City Council has tentatively adopted the plan proposed by Mayor Gill to develop the Cedar River power project before steps are taken to acquire other power sites. It is proposed to raise the dam to an elevation of 1555 ft., increasing the output of the Cedar Falls plant from 9000 kw to 14,000 kw, while the completion of the first unit of the Lake Union Steam plant will add 7500 kw to the municipal electric system. J. D. Ross is superintendent of lighting.

SOUTH BEND, WASH.—Application has been filed with the County Commissioners by Frank McLean, vice-president and general manager of the Willapa Pwr. Co., recently incorporated, for a franchise for an electric railway and to furnish electricity in Pacific County. This is a part of the proposed development of the company's electric system on the south fork of the Willapa River and in South Bend. The headquarters of the company are in the White Building, Seattle.

DRAIN, ORE.—At an election held May 12 the proposal to issue bonds for the installation of an electric-light plant was carried.

GLENDALE, ORE.—The property of the Glendale Lt. & Pwr. Co. has been purchased by the California-Oregon Pwr. Co., of Medford. The latter company will erect a 12-mile transmission line from Placer to Glendale, for which contracts have been awarded. H. C. Stoddard, of Medford, is engineer in charge of the work.

SALEM, ORE.—Application has been filed with State Engineer Lewis by U. G. Hayne, of Portland, for a permit to build a 10,000-acre-ft. storage reservoir on Parmelia Lake, to be used for the development of 21,136 hp. Mr. Hayne also proposes to utilize the water of Marion River, Minto Creek, Parmelia Creek and White Water Creek.

BISHOP, CAL.—Arrangements are being made by the Nevada-California Pwr. Co. for financing for the hydroelectric plant to be built on Bishop Creek this year. It is expected to have the first 13,000-hp unit in operation in 1915.

PORTOLA, CAL.—The Supervisors of Plumas County have granted R. B. Young, of Loyalton, a franchise to construct and operate an electric-lighting system in Portola.

SAN FRANCISCO, CAL.—The directors of the Northern California Pwr. Co., of San Francisco have called a special meeting of the stockholders for July 17 to authorize an increase in capital stock of $2,000,000, of which $500,000 is to be issued and sold at once.

SALT LAKE CITY, UTAH.—Bids will be received by the State Capitol Commission, Salt Lake City, until June 5, for furnishing lighting fixtures or lighting systems, required for the entire Utah State Capitol Building, now being erected on the Capitol grounds. Plans are on file in the office of Richard Kletting, architect, 415 Felt Building, Salt Lake City, Utah.

GREEN RIVER, UTAH.—A special election will soon be called to vote on the proposal to issue bonds for the purpose of establishing a municipal electric-light plant in Green River.

FLORENCE, ARIZ.—The City Council has instructed the city engineer to make investigations as to necessary legal steps to be taken by the city to raise funds for the establishment of a municipal electric-light plant.

LEWISTOWN, MONT.—The City Council has awarded the contract for furnishing material and installation of a special lighting system in the business district to the Veley Construction Co., of Livingston, at $15,000.

GREELEY, COL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 30, for construction complete, including mechanical equipment, lighting fixtures and approaches, of the United States post office building at Greeley. Drawings and specifications may be obtained from the above office or from the custodian of site at Greeley. O Wenderoth is supervising architect.

PLATTEVILLE, COL.—H. Woodward, who is erecting an alfalfa mill in Platteville, it is reported, has applied for a franchise to furnish electricity for lamps here.

Canada

KELOWNA, B. C.—Tenders will be received by G. H. Dunn, city clerk, until June 11 for furnishing the following apparatus, f.o.b. on cars Kelowna: One 225-hp vertical, two-crank, compound steam engine, one feed-water heater, one independent air pump and jet condenser, one 150-kw, three-phase, 60-cycle, 2200-volt generator for direct connection to engine, exciter for direct connection to generator, one switchboard panel to match present switchboard. Specifications may be obtained from the consulting engineer's branch office at Vernon, B. C. C. R. Yuill, successor to Mather, Yuill & Co., of Vancouver, is consulting engineer.

WINNIPEG, MAN.—Bids will be received by the City Light and Power Department of Winnipeg until June 12 for furnishing and installing approximately 5500 ft. of three-core, paper-insulated, lead-covered, 13,000-volt cable. Specifications are on file in the office of J. G. Glassco, engineer, 54 King street, Winnipeg.

ESSEX, ONT.—The Town Council is considering the question of installing a generator, motor and pump, and also laying mains to connect Garrow well with the town system.

STRATFORD, ONT.—The by-law appropriating $22,000 for an ornamental street-lighting system on the two main streets and for extensions and improvements to the present street-lighting system has been approved by the ratepayers.

MOOSE JAW, SASK.—The by-law providing for an expenditure of $155,000 for electric-lighting was approved by the ratepayers at an election held recently.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until June 11, for material for oil-handling plants, including pumps, headers, valves, pipe and fittings; centrifugal pump unit, complete with motor, automatic starting apparatus, float switch, etc.; altitude gages, compound gage, paving brick and tiles. Blanks and general information relating to this circular (No. 854) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C Boggs is general purchasing officer.

New Incorporations

MONTEZUMA, GA.—The Montezuma Lt. & Pwr. Co. has been incorporated with a capital stock of $20,000 by E. B. Lewis, W. H. McKenzie and J. W. McKenzie. The company, it is understood, will take over the property of the Montezuma Mfg. Co.

BLACKFOOT, IDAHO.—The Bingham County Pwr. Co. has been incorporated with a capital stock of $50,000 by J. M. Stevens, J. T. Carruth and W. R. Jones, all of Blackfoot. The company owns several power sites on Wolverine Creek, which, it is understood, will be developed.

MARS HILL, MAINE.—The Westfield El. Co. has been organized with a capital stock of $5,000 for the purpose of generating and distributing electricity. The officers are Royal J. Colbath, of Westfield, president, and Aubrey C. Frost, of Limestone, treasurer.

NASHVILLE, TENN.—The Tennessee Trac. & Lt. Co. has been incorporated with a capital stock of $10,000 by R. G. Sparrow, S. E. Goodwin, W H. Parrish, Jr., C. H. Smith and J. N. Vaughn.

GOWGANDA, ONT., CAN.—The Gowganda Pwr. Co. has been incorporated with a capital stock of $100,000 by J. G. Shaw, J. Montgomery and H. P. Edge.

SOREL, QUE., CAN.—The General Utilities Corporation has been chartered with a capital stock of $50,000 and the following directors: A. E. Pontbriand, J. A. Simiard and A. Peticlere, of Sorel, Que., and G. E. Pontbriand, Shawinigan Falls, Que.

ments upon which accountants are unable to agree. Costs are not the same for different forms of service. If values and costs were the same, the simplest way to make rates would be to make uniform rates. But uniform rates would not develop the gross business needed to assure the largest use of the investment. The central station was formerly idle a large part of the day. Then it developed a market for its product during hours when the customers for whom the plant was originally intended used no energy. By so doing it increased use of capital and efficiency of service and made reduced rates possible for all users. What the companies should do is to make sure that their rates are the same for like purposes. They can justify on plain economic grounds the making of different rates for different classes of service. Rates should be differentiated by class, not by individual. The electrical utility is naturally a monopoly. Yet its rate-making is guided to some extent by actual or theoretical competitive rates. A company would naturally try to make a rate low enough to get business if a competitor was in the market. Though protecting itself and its return on capital, it should also try to make rates equally favorable when it enjoys protection as a monopoly.

The Electrification of New Jersey

In many respects the system of the Public Service Corporation of New Jersey, a description of which appears on page 1329 of this issue, is the most notable agglomeration of interests in the country. Without including any city of the first rank, it serves 178 municipalities, with a population of 2,000,000, and has a yearly output of more than 400,000,000-kw-hr. for motor service, lighting and railways. Its network is in three sections, of which the southernmost is isolated as yet from the others, but all are worked at the standard voltage of 13,200. The system is the growth of a decade, in which time the generating rating has increased threefold and the output in like ratio. During this period there has been a steady concentration of generating equipment so that now the chief station, at Marion, carries 75,000 kw.

In the southern division the chief station is now being built at Burlington, with an ultimate rating of 100,000 kw. Unhappily, the exigencies of railway load forced the company, like many another, into the use of two frequencies so that the distribution is not homogeneous, although in other respects there is a remarkable degree of standardization throughout the system. From the engineering standpoint, the most interesting feature is the thorough system of load dispatching by which the several stations are put into action for maximum efficiency, the main station at Marion being worked at maximum load-factor and the auxiliaries elsewhere being utilized as needed. The complete and thoroughly analyzed record of interruptions which is kept discloses some striking facts. Of the nearly 700 miles of lines about one-sixth is underground, yet the cable failures were chargeable with barely over one-tenth of the service interruptions. Insulator failures, while more numerous, still accounted for only about one-fifth the troubles, showing clearly that main-line troubles are well under control and that miscellaneous accidents to the network are the most prolific sources of service interruptions. In other words, there is practical evidence that the big transmission networks are not in themselves less reliable than the several component plants. In fact, because of better and more systematic inspection they are probably more reliable.

The New Jersey system is now barely beyond the preliminary stages of its growth. It serves a rapidly growing group of communities and is destined to cover fully the great belt of territory along the line from New York to Philadelphia. Its rapid increase of output is the most conclusive evidence of its usefulness to the communities it serves. No similar organization has, we fancy, taken over more numerous and diverse plants giving services to more separate municipalities. It is only a question of very short time before the physical unification of the various properties will be complete, with all the accompanying benefits. It is not wise to look askance at the merger of small plants, for time soon brings its justification.

Developments in Electrical Apparatus

The report of the committee on electrical apparatus read at the National Electric Light Association convention contains much valuable material concerning apparatus of various kinds and sizes, from large turbo-generators to instrument shunts. Special attention is given to out-of-door substation construction, which has recently been rendered necessary by the large size and high voltage of transformer and switching apparatus. In such cases there is no vault so economical to rent and occupy as that of heaven. Climatic extremes of temperatures have, however, to be taken into consideration in the designs of these outdoor substations. Encouraging reports are given concerning the development of large rectifiers in experimental use under service conditions. The prospects are auspicious for the eventual supersession of synchronous converters by rectifiers, which means the substitution of electron-stream motion for rotary mass motion. Electrons have neither brushes nor journal bearings to care for. On the other hand, the use of large synchronous machines for the purposes of voltage control on long lines is steadily increasing.

An important chapter is that devoted to the standardization of mechanical phase rotation in polyphase machinery. The successive advance of phases is indicated very simply and conveniently by the use of the successive numerals 1, 2, 3. Standard rotation from the mechanical point of view is taken as clockwise when viewed from the load end; that is, the pulley or commutator end of the rotating shaft. It is somewhat unfortunate that machine men generally regard positive rotation as clockwise, whereas throughout mathematics positive rotation is taken as counter-clockwise, perhaps because the earth so rotates as contemplated by an observer standing at the north pole. Whatever the history of the mathematical convention may be, it is somewhat unfortunate that the mechanical convention should be in opposition thereto. However, since every shaft must have two ends, the standard rotation proposed by the committee can be brought into agreement with mathematical convention by stating it in the form that it shall consist of counter-clockwise rotation when viewed from the counter or unloaded end of the shaft—i. e., the end needing a counterweight. By this reversal of viewpoint, harmony between conflicting conventions may be restored.

The report is concluded with some interesting history concerning the co-operation between the committee and the A. I. E. E. in preparing the forthcoming expected new edition of the Institute's standardization rules. The experience and technical relations of the N. E. L. A. committee, as well as of the committee of the Association of Edison Illuminating Companies, have, we understand, been most welcome and helpful to the standards committee in this work; so that it is hoped the new standardization rules, when finally adopted, may be acceptable not only to the Institute but also to all the large electrical engineering organizations in America, while still keeping in substantial conformity with the International Electrotechnical Commission.

Grounded Neutrals in Transmission Systems

The paper by Messrs. Jollyman, Downing and Baum read at the Pittsfield meeting of the A. I. E. E. last week, on the experience of the Pacific Gas & Electric Company with star-connected, three-phase transmission systems and definitely grounded neutral, is strong testimony on behalf of that procedure after more than ten years of experience. The arguments in favor of the grounded high-tension three-phase neutral are essentially similar to those in favor of the grounded low-tension three-wire system neutral—namely, that if a ground comes on an outside conductor, the short-circuit occurs at once and is limited in voltage to that of one branch; whereas with the system normally ungrounded any accidental ground will greatly disturb the potential distribution and tend to produce a ground on the opposite side of the system.

The ground connection as an essential element of the system increases the electrical stability. Of course, any accidental grounding involves a short-circuit when the system neutral is grounded; but that difficulty has to be faced and guarded against in any case. As this question of the neutral free, grounded, or grounded through resistance is debatable ground, the discussion over it was somewhat vivacious. Thus in a paper by Mr. R. C. Clinker read at the same meeting it was pointed out that the star three-phase system may produce peaked voltages higher than the corresponding delta system owing to the unleashing of triple harmonics.

The Public Policy Report

The report of the public policy committee of the N. E. L. A., presented at this week's convention, reaffirms the recommendations of previous years on questions of public concern and welfare work. It is not so constructive as some of the previous reports, but the constructive declarations came in earlier years. Earlier reports were strongly constructive when the problems were mainly new. They outlined fundamental policies which have not lost importance; in fact, these policies have become the vital issues of the day with public utilities. Since the first declaration of these sound policies preceded the declaration of the attitude of other classes of utilities, the electrical industry can fairly reaffirm what others affirm for the first time. It advanced when they at first held back. It led where they now follow. Except very briefly, no other point than that of recognition by the public service commissions of the monopoly character of utilities is mentioned in the section relating to commissions. This indicates that the committee regards the principle of recognition of the monopoly nature of the utility as the most important one emphasized during the year in the relations between commissions and companies. The committee, however, very wisely quotes the California decision which warns the companies that they have no right to accept the benefit of protection in monopoly and to refuse to give the public the good service that they would furnish under competition. In the 1915 report the committee should advise the companies how to conduct operations so as to prevent any criticism that they are abusing their privileges.

Directing attention to the importance of fair rates and good service, the committee declares that rates are the most common point of contact with the public and that usually criticism begins there. Electrical utilities are fortunate because the quality of their service is not always before the public for inspection as is the case with the electric railway. They should tell why they make rates according to the time, use and amount of service. Only by so doing can they protect themselves and build up the largest use of the investment. The committee has properly emphasized the need of the widest publicity for rate schedules and of non-discrimination. It ought not to be necessary to call attention to the wisdom of sound practices in rate-making and service; it is desirable, however, in order that no company may fail to make its practices square with modern public policy.

Although the public policy committee was formed only a few years ago to cope with the many problems discussed, it has been a source of strength and guidance from the beginning. Older though the industry and the association are, they owe much to the stimulating work of this committee. It is necessary only to read the report in order to realize that the committee is contending earnestly with the large problems of the industry and that it should receive the support of all companies in the effort to establish wholesome conditions.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Cleveland Rate Hearing Case Postponed

In the matter of the appeal of the Cleveland Electric Illuminating Company from an order passed by the city of Cleveland on March 16, 1914, fixing the maximum electric-light rate in the city of Cleveland at 3 cents per kw-hr., the Public Utilities Commission of Ohio on May 25 postponed the hearing, by consent, until further order of the commission, notice to be given to each party. It is probable that the matter will not come up for several months, as the company is preparing to make an appraisal. In the meantime the city is offering electricity at not more than 3 cents or less than 1 cent per kw-hr., making an especial effort, apparently, to get industrial business. The company's rates have been 10, 5 and 3 cents.

Spring Meeting of the A. S. M. E.

The spring meeting of the American Society of Mechanical Engineers will be held at St. Paul and Minneapolis, Minn., from June 16 to 19. Many features of technical and social interest have been arranged. Included in the program will be papers and a topical discussion on powdered fuel, and papers on "Industrial Service Work in Engineering Schools," by Mr. J. W. Roe; "Classification and Heating Value of American Coal," by Prof. William Kent; "The Railroad Track Scale," by Mr. W. W. Boyd; "Gear-Testing Machine," by Mr. Wilfred Lewis, and "A New Flow-Metering Appliance," by Mr. A. M. Levin. Mr. John Hearding, superintendent Oliver Iron Mining Company, Duluth, Minn., will give a lecture on "Iron Ore Handling" illustrated with moving pictures.

Appraisals and Uniform Accounting in Ohio

The appraisal committee of the Ohio Electric Light Association, appointed at the special meeting held in Columbus on May 6, has organized by the election of Mr. Robert Lindsay, of the Cleveland Electric Illuminating Company, as chairman. The other members of the committee are Messrs. F. M. Tait, Dayton; W. W. Freeman, Cincinnati; F. J. Derge, Toledo, and M. F. Millikan, Canton. The committee was appointed to represent the electric-service companies of the State in carrying out the instructions of the Public Utilities Commission of Ohio in the matter of the appraisal and valuation of the utilities of the State for rate-making purposes. The committee has started on its important task, taking up first the preparation of forms.

On the part of the committee on uniform accounting, also appointed by the association on May 6, Mr. Scobell was instructed to arrange a meeting with Mr. Carl Nau, of Cleveland, certified public accountant. Mr. Nau has been retained by the Public Utilities Commission of Ohio to advise it in relation to the preparation of a system of uniform accounts for the utilities of Ohio. The committee of the Ohio Electric Light Association on uniform accounting consists of Messrs. J. H. Scobell, Cleveland Electric Illuminating Company; L. K. Funkhouser, Dayton Power & Light Company; T. F. Wickham, Cincinnati; F. B. Lasher, Youngstown, and F. W. Drager, Canton.

Twenty-fifth Anniversary of First E. E. Course

The twenty-fifth anniversary of the inauguration of electrical-engineering studies at Columbia University—declared to be the first purely electrical-engineering course established in America—was celebrated with informal ceremonies at the university, New York City, May 30. A number of alumni attended the meeting, and brief reminiscent addresses were made by Profs. Francis B. Crocker and Michael I. Pupin, who have served as members of the faculty since the creation of the department. Hon. Thomas Ewing, United States Commissioner of Patents, was also present and spoke of the pioneer days of the electrical industry, and Prof. W. I. Slichter outlined the plans for future graduate instruction in electrical engineering, which, beginning with this fall, will wholly supersede the present undergraduate courses.

Columbia was the first and for several years the only institution to put electrical engineering squarely on an equal, independent basis with mining, civil and mechanical engineering, said Professor Crocker. The Columbia electrical course was established in May, 1889, whereas in all other institutions of that time the electrical courses were subdivisions or off-shoots of the older courses in physics, chemistry and mechanical engineering. A copy of the prospectus of the Columbia course as originally written in 1889 was also exhibited by Professor Crocker. It covers in surprisingly thorough fashion even the wide range of the science and art to-day, with the single exception of wireless telegraphy, although this may be fairly considered to come under the heading of telegraphy, which was an important division of the early course.

"Selling Electric Vehicles" in Moving Pictures

At the Willow Grove Park Theater, Philadelphia, Tuesday evening, the Electric Vehicle Association of America made the first public presentation of its new moving-picture film entitled "Selling Electric Vehicles," the parts in which were taken by a number of amateur actors prominent in the work of the vehicle association. Among those appearing in the picture are Messrs. F. W. Smith, Harvey Robinson, S. G. Thompson, W. P. Kennedy, J. Becker, A. J. Marshall, P. D. Wagoner, Charles Blizard, Bruce Ford, W. G. Bee, W. C. Andrews, and others. The film was produced by the Edison moving-picture company and has been presented to the Electric Vehicle Association by the Edison Storage Battery Company. It will be loaned for exhibit before various electrical gatherings throughout the country to stimulate interest in the electric vehicle.

The story of this picture-play was written by Mr. S

G. Thompson, of the Public Service Electric Company, Newark, N. J., and its opening scene shows the transportation troubles of a big city merchant who receives discouraging reports from his stable foreman on the ravages of death and disease among his horses. Transportation costs are eating up the returns of the business and bankruptcy seems imminent, when the interest of the merchant is attracted by a letter from the Electric Vehicle Association pointing out the advantages and economies of electric vehicles. Reaching the association headquarters by wire, the executive is soon in possession of additional figures and data which further excite his interest in electric transportation. The local central-station man is summoned, and the services of a consulting engineer are also enlisted for a study of the problem. Meanwhile the battery salesmen learn of the situation, and call at the merchant's office. Demonstrations of the discharge capacity, power, construction, etc., of both the lead and nickel-iron storage batteries follow. The last caller is a salesman of commercial electric cars, who convinces his customer in quick order by arranging a parade of electric trucks just outside the office window, and a contract is soon signed for a fleet of ten electric power wagons. The sequel is shown in the final picture, staged a year later. The electric trucks are giving splendid service, having effected a saving of $10,000 during the twelve months, the concern is prospering, and the merchant is enjoying the conveniences and dependability of his all-electric transportation service.

SCENE FROM ELECTRIC-VEHICLE MOVING-PICTURE FILM

Attitude of California Commission on Hydroelectric Development

The following statement has been made by Mr. John Hays Hammond in regard to public utility and water-power development under the California commission:

"I am interested in hydroelectric developments in California, and must admit that when the Railroad Commission was established to control the developments of this industry I shared the apprehension of others interested in water-power companies that there would be some serious disadvantages in the operation of those companies by reason of restrictions imposed by the Railroad Commission. But, as a result of my own experience, I am confident that, on the whole, such a commission is of great advantage not only to the investors in the securities of such companies and the consumers of power, but to the companies themselves.

"I discussed with the Railroad Commission many phases of the development of hydroelectric companies. The commission is sincerely desirous of encouraging the development of such enterprises in the interest of the people of the State in general, and the commission absolutely repudiates the rumors that have been current that it would oppose any capitalizations of companies and any rates for energy that would make it possible for investors to earn more than 6 per cent on the investment.

"It realizes that such investments must be attractive to investors, and it is willing to allow a rate of earnings attractive to the legitimate investor. Besides this, the commission has wisely established the principle that it will not encourage cut-throat competition in the industry."

Annual Meeting of Society for Electrical Development

At the meeting of the Society for Electrical Development, Inc., in the Bellevue-Stratford in Philadelphia on June 1 Mr. J. M. Wakeman, general manager of the society, reported that the $200,000 required to start business has been pledged and that the best men available for promoting the electrical development work have been secured. The work of the society has been divided for the present into four sections: Field co-operation, new development, commercial exchange bureau, and publicity and advertising.

A man to supervise the work of the first section has not been secured yet, but Mr. Robert N. Lee has been engaged to assist the person selected. Mr. John P. Mallett has been employed to investigate the present uses of electricity and report how these applications can be extended. The commercial exchange bureau, which is in charge of Mr. Theodore Dwight, will secure and index information regarding the uses of electricity. The bureau will prepare bulletins containing this information, which will also be furnished to class journals for publication. The publicity and advertising department is in charge of Mr. H. C. Spaulding.

Whoever may be appointed to supervise the field co-operative section will travel around the country forming co-operative leagues, inducing architects and builders to arrange for complete electric service instead of lighting alone, and bringing textbooks and lecture courses up to date.

Realizing that moving pictures are among the best mediums for educating the public, the society has established a department in charge of Mr. L. G. Harkness-Smith, who is arranging for photographing scenarios illustrating the uses of electricity in the home, mill, factory and farm.

A window-trimming department has also been organized and placed under the supervision of Mr. A. J. Edgell. Sample electrical displays are being set up in windows and photographs taken and distributed among the members of the society. Printed instructions on how to trim the windows are sent with the illustrations.

Mr. Wakeman reported that the present society membership consists of 298 central stations, 186 manufacturers, 272 jobbers and dealers, 588 contractors and 23 miscellaneous industries. While the amount ($200,000) required to start operations has been secured the society is still desirous of increasing its membership in order that the development work may be made more extensive.

Following Mr. Wakeman's report the acting treasurer, Mr. James Smieton, Jr., read his report.

By vote of its members the society changed the fiscal year to end April 30, instead of May 15, to facilitate preparing the annual report before the convention meeting. New members of the board of directors were elected to represent the central stations, manufacturers, jobbers and dealers and contractors, as follows: Messrs. J. E. Montague, Niagara Falls, N. Y.; H. B. Crouse, Syracuse, N. Y.; Fred. Bissell, Toledo, Ohio, and G. M. Sanborn, Indianapolis, Ind., each to serve four years.

At the meeting of the board of directors which followed a number of important matters were discussed, including a resolution defining the policy of the society in regard to central stations merchandising apparatus, supplying incandescent lamps to customers, etc. The resolution, which was unanimously adopted, stated: "That the society's efforts shall be devoted to developing the use of electrical energy by the general public, thus increasing the market of all engaged in the industry, leaving the question of defining the channels through which, and methods by which, the present and increased market shall be reached to experience and local co-operation."

The following officers were elected to serve for the ensuing year: President, Mr. Henry L. Doherty, of New York; first vice-president, Mr. W. H. Johnson, of Philadelphia; second vice-president, Mr. A. W. Burchard, of New York; third vice-president, Mr. W. E. Robertson, of Buffalo; fourth vice-president, Mr. J. R. Crouse, of Cleveland; fifth vice-president, Mr. Ernest Freeman, of Chicago; general manager, Mr. J. M. Wakeman; acting secretary-treasurer, Mr. James Smieton, Jr. The following were elected to serve as the executive committee during the ensuing year: Messrs. H. L. Doherty, Ernest Freeman, A. W. Burchard, J. R. Strong, Gerard Swope, L. A. Osborne, W. E. Robertson, J. R. Crouse and W. H. Johnson. Mr. Johnson was elected chairman of the executive committee. The board approved the action of the executive committee of March 30, 1914, adopting the plans and budget for the first year's activities of the society.

A resolution was adopted to the effect that any member whose semi-annual subscription becomes seven months in arrears shall be dropped from membership in the society.

Universal Use of Electricity on the Panama Canal

With the electrification of the Panama Railroad, which is being seriously considered, electrical operation on the Isthmus will be practically complete, said Mr. D. P. Gaillard, Chicago, before a recent meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers. That our government realizes how important are the electrical features of the canal is evidenced by the recent appointment in the permanent canal control organization of an electrical engineer who is subordinate only to the governor of the Canal and the engineer of maintenance.

Continuing his description of the electrical work which is being carried out on the Isthmus, the speaker described the 6000-kw hydroelectric plant at Gatun, operating on a 77-ft. head and at its maximum demand requiring but 7 per cent of the minimum water available. The only unusual feature in the design of this plant is the location of an emergency exciter on the main shaft of the turbo-generators between the turbine and the generator. Ordinarily motor-driven exciters are used. Supplementing this power house is a steam reserve station with four units aggregating 6000 kw at Miraflores, and the steam-electric construction plant at Gatun. The high-tension line distributing 44,000-volt energy to four substations near the greatest centers of load—at Gatun (Atlantic locks), Miraflores (Pacific locks), Cristobal and Balboa—was described. The load at the two last-named places is largely made up of machinery operating on the wharves, shops, dry docks, etc. Fearing that induction would disturb communication, all telegraph and telephone circuits were placed underground.

Although the hydroelectric station, upon which dependence is placed, is rated at but 6000 kw, the connected load is approximately 20,000 hp, motors ranging in size from 75 hp to fractions of a horse-power. Two hundred and fifty miles of lead-covered cable were used in making these installations.

Speaking of the unforeseen things which have happened since the completion of the canal, Mr. Gaillard cited the fact that, upon the emptying or filling of the locks at Pedro Miguel, surges were set up approximating 1 ft. or more in amplitude and lasting for as long as an hour. These surges sometimes make it momentarily impossible to open the gates.

Dynamite charges in the canal work were always fired electrically. At first series circuits were used for this purpose. Later, however, it was discovered that by the use of 110-volt multiple circuits no cartridge missed fire, as sometimes happened with the series arrangement.

The discussion was confined almost entirely to questions from members seeking further information. Those participating were Messrs. F. J. Postel, F. A. Banning, Jr., L. L. Holladay, G. A. Mayer, L. P. Howard, E. T. Foote, W. S. Pederson, William B. Jackson, B. H. Peck and H. M. Wheeler.

An invitation to the Chicago Section of the A. I. E. E. from the Spokane Section of the A. I. E. E. was read, asking the members to attend the Pacific Coast convention to be held in the Davenport Hotel, Spokane, on Sept. 9, 10 and 11.

Competition in Portland, Ore.

In the annual report issued to stockholders of the Portland (Ore.) Railway, Light & Power Company, covering the operations during 1913, Mr. C. M. Clark, chairman of the executive committee, and Mr. Franklin T. Griffith, the president, discuss the entrance of a competitive company.

Mr. Clark says that the entrance of the Northwestern Electric Company into the lighting and motor-service field in Portland is to be regretted, but that, in view of conditions in other Pacific Coast cities, competition of some kind was probably inevitable. The total development of the new company is small compared to that of the Portland company, and the competition is restricted to the lighting and motor service business in Portland and does not affect the railway business nor the lighting and motor-service business in the other communities served by that company. It is as unfortunate for the Northwestern company as for the Portland company, Mr. Clark adds, that it should have made its investment and entered the field at a time when there was not sufficient new business available to warrant the investment.

Mr. Griffith explains that on Dec. 23 the Northwestern Electric Company began serving customers on the east side of the city, and by March 9, 1914, had extended its operations to the west side. This company, which will compete for business in Portland, has completed a hydroelectric plant of 12,000 kw on the White Salmon River, about 70 miles from that city. Probably 5000 kw of this generating capacity will be required by the Camas Paper Mills, and the remainder, when available, will be brought into Portland. At times of low water the deficit will be made up by a steam plant of 7500 kw rating in the business district of Portland, which is also equipped to supply steam heat.

National Electric Light Association Convention

Attendance at Philadelphia meeting exceeds 4000—News features of general interest outlined below—Formal papers and discussions abstracted on pages 1305-1328 of this issue

THE convention of the National Electric Light Association held in the Bellevue-Stratford Hotel, Philadelphia, this week, will long be remembered as one of the most successful gatherings of electric-light men in the country. Not only was the attendance large—more than 4000—but there was a notable gathering of the prominent men of the industry. In addition, pioneers like Edison, Brush and Sprague graced the public policy meeting on Wednesday night, when each received an ovation.

The convention arrangements were ideal. Seldom in the history of the organization have sessions been so well attended and been marked with more enthusiasm. Comments of the most favorable kind were heard on all sides regarding the exhibition of the Class D members on the roof of the hotel, and although the exhibition as a whole might be characterized as a group of reception booths rather than working exhibits, the Class D members were generally gratified with results and the delegates expressed nothing but admiration for the layout. The daily press of the city was exceptionally responsive in its treatment of the convention and in editorial comments, and the people of the city, as well as all those in attendance, evinced a warm interest in all that transpired. The plan of cutting down the number of papers so as to give greater time for discussion proved to be most wise.

In accomplishment the convention was most successful. Not only were two important books of vast usefulness to the industry brought out—namely, "The Electrical Salesman's Handbook" of the Commercial Section and the "Handbook on Overhead Line Construction"—but the association rescinded its action on the 1911 report of the committee on overhead-line construction by eliminating from it any recommendations, by inference or otherwise, of voltage limitations. At the session of the Hydroelectric Section on Thursday morning it was decided on the recommendation of the executive committee of the association to discontinue the Hydroelectric Section and to place work heretofore done by that section in the hands of a proper committee.

In accordance with previous action taken at Seattle, the next convention of the association will be held in San Francisco.

Elsewhere in this issue are printed abstracts of papers, reports and discussions, while the other activities of the convention are recorded in what follows.

Opening Events

The convention opened with a reception held by President and Mrs. McCall in the ballroom of the Bellevue-Stratford Hotel on Monday night. Friendly greetings were extended to the hundreds of delegates and guests in attendance, to the accompaniment of music rendered by the Philadelphia Company Section's orchestra of twenty-five pieces. The ballroom was most tastefully decorated for the occasion, and following the reception informal dancing was enjoyed and the warm hospitality there extended by Philadelphians continued throughout the week.

The regular work of the convention began on Tuesday morning, with President McCall in the chair and the great ballroom of the hotel filled. Mr. McCall introduced the Hon. Rudolph Blankenburg, Mayor of Philadelphia, who welcomed the convention to the city in a really inspirational address. The Mayor, in passing, testified his high appreciation of the benefit to civilization, the betterment of home conditions, manufacturing facilities and scientific development born of the great electrical industry. The dominant note of his address, however, aside from his plea to the delegates to witness what Philadelphia is doing to safeguard the lives of little children and instructing mothers in their care, had reference to municipal ownership and to the elimination of politics from the administration of municipal affairs. On this subject Mayor Blankenburg waxed most eloquent. He said that in England, and especially in Germany, city administrations are far ahead of those in America, and that Americans know too well that in many cities the administration of municipal affairs is inefficient. He asked what would happen to the great National Electric Light Association if it were so beset in its work by politicians as most cities are in carrying out their destinies. The address was well received and a rising vote of thanks was extended to the Mayor.

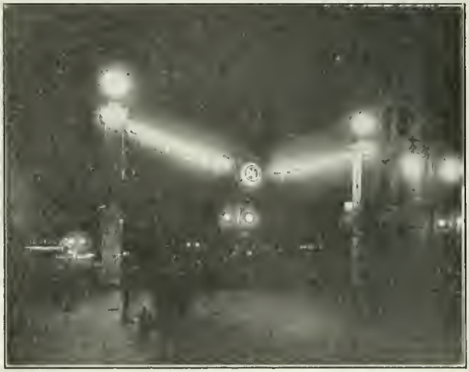


FIG. 1—WELCOME ARCH ERECTED BY THE PHILADELPHIA ELECTRIC COMPANY

Mr. H. H. Scott, vice-president, then took the chair while President McCall delivered his address.

Presidential Address

In his annual address as president of the National Electric Light Association Mr. McCall noted that the last convention held in Philadelphia convened in the assembly room of the Union League twenty-seven years ago. He spoke also of the fact that this year marks the thirtieth anniversary of the first international electric congress and the first international electrical exposition, both of which were held in Philadelphia in

1884. He commented on the great growth of the association and referred to the effort made to limit the number of papers with the view of giving more time to discussion.

During the year the public policy committee held a number of meetings and has continued its valuable work in dealing with broad questions of public policy. Joint meetings have been held with other organizations looking toward co-operative effort. Upon the important question of government control Mr. McCall said the principle of governmental regulation through the medium of state commissions has been generally adopted and in the many activities of those bodies has lead to a better understanding of the relations between the public and the utilities. Commissions have evinced a general disposition to use wisely the powers intrusted to them and in their administration to safeguard the equities of all parties concerned.

Special mention was made of the work done by the rate research committee during the year and attention was called to the work of the educational committee and to the great movement in accident prevention and welfare work. The president said he had been impressed with the need of some change in the financial plan of the organization because the income derived was not sufficient and important work was therefore left undone. He said a plan should be devised which will warrant the most liberal treatment of Class B members, while at the same time permitting them to possess an independent interest by contributing to the work of the association through the medium of the membership fee. In his estimation there should be a re-rating of the dues in Classes A and D. The president also made mention of the foreign members, which at the close of the convention totaled 33.

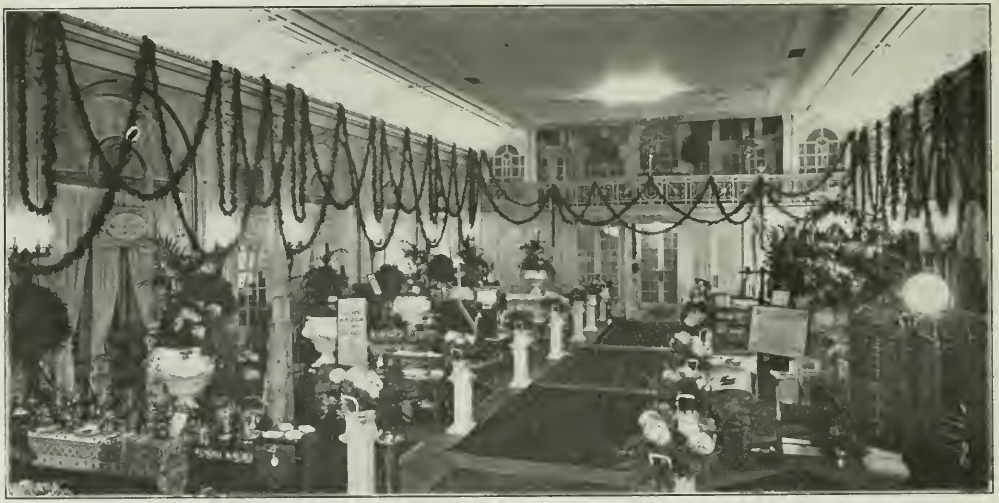


FIG. 2—ONE OF THE AISLES IN THE ROOF-GARDEN EXHIBIT HALL, NATIONAL ELECTRIC LIGHT ASSOCIATION CONVENTION, PHILADELPHIA

As is customary the president's address was referred to a committee, consisting of Messrs. C. L. Edgar, Boston; J. L. Gilchrist, Chicago, and F. M. Tait, Dayton, Ohio, which reported its findings at Friday's session.

Organization of the Industry

Mr. H. H. Scott, in his report on the organization of the industry, gave the membership of the association as follows:

Class	June 2, 1914	June 3, 1913
A	1,091	1,093
B	10,817	10,256
C	73	53
D	250	242
E	785	798
	13,016	12,442

He pointed out, however, that there was an error in last year's report, which showed 44 too many class A members and 330 too many Class B members, so that in reality instead of a loss there was an actual gain of 42 Class A members. Such losses as occurred in operating companies were due to consolidations and to the acquisition of holding companies. Of the 6129 towns and cities, with a population of 46,000,000, receiving service, 2691, with a population of 36,400,000, are served by 140 holding companies. The Class B membership in company sections showed a loss of several hundred and the number of geographic sections has not increased.

Report of Secretary

Secretary Martin in his report told of the miscellaneous work handled in the executive offices in New York City. Of last year's proceedings 19,000 volumes were printed. The monthly bulletin has been increased in size. No fewer than 150,000 copies were printed and distributed during the year, and the *Bulletin* itself is now admitted as second-class matter by the post office authorities, resulting in a saving of $2,000 in postage. Of the general publications of the association, 40,000 have been sold in addition to over 180,000 of special pamphlets and brochures of the Commercial Section. The "Meterman's Handbook" has reached a sale of 4150 copies, and the association has just issued the new handbook on overhead-line construction, 900 pages, and the new salesman's handbook in loose-leaf form, with special binder and case. The lecture bureau has proved its usefulness. There are approximately a thousand lantern slides and three motion picture films used in connection with the lectures, which were delivered eighty-one times during the year to approximately 16,000 employees. The rate-research bulletin has reached its fifth volume and has 583 subscribers. Other points touched on by Mr. Martin in his report were the results of his European trip, educational conferences, accident prevention, electric vehicle co-operation and public service commission annual report forms.

Report of the Insurance Expert

In his report as insurance expert, Mr. W. H. Blood, Jr., of Boston, told of his relations with the National Fire Protective Association, and of the wide adoption by municipalities of the National Electrical Code. Two matters of importance which will come up for consideration at the meeting of the Fire Underwriters in New York City next March are revisions of the rules on constant potential pole lines of over 5000 volts and on the use of renewable and refillable fuses. Attention was also called to the work of some inspection bureaus in the examination of electric lighting properties with a view to reducing liability of fires arising and amount of insurance premiums.

Mr. Leonard Fitzgerald, of the Gary (Ind.) Heat, Light & Water Company, said that in that city the municipal authorities have appointed the underwriters' inspectors the electrical inspectors of the city.

Committee on Progress

The report on progress, prepared by Mr. T. C. Martin, dealt as usual with the general conditions of the industry and presented its statistics as based on the United States census figures of 1912, with other data on development. Sections were devoted to public questions, such as the relations and usefulness of holding companies, public service commissions and regulation, and municipal ownership. Various features of engineering work were discussed, one or two typical new plants being described rather fully. Advance in different fields, such as lamps and lighting, electric vehicles, electric heating and cooking, railway energy, industrial uses of electricity, electric pumping and ice making, signs and slogans, and electricity on the farm, were reported. Some miscellaneous applications of central-station energy were also recorded, and recent educational and welfare work chronicled.

Question Box

Mr. S. A. Sewall, assistant secretary of the association, in speaking of the work of the Question Box, said it was designed to be a clearing house of experiences. During the year it contained 254 new questions, with 1296 answers, made by 746 contributors. The method of handling inquiries was outlined in detail.

Safety First

One of Paul Lüpke's classics, which have been features of conventions for many years past, was again forthcoming this year, but this time it was read by the Sage of Trenton himself. The author called attention to the necessity of reiteration for the purpose of driving a matter home to those whom it is wished to reach. He appealed to the rank and file for the development of the convention spirit and pointed out various causes for the lack of this spirit. The paper was in Mr. Lüpke's characteristic epigrammatic style, and the following are some of the trite sayings: "Business is no poker game." "The man who can keep his head level in an emergency and instantly recognize a true 'Carnegie medal occasion' that demands taking a risk is a real hero." "Nowhere else does dire tragedy tread so closely and so frequently upon the very heels of supposedly harmless fun than in the working out of a practical joke." "In the name of common sense, live within your means: it's the best means of getting more to live on." "For all kinds of sports we train. We take particular precautions to guard our health. Why then ignore the axiom that life itself is the most exacting sport of all?"

Tuesday Afternoon's Session

The first technical session held on Tuesday afternoon was presided over by Mr. W. F. Wells, of Brooklyn, N. Y. The feature of the session was the address of Dr. C. P. Steinmetz on the electric vehicle, which is printed elsewhere in this issue.

Address of Chairman Jones of Commercial Section

Mr. T. I. Jones, of Brooklyn, N. Y., in opening the first commercial session on Tuesday afternoon spoke of the things accomplished during the year and made some pertinent suggestions and recommendations. He traced the growth of the Commercial Section during its four years of existence, from a membership of 163 to a membership of 1793 and from an inconspicuous modest start to a useful force among the commercial men in the industry. One of the most interesting developments in the past year has been the matter of the section's publications. The "Electrical Salesman's Handbook" added this year, Mr. Jones maintained, is a monument to the industry of the publication committee and a credit to the section. The other publications followed along the same general lines as last year, excepting that the section is now about to introduce a new advertising campaign called "Residence Business." Co-operative relations have been held with the Electric Vehicle Association, the National Electrical Contractors' Association, the Electrical Supply Jobbers' Association and other national bodies, which have been of mutual benefit. Mr. Jones referred to the fact that the number of reports arranged for each session had been limited to two and that only six committee reports had been compiled throughout the year.

Mr. E. L. Callahan, of Chicago, in his report for the finance committee, showed that the Commercial Section had a substantial amount in its treasury.

Commercial Section Membership

Mr. J. F. Becker, of New York, chairman of the committee on membership of the Commercial Section, reported a net gain of 239 members up to May 15, 1914, at which time the total membership of the Commercial Section was 1461. The plan of increasing membership through active state captains did not show the results expected. This was attributed to the additional dues demanded by the Commercial Section. The committee felt that as soon as this question of dues is eventually settled the ranks of the Commercial Section will be greatly increased. A printed list of the membership as of Jan. 1 has been mailed to each member of the section.

Address of Chairman Edwards at Accounting Session

Mr. H. M. Edwards said that the time has come for the accounting committee to determine whether some change should be made in its organization so that the scope of the work will be more representative of the industries embraced. He suggested that delegates select their own officials. The most important work of the accounting committee was the completion and adoption of a classification of accounts. The chairman pointed out that the standing of a corporation in the estimation of a state commission and the public is largely dependent on the character of its records and the accuracy with which they are kept.

To fill his position most effectively an accountant should be a close student of economic literature. When the company he represents is attacked on subjects relating to rates, etc., the accountant must furnish the defense from the records he has in charge. Data should therefore be intelligently selected and concisely arranged. The chairman also suggested that special assessments on members of the accounting committee should be discontinued and only the regular N. E. L. A. membership fees be required.

Mr. C. L. Campbell, New York, made a motion which was passed to the effect that the accounting committee be organized along national lines and that special dues from its members be abolished.

Wednesday Morning Sessions

At the second technical session held on Wednesday morning a great deal of interest was evinced in the report of the committee on overhead-line construction, of which Mr. Thomas Sproule, of Philadelphia, was chairman. The report of this committee was printed in full in an 800-page handbook on overhead-line construction prepared by the sub-committee, and warm appreciation of the work of the handbook sub-committee was expressed on all sides.

Two very important matters were also brought out before the commercial session, one the report of the rate research committee and the other the report of the lamp committee, which was followed by an exhibit of lighting units.

The feature of the second accounting session of Wednesday morning was the address of Dr. D. C. Jackson, of Boston, on "Appraisals." The uniform system of accounts was also brought up for official discussion at that session.

Treasurer's Report

At the executive session on Wednesday afternoon Mr. W. F. Wells, of Brooklyn, in his report as treasurer showed that the revenue received from all sources during 1913 was $122,519.61, against which were charged running expenses of $84,156.94 and convention expenses of $34,241.97, or a total of $118,398.91, leaving a surplus of $4,120.70.

The treasurer's report was referred to an auditing committee consisting of Messrs. J. F. Gilchrist, of Chicago, and T. C. Martin, of New York.

Constitutional Amendments

Mr. Frank W. Frueauff, for the committee on constitutional amendments, also submitted the following proposed amendments at the executive session on Wednesday, and these were adopted at the session on Friday morning.

To amend Article IV, Section 2, first sentence, to read:

"The president, vice-presidents and treasurer shall be elected from Class A or Class B members, to serve one year from July 1 or until their successors shall have been elected."

To amend Article IV, Section 3, first sentence, to read:

"The executive committee shall consist of the president and vice-presidents, of the treasurer and the retiring president and of nine members elected from Class A or Class B."

To amend Article IV, Section 6, first sentence, to read:

"The treasurer shall perform the duties assigned to him by the executive committee and subject to its approval."

The purpose in all the above amendments was to make the treasurer of the association an elective officer and to give him a vote at the meetings of the executive committee.

To amend Article VII, Section 1, first paragraph, to read:

"The annual dues of member companies (Class A) in cities and towns of less than 5000 population shall be $10; in cities and towns of 5000 and less than 10,000 shall be $15; in cities and towns of 10,000 and less than 25,000 shall be $20; in cities and towns of 25,000 or more shall be $25 plus one-fiftieth of 1 per cent of the gross earnings from the sale of electrical energy by the company for the preceding calendar year."

To amend Article VII, Section 2, to read:

"The annual dues of Class B members shall be $5, including membership in a geographic section and in a national special section. Class B members shall receive without cost such publications as shall be approved and authorized by the executive committee for distribution through a national special section."

To amend Article VII, Section 4, to read:

"The annual dues of Class D members shall be fixed by the executive committee, but in no event shall the dues of any such member exceed $2,500 per annum."

To amend Article VII, Section 5, to read:

"The annual dues of Class E members shall be $5, including membership in a geographic section and in a national special section. Class E members shall receive without cost such publications as shall be approved and authorized by the executive committee for distribution through a national special section."

The above amendments were recommended to enable any Class B or Class E member to belong to the particular special section which he may care to select without the payment of any extra dues and to give him the full benefit of such section's work.

To compensate for this loss of revenue from individual members, to add to the association's annual revenues for the carrying on of further important work of the industry, and to enable the Class A and Class D members to contribute a larger proportion of the association revenues, the committee recommended that the percentage dues paid by the companies in cities of over 25,000 be increased and that the manufacturing and supply companies pay annual dues upon a basis to be determined from time to time by the executive committee within reasonable limits.

At the close of the executive session the following nominating committee was elected: Messrs. Frank W. Frueauff, of New York; John F. Gilchrist, Chicago; W. H. Johnson, Philadelphia; F. M. Tait, Dayton, Ohio, and J. L. Bailey, Baltimore.

Public Policy Meeting

The public policy meeting on Wednesday night was a gala affair. Preceding the meeting a dinner was given in the "red room" of the hotel to members of the committee and distinguished guests by Mr. Arthur Williams, its chairman, and President J. B. McCall. Fifty covers were laid, the table presenting a very beautiful appearance with an electric fountain as the center of a very ornate decorative scheme. The "place cards" consisted of convention numbers of the Philadelphia Electric Company section magazine, *Current News*, in individual gilt-lettered leather bindings. At the close of the dinner there were informal addresses, and a pleasurable feature was the presentation by Mr. Williams, as presiding officer of the last New York Electrical Show, to Mr. Thomas A. Edison, the guest of honor, of a solid gold medal bearing the portrait of the great inventor. Those in attendance included Messrs. T. A. Edison, Charles F. Brush, Frank Sprague, S. T. Bodine, E. W. Rice, Jr., Guy E. Tripp, Frederic Nichols, T. N. McCarter and all the past-presidents of the association and members of the public policy committee in attendance.

Comments of Mr. Insull

After concluding the reading of the report, Mr. Insull called attention to the growing importance of the electrical industry in civic life. Its prosperity, he said, depends very much on the prosperity of the country, and yet, strange to say, hard times do not seem to affect it. This he attributed to the fact that not any of the companies have yet developed their territories to the saturation point. In older cities, where the companies have succeeded in getting a larger proportion of available business, general business conditions do in a measure show some effect on the income. He voiced the seriousness of any contemplated national legislation designed to limit the activities of generating companies to certain states or communities. Legislation of this type has kept back economic development and utilization of electricity in England, and if enacted in this country will seriously check the use of electricity, especially in the rural districts, which now enjoy electrical advantages only because of the activities of large holding companies in covering the country with networks over which electricity is transmitted from one state to another. Mr. Insull suggested that some missionary work be done in educating congressmen and senators on the economics of the business as a natural but regulated monopoly, so that there would be no tendency to check electrical interstate business through misdirected anti-trust legislation.

Exposition Anniversary Exercises

Notable exercises marking the thirtieth anniversary of the First International Conference and the First International Electrical Exhibition, held at Philadelphia in 1884, followed the presentation of Mr. Insull's report on Wednesday night.

Seated on the platform and in the audience and honoring the occasion with its presence was a brilliant company, which included a number of the master workers and commercial leaders of the electrical industry. Among those who occupied places on the stage were Mr. Edison, Charles F. Brush, Frank J. Sprague, E. W. Rice, Jr., President J. B. McCall, Samuel Insull, Arthur Williams, C. L. Edgar, J. W. Lieb, Walton Clark and H. H. Scott.

President McCall introduced Mr. Walton Clark, president of the Franklin Institute of Philadelphia, under the auspices of which the International Electrical Exhibit of 1884 was held. This exhibit was the first expression of the kind ever devoted exclusively to electrical devices. In his introductory remarks President Clark cited the influence wrought by the spirit of Franklin and by the Franklin Institute on the electrical industry of to-day and its scientific and industrial development.

Address by Mr. E. W. Rice, Jr.

Mr. E. W. Rice, Jr., president of the General Electric Company, who was the next speaker, compared for the benefit of his audience electrical conditions existing in the year of the Philadelphia exhibition with the development achieved to-day. In 1884, he said, not a single trolley car was in existence, the highest potential employed was 2000 volts, the largest currents in use did not exceed the order of 5000 amp, the largest electrical generator was the Edison "Jumbo" machine with a rating of 1200 16-cp lamps, and the largest engine on exhibition was of less than 150 hp. The electric motor was just coming into use, although less than 500 hp had yet been applied. A feature of the Franklin Institute exhibit was, however, an electrically operated printing press on which the *Electrical World* was printed during the period of the exposition.

The international electrical conference was distinguished by the presence of such scientists as Kelvin, Preece, Thomson, Newcomb and Rowland. This Philadelphia conference ratified the present system of electrical units, although incidentally much dissatisfaction was expressed with the accuracy of the available measuring instruments. No other influence has contributed so much to the rapid development of the electrical industry, said Mr. Rice, as has the convenience with which electrical energy can be measured.

Dr. Brush's Reminiscences

In introducing Dr. Charles F. Brush, inventor of the arc-lighting system, President Clark declared that no man in history has done more than did Dr. Brush for the protection of life and property in the great cities by his provision of a scheme of general street lighting. After detailing some interesting reminiscences of early experiences with his electric lighting system, Dr. Brush told of the pioneer electric lighting of John Wanamaker's Philadelphia store by twenty arc lamps in 1878, and the first electric street illumination in Cleveland's public square the year following. Dr. Brush said he traced the great development of electric lighting as having followed upon the invention of the series arc system in 1878, which made it possible for one generator to operate a large number of lamps. The electrical industry, said the speaker in conclusion, is now absorbing capital at the rate of $1,500,000 every working day.

F. J. Sprague on Railways, Past and Future

Mr. Frank J. Sprague, the last speaker, declared that the N. E. L. A. should add the word "power" to its name, since the connected load in motors served by the lines of its member companies now even exceeds their total load in lighting units. Invention, said the speaker, is seldom due to inspiration, but is rather the result of necessity. Mr. Sprague compared the Edison generator exhibited at the early exposition with the great turbine unit, 10,000 times as large, now being installed by the Philadelphia Electric Company. He also referred briefly to his own work in the installation of an electric street-car line in Richmond, Va., in 1887, and he exhibited a piece of the first cloth woven on a constant-speed motor-driven loom.

After a comment on the apathy displayed in substituting electricity for steam on the New York elevated railways in the early nineties, Mr. Sprague declared that for trunk-line electrification the electric locomotive still has in its steam competitor a worthy rival, particularly when electrification involves the scrapping of expensive equipment and the purchase of other expensive apparatus. He predicted with certainty the coming of centralized energy generation, with interconnecting transmission lines following railroad rights-of-way, perhaps in underground conduits for greater safety and reliability. Such great central stations, he insisted, can produce electricity more cheaply and more dependably than could the railroads themselves. But even before the electrification of the railroads, prophesied Mr. Sprague, there will come some means of positively connecting the signals along the right-of-way with the control levers in the locomotive cab, so that in the event of failure of the driver to observe signals the train will be automatically braked and collisions avoided.

The Age of Co-operation

In a witty address that held the lively interest of his audience for more than an hour, and was punctuated by numerous epigrams which earned the enthusiastic applause of his hearers, Mr. Elbert Hubbard, East Aurora, N. Y., spoke before the Commercial Section Thursday morning on the subject of the coming of the age of co-operation.

"In the future," said the speaker, "we shall talk less and say more, write less and mean more, eat less and breathe more, and hate less and love more." The greatest book ever written on co-operation, declared Fra Elbertus, is Maeterlinck's "The Life of the Bee," which points out the lesson that while the individual insect alone is without intelligence or productive ability the collective spirit of the hive shows the greatest instinctive intelligence and reveals that the insect community is close indeed to the secrets of nature.

No man in planning his own success, said Mr. Hubbard, can afford to leave the rest of humankind out of those plans. The badge of sanity is the ability to co-operate with others—the ability to do team work—and the more men one can co-operate with the bigger and better does he prove himself to be. Work, study, play and laugh, advised the Sage of East Aurora, for these mixed in the right proportions and flavored with love give the key to any situation. Courage and ambition, like co-operation itself, are mere matters of psychology.

Having tried everything else, he added, the business world has now adopted the policy of truth. "But when we make a sale," he continued, "let us make a friend." We make money by conferring upon the world service that it needs, but any man who merely chases the rolling disk will soon find that it can attain a fearful velocity and may lead him to ruin or destruction. The man who can make two grins grow where there was one grouch before will be paid generously in the coin of the world. "Cast thy bread upon the waters," quoted Mr. Hubbard, "and," he added, "it will shortly return buttered."

The man who earns less than five dollars a day, he declared, is paying the difference for supervision. The intangible values of assembly, manufacture, transportation and distribution are no less important than the tangible ones of the more ponderable material. The raw products entering into a well-known automobile have, for example, an average cost of about 7 cents a pound, although the finished car is sold at a well-deserved price of 50 cents per pound. The world is willing to pay for such intangible ingredients of genius which can transform raw materials into things of utility and beauty.

For the first time in history, said the Sage of East Aurora, the business man of to-day has had the imagination to place himself in the position of the buyer and to consider the rights of the purchaser as well as his own. The twentieth-century world has adopted the golden rule in business and finds that it pays. And business of to-day has already passed from the feudalistic age of competition to a recognition of the benefits of co-operation.

Election of Commercial Section Officers

The afternoon commercial session's feature was the presentation of the report of the committee on wiring of existing buildings, Part II of which was the special report on the successful handling of the small consumer in Europe printed in the *Electrical World* of May 23. This report elicited considerable discussion.

The nominating committee, composed of Messrs. M. O. Dellplain, J. D. Israel, J. C. McQuiston, F. D. Pendleton and L. R. Wallis, chairman, submitted its report on Thursday afternoon naming its choice of officers for the Commercial Section during the twelve months beginning July 1. This report was unanimously accepted and officers were declared elected as follows: Chairman, Mr. E. L. Callahan, Chicago; vice-chairman, Mr. Douglas Burnett, Baltimore, and Mr. Joseph F. Becker, New York; secretary, Mr. C. A. Littlefield, New York; assistant secretary, Miss Gladys Burkhalter, New York. Executive committee, Messrs. F. D. Beardslee, St. Louis, Mo.; E. A. Edkins, Chicago, Ill.; G. V. Walton, San Francisco, Cal.; J. G. Learned, Chicago, Ill.; H. N. McConnell, New York, and G. Weiderman, Brooklyn, N. Y.

Address of Chairman Freeman of the Hydroelectric Section

In a brief address at the opening of the hydroelectric session, Chairman W. W. Freeman outlined the work performed by the recent Conservation Congress at Washington, D. C. He said that although many points of view were expressed which were not in harmony with association ideas, much good was accomplished by the gathering, and a forward step taken toward the realization of a more constructive policy on the part of the federal government.

Hydroelectic Section Disbands

At the hydroelectric session on Thursday morning Chairman W. W. Freeman announced that the executive committee of the association had reached the conclusion that the dissolution of the section and the possible substitution of a committee upon hydroelectric practice offered a better method of carrying on the work than the present plan. Mr. R. J. McClelland, New York, moved the discontinuance of the section, and the meeting unanimously passed the measure, with the proviso that the subject of hydroelectric development and transmission shall continue to receive due attention from the association through other agencies.

Hydroelectric Development in California

A lecture by Mr. H. J. Lisberger, San Francisco, Cal., describing the system of the Pacific Gas & Electric Company, was given at the hydroelectric session. Numerous lantern slides were displayed, including some recent views of the Panama-Pacific Exposition buildings.

Matters of importance were discussed at the final technical session on Thursday afternoon. The committee on prime movers presented an excellent report and the report of the committee on street lighting was especially interesting marking as it did a more thorough study of the subject than in the past. It is planned to study the psychological aspect of street lighting, and it is proposed to enlist the aid of Prof. Hugo Münsterberg, of Harvard University, in the experiments, particularly in laying out methods of personal observation. Much that is interesting and instructive is expected from these experiments which will be conducted in the Bronx, New York City.

Meeting of Class D Members

The annual meeting of Class D members was also held on Thursday. Mr. J. I. Ayer, chairman of the exhibition committee, made a few remarks on the work of the year, stating that while no great gains were made in membership the Class D membership now totals 250. The thanks of the exhibition committee was extended to the committee having the exhibition in charge, especially to Mr. H. G. McConnaughy, for the excellence and completeness of the arrangements on the roof of the Bellevue-Stratford Hotel.

The following were elected members of the standing committee: Mr. J. I. Ayer, of Boston, to succeed himself; Mr. J. C. McQuiston, of Pittsburgh, to succeed himself, and Mr. C. L. Peirce, Jr., of Pittsburgh, to succeed Mr. H. J. McConnaughy, who as secretary-treasurer is an ex-officio member of the committee.

It was pointed out that at the next year's convention in San Francisco it will not be practicable for Class D members as a body to have an exhibit.

Award of Prizes

At the final general and executive session held on Friday morning Mr. H. H. Scott reported the awards made by the committee on the Doherty Company section medal and other prizes as follows: The first prize, the Doherty gold medal, went to Mr. Harold Goodwin, Jr., of the Philadelphia Electric Company, for his paper entitled "Practical Economies and Distribution with Their Effect on the Commercial Policy of a Central Station Company," read before the Philadelphia Electric Company Section on December 1, 1913. The second prize, the Harriet Billings cash prize, donated by Mr. Arthur Williams, of New York, was awarded to Mr.

H. B. Gear, of the Commonwealth Edison Company of Chicago, for his paper entitled "The Distribution System and the Cost of Electric Service," presented at the November, 1913, meeting of the Commonwealth Edison Company section. The committee said that both of these papers have great merit, and their publication in the regular proceedings of this convention was recommended. Honorable mention was made of the paper entitled "Chestnut Poles," presented by Mr. Thomas Sproule before the Philadelphia Section, April 7, 1913.

Society for Electrical Development

Mr. J. M. Wakeman, general manager of the Society for Electrical Development, Inc., in an address before the final session on Friday morning said that, the necessary funds having been pledged, the staff for carrying out the plans has been selected and the work of the society has been divided into sections, each one in charge of a competent man. Mr. Wakeman then proceeded to outline the plans for the society's activities and concluded his remarks by emphasizing the necessity for a more hearty support of the society and a closer co-operation with it on the part of the central stations. Practically every new use for and user of electricity means additional business for the central station, and Mr. Wakeman pointed out that while the Society for Electrical Development is now active it has not received the support from the central stations to which it is entitled by the importance of its work.

PRESIDENT-ELECT HOLTON HENRY SCOTT

Memorials and Resolutions

Mr. T. C. Martin as the committee on memorials presented his report. The names of those included were S. R. Anthony, R. D. Apperson, D. M. Barton, A. N. Brady, J. S. Cummins, E. F. Catchings, C. A. Chapin, J. C. Calisch, W. Cooper, R. N. Dyer, W. F. Davidson, M. J. Francisco, W. W. Gamewell, J. E. Hodgson, E. J. Houston, F. V. T. Lee, C. W. Morse, A. S. Michener, L. N. Peart, J. Pass, C. F. Pritchard, H. M. Richards, F. H. Soden, G. Stevens, R. C. Winchester, J. R. Wiley and G. Westinghouse.

In the resolutions adopted, special mention was made of the interest taken in the affairs of the N. E. L. A. by the daily papers published in Philadelphia, the activities of the hotel managers regarding the welfare of the visiting members, and the remarkably complete preparations made for the event by the Philadelphia Electric Company. Thanks were extended to the Franklin Institute, to President Joseph B. McCall and Mr. W. C. L. Eglin, to the McGraw Publishing Company, publisher of the *Convention Daily*, to the technical press, to the various committees and to all those who contributed to the comfort and success of the convention.

Appreciation was also expressed for the interest displayed by Messrs. Thomas A. Edison, Charles F. Brush, Frank J. Sprague and E. W. Rice, Jr., in attending the thirty-seventh convention of the association. Before adjourning, the members in attendance at the convention voted to send a telegram of good wishes to Miss Harriet Billings, assistant secretary and treasurer of the association.

Election of Association Officers

The following officers selected by the nominating committee were declared elected: President, Mr. H. H. Scott, New York; first vice-president, Mr. E. W. Lloyd, Commonwealth Edison Company, Chicago; second vice-president, Mr. H. A. Wagner, Consolidated Gas Electric Light & Power Company, Baltimore, Md.; third vice-president, Mr. L. D. Gibbs, Edison Electric Illuminating Company of Boston; fourth vice-president, Mr. J. S. Bleecker, Columbus (Ga.) Power Company; treasurer, Mr. W. F. Wells, Edison Electric Illuminating Company of Brooklyn; executive committee to serve for three years: Mr. Paul Spencer, United Gas Improvement Company, Philadelphia, Pa.; Mr. A. C. Einstein, Union Electric Light & Power Company, St. Louis, Mo., and Mr. Walter Neumiller, New York Edison Company.

The nominating committee recommended Mr. T. C. Martin as executive secretary.

The newly elected president is one of the youngest men elevated to that rank. Born in Orillia, Canada, Sept. 14, 1874, he emigrated with his parents to Ashland, Wis., in 1882. There he received his early education, graduating from the Ashland High School in 1892, subsequently entering the University of Wisconsin, from which he graduated in 1896, with the degree of B. S. Immediately after receiving his sheepskin he entered the employ of Mr. Henry L. Doherty, who was then connected with the Emerson McMillin Company. His first position was with the Madison (Wis.) Gas & Electric Company, where he was engaged in general work. Four years later he went to Lincoln, Neb., as superintendent of the Lincoln Gas & Electric Light Company, and in 1902 he left Lincoln for San Antonio, Tex., where he was appointed engineer for the San Antonio Gas & Electric Company and the San Antonio Traction Company. He subsequently became general superintendent of the former and assistant to the president of the latter, both companies being at that time part of the American Light & Traction Company's holdings. In the spring of 1905 he returned to Madison, Wis., as general superintendent of the Madison Gas & Electric Company, and in 1906 he went to New York City as chief engineer for Henry L. Doherty & Company and was engaged in examining all the properties taken over and owned by that company. He is at present general manager of the Doherty Operating Company, which operates 104 public utility plants in all parts of the company and is also a director in many of the corporations owned and controlled by H. L. Doherty & Company.

Mr. Scott has worked assiduously as chairman of the organization committee of the National Electric Light Association in making that body in point of membership one of the largest, if not the largest in the world. During the five years in which he has been chairman of the organization committee the membership of the association has increased from 3000 to over 13,000. Mr. Scott has also been a member of the executive committee for three years and has occupied the vice-president's chair for two years. He is a member of the

National Commercial Gas Association, the New York Electrical Society, the National Electric Light Association, an associate member of the American Institute of Electrical Engineers, an honorary member of Tau Beta Pi and a member of the Engineers' Club of New York.

Company Section Co-operation

At a meeting of delegates representing the forty-four company sections, which embrace more than 85 per cent of the total enrolled membership of the N. E. L. A., steps were taken on Wednesday evening to secure, if possible, the appointment of a permanent association committee having jurisdiction over company section affairs. The meeting was called by Mr. Joseph B. Seaman, chairman of the Philadelphia Electric Company Section, who turned the meeting over to Mr. E. A. Edkins of the Commonwealth Edison Company of Chicago.

An extended discussion on section matters, methods of conducting meetings, planning of section work and the difficulties involved, occupied most of Wednesday evening's two-hour meeting of the delegates. Among those who took part in the discussion were Messrs. J. W. Cowles, Boston; E. C. Stone, Pittsburgh; C. E. White, Brooklyn; F. A. Birch, Philadelphia; D. C. Bruce, Baltimore, and F. J. Arnold, Chicago.

Power Sales Club Organized

At an enthusiastic meeting Thursday afternoon plans were made for the organization of a Power Sales Club to be affiliated with the Commercial Section. An organization committee was appointed to perfect the details of the work of the club. It consists of Messrs. Harry G. Glass, R. H. Knowlton, J. J. Hurley, H. H. Holding, S. V. Walton and H. C. Gille. At the close of the meeting a suggestion was made that every influence be exerted to secure at the next convention a session especially devoted to motor-applications business.

Meter Exhibit

The meter committee, in accordance with established precedent, prepared a very attractive exhibit. The display was confined in general to primary and secondary standards and to the new instruments and meters placed on the market during the past year. There were also a number of new and interesting accessories, load boxes, storage battery lamps for meter reading, etc., and a complete exhibit of all the demand instruments and meters now available. Included among the latter were the Pick demand meter, the Ingalls demand recorder and a new model of the Sangamo demand instrument, which while only experimental at present the committee hopes will be produced during this year.

"Safety First" Exhibit

An interesting exhibit of accident prevention devices and literature was maintained at the Bellevue-Stratford Hotel during the convention by the New York Edison Company, United Gas Improvement Company, Rochester Railway & Light Company, General Electric Company, and the Bureau of Safety representing the Commonwealth Edison Company, Public Service Company of Northern Illinois, and Middle West Utilities Company.

N. E. L. A. Welcome Arch

As an indication of its cordial greeting to the National Electric Light Association, the Philadelphia Electric Company placed across Broad Street at the Bellevue-Stratford corner a most conspicuous arch, artistic in design, which excited general admiration. The effect was that of a brilliant necklace of electric lamps supporting a pendant, the whole attached to two graceful wooden pedestals each of which was surrounded by an open-work ball with lamps inside. The pillars reached to a height of 52 ft. The string of lamps crossing the street consisted of twenty-four 1000-watt nitrogen-filled incandescent units, each in a frosted globe. Each of the balls at the top of the pedestals contained four of the same type of lamps. The medallion, or pendant, supported by the "necklace" displayed the well-known emblem of the N. E. L. A., the letters being outlined at night in 25-watt frosted lamps. The entire decoration was designed by Mr. John T. Windrim and was erected and operated by the Philadelphia Electric Company.

Entertainments of the Week

Despite the crowded business program of the convention many of those in attendance found time to share the delightful entertainment features of the week. On Monday a preliminary baseball game for the Westinghouse trophy was played between Philadelphia and Baltimore at Franklin Field, Baltimore winning, 7 to 4. The opening reception by President and Mrs. McCall at the Bellevue-Stratford Hotel on Monday evening was enjoyed by many hundreds of delegates and guests. On Tuesday a sightseeing tour of the city was participated in by the ladies, the trip including visits to Independence Hall, Franklin's grave, Christ Church, Wanamaker's, the Curtis Publishing Company's plant and many other points of interest. In the afternoon the ladies enjoyed a musicale in the auditorium of the Manufacturers' Club. The entire convention adjourned Tuesday evening to Willow Grove Park, where a concert was given by Pryor's Band, and the Jovian Order held a rejuvenation at the same place and time.

On Wednesday morning the ladies enjoyed an automobile trip through Fairmount Park, and in the afternoon the New York Edison Company's baseball team defeated Baltimore, 13 to 1, on Franklin Field, thereby winning the championship cup for this year, each member of the club also receiving a silver loving cup. Wednesday evening a dinner was given by Chairman Arthur Williams and President McCall to members of the public policy committee and other distinguished visitors, Mr. Edison being the guest of honor. On the same evening a delightful card party for the ladies took place at the Hotel Adelphia.

A river excursion for ladies on the steamer *City of Philadelphia* took place on Thursday morning, the trip affording a view of many commercial and historical institutions, including the immense plants of the Cramp Shipbuilding Company and the New York Shipbuilding Company, Fort Mifflin, and the monument that marked the battlefield of Red Bank. The party landed at the League Island Navy Yard, and luncheon was served during the trip, the enjoyment of which was enhanced by orchestral music.

On Thursday evening a dance was held in the Bellevue-Stratford ball-room. On Friday about 200 delegates and guests visited the power development of the Pennsylvania Water & Power Company at Holtwood, on the Susquehanna River, as guests of Mr. Herbert A. Wagner, making the trip by special train.

During the week a number of informal dinners took place, among these being one given for representatives of Stone & Webster in attendance at the convention, and another given by Mr. L. A. Osborne at the Racquet Club to his friends, the guests including President McCall, Mr. E. W. Rice, Jr., Mr. Guy E. Tripp and Mr. Joseph Buffington.

Members and guests were offered the hospitality of the Huntingdon Valley Country Club, the Philmont Country Club, the St. David's Golf Club, the Philadelphia Cricket Club, the Whitemarsh Valley Country Club and the Springhaven Country Club.

Pittsfield A. I. E. E. Meeting

The relative merits of star and delta connections in generators and transformers as viewed by designers and operators was the general subject of a meeting of the American Institute of Electrical Engineers held at Pittsfield, Mass., on May 28 and 29. Prof. D. C. Jackson, President-elect Paul M. Lincoln and President C. O. Mailloux acted successively as chairman of the three sessions.

Experience with Line Transformers

Mr. D. W. Roper, of the Commonwealth Edison Company, Chicago, presented an analysis of troubles encountered during the year ended Dec. 31, 1913, with 14,274 transformers, having a total rating of 129,056 kw, the average rating being about 9 kw. Transformers of 5-kw rating and smaller comprise over 60 per cent of the total number installed. Of the 220 transformer burn-outs recorded, 129 were attributed to lightning, 12 to overloads, 23 to defects, 9 to grounds and secondary short-circuits and 47 to causes unknown. Of the total number of transformers in service, 9878 have connection boards above the oil, and the remainder are without connection boards or are provided with submerged boards. The relative number of troubles encountered with transformers having connection boards above the oil was about twice that with the other transformers.

The author made use of the standard specification for transformers issued by the Bureau of Standards as a basis for discussing possible improvements. He claimed that the standard specifications represent a long step forward in placing the connection boards under oil. As only a small percentage of the transformers that are provided with connection boards are ever used on 1000-volt circuits, the author suggested that a further improvement could be made by requiring that transformers for use on 2000-volt circuits shall be furnished without connection boards and limiting the use of submerged connection boards to those companies which have 1000-volt distributing circuits.

The author remarked that the protection of distributing transformers against lightning has not received the attention it deserves. Records show that the larger sizes of transformers are comparatively immune from lightning, and that the greatest number of troubles occur with the smaller sizes, that is, below 10 kw. The number of transformers of these sizes comes to about 70 per cent of the total installation, so that the transformers which are most susceptible to damage by lightning are the most numerous. It is suggested that careful attention by the manufacturers to the primary bushings, the clearance of the primary leads inside the case, the manner of their support and other minor details would probably result in a material improvement in these records.

For experimental purposes lightning arresters were installed upon the same pole with each of a large number of transformers. The remainder of the distributing system is protected by arresters not placed on the transformer poles but scattered over the lines at a distance of about 2000 ft., resulting in a ratio of arresters to transformers of about 40 per cent. In that portion of the territory where there was an arrester on the same pole with each transformer the results to date as compared with the older practice indicate that the percentage of transformers burned out by lightning is reduced by about two-thirds.

The several experiments indicate that by means of a combination of the two schemes, and possibly by some further improvements in some details of the transformers and in the design of the lightning arresters, there should be no great difficulty in reducing the percentage of cases of trouble due to lightning to one-fifth, and possibly to one-tenth, of those experienced in former years.

Discussion

Mr. W. S. Moody, Pittsfield, remarked that there are many factors that should be taken into consideration in the design of transformers which nothing but service will demonstrate. The manufacturer cannot benefit by experience in service to any great extent without the very complete assistance of the operating man. The manufacturer wishes to make his apparatus just as reliable as possible. It is only by keeping exact records of reliability that the most economical point in the balance of cost and factor of safety can be found.

Mr. A. D. Fishel, Pittsburgh, stated that continuity of service is especially important in a large distributing system. He claimed that remarkable improvements contributing to reliability have been made during the past few years in distributing transformers following the introduction of silicon steel and changes in the arrangement of coils and core. Compared with the earlier types, modern transformers have greater factors of safety in the insulation and more uniform temperature rise, which improvements have resulted in more reliable service. The new transformers have larger clearances at the terminal board than the old and are giving very satisfactory service with the board at the oil level. Such an arrangement would not be permissible at 6600 volts because of the great clearance needed, but it is advantageous at lower voltages.

Mr. H. W. Hough, Cleveland, said that there are about 10,000 transformers in service in Cleveland. About 400 of these were burned out last year. In a great majority of cases exposed terminal boards were damaged. In no case was damage done to a submerged terminal board.

Mr. Joseph Franz, Lenox, Mass., called attention to the fact that in the Berkshire region of Massachusetts it is not always possible to obtain good ground connections in remote sections, and in two instances during lightning storms trouble arose where arresters were on the same pole with the transformers. As a result of a fire caused in this manner the company now places no lightning protectors on the same poles with transformers.

Mr. M. O. Troy, Schenectady, expressed the opinion that the best solution of the terminal-board problem is to be found in its elimination by standardization of the operating voltages. Whenever a terminal board is used it should be submerged and a weak point for lightning path should be provided external to the transformer.

Prof. E. E. F. Creighton, Schenectady, made the following suggestions for protection from lightning: Discontinue the practice of using a terminal board as any sort of protection for the transformer; use an arrester with good protective qualities placed on the same pole with the transformer, utilizing two ground connections where desired; connect the transformer case to the ground terminal of the arrester.

Mr. H. B. Alverson, Buffalo, claimed that a limited number of arresters properly placed will do as much good as many arresters connected with the distributing transformers.

Mr. W. L. Granger, Detroit, stated that exposed terminal blocks cause transformer failures even in the winter time when there is no lightning and can best be eliminated entirely.

Mr. W. J. Wooldridge, Pittsfield, Mass., explained the relation between the attitude of the workman in the transformer factory and the safety and reliability of the apparatus manufactured. The workman must be saturated with the "safety first" idea to insure his proper attention to details of transformer insulation. Mr. Wooldridge displayed Pittsfield factory accident data curves for 1912 and 1913 and the first three months of 1914, showing that the ratio of the number of accidents to the number of men employed was reduced by about 50 per cent in 1913 as compared with 1912, and has been further reduced by about 50 per cent in 1914 as compared with 1913.

Three-Phase Connections

A paper by Prof. Royal W. Sorensen and Mr. Walter M. Newton and one by Mr. R. C. Clinker dealt with similar subjects and hence were read consecutively and discussed together.

Star and Delta Connections

The paper by Messrs. Royal W. Sorensen and Walter L. Newton, entitled "Inherent Voltage Relations in Star and Delta Connections," was read by Mr. H. W. Tobey. The authors reported the results of experiments made on a small transmission system consisting of a 7.5-kw revolving-field generator and two banks of transformers, each consisting of three 3-kva shell-type units with the necessary interconnecting leads, forming a miniature transmission installation. Tests were made with both star and delta connection without load, with balanced non-inductive load and with non-inductive load on only one phase for various conditions of grounding.

The authors concluded that the complete delta system for generators and transformers with load connected in star is not to be recommended, but that the ideal system is one with the transformers connected in delta and the generators in star.

Triple Harmonics in Transformers

The conditions under which triple harmonic voltages and currents are produced in star-connected and delta-connected transformers were reviewed in a paper by Mr. R. C. Clinker which was abstracted by Mr. H. O. Stephens. These harmonics are produced by variation in the permeability of the core with the cyclic change in the magnetization. In a single-phase transformer increase of series resistance tends to suppress the current harmonic and increase the voltage harmonic. In three-phase transformers a star connection suppresses the current harmonic and allows the full flux and voltage harmonics to appear. Delta connection provides a closed path for the current harmonic and suppresses the triple voltage.

The author cited a case where a star-connected auto-transformer was used to step up from 6600 volts to 12,000 volts at a substation. The neutral was not grounded, and trouble resulted owing to partial resonance at triple frequency between line capacity and transformer reactance. He showed that, although not generally recognized, a triple component can exist in the line-to-line emf wave of a three-phase system. This is possible in a case where a two-to-three-phase transformation is used, and the emf wave of the two-phase generator contains a triple harmonic.

Discussion

In a written communication Mr. Waldo V. Lyon, Boston, pointed out that for the same flux distribution and same phase voltage the third harmonic component is only one-half as great in a two-phase generator as in a three-phase generator. Dr. A. E. Kennelly and Dr. Harold Pender, Boston, submitted a joint written communication in which attention was called to the great increase in voltage rise at the end of a transmission line when the length is such as to equal a quarter wavelength corresponding to one of the pronounced higher harmonics in the voltage wave.

Mr. F. W. Peek, Jr., Schenectady, showed that the third harmonic is produced by variation in the reluctance of the magnetic path and explained the methods by which either the voltage or the current wave, but not both, could be freed from a triple-frequency component.

Mr. Louis F. Blume, Pittsfield, expressed the opinion that, with the present knowledge of the production, effect and elimination of triple-frequency components, there now remains no excuse for permitting the voltage wave to contain a third harmonic.

Mr. Charles L. Fortescue, Pittsburgh, attributed the presence of the triple harmonic in the secondary circuits of Scott-connected transformers receiving energy from a two-phase generator to the dissymmetry in the phases as well as to the distortion in the generator wave-shape.

Mr. J. M. Weed, Pittsfield, stated that change in permeability rather than hysteresis is the cause for the presence of the third harmonic in three-phase transformer groups.

Operation of Three-Phase Systems

In view of the similarity in subject matter, papers by Mr. Louis F. Blume, Mr. Charles L. Fortescue and Messrs. J. P. Jollyman, P. M. Downing and F. G. Baum were discussed collectively.

Transformer Operation

The relative advantages and disadvantages in the operation of the more important transformer connections in three-phase systems were outlined in a paper by Mr. Louis F. Blume, of the General Electric Company, Pittsfield, Mass. In addition to the normal condition of operation, consideration was given to operation with one phase disabled and to operation with grounds on the line. The insulation stresses under normal and abnormal conditions of operation were discussed. As a result of his analysis the author reached the following conclusions: Isolated systems are subject to greater insulation stresses than grounded systems. In grounded systems the average insulation factor of safety is greater than in isolated systems under similar conditions of operation. In isolated systems the stresses at lower frequencies under certain conditions may reach values sufficiently high to injure or destroy the transformer and other apparatus connected to the system. In an isolated system a ground on the line is more likely to result in intermittent arcs than in a grounded system. A ground on the line in a solidly grounded system reduces the potential of the system with respect to ground, whereas in the isolated system a ground on the line increases the potential of the system with respect to ground. A resistance inserted between neutral and ground to limit the value of short-circuit current increases thereby the insulation stresses resulting from line grounds. If it is desired to limit the value of potential at fundamental frequency above ground of any part of the system to 57 per cent of line potential, it is necessary to ground the neutral solidly at both the receiving and the generating end of the transmission line. If receiving transformers of relatively small kilovolt-ampere rating are connected with grounded neutral to an otherwise isolated system, they are liable to severe short-circuits, and the grounded neutral only partly protects the system from potential rises. In star-connected auto-transformers it is dangerous to operate with isolated neutral except when the ratio of transformation is very small. In star-connected auto-transformers it is dangerous to operate with isolated neutral except when the entire system is isolated. In star-connected auto-transformers it is dangerous to operate with grounded neutral unless the triple harmonic voltage between line and neutral is eliminated or kept negligibly small.

Study of Three-Phase Systems

Mr. Charles L. Fortescue read a paper relating to the advantages and disadvantages of the several common methods of connecting transformers in three-phase systems, including the "star-star," the "delta-delta," the "star-delta" and the "delta-star." The paper contained a list of thirty-seven systems operating at or above 70,000 volts, similar to the table which was issued as a supplement to the *Electrical World* on April 25, 1914. In twenty-two of these systems use is made of the star connection of transformers on the high-tension side.

The author expressed his belief that for pressures below 44,000 volts either star or delta high-tension transformer connection may be used. The delta connection has a slight advantage owing to its greater flexibility. For higher voltages the star high-tension connection is preferable, chiefly on account of its greater strength and lower cost. There is a probability that a delta-star bank of transformers will cause less disturbance in switching than one that is delta-delta-connected. There are much greater possibilities of development in transformers designed for delta-star connection than for any other. Past and present practice upholds the use of the delta-star connection in preference to the delta-delta for high-voltage transmission.

Experience with Grounded Neutral

A paper by Messrs. J. P. Jollyman, P. M. Downing and F. G. Baum, entitled "Experience of the Pacific Gas & Electric Company with the Grounded Neutral," was read by Mr. V. M. Montsinger. The system of this company is operated at 60,000 volts with star-connected transformers and solidly grounded neutral at all generating stations and the important substations.

As a result of its experience the company believes that the grounded-neutral system has a number of important advantages with regard to the transformers, the transmission lines and operation. The fewer turns of larger size of the star-connected transformers with fixed lower average voltage to ground greatly increases their reliability. The maximum voltage on the line insulators with the grounded neutral is never more than 57.7 per cent of the line voltage, and it is possible to maintain polyphase service at a substation on a branch line with only two wires in case one wire should be cut out. This cannot be done on a delta system unless one phase of the system be grounded, which is very undesirable. With a grounded neutral the falling of a wire is instantly detected and power must be shut off. In a delta-connected system the formation of an arcing ground is often followed by surges which break down the insulation at other points, the cause of this disturbance being the oscillatory character of the arc. In the grounded star-connected system no such disturbances occur, as the frequency of an arc to ground is the same as that of the system and any damage is confined to the point of failure.

The authors expressed the belief that operation with the grounded neutral causes less disturbance in telephone and telegraph lines than would be the case in delta-connected lines.

Discussion

In a written communication Mr. Guido Semenza, Milan, Italy, stated that in Italy, which has an area about double that of the State of New York, there are more than 2400 hydroelectric generating stations nearly all of which are provided with transmission lines. The great majority of the systems are delta-connected without grounds; a few are star-connected with spark-gap to ground, a few are connected to ground through resistance, while only two are directly grounded. Of the underground high-tension lines not one is operated with grounded neutral.

Mr. Semenza gave the following résumé of the reasons usually assigned for the Italian practice: With good circuit-breakers a ground on one line will always result in an interruption of the other lines. Grounding through a resistance is an immediate solution which presents the disadvantages of both insulated and grounded systems. Directly grounded neutrals are apt to disturb all low-current circuits. The practice in Italy is to over-insulate the lines. One of the most serious disturbances on long-distance transmission systems is the traveling surges caused by atmospheric influences. It is said that a grounded neutral prevents the accumulation of static charges. In many Italian systems this accumulation is prevented by water-jet dischargers acting on the busbars or on the line wires.

Mr. Semenza stated that he did not see many reasons for supporting the grounding of the neutral, while he saw many reasons for not doing so. By using good insulation and good terminal protection the insulated system affords all the conditions needed for good and regular operation.

Mr. W. W. Lewis, Pittsfield, called attention to the transmission-line data published in the *Electrical World* dated April 25, 1914, relating to thirty-five American and nineteen foreign systems operating at and above 70,000 volts. Of the American systems fourteen are delta-connected and nineteen star-connected, all but one of the latter having grounded neutrals. Of the foreign systems six are delta-connected and ten star-connected, six having grounded neutrals.

Mr. Lewis discussed in detail the operating conditions of six typical systems: the Great Western Power Company with isolated delta; the Colorado Power Company with isolated delta; the Au Sable Electric Company with isolated delta; the Sierra & San Francisco Power Company with grounded star; the Yadkins River Power Company with grounded star, and the Pennsylvania Water & Power Company with grounded star. He concluded that neither the isolated delta nor the grounded star system is free from trouble, which is governed largely by location, climate and mechanical details of line construction.

Two arguments which are frequently used in favor of the isolated delta system are proved in practice to be fallacious, namely, that only voltage troubles need be expected and that a delta system can operate continuously in case of a dead ground on one line. The latter is true only for very short lines, as on long lines the charging current—due to the increased capacity and voltage—becomes excessive, as does also the corona loss. The telephone system is also invariably disturbed, and hence operation must usually be discontinued. On the other hand, the short-circuit troubles on the grounded star system are very severe, and some auxiliary short-circuiting and field-destroying devices are almost essential to render the operation satisfactory. As far as operation is concerned, it seems that each system has its advantages and defects, and that in selecting a system the location and climatic conditions should be carefully considered.

Mr. V. M. Montsinger, Pittsfield, displayed a series of lantern slides recording the results of an investigation of the effect of electrostatic capacity reactance on third harmonic phenomena in star-connected transformers. The third harmonic was found to reach its maximum at a certain value of core density largely independent of the amount of capacity in circuit, the magnitude of the harmonic depending, however, on the capacity. These relations were demonstrated by tests made upon transformers in the lecture room, the meter readings being projected on the screen before the members assembled.

Mr. H. S. Osborne, New York, announced that so far as concerns the disturbance in neighboring telegraph and telephone lines, the delta-connected system is preferable to the star-connected system. It is not felt, however, that any one is now in a position to state finally and authoritatively the extent to which the disturbances can be reduced in these two systems and the amount of disturbance which must necessarily be experienced from them. Without precautions being taken to reduce the interference, the disturbance from either type of system can be very serious, as the telephone companies can abundantly testify.

The joint committee on inductive interferences in California is now carrying out an extended investigation on the entire subject of inductive interferences, and it is to be hoped that the comparative study of the relative possibility of minimizing the inductive effects from star-connected and delta-connected systems will be of great value.

Prof. E. E. F. Creighton stated that the electromagnetic disturbance is a greater menace to telephone lines than is the electrostatic, especially in railway circuits, because of the great depth to which the return current penetrates.

Mr. John B. Taylor, New York and Schenectady, remarked that the star connection of transformers does not inherently mean grounded neutral. In general, the difficulties which may arise from grounding the neutral result from grounding at more than one point. Many of the advantages of the grounded neutral are perfectly well secured with the single ground, and many of the disadvantages are thereby avoided. With extra high-voltage work it seems best to use star connections with the neutral grounded at one point only, the generating station.

Mr. F. C. Green, Pittsfield, presented arguments to show that, since with the isolated delta system an "arcing ground" tends to produce high-voltage disturbances and hence to cause the transformers to break down, this system is not safer to the line or transformers than is the star-connected system.

Mr. D. W. Roper, Chicago, stated that much trouble arose when the transformer neutrals were grounded to the system neutrals in Chicago, and the present practice there is to connect the three transformers of a customer in star, leaving the neutral of the transformers entirely free from the neutral of the system.

Mr. F. W. Peek, Jr., Schenectady, expressed the opinion that the most important point in a transmission system is the insulation of the line. The insulators should be so designed as not to act as weak points in the system which should be confined to the lightning arresters. The insulation should be designed with reference to the abnormal voltage which will cause damage—such as that of lightning—rather than the normal operating voltage of the system.

Star and Delta Connections for Alternators

Mr. T. S. Eden, of the General Electric Company, Schenectady, N. Y., presented a paper entitled "Relative Merits of Star and Delta Connection for Alternators," in which it was stated that over 90 per cent of three-phase generators are star-connected.

The delta connection seems to have no advantage except when used for convenience in design for certain voltages when proper precautions must be exercised to eliminate excessive circulating currents, the triple harmonic voltages being in time-phase with each other.

In a star-connected machine with ungrounded neutral it is impossible for currents of triple frequency or multiples of triple frequency to flow, since the third harmonics existing in the two legs of the winding which are in series between a pair of terminals are opposed to each other and of equal value, thus neutralizing one another.

With the star connection it is possible to bring out a neutral lead for various uses, while the required voltage is obtained with 58 per cent of the turns required with delta connection. This is a large factor in cost, especially in machines of high voltage and large numbers of turns per coil, where the expense of internal insulation increases rapidly.

In general, for the average alternator, the emf wave of the star-connected winding is nearer a true sine than that of the delta-connected generator.

Transformer Connections for Railway Service

Mr. Cassius M. Davis read a paper on delta and star connections for railway transmission and distribution, in which he stated that the choice between the two is frequently determined by purely economic consideration. However, it is common practice to use the delta connection on both the high-tension and the low-tension sides of transformers except in the case of six-phase converters, where the diametrical connection on the low-tension side is the rule. Synchronous converter substations employing two machines in series for high-voltage direct-current railways are frequently operated from single banks of transformers which have double windings on the low-tension sides. Methods of starting have little effect upon transformer connections except in the case of six-phase converters. Transformer connections are seldom important electrically in single-phase and three-phase railway systems. A secondary distribution system may at first be delta-connected and later changed over to star connection to obtain better voltage regulation.

The author stated that the low-tension sides of substation transformers are usually delta-connected, except for six-phase synchronous converters and except where specific local conditions demand a star connection for reaching the neutral point. Six-phase synchronous converters are usually supplied with energy from delta-diametrical connected transformers. The choice of connection for low-tension distribution systems between substations is largely dependent upon commercial economy rather than upon purely electrical considerations.

Discussion

Mr. Carl J. Fechheimer, Ampere, N. J., mentioned the fact that for a large low-voltage machine, such as a 2000-kva, 240-volt generator, the delta connection is preferable to the star connection. Moreover, for certain voltages it is better to use the delta than the star arrangement on account of the number of conductors required in the slots. The circulating current in delta-connected windings caused by distortion in the voltage wave can be reduced not only by using a two-thirds pitch but also by inserting reactance in the winding and by carefully designing the pole shoes. The effect of the circulating current upon the efficiency is of less importance than its effect upon the temperature rise.

Mr. E. G. Merrick, Schenectady, explained that in modern turbo-generators the equivalent of non-uniformity in the depth of the air-gap is obtained by varying the ratio of the wound to the unwound portion of the revolving field structure.

Summary of Program

At the conclusion of the presentation and discussion of the formal papers on the program, the subject matter as a whole was reviewed by Mr. Percy H. Thomas, New York, who outlined the methods by which triple-frequency voltage and current waves are produced in three-phase systems, explained their effect upon the operation of the system and showed how so to minimize or localize their activities as to render them harmless.

National District Heating Association Has a Good Year

The sixth annual convention of the National District Heating Association, held in Rochester on May 26-28, closed a year marked by a decided increase in membership, greater financial strength and effective committee work. President S. Morgan Bushnell, of Chicago, presided, and the experienced secretary-treasurer, Mr. D. L. Gaskill, of Greenville, Ohio, looked after details. The attendance was about 140, and a few manufacturers made exhibits. At the opening session Mr. Charles S. Owen, commissioner of public safety of the city of Rochester, made an address of welcome, to which Mr. Fred B. Orr, of Chicago, responded.

President Bushnell's Address

The presidential address of Mr. Bushnell was well considered. The speaker sketched the rise of electric-light companies and showed how there gradually arose the demand that central-station companies give a complete service—light, power and heat. It would be desirable, no doubt, if electricity could be the agent to supply all these utilities, but Mr. Bushnell gave calculations to show that at prevailing commercial rates the relative cost of heating buildings by steam and electricity would be as 1 to 11.8. In other words, electric heating for buildings would cost over ten times as much as steam.

Central-station heating possesses several advantages—cheaper coal can be burned in more efficient plants; its convenience and labor saving are very attractive to the householder; it helps abolish the smoke nuisance, and, also important, it helps the central-station manager to combat the isolated electric plant. It is difficult to set any limit to the development of central-station heating. When electric-lighting companies were established, no one could foresee how important would become the supplying of electricity to motors. Similarly, the supplying of heat from the central station may outstrip both light and power. The association has grown to a membership of 300. It has a place in collecting information and studying the district-heating problem scientifically. It works harmoniously with the American Society of Heating and Ventilating Engineers, to which it sustains much the same relation that the National Electric Light Association does to the American Institute of Electrical Engineers. Mr. Bushnell concluded by emphasizing the importance of high-grade work.

Professor Hoffman Made an Honorary Member

Secretary Gaskill read his report, showing the good record of the year. He praised President Bushnell for the impetus he had given the society, saying that he had secured more new members than any other person.

On recommendation of the executive committee, Prof. James D. Hoffman, of the University of Nebraska, formerly of Purdue University, was elected an honorary member, the vote being unanimous. Professor Hoffman is a mechanical engineer, and this distinction is in recognition of his work on district heating.

Underground Construction

As chairman of the committee on the subject, Mr. H. A. Woodworth, of Indianapolis, read a long and valuable report on "District Heating Distribution Systems." The speaker gave some interesting chapters from the district-heating history of the Merchants' Light & Heat Company, of Indianapolis. Among other things he said, in the discussion, that it had been found necessary to re-insulate the whole hot-water heating system in Indianapolis.

Mr. John F. Hale, of Camden, N. J., was introduced as a past-president of the American Society of Heating and Ventilating Engineers. He complimented the association on its work, but urged the members to "get somewhere" on each subject. Messrs. A. C. Rogers of Toledo, D. S. Boyden of Boston, Thomas Donohue of Lafayette, Ind., Henry Meyer of Terre Haute, Ind., and others took part in the discussion on Mr. Woodworth's report.

The New Officers

The report of the nominating committee, subsequently followed by election, was presented on the evening of May 26. These are the new officers: President, Mr. H. R. Wetherell of the Central Illinois Light Company of Peoria, Ill; first vice-president, Mr. D. S. Boyden of Boston; second vice-president, Mr. Byron T. Gifford of Grand Rapids, Mich.; third vice-president, Mr. George W. Martin of New York; secretary-treasurer, Mr. D. L. Gaskill of Greenville, Ohio; executive committee, Messrs. S. Morgan Bushnell of Chicago, H. Almert of Chicago and C. F. Oehlman of Denver.

Mr. H. S. Patterson, New York, of the National Tube Company, displayed interesting motion pictures showing the manufacture of steel pipes and tubes from the digging of the iron ore to the testing of the finished product.

Giving the Public a Square Deal

Mr. R. M. Searle, vice-president of the Rochester Railway & Light Company, gave an instructive address on "Public Policy of Utilities" at the morning session of May 27. He spoke of the pleasant and reasonable attitude of the public in Rochester toward the utilities. Criticism of utility operation is inevitable; constructive criticism should be welcome. What is needed by the utility, in other words, is "knocks without knocking." The manager should not forget that the public may give practical engineering advice that the company would be willing to pay for. Utility men should discuss matters with their public on a human-being basis.

Mr. Searle spoke of the "five magnificent newspapers" of Rochester. Any man in his organization is authorized to talk to any newspaper man about any news happening, including accidents, provided he tells the truth. The newspaper men know of this policy and appreciate it. There is no reason why any employee should fear to make any truthful statement in relation to utility matters. As to municipal ownership, the speaker made the remark that the waste during the political changes of a long term of years would invariably be more than the profit asked by the corporation. Any taxpayer can participate in the profits of the utility by buying one share or more of its stock. In this way it is probable that he will get greater benefits than he could by the possible reduced taxation of municipal operation. Incidentally, to show the good feeling toward utility men in Rochester Mr. Searle mentioned the fact that he is a former president of the Chamber of Commerce. As an officer in sixteen companies and serving on forty-four civic or other committees, the manager of the Rochester company finds plenty to do.

The speaker expressed himself as a firm believer in government regulation. As one incident, showing the relation of the public and utilities in Rochester, he told of the method adopted to take the poles off the streets in residence districts by securing pole rights in the shape of easements over the rear ends of lots, Rochester having no alleys between streets. Mr. Searle also made the statement that in the public utility business if the public is kept in ignorance it is because the utility men keep it ignorant. Much money will be needed to finance the district-heating extensions of central-station companies in Rochester and elsewhere.

Mr. Searle believes that in the case of his own city the securities issued for this purpose will practically all be placed in the home town. This indicates the local feeling toward the utility, and this feeling is a very desirable asset.

In concluding his talk the Rochester manager argued strongly against the one-man idea of administering utilities. The subordinates should be the right kind of men to make decisions on all ordinary matters. They should be trusted by the chief executive and handle all detail. They should have sufficient authority to give positive answers to customers. Monopoly is a great opportunity to do good, said Mr. Searle. "But never forget," said he in effect, "to dwell on the fact that good honest service is worth a good fair price. To give the elasticity and service that the public demands and is entitled to receive, the contract price should include something for reserve."

Meters for Central-Station Heating

Mr. A. D. Spencer, of Detroit, presented the report of the meter committee, giving some data on the performance of steam-flow meters and condensation meters. One conclusion arrived at by the committee was that thermostatic regulation cannot supplant the metering of steam service. Messrs. Gaskill, of Greenville, Ohio; Rogers, of Toledo; Boyden, of Boston; Orr, of Chicago; Wetherell, of Peoria; G. D. Bly, of Toronto; Hale, of Camden, N. J., and others, took part in the discussion. In Ohio it is required that water of condensation shall not be discharged into sewers at a temperature higher than 140 deg. Some of those present thought that 150 deg. should be allowed.

Station Records

Mr. A. P. Biggs, of Detroit, presented the short report of the station record committee. He also exhibited a number of blanks and forms collected by the committee. This report was discussed by Messrs. Whitney, of Boston; Hecht, of Chicago, and Boyden, of Boston.

Centrifugal or Reciprocating Pumps

Mr. A. C. Rogers, of Toledo, opened the discussion on the relative merits of centrifugal and reciprocating pumps for hot-water heating. He said that further investigation is needed, and for his part he would not recommend one type to the exclusion of the other. There was some discussion. Mr. Hecht, of the Public Service Company of Northern Illinois, said that his experience would indicate that the centrifugal pump is not only more economical as far as maintenance is concerned but is also more economical in the matter of steam consumption. Messrs. Boyden, Wolls, Woodworth and others discussed the report briefly.

Hot-Water Heating

Mr. Thomas Donohue, of Lafayette, Ind., gave a short talk on "Hot-Water Heating Under Forced Circulation." He took up the question of pumping and spoke of the flexibility and efficiency of hot-water heating. He dwelt on the need of paying attention to conditions in customers' premises. This will be found to effect economy in pumping. Mr. L. B. Shaw, of Chicago, described and illustrated a method of caring for the combined hot-water and electric load in a generating station.

Superheated Steam in the Heating System

A short paper on "Effects of Superheated Steam on the Heating System" was read by Mr. Davis S. Boyden, of Boston. He contrasted the advantages and disadvantages of superheat for this service and concluded, considering economy alone, that the preponderance seemed to be slightly with the superheated steam. Messrs. C. R. Bishop, of North Tonawanda, N. Y.; Spencer, E. L. Wilder, of Rochester; Orr, and others, participated in the discussion.

Some Aspects of Government Regulation

Mr. D. L. Gaskill, of Greenville, Ohio, gave a short talk on utility regulation. He declared that nearly all the troubles of the utility are its own fault. If it has conducted its business so that the public has faith in it, it need not fear control by some governmental body. Politicians and agitators cannot exploit the utility unless they have something to work on. The public should be educated as to the cost of district heating. It is very important that utilities should know their real costs, but perhaps 90 per cent of them do not. If an honest record of costs can be presented to the state commission, the utility has little to fear. Mr. Gaskill told how the Ohio Electric Light Association had stood back of the Bucyrus Light & Power Company in the initial valuation case of the Ohio state commission. In relation to the appraisals asked of all Ohio utilities by August 1, the secretary said that the state commission has consented to extend the time. The O. E. L. A. has an appraisal committee at work; that committee has an office in Columbus and will probably be busy for two years.

Mr. Donohue told something of the commission situation in Indiana, and Mr. Rogers, of Toledo, said that as the result of his personal experience with the Ohio commission he is confident that one going to the commission with clean hands will receive fair treatment.

District Heating for Small Towns

Mr. L. T. Mason, of Hornell, N. Y., read a short paper on "District Heating for Small Towns," in which he said that in many circumstances combined electric and steam-heating plants will pay a satisfactory return in small communities. Mr. Wetherell, of Peoria, Ill., took part in the discussion and Mr. Gaskill gave a forcible description of the manner of levying taxes on utilities in Ohio.

Intermittent Operation of Plants

The question whether it is more profitable to shut off steam at night or to keep it on continuously was taken up in a paper read by Mr. E. L. Wilder, of Rochester. The author said that as the results of observations in connection with the central-station heating of several factory buildings he had been led to the conclusion that a saving of from 10 to 30 per cent may be effected by the method of intermittent heating—that is, shutting off the heat during certain hours at night. Mr. Woodworth, of Indianapolis, mentioned some tests where when the thermometer outside stood at 25 deg. or less the heating was done continuously, but above that point the heat was shut off for part of the night. This resulted in a saving of 22 per cent. Mr. Wetherell, of Peoria, described some interesting experiments with a theater where intermittent heating was successfully practised. Others taking part in the discussion were Messrs. Boyden, C. H. Spiehler, of Dayton; Mason, Bly, R. C. Marsh, of Chicago, and others.

Heat Losses from Buildings

A contribution on "Heat Losses from Buildings of Latest Construction," from the pen of Mr. J. Byers Holbrook, of New York, was read by Secretary Gaskill. There was no discussion.

Economic Advantages of Central-Station Heating

Mr. A. C. Rogers, of Toledo, opened the discussion on "Economic Advantages of Central-Station Heating Service Over Individual Heating Plants." He pointed out that the expense of operating an individual heating plant is considerably greater than the fuel bill alone. District-heating men should assume more direct responsibility for installing heating equipments on customers' premises. Mr. Wetherell remarked that on flat rate his company offered heating service in Peoria on the basis of twice the customer's heating bill. However, the cost may be made much less if the consumer will buy steam on a meter basis and regulate the consumption carefully in accordance with actual requirements. Mr. Wolls spoke of one case where central-station heating had practically eliminated pneumonia in a state institution in Columbus, Ohio, caring for children. Mr. Bishop told of an instance where by metering separately the tenants in an office building the receipts for district heating were increased from about 33 cents to about 80 cents per 1000 lb.

Customers' Steam-Heating Systems

The paper by Mr. H. R. Wetherell, of Peoria, on "Customers' Steam-Heating Systems," described several interior-heating systems as used on customers' premises and connected to central station service. In the discussion Mr. Woodworth, of Indianapolis, said that his company was having better success with the vapor system than with the cooling coils. Mr. R. P. Bolton, consulting engineer, New York, declared that the man who could devise a method of measuring steam-heating service as electric service is measured would confer a great benefit on the industry. Messrs. F. M. Noecker, of Renovo, Pa.; R. C. Marsh, of Chicago, and A. C. Rogers, of Toledo, also took part in the discussion.

Commercial Steam Heating in New York City

Mr. George W. Martin, vice-president of the New York City Service Company, read a paper on "Commercial Steam Heating in New York City." He described the methods employed by his company. In the discussion Mr. Bolton spoke of the cost of labor in the firing of coal. Sometimes the waste in the boiler room is almost incredible. Figures given by Mr. Bolton showed that the labor cost alone for firing in heating plants in commercial buildings in New York City ranges from 56 cents to 86 cents per ton of fuel handled. In government buildings this figure is larger, ranging between 86 cents and $1.31. In one city building (Tombs prison) the labor cost for firing was $1.74 per ton of fuel handled, while in another (police headquarters) this cost reached the astonishing figure of $3.59, or 19 cents a ton more than the cost of the fuel itself. Mr. Bolton pointed out the field for the intelligent operations of a service company. He also suggested the establishment of preferential rates to encourage the use of the district heating company's steam in summer. He recommended the use of an indicating steam meter for each boiler.

Mr. D. S. Boyden, of Boston, remarked that without full knowledge of conditions of plant and fuel used figures of labor cost of firing may not mean very much. Mr. Orr, of Chicago, said that apparently it required the burning of about twice as many tons of coal to heat buildings in Chicago as in New York. This is probably due to local conditions, such as colder winters and higher wind velocities. Mr. Orr remarked that up to 900 tons of coal a month there is no advantage in using stokers, so far as labor is concerned. Mr. C. R. Bishop, of North Tonawanda, N. Y., pointed out that in estimating costs the length of the heating season should be taken into consideration.

Rate Making for Heating Companies

The report of the rate committee was presented by the chairman, Mr. E. L. Wilder, of Rochester. The committee said that rates for heating should be placed on a logical basis. It recommended a two-rate charge for steam heating, based in a general way on the maximum demand and the demand charge for steam. In the case of a hot-water plant the committee said that but one charge could be made, owing to the lack of a suitable meter for measuring the service rendered In the discussion Mr. Rogers, of Toledo, said that in a district-heating case in Ohio the Public Utilities Commission of that State had virtually justified a readiness-to-serve charge. Mr. W. G. Carlton, of New York, mentioned the fact that in the hot-water heating supplied to the New York Central Terminal what is in effect a metered system has been adopted. This method of charging is based on volume and temperature of the water. Mr. Bishop pointed out that higher rates for central-station heating may bring about economy, with sliding scales, for customers will be more careful when they are finally shown that they will gain by it. Mr. Donohue, of Lafayette, Ind., said that the flat rate for hot-water heating varies from 15 cents to 24 cents per square foot of radiation. Messrs. A. D. Spencer, of Detroit; R. C. Holley, of North Tonawanda, and others took part in the discussion. In closing Mr. Wilder said that the sale of heating service is not essentially different, so far as rate making is concerned, from electric service, since similar principles govern both.

Economies in Station Operation

In the absence of Mr. Byron T. Gifford, of Grand Rapids, Mich., chairman of the committee, the long and valuable report on station operating was abstracted by Secretary Gaskill. It contained contributions by Messrs. E. C. Fisher, D. S. Jacobus, Joseph Harrington, F. F. Vater, and others, relating to boilers and general operating conditions. In the discussion Mr. Martin, of New York, praised the report and made the point that if feed water is to be treated it should be treated before it gets into the boiler. Mr. Bolton referred to the importance of furnace settings and combustion chambers of sufficient size. He said that he thought the boiler of the future would have vertical tubes. He urged the members to give the association information about their unit cost. Mr. J. L. Hecht said that the Public Service Company of northern Illinois has placed a fuel engineer in the boiler room of each of its large stations. These are technically educated men, and the company estimates the return on them as fifteen to one. Mr. Hecht thinks that firemen should rank above water tenders, the duties of the former being of a more responsible kind.

Information About Franchises

Mr. Charles H. Green, of New York, the subject of franchise forms having been brought up, mentioned Mr. Delos Wilcox's book, as being of possible value to those seeking this information. A number of members told what they paid annually for their franchise rights.

Work of the Educational Committee

Mr. Davis S. Boyden, of Boston, presented the report of the educational committee, which has co-operated with a similar committee of the American Society of Heating and Ventilating Engineers. Subjects like pipe sizes, steam meters, proposed flange standards, weather stripping, accident prevention and first aid, low-pressure steam cooking and meteorological conditions were discussed in a report of seventy-one printed pages. The committee was continued, and the National Electric Light Association and the American Society of Mechanical Engineers were invited to co-operate.

Visits and Entertainments

Pleasant entertainment was provided for the ladies, and the men had an opportunity to visit plants of the Rochester Railway & Light Company and the Taylor Instrument Companies. There were also a theater party and an informal dance, and on May 29 the American District Steam Company entertained the entire party of 140 in a 300-mile all-day trip to Niagara Falls and return.

Entertainment by the American District Steam Company

On Friday, May 29, the day following the last regular business session, the delegates were the guests of the American District Steam Company, of North Tonawanda, N. Y. At 9:30 a.m., in the New York Central station at Rochester, they boarded a special train, composed of five Pullmans and a club car, every convenience being provided. The first stop was made at Lockport, the home of the original central-heating plant. The entire party was conveyed through the principal residential and business districts of the city, including a visit to the heating plant on Elm Street, by large motor-driven sightseeing trucks. A luncheon was tendered by the company at its works in North Tonawanda. Then followed an inspection of the large plant devoted to the manufacture of materials for use in the construction of central-heating plants. Subsequently the trip was continued to Niagara Falls, where a ride was taken in special cars around the scenic gorge route. Thence the party went to the Cliffton House, on the Canadian side, for dinner, which was served about 7:30 p.m. At the close of dinner Mr. D. L. Gaskill, secretary of the association, expressed for those present their appreciation of the hospitality extended by the company and commented upon the way in which every part of the scheduled program had been carried out. Mr. Wells, president of the company, responded in a brief talk and made it apparent that the company's reward lay in the appreciation manifested on all sides. Dancing was then indulged in until 10 p. m., when the return trip to Rochester was made, by way of Buffalo.

Convention Cruise of the Missouri Utilities Association

Leaving St. Louis on the morning of May 21, the delegates of the Missouri Electric, Gas, Street Railway & Water Works Association enjoyed a three days' trip on the Mississippi River. Keokuk, with its 150,000-hp hydroelectric development, was the objective point of the steamer *Quincy*, on board which all convention sessions were held. In the absence of President J. E. Harsh, formerly of Sedalia, and First Vice-president C. L. Clary, formerly of Sikeston, Second Vice-president A. C. Einstein, of St. Louis, presided. Businesslike sessions and a maximum of wholesome entertainment and outdoor enjoyment marked the convention from beginning to end.

On the afternoon of May 21 communications from Messrs. John M. Atkinson and J. M. McShane, of the Missouri Public Service Commission, were read by Mr. J. D. Bowles, one of the commission's engineers. Reflecting the fair, judicial attitude of the newly created commission, these letters indicated that the problems will be squarely met, and in the decisions rendered the viewpoints of the people and the utilities will both be considered.

Growth of Missouri Association

During the last year the Missouri Gas, Electric, Street Railway and Water Works Association has grown and prospered, said Mr. Einstein in his address as acting-president. Much good work has been done in co-operating with the Missouri Public Service Commission to secure an acceptable classification of accounts. Since the coming of the commission utility men have had much to learn, and even yet among the smaller utilities the importance of the working of the commission is hardly comprehended. However, conferences attended by members of the commission and the association have resulted in giving the commission a thorough understanding of conditions, and it is the commission's desire to inaugurate a system of accounting which will be neither onerous nor burdensome to the small companies, and yet at the same time will be a practical subdivided system for the larger companies.

Work for the future was mapped out by Vice-president Einstein as follows: A committee on public affairs should be created; small companies should have a uniform form of rate schedule; the association should request the Missouri Public Service Commission to withhold action on joint pole construction, as the National Electric Light Association standards at present need qualification in many instances on account of the fact that the N. E. L. A. specifications for 1911 were made up largely from data supplied by telephone and telegraph companies and that their use works a hardship on the lighting companies. In closing Mr. Einstein suggested that action be taken to incorporate the association.

In the executive session following Mr. Einstein's address the membership committee reported a total of 115 members in good standing. The report of the treasurer showed that the association was in comfortable financial circumstances. Other committees reporting were the executive committee, special committee and new bylaws committee. Embodied in the report of the latter was a new set of by-laws providing that the society be incorporated under the name of the Missouri Public Utilities Association. Member grades were also changed, the annual dues of member companies as finally amended ranging from $5 to $250.

Indeterminate Permit

Presenting a paper on "Complete Regulation Under the Indeterminate Permit," Mr. William J. Norton, of Chicago, declared himself to be a firm believer in the indeterminate permit as the solution of franchise and regulatory problems, especially those of small plants. Regulation in Missouri, said Mr. Norton, is now incomplete. The commission has the power under the public service commission laws to require municipalities to file their rates and contracts and complete reports as to operation, and also the right to fix the price to be charged by municipalities as well as by private corporations. However, citizens are left to decide such matters of vital importance as the prevention of unnecessary competition and duplication of private utility properties at the hands of municipal authorities. Sketching the history of the indeterminate permit in Wisconsin, Indiana and Massachusetts, the speaker pointed out the advantages to be gained from a franchise extending for an indefinite period during good behavior, so to speak, over one which expired at the end of a definite period of years. In decisions and public addresses the Wisconsin commissioners have discussed various features of the indeterminate permit and pointed out the advantages accruing to the company and the public. In the Appleton case the commission held that the indeterminate permit is "more valuable than the ordinary special franchise because the company now is a legally protected monopoly and is subject to no different supervision and regulation than it would have been had it continued to operate under its original grant. Furthermore, its investment is now protected not only against the consequences of competition but also against the possibility of total loss on expiration of the original grant. It can never be deprived of its property except on payment of fair value therefor by the municipality."

Those discussing the paper were Messrs. I. R. Kelso and J. P. Kealy, of Kansas City; J. N. Chester, of Jefferson City, and A. C. Einstein, of St. Louis.

Visits to Member Companies

Last October the executive committee of the association delegated Mr. John C. Hall, of St. Louis, to make a trip throughout the State, calling on various utilities for the purpose of explaining the Public Service Commission by-laws and incidentally to secure new members for the association. Most of the time of the special representative was spent with the smaller or independent companies on the assumption that the syndicate companies were better able to care for themselves. The representative reported that what the small company needs is time to prepare its affairs, as it is unreasonable to expect the small company to grasp the entire situation at once. Even the large companies had to digest the public service commission laws a little at a time. The general impression prevailing throughout the State, according to Mr. Hall, is that Missouri has a good public service commission law and commission. The only existing fear—and this is especially true among the smaller utilities—is that they will not be prepared to comply with all the commission's orders and rulings when issued.

Classification of Accounts

Mr. P. J. Kealy, Kansas City, chairman of the committee co-operating with the Missouri Public Service Commission on classification of accounts and annual reports, stated that the work was progressing, a tentative draft of the forms for electric and gas companies now being in the hands of Commissioner McShane. This classification follows quite closely the N. E. L. A. draft to be submitted at the Philadelphia convention. After commenting favorably upon the fair and receptive attitude of the commission Mr. Kealy predicted that the final draft of the classification would satisfy every utility operator in the State. The matter of depreciation and bond discount, however, is still an issue with the commission.

At the close of the afternoon session Mr. C. H. Jaccard, of Webb City, presented a paper entitled "Meters Versus Flat Rates on Water," setting forth arguments in favor of selling water on the metered plan, eliminating the guessing incident to all flat-rate schedules.

Effecting Economies in a Small Plant

The first paper of the session on May 22 was read by Mr. F. M. Wilkes, of Poplar Bluff, and was entitled "A Trip Through a Small Plant." Beginning at the coal car and describing realistically a walk through his plant in company with the president of his organization, the speaker told how economies had been effected by cleaning all coal from the bottoms of cars, firing boilers properly, closing small steam leaks, cutting gaskets economically and effecting a general clean-up in the engine room.

In a paper on "High-Pressure Gas Distribution and Its Advantages," Mr. S. H. Wallace, of Webster Groves, told of the great development in the electrical industry due to high-tension transmission and centralization of power plants. The speaker firmly believed that the time will soon come when the gas industry will be handled in a similar manner.

Electric Signs

Reading a paper entitled "Electrical Advertising," Mr. F. T. Hopkins, of St. Louis, declared that the electric sign is the thermometer by which the town is judged. There is no such selling argument as a demonstration, and the use of electric signs by the central station should be encouraged to show the faith of the electric-service company in its own product.

Central-station men in small towns sometimes complain that the available sign load is so small that it would not pay to develop it, said Mr. F. A. Kehl, of St. Louis. Most of the profit, however, in such cases comes not from the sale of energy, and if these men would develop their sign business the profit on maintenance would surprise them. In addition to the profit, the value of the signs as an advertisement for electric service should be considered.

Speaking of the sign business in St. Joseph, Mr. J A. Porter said that in the past year 12,500 10-cp lamps had been installed upon sign circuits, operating from dusk until 11 o'clock. In addition, said Mr. Porter, 165 good prospective sign customers have been secured, these becoming more numerous with each sign sale. Throughout the campaign of this company only high-class signs have been sold, as a poor sign never satisfies a purchaser. The St. Joseph company includes lamp renewals and flasher maintenance in its flat-rate schedule.

Mr. F. D. Beardslee, of St. Louis, said that the companies in small towns should get in touch with sign companies and establish a sign campaign with the help of the manufacturers. The chief way to attract attention at the beginning of a sign campaign, the speaker said, is by placing electric signs upon the company's office and generating station to show confidence in the advertising ability of such displays.

As an example of what can be accomplished in small towns, Mr. R. J. Irvine, of Trenton, stated that he had started a sign campaign a few months ago and now had enough signs connected to justify a separate sign circuit, 600 lamps being in operation and 4800 lamps in prospect.

Others who spoke in the discussion were Messrs. B L. Elbert, of St. Joseph; W. S. Merkle, of St. Louis, and J. W. Van Brunt, of St. Joseph.

Co-operation with Public Service Commission

The session on Saturday morning (May 23) was opened by Mr. J. D. Bowles with a paper entitled "Opportunities for Co-operation between the Public Service Commission and the Missouri Public Utilities Association." The commission is about to issue rules governing voltage regulation, interruption records, records of time of starting and stopping generating systems, and records of output. The rules will also cover maximum allowable deposit as security and will probably require that service meters be furnished free by the utility companies. All utility operators will be informed of public hearings on these rules before their final adoption and promulgation. With the co-operation of the Missouri association and under the guidance of the N. E. L. A. report to be made at Philadelphia, the commission hopes that it will be able to establish suitable overhead distribution standards and specifications

Employees' Welfare

Presenting a paper entitled "Employees' Welfare," Mr. Hermann Spoehrer, of St. Louis, told what the Union Electric Light & Power Company of St. Louis is doing to promote the welfare and happiness of its employees. Mr. Spoehrer sketched the organization of the Employees' Mutual Benefit Association and told of its financial standing, stating that during eighteen months' operation the company had extended ninety-four loans, aggregating $2,250, under this plan. The loss entailed during the eighteen months has been but $15. Mr. Spoehrer also spoke of the work of the safety committee and outlined the bonus plan which the company contemplates placing in operation among employees not in the sales department of the company.

Following Mr. Spoehrer's paper, the report of the resolutions committee suggested that the committee co-operating with the Missouri Public Service Commission be continued and resolved that it was the sense of the association that setting aside of depreciation in a fund is impracticable.

Election of Officers

Following the report of the nominating committee, the secretary was instructed to cast a unanimous ballot for the following as officers for the ensuing year: President, Mr. A. C. Einstein, of St. Louis; first vice-president, Mr. G. E. Hayler, of Joplin; second vice-president, Mr. J. R. Woodfill, of Aurora; third vice-president, Mr. Hugo Wurdack, of St. Louis; secretary and treasurer, Mr. F. D. Beardslee, of St. Louis. The public affairs committee as elected consists of Mr. P. J. Kealy, of Kansas City, chairman, and Messrs. C. C. Barnard of Marshall, E. R. Locke of Mexico, L. D. Kelsey of Brookfield, Richard McCulloch of St. Louis, A. Harbut of Kansas City and S. E. Bronson of Ozark.

Mr. A. C. Einstein, the president-elect of the Missouri Public Utilities Association, is a native of St. Louis, graduating from the Manual Training School of Washington University in 1884. After a varied experience in engineering and mining work he organized a construction and engineering company in 1894 for the erection of electric and gas plants. Later he removed to Paducah, Ky., where he served as president and general manager of the electric light and street railway property until 1898. The following year he invented a number of acetylene-gas generators and became president of the Eagle Generator Company, serving in that capacity until 1907. In the meantime he had become associated with the Suburban Electric Light & Power Company in 1901, and in 1906 he purchased the King Electric Light Company. In December, 1911, Mr. Einstein was made president of the Union Electric Light & Power Company of St. Louis, and he still serves in that capacity.

Entertainment Features

With a cabaret troupe and an orchestra on board the steamer *Quincy* abundant entertainment was afforded the delegates and during the sessions card games and contests were provided for the ladies. Chafing-dishes and other electric appliances were given as prizes. At the banquet given the association by the Mississippi River Power Company at Keokuk addresses were made by Mayor H. W. Kiel of St. Louis, Mayor S. W. Moorhead of Keokuk, Messrs. J. A. Trawick of Keokuk, Richard McCulloch of St. Louis, J. W. Van Brunt of St. Joseph, J. D. Bowles of Jefferson City, C. R. Joy of Keokuk, A. C. Einstein of St. Louis, and Major Montgomery Meigs of Keokuk. Judge William Logan, of Keokuk, acted as toastmaster. One of the events was a visit to the cavern near Hannibal, Mo., described by Mark Twain in "Tom Sawyer."

Convention of Electrical Contractors in Indiana

Convening at the Claypool Hotel, Indianapolis, Ind., May 28 and 29, delegates to the Electrical Contractors' Association of Indiana took advantage of the opportunity to see the annual 500-mile automobile race held at that place on May 30. The morning session of May 28 was given over to the reports of the by-laws, membership and finance committees and to general business.

Eliminating Old-Code Wire

At the afternoon session Mr. J. E. Latta, Chicago, spoke on the "Underwriters' Attitude," telling of the work being undertaken to eliminate the use of old-code wire. The speaker also sketched the organization of the laboratories, stating that they are not run as a money-making business but charge only enough for tests to pay running expenses.

Mr. W. I. Stone, of the Indiana Inspection Bureau, said that the bureau knows what jobbers are selling old-code wire, and declared that he hoped to rid the State of this inferior product within the ensuing year. Others who took part in the discussion were Messrs. A. L. Swanson, D. Heimann, Jr., G. M. Sanborn and George W. Hill.

Co-operation Between Contractors, Jobbers and Central Stations

Mr. Egbert Douglas and Mr. C. C. Perry, Indianapolis, made several pertinent suggestions for closer co-operation between contractors and central stations. Both spoke highly of the co-operative selling scheme wherein the lighting company respects the rights of the contractor and dealer and refrains from selling electrical appliances at reduced prices. The jobbers' views on this subject were voiced by Mr. C. E. Roberts, Western Electric Company, Indianapolis, and Mr. H. A. Robertson, Electric Service Company, Evansville.

Better Wiring and Better Service

In a paper entitled "The Electrical Contractor and Lighting Service" Mr. M. D. Cooper, of the engineering department of the National Lamp Works, Cleveland, Ohio, presented a forceful argument for more adequate wiring. In the interest of better quality of lighting service, the speaker recommended that wherever possible installations of wiring should be designed to give a potential drop of not more than 1 volt. Data collected in the city of Cleveland in industrial, commercial and residential service show that the average drop is generally more than twice this limit. In closing, the speaker said that the stringency of competition in bidding on wiring in many cases may be due to the fact that architects do not fully realize the importance of careful attention to these matters. Consistent effort on the part of members of the association, said the speaker, should bring this subject forcibly to the attention of architects, thereby opening up an avenue for profitable business.

President Freeman's Suggestions

Mr. Ernest Freeman, president of the National Electrical Contractors' Association, read a paper containing several suggestions for making the work of the state associations more interesting and giving reasons why membership in contractors' associations is worth while. Among the principal things to be gained in meeting competing contractors are the acquaintanceships and the new ideas that are formed. Mr. Freeman attributes 80 per cent of the success of his organization to the help gained from national and state associations. Briefly, the remaining ideas included in the paper were: Build credit among Indiana contractors so that their reputation will stand as high as that of any other class of business men; get a state license law enacted; appoint a supply committee to confer with jobbers in regard to maintaining prices; attain a greater spirit of co-operation with central stations. Mr. Freeman also placed much emphasis on the desirability of the association's hiring a special representative. He said that if this man obtained a more equitable adjustment of rates on liability insurance enough money could be saved through his efforts more than to pay his salary.

Mr. George W. Hill, special representative of the National Contractors' Association, briefly explained the standard system of bookkeeping.

Definite Plans of the Society for Electrical Development

Stating that the Society for Electrical Development had now completed its working plans, Mr. H. H. Cudmore, Cleveland, read a short paper entitled "Why and How." The plans of the society, said he, although national in scope, will be local in action. The paper covered the general plans of the society as printed in the *Electrical World.*

Wider Scope for Jovians

In the absence of Mr. T. A. Wynne, Indianapolis, Mr. George L. Skillman, secretary of the association, read Mr. Wynne's paper on Jovianism, in which the writer said he favored wider membership in the society, including those who have financial interests in electrical public utilities. Pointing to the franchise and competitive situations existing in Toledo and Cleveland at the present, Mr. Wynne said that the efforts of the Jovian order should be directed toward the relief of utility companies in those towns.

Commenting upon the general interest shown by contractors installing high-efficiency tungsten lamps, Mr. H. H. Magdsick, Cleveland, told in what branches of business these units have been applied most successfully, pointing out their adaptability to projection work.

Too Much Estimating Leads to Failure

Speaking extemporaneously upon the pitfalls in estimating, Mr. G. M. Sanborn, Indianapolis, said that the general failing among contractors lay in estimating too often. The contractor who is financially successful, said he, selects with care the jobs upon which he bids, and having selected them makes a careful analysis of the work to be done. Having a list price of the material to be used and sufficient experience to tell him something of the cost of labor, the contractor should find no pitfalls in estimating.

At the close of the convention, Mr. G. E. Varney, of the Varney Electric Company, Indianapolis, stated that at present there are, strictly speaking, no jobbers in the electrical business. The men who are known as jobbers are really distributers or service men. Mr. Varney said that the so-called jobber should confine his operations to his own geographical territory, distributing through the contractor and not selling to the contractor's customer.

Officers for the Ensuing Year

Election of officers held at the second executive session resulted in the re-election of President M. K. Foxworthy, Indianapolis; Vice-president A. L. Swanson, Evansville; Secretary George L. Skillman, Indianapolis, and Treasurer F. L. Meier, Indianapolis.

First National Foreign Trade Convention

The first national foreign trade convention was held at the Hotel Raleigh, Washington, D. C., on May 27 and 28. Representatives of the large industries of the country were present to discuss methods of development of export trade and the effect of new laws on foreign commerce. The convention was held under the auspices of the American Manufacturers' Export Association, the Pan-American Society of the United States and the American Asiatic Association.

Mr. M. A. Oudin, manager of the foreign department of the General Electric Company, read a paper on "Government Assistance in Foreign Trade." In beginning he remarked that a trained observer of our foreign trade once said that the greatest need of the American manufacturer was to convince himself that what he really needed was a foreign market. Figured in dollars and cents our total exports are prodigious. Analyze these figures and it is found that the volume of exports of manufactured articles of complicated character is not altogether satisfactory. Mr. Oudin added that we are misled by the astonishing total of our exports and also by the classifications, in which manufactures of low form—products of the soil, mines and forest—on which comparatively little labor has been expended, are included.

England and Germany

The chief competitors of the United States, in the order of their importance, England and Germany, surpass the United States in the extent and variety of their exports, especially manufactured goods, Mr. Oudin declared. They should be considered as examples of what nations may do when the peculiar genius of their peoples is assisted by the most efficient use of their none too prolific resources and is backed by the powerful influence of government. The export business of these countries presents a most serious national problem. Both invest their surplus funds in foreign loans and foreign enterprises on the theory that "trade follows the loan." A forceful national policy has been adopted as a matter of course. These and other European countries consider that it is the first duty of a government to favor in every possible way the growth of commerce.

The progress of our foreign trade is beset with many difficulties in addition to those already mentioned. The lack of experience no doubt will be replaced in time by the knowledge of how to conduct that trade. An ultra-conservatism in the investment of surplus funds abroad may give place to the audacity characteristic of home enterprises, particularly if capital, naturally timid, can be made to feel that it will have the moral and physical support of government. Our immediate concern, said Mr. Oudin, is with the attitude of government toward those engaged in commerce with other countries. Unfortunately, government assistance and government co-operation in such matters have not yet become a part of our national policy. Until we are willing to adopt a policy with respect to the furtherance of our foreign trade at least as aggressive and stimulating as that followed by our commercial rivals we must not expect to equal them as international traders.

In the case of this country, Mr. Oudin continued, the new competitive conditions introduced by the latest tariff law have brought home more strongly than ever the need of acquiring an enlarged foreign market. The foreign offices, ambassadors and ministers of the great commercial nations are now chiefly occupied in playing the great game of international trade. This diplomatic activity seeks to obtain government contracts, concessions and participation in loans, to safeguard patent, commercial and other rights, and in countries of inferior civilization to prevent the repudiation of financial obligations and commercial contracts, or the passage of laws unfavorable to the extension of trade or similar acts.

Germany was cited by Mr. Oudin as presenting the best example of what close co-operation between government and trade may accomplish. The marvelous strides of its commerce at home and abroad have been quickened by the constant vigilance and well-directed efforts of its foreign office, the enactment of favorable legislation and the paternal attitude of the administrative branches of the government. No international trade incident seems to be too insignificant for the attention of the Foreign Office. The regulation of trade in Germany is intended to free trade and permit it to follow natural and economic laws. But it is startling to learn that to enable exporters to meet competition the government will reduce freight tariffs on the state-owned railroad in special cases. By pressure or otherwise, steamships will give special rates and banks will grant unusual credits. What has been said of Germany applies to other European countries.

Continuing, Mr. Oudin said that the commercial activities of our own people find to-day their most hearty support in one of the executive departments of the government, namely, the Department of Commerce, a subdivision of which, the Bureau of Foreign and Domestic Commerce, deals with affairs in which manufacturers, producers and exporters are deeply concerned. Unfortunately, the desire and ability of the bureau to second the efforts of private enterprise are limited by the resources available. To place the bureau on a footing commensurate with the greater ideas of usefulness in the mind of the Secretary of Commerce, the latter has recommended an enlargement of its scope. The proposed plan provides for the appointment of a higher grade of officials than consuls, to be known as commercial attachés and connected with our embassies and legations, and for an increase in the number of commercial agents, who so far have operated with excellent results, and finally that consuls on purely commercial matters shall co-ordinate with the attachés and report to the Department of Commerce.

Most prominent on the list of exports first to be mentioned in any discussion of the subject, Mr. Oudin added, stand steel products, automobiles, agricultural implements, locomotives, electrical machinery, sewing machines, cash registers and other articles, all of which are produced and marketed by manufacturing companies of very large size. These concerns have accumulated a foreign experience derived from a foreign trade extending in most cases over many years and in many lands.

Friendly Intercourse and Commercial Treaties

There are many doors leading to the trade of oversea countries. Some of them are partly opened. Some of them are locked to all but those who have the key of experience, but the main door is that which is opened by friendly intercourse and commercial treaties and which is kept open by the co-operation of government. While other nations are crowding through the open doors which we as well as they have created care should be taken lest Americans be prevented from utilizing their hard-won advantages or be handicapped in freedom of action because of ill-considered government regulation.

Without in any way mitigating the law in its application to conditions within our own borders, and without in any way imperiling the interests of Americans competing with each other in foreign markets, something ought to be done to relieve the situation in respect to Americans selling American goods in foreign markets in competition with foreigners. Much of the proposed anti-trust legislation now pending in Congress threatens great harm to the export trade. Some of the provisions, if enacted into law, would practically make it impossible to continue to do business abroad.

The committee on judiciary of the House of Representatives has reported a bill containing strict prohibitions against discriminations in prices and agreements for exclusive agencies, but providing that such prohibitions shall apply only in respect to commodities sold within the jurisdiction of the United States. This emphatic recognition of the distinction between domestic commerce and export commerce reflects the growing disposition of the government to render sympathetic assistance to American exporters. Unfortunately, however, this distinction was not recognized when the Sherman law was passed, so that all prohibitions enacted in the Sherman law with a single eye to domestic commerce now fall with blighting effect upon our entire export commerce. Until this situation is squarely faced and the Sherman law is supplemented with legislation making it inapplicable to American commerce outside the borders of the United States, Americans will continue to be handicapped in selling American goods in foreign markets in competition with foreigners.

To Stimulate Foreign Trade

In order to increase co-operation between the legislative and executive branches of the government and to remove existing handicaps to foreign trade and commerce, Mr. Oudin said that the convention might properly urge that funds be appropriated to put the Department of Commerce on the footing of usefulness and importance advocated by the Secretary of Commerce, that the commercial efficiency of our foreign diplomatic and consular service be strengthened in the manner suggested by the Secretary of Commerce, and, finally, that provision be made to remove the handicap which the existing law places upon American capital and American enterprise now engaged in the American export trade and to permit Americans a free hand while selling American goods in the markets of the world.

In conclusion, Mr. Oudin said that it is proper, while earnestly advocating these steps, to remember that government assistance and regulation cannot create trade. They can only prepare the way for the private enterprise of our citizens, upon whom must fall the burden of fulfilling the promise held out by our resources, wealth and geographical position.

Addresses were also made by Messrs. James J. Hill, president of the Great Northern Railway; James A. Farrell, president of the United States Steel Corporation; John D. Ryan, president of the Amalgamated Copper Company; William C. Redfield, Secretary of Commerce, and many others.

Public Service Commission News

New York Commissions

Upon an opinion rendered by Commissioner Milo R. Maltbie, the Public Service Commission for the First District has ordered the New York Railways Company to restore to its reserve for injury and damage claims the sum of $33,984. In its last report for 1913 the company showed the transfer of this amount from the reserve account to the surplus account covering a prior period. The commission decided that while the company could fix the amount of the reserve, it had no right to transfer it to another account for a different period of time.

Mr. D. B. Murphy, of Buffalo, has been retained by the New York Public Service Commission, Second District, as its counsel in connection with its inquiry into the rates of the New York Telephone Company. Other duties prevented Mr. Ledyard P. Hale, the commission's regular counsel, from taking up the telephone work. At a meeting of representatives of the various bodies interested in the investigation, Mr. John L. Swayze, counsel for the telephone company, estimated it would take a year for 300 men to make a complete appraisal of the telephone property.

Massachusetts Commission

The public lighting committee of the Massachusetts Legislature has voted to report a bill codifying the laws relating to the manufacture and distribution of gas and electricity.

Among the amendments which have been suggested to the present law are provisions to bring the hydroelectric companies of the State under the supervision of the Board of Gas & Electric Light Commissioners; to allow electric companies with the consent of the commission to take land by eminent domain for transmission lines, and to give the board further powers of control over voluntary associations. The committee has also voted to report a bill to transfer from the Public Service Commission to the Gas Commission the supervision of telephone and telegraph companies.

Idaho Commission

Advices from Boise state that the cases involving the power of the Public Utilities Commission of Idaho to deny competing companies the right to do business in territory served by existing companies have reached the stage of presentation to the State Supreme Court. The cases are those in which the Great Shoshone & Twin Falls Water Power Company filed a complaint before the commission against the Idaho Power & Light Company and the Southern Idaho Power Company complained against the Beaver River Power Company. The companies against which complaints were made sought to enter districts already served by the other companies. The two companies which were brought before the commission on complaint declared that the commission was without authority to prevent them from constructing in the territories served by the other companies, and the cases went to hearing before the commission.

The commission decided that it was within its jurisdiction in investigating the complaints and held a number of hearings at which evidence was presented. The main contention of the companies already serving the territory was that they were in a position to supply consumers with electrical energy for years to come and were generating more energy than consumers could use, and that to permit competitive companies to enter the territory would only be wasteful competition and duplication of systems, which would be unfair to the investors who already had their money in the existing properties.

The attacking companies held that the rates of the existing companies were unreasonably high and unfair and that public necessity demanded competition, that there was a demand for more electrical energy and that the companies serving the field could not meet the demand.

The decisions of the commission were that wasteful competition and duplication would occur if the new companies were permitted to enter the territory and that this would be unfair to the existing corporations. The commission ordered reductions in rates of the existing companies and later promulgated a schedule of uniform rates for all of the large power companies in the southern Idaho territory. Since that time the commission has steadfastly upheld its policy of preventing wasteful competition, following the position taken by the State commissions generally.

In their petition to the Supreme Court the contesting companies asked that the findings of the commission be reviewed and alleged that they were unlawful. The companies declared that the existence of the commission is unlawful and in violation of the constitution of Idaho. Upon these grounds they asked that the orders of the commission be overruled.

Current News Notes

ASSESSMENT OF MISSOURI PUBLIC UTILITIES.—The Missouri State Board of Equalization convened at Jefferson City, Mo., on May 18 for the purpose of assessing public utilities of the State. Indications were that electric light companies would receive about the same valuation as in 1913 in most instances. The State Attorney-General, however, called attention of the board to the valuations of telephone companies and asked that they be raised.

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AVALANCHES ON ORDER.—By means of electric mines placed deep in the congealed névés mantling the crests of the Swiss Alps, avalanches are being manufactured to order for the benefit of moving-picture photographers and others who find the sport attractive enough to pay the prices charged. The mines are connected by cable with a magneto in the valley, and when all is ready a push of the control lever fulminates a large quantity of gunpowder up on the side of the mountain and down comes the artificial avalanche with all the terrifying rush and roar of a natural landslide.

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HUCKLEBERRY FINN'S ISLAND.—The Mississippi River region served with hydroelectric energy from the Keokuk water-power plant of the Mississippi River Power Company was long ago made famous by the writings of Mark Twain (Samuel L. Clemens), who lived at Hannibal, Mo., and as a boy took part in the juvenile adventures afterward recounted in the familiar stories of Tom Sawyer and Huckleberry Finn. Huckleberry Finn's island still remains in the Mississippi River near Hannibal, but is now the property of the power-transmission company and supports the mid-stream tower structure of the high-tension crossing at this point.

* * *

INTERIOR ILLUMINATION IN LORD & TAYLOR'S STORE, NEW YORK.—In the May 23 issue of the *Electrical World* the interior lighting installation of the Lord & Taylor department store, New York, was described as consisting of semi-indirect lighting fixtures having a "bowl within a bowl." To be more accurate the article should have read: "The semi-indirect bowls used on the two lower floors are made of cased glass, the inner layer being a special shade of blue glass which modifies the light of the tungsten lamps so as to produce approximately subdued daylight." Because of this color correction fabrics will retain their approximate daylight color values when examined under the light. Dark navy blue can even be distinguished from black in this light.

* * *

ELECTRIC DRIVE IN THE WORLD'S LARGEST COAL MINE.—In the Nokomis (Ill.) mine of the Peabody Coal Company, which is said to be the largest coal mine in the world and which is operated entirely by electrical energy, the electricity is purchased from the Central Illinois Public Service Company, being transmitted 28 miles at 33,000 volts from the generating station at Kincaid. Transformers and motor-generators change this energy into direct current for operating the main mine-hoist motor, which is rated at 1500 hp and is operated at 550 volts. Thirty electric coal-mining machines are used, and also ten 5-ton electric locomotives and two 15-ton main haulage locomotives. The main ventilating fan is driven by a 150-hp, 440-volt induction motor, and all auxiliary equipment throughout the mines is electrically driven. The Nokomis mine, when working at full capacity, is capable of an output of 8000 tons a day.

SOCIETY MEETINGS

Meeting of Minnesota Electrical Contractors.—The fifteenth annual meeting of the Minnesota Electrical Contractors' Association will be held at the Builders' Exchange, St. Paul, Minn., on June 22, 1914. The morning session will be called to order at 9:30 o'clock. Mr. G. M. Jones, of the Minneapolis Electric & Construction Company, is secretary of the association.

* * *

Chicago Illuminating Engineers to Discuss Electric Signs.—A joint meeting of the Illuminating Engineering Society and the Western Society of Engineers will be held in Chicago on June 10. A paper on the design of electric signs will be presented by Prof. A. H. Ford, Iowa City, Ia., and Mr. P. E. Haynes, of the city electrical department, will present a paper on street and subway plans.

* * *

American Institute of Consulting Engineers.—A meeting of the American Institute of Consulting Engineers will be held at the City Club, New York City, June 11. The special order of business will be the question of a memorial to Alfred Noble, and the proposed changes in the constitution, and by-laws recommended by the special committee appointed at the last annual meeting will be considered.

* * *

Meeting of Cincinnati Jovians.—A banquet at the Sinton Hotel and the initiation of fifty-three new members featured the recent rejuvenation held by the Cincinnati Jovians on May 18. The membership has now reached over 200 as the result of the general enthusiasm among the electrical men in the city. Informal talks were made at the banquet by Mr. J. A. Brett, sales manager of the Cincinnati offices of the Westinghouse Electric & Manufacturing Company, who declared that all branches of the electrical trade should stand behind public service corporations as against unjust legislation, and Mr. T. J. Ryan, of the General Electric Company, Mr. W. W. Freeman, vice-president of the Union Gas & Electric Company, also addressing the gathering.

* * *

Institute of Radio Engineers.—At a meeting of the Institute of Radio Engineers held at Columbia University on May 13 two papers were read and discussed at length. Dr. John Stone Stone presented a study of oscillations in circuits containing spark-gaps and those coupled thereto whereby computation is much simplified by the use of linear decrements. Mr. Emil J. Simon then described some recent work on three-phase radiotelegraph quenching-gap transmitters, and demonstrated the actions to be observed in such apparatus by the use of three 0.5-kw sets operated in rotation from a three-phase generator. Circuit interactions and irregularities could be noted with ease by means of the rotating vacuum tubes and loud-speaking telephones which were used in the demonstration experiments.

* * *

Change in Method of Judging Students at Technical Schools.—Speaking before the Chicago Jovian League on May 25, Mr. Fred R. Jenkins, secretary of the Chicago Central Station Institute, stated that there are now over 200 corporations which are maintaining schools for the education of their employees and prospective employees. One of these concerns is spending over $50,000 a year in this work and maintains that were the price three times what it now is the work would not be discontinued. Most of the men entering these schools are selected from the technical schools of the country, and the professors of these universities, realizing that men for these positions must have some requirements besides high standing in scholarship, are changing their methods for judging men. Among the leaders in this movement, said Mr. Jenkins, is Prof. C. F. Harding, of Purdue University, who requests all instructors in electrical engineering to judge the men on mental caliber, speed, interest, reliability, honesty and popularity. Later the men are again judged by committees of their classmates, and it is of interest to note that men are generally rated lower by their classmates than by the instructors. Mr. Thomas A. Grier, of Chicago, and Mr. W. W. Winship, Jovian statesman-at-large, of Philadelphia, also spoke.

* * *

Annual Convention Oregon Electrical Contractors' Association.—The second annual convention of the Oregon Electrical Contractors' Association will be held on June 8 and 9 at Pittock Block, Portland, Ore. The program comprises an address of welcome and a response by Mr. R. G. Littler, president of the Oregon Electrical Contractors' Association. An address will also be given on fire causes and prevention, with stereopticon views, by Mr. E. M. Underwood, of the Failing-McCalman Company, and the following papers will be read: "Electrical Contractors' Association," by Ernest Freeman, president of the National Electrical Contractors' Association; "Electrical Jobbers," by Mr. Ross Hartley, manager Pacific States Electric Company; "The Society for Electrical Development," by Mr. J. M. Wakeman, manager of the society. A business session open to members only will be held on the afternoon of June 8. This will be followed by a trolley ride to Council Crest. In the evening a trolley ride to "The Oaks" is scheduled. On June 9 a tour of inspection will be made of the power plants of the Northwestern Electric Company and of the Portland Railway, Light & Power Company. On the afternoon of June 9 the delegates will be taken in automobiles to the baseball game of the Pacific Coast League. The convention will close with a banquet and entertainment at the Portland Hotel on the evening of June 9.

* * *

New York Electrical Society.—The following have been nominated for officers of the New York Electrical Society for 1914-15: Mr. Frederick A. Scheffler, president; Messrs. O. A. Kenyon, Bernard Rowntree and George Weiderman, Sr., vice-presidents; Mr. George H. Guy, secretary; Mr. James H. McGraw, honorary treasurer, and Mr. Henry J. Hoeltge, treasurer. On May 25 Dr. L. A. Bauer, director of the department of terrestrial magnetism of the Carnegie Institution, Washington, delivered a lecture before the Society at Columbia University on the work and cruises of the non-magnetic yacht *Carnegie*. This vessel has covered more than 100,000 route miles. She will leave early in June for a cruise in the North Atlantic Ocean toward Norway and Iceland, returning to Brooklyn at the end of the present year. During the two years 1915 and 1916 she will be cruising in the South Pacific and South Atlantic Oceans between the parallels 50 deg. S. and 70 deg. S. Thus within the next three years it will be possible to issue new magnetic charts for the greater part of the globe. After Dr. Bauer's lecture Lieut. John Cyril Porte, who will be the pilot of the Rodman Wanamaker transatlantic flier, addressed the society on "Aerial Navigation." Much care has been expended on the work of preparation and every scientific resource now available is to be utilized in this enterprise. The annual meeting of the society will be held on June 10, at which time Mr. William P. Kennedy will deliver a lecture on "The Electric Vehicle in New York City," illustrated with motion pictures, relating to the simplicity, economy and other features of the vehicle.

N. E. L. A. Convention Papers and Discussions

Abstracts of reports and papers read at the thirty-seventh annual convention, held at the Bellevue-Stratford, Philadelphia, from June 1 to June 5, 1914

On preceding pages are reported those features of the thirty-seventh annual convention of the National Electric Light Association held at the Bellevue-Stratford Hotel, Philadelphia, Pa., June 1 to 5, which are of particular interest from the point of view of their news value. Herewith and on the pages following are given abstracts of the papers and committee reports presented during the convention, together with accounts of the discussions occurring during the various sessions. It will be noted that these abstracts and their discussions are arranged under general topics, without respect to the order of their presentation in the sessions or to the section of the convention before which they were discussed.

RELATIONS WITH THE PUBLIC

Public Policy Committee Report

Looking back over the reports of previous years, the committee on public policy stated that it found no reason to retract or modify any of the recommendations of the past. Rather has time proved that they indicate a wise, constructive course which may well be followed to the benefit of the members individually and the industry collectively. The committee made note of an evident and spreading effort throughout the industry to maintain the highest attainable standards of service, to safeguard the health and lives of employees and to conduct affairs generally in a manner to commend the industry to the public at large. The report was signed by the following members of the committee: Messrs. Nicholas F. Brady, Everett W. Burdett, Henry L. Doherty, Charles L. Edgar, W. W. Freeman, George H. Harries, Samuel Insull, John W. Lieb, Joseph B. McCall, ex officio, Thomas E. Murray, Samuel Scovil, Charles A. Stone, Herbert A. Wagner, and Arthur Williams as chairman.

The committee found little conflict between its own views and those generally recorded by the various public service commissions. It has held consistently that the business of supplying electrical energy from large central stations is essentially a monopoly in the best meaning of the word. If a monopoly and privately owned and operated, but occupying public property to render a public service, it must be regulated by some public authority. Monopoly in public service can be justified only on the ground that some advantages accrue to the public. This position with the public cannot be maintained unless it can be shown that the greater part of the benefit resulting from such monopoly goes to the public and not to stockholders of the corporation.

The committee quoted from a recent decision of the Railroad Commission of California in the San José telephone case which says in part: "Life is entirely too short to be utilized in trying to make natural monopolies do what they say they can and ought to do without competition." The committee believes that the newer commissions are approaching their duties in a broad spirit of fairness and notes the reaffirmation of the newer as well as the older commissions of the general principle of non-competition in the field of regulated public utility enterprises.

In taking up "fair rates and good service" the committee says that usually, but not always, criticism begins with rates. All rate schedules should have the widest publicity. They should never be discriminatory in their nature and they should be fairly representative of the cost of rendering the various classes of service to which they pertain. The committee stated that there are certain localities within which, while the rates have been reasonable, serious dissatisfaction has arisen because of the unsatisfactory nature of the service, or indifference or ignorance on the part of employees of the company. Reasonable, simple public rate schedules, an efficient, well-trained organization covering every feature of the activities of the company and a service of the highest standards, made available through the lastest and most improved types of incandescent lamps and other apparatus, are service features to which every community is justly entitled. If members fail in giving these, they fail in performing their just obligations to the public and to their own stockholders.

One of the purposes in maintaining a regulated monopoly in the electrical industry is to secure to the public and to the corporation the inherent advantages of generating and distributing electrical energy on a large scale to widely diverse classes and conditions of service. The larger the scale and the wider the diversity the greater the obtainable economies. Members are urged to endeavor to combine all of the electric service of the respective communities. The resultant benefits will be shared not only within the industry but with the public to the largest practicable extent.

In speaking of industrial education the committee says that throughout all of the undertakings of the membership special and general training from the elementary to the highest stages should be a continuing effort. The committee believes that, wherever practicable, the so-called continuation schools covering the various activities of the industry should be conducted by the members, that attendance should be within the employers' and not the employees' time, and that the courses should be broad and general as well as specific and individual, so as to be most productive of the highest degree of human efficiency.

Regarding safety and sanitation the committee says that attention should be directed first to the elimination of all possible danger spots in the plants and distributing systems and second to the training of the employees and members to be constantly alert for danger to themselves and their fellow-workers. One of the member companies found that during the last seven years only 7.7 per cent of its accidents occurred as the result of negligence on its own part. The other 92.3 per cent occurred through carelessness and negligence on the part of the person injured or on the part of a fellow employee or an outside contractor. The average number of fatalities per 1000 employees among central stations of the Second District of the State of New

York for the three years 1910 to 1912, inclusive, was 4.67, while for the central stations of the First District, which includes most of the larger central stations of the State, the corresponding figure for the years 1909 to 1911, inclusive, was 1.93. The largest central station in the latter group averaged less than one fatality per year per 1000 employees in the last seven years. This would tend to show that the accident-preventive measures which the largest companies have been particularly active in adopting have borne fruit. Several members have well-organized safety departments. One has recently adopted the rule that 10 per cent of its employees shall be appointed to membership upon safety committees for a period of six months. At the expiration of this period another 10 per cent is appointed to these committees and so on, until within a period of five years all of the employees will have served on the safety committees. This plan is commended to members.

The section of the report dealing with hydroelectric development expresses gratification that the Legislature of New York State declined this year to pass the proposed measures under which the State would have developed its water-powers and entered into competition with electric utilities. The committee says that the defeat of these unjust and destructive measures would indicate that matters of this kind, involving questions of good faith and the wise conduct of public affairs, may be safely left to the people and in general to their lawmaking representatives. The committee indorses most of the recommendations which were unanimously adopted by the committee on water-powers of the Fifth National Conservation Congress.

Concerning public ownership and operation the report says that perhaps the most serious and unfair instance culminating during the year is that of the municipal electric-light plant in Cleveland. The committee claimed that the membership will recognize that if the price of 3 cents per kw-hr. prevails a very large percentage of the service will be supplied at a serious loss. In the judgment of the committee, with fair public regulation municipal ownership is bound to fail. Approximately 235 plants have been abandoned—in some instances only the plants, and in others both plants and distributing systems. The committee remarked that various municipalities in England are beginning to awaken to the serious burdens imposed by the ownership and operation of public utilities and that signs abound of a general reaction against this policy. Attention was called to the recent book by Yves Guyot on "Where and Why Public Ownership Has Failed," which was translated into English through the efforts of the committee. The committee has also encouraged the organization of the Bureau of Public Service Economics, New York. This bureau is prepared to make reports upon any government or municipal undertaking in this country or Europe on very short notice. The committee adds that it will be appreciated that there is no thought of concealment of the moral support behind the bureau. What little financial support it has needed has been available through its activities and the sale of various publications. The committee feels that with a straightforward statement of the purpose of the bureau this latter point is of incidental importance, as enlightened public opinion would hardly fail to support even material contributions to a purpose which simply sought to inform the public and place the industry before it in a proper light.

One phase of employee relationship highly commends itself to the members of the committee. This is the provision of convenient means to accumulate savings whereby employees of the industry are aided in the purchase of their homes and of the securities of the companies by which they are employed. One of the members whose stock is not upon the market has assisted its employees in organizing a security-holding corporation, the shares of which are purchased upon the instalment plan. The securities behind the shares are the securities of the local electric light and gas companies. The committee commends to members any methods by which their employees are encouraged in the acquirement of either the homes in which they live or the established securities of the corporation by which they are employed.

There are three appendices to the report. A number of decisions were reviewed by Messrs. Beardsley, Hemmens & Taylor, counsel of the New York Edison Company. In these attention was called to the recognition by commissions of the monopoly character of publice service companies, the provision of supplementary service to block-lighting plants and the inclusion of business-building expenditures and going values in appraisals. Another well-established principle which has been reiterated by the courts during the last year, and which to a certain extent affects the large wholesale business of electric-supply companies, is that relating to the resale of merchandise. These decisions are of considerable importance to electric companies in cases where energy is sold in bulk to a customer who may dispose of it as he sees fit. Another appendix contains the unanimous recommendations of the committee on water-power of the Fifth National Conservation Congress. The last appendix contains an article on "Three-Cent Light In Cleveland," written by Mr. H. W. Wilson for the Bureau of Public Service Economics.

Rate Research

The rate research committee, of which Mr. E. W. Lloyd is chairman, presented a brief report accompanied by an appendix on the value of the service theory in rate making, and a set of rules to govern the form and construction of electric rate schedules.

Early in the year the committee discussed at some length the tendency of the public service commissions to require complete valuation of electric-light properties as a basis for rate-making. This is a natural tendency on the part of the commissions, owing to the facts that it is necessary for them to base their conclusions upon actual figures, and that the usual methods used by the companies in making rate adjustments from time to time are not considered by the commissions as substantial enough to form a basis for a final conclusion as to rates, when such conclusion might be reviewed by the courts. It is an interesting fact, however, that some of the commissions have not required valuation for rate-making purposes and have considered that it is practicable to make rate reductions based upon the annual reports and general condition of the company under consideration.

Even the commissions that base their rate determinations upon valuations are forced, when they come to the actual determination of the individual rate, to depart from the mathematical exactness that a detailed valuation implies, and the great amount of labor and expense in determining the valuation and fair rate of return can be used only in determining the amount of net revenue which the company is entitled to receive for its corporate purposes.

In fixing the individual rates for each class of service the commissions are forced, on the one hand, to consider that maximum rates cannot be based upon an actual cost theory, but must be governed largely by policy and by precedent, and in fixing the wholesale rates the commissions have in general recognized that a central station must be free to meet the competition of the private plant. In the latter case they depart entirely from the cost-of-service theory and adopt a value-of-service theory, but in general they have not recognized the great importance of the value-of-service theory in the actual formation of electric-lighting rates.

Rate Schedules

The committee, in completion of its work of the last two years upon the method and form for the filing of electric rate schedules, has also prepared a general set of rules for such schedules.

The committee believes that this is an opportune time to bring out a standard uniform form for the construction of electric rate schedules. While uniformity might be acquired through the co-operative effort of the various commissions, the committee believes, as was the case with rules for uniform accounting, that the N. E. L. A. is the best medium through which uniformity can be speedily attained.

The rate research committee, through the N. E. L. A., invites the co-operation not only of the member companies, but also of the state commissions in the general adoption of this "form and construction of electric rate schedules."

Appendix—Basis of Rates

The committee believes that there are two fundamental principles:

First—The rates should, as a whole, produce an income sufficient to give a fair return on the investment and attract capital freely to the enterprise. The gross earnings from the sale of the product must, therefore, be sufficient to cover all the necessary expenses of operation, including taxes, bad debts, etc., a reserve for renewals and contingencies, interest at current rates, and a reasonable profit in addition.

Second—When the rates as a whole are giving a fair return on the investment as above provided for, then the rates to separate individuals and classes which go to make up the rates as a whole should be so adjusted as to make the total cost as low as possible, and the service rendered as great as possible, by means of the most effective utilization of the plant.

The committee has further come to the conclusion that these results can best be obtained by adjusting the various rates to the value of the service rendered, giving proper consideration also to the relative costs of service, and defining value of the service rendered as the amount which the user would have to pay for the same or equivalent service under absolutely fair but not destructive competition; in other words, the amount at which the user could serve himself or provide an equivalent or substitute means of service under free but not destructive competition.

Disposition of the Profit to the Seller

When the profits to the seller are increased so as to be excessive and to exceed a fair return, whether by such a reduction as described or by any reduction in the sellers' total costs, then the original seller should reduce the rates or a new seller is likely to come in and do business at lower rates.

It is the province of commissions that regulate the prices of monopolies to regulate prices along these lines so that the public may obtain substantially the same prices as it would obtain under fair competition and provide that the public and the seller jointly may share in the savings that come from the avoidance of any unnecessary duplication of plant.

However, unless some of the profits are given to the seller, there will be no incentive to him to plan for a reduction of any sort, and this profit for the seller above an ordinary return is only his fair return for the extra skill in management, initiative, risk or energy that makes the reduction possible.

Competition of other methods with certain classes only would naturally affect only those classes and those rates. Competition (actual or potential) of the same methods by a similar seller affects all classes momentarily, but later affects only some. The competition referred to is the kind of competition that is fair and permanent, and not merely temporary or destructive. Destructive competition that merely reduces prices temporarily is not what the committee considered. Such competition does not permanently reduce prices; on the contrary, it will ultimately raise them.

Exceptions to the Rule

The committee notes some exceptions to the general rule that rates depend only on values. If there is a monopoly, the prices need not necessarily be reduced, but the seller may receive some or all of the extra profit within reasonable limits. Further, if the monopoly is controlled, the controlling authority may take the extra profit in the form of a tax or free service for itself or may decide who shall get the profit, as by requiring that free service be given to schools or at some arbitrary price to some particular class. Adjustments of prices to particular classes are sometimes made by controlling authorities for so-called sociological reasons. It should, however, be noted that attempts to solve sociological problems by means of low public utility rates are usually inefficient. These considerations have to do with the economic aspect of such special rates rather than the question of their expediency as a matter of public policy, which, in general, the committee considers outside the province of this presentation.

In ordinary business the seller sometimes attempts to whet his customer's appetite by making a low rate for a short time, or a landlord might make low rates in order to fill up his building, with the expectation of raising rents later, but such procedure is not usually considered proper for a public utility, unless it is very clearly announced that such low rates are merely temporary and are likely to be raised.

The public utility is expected to make its rates such that no permanent business shall be built up except on rates that are reasonably certain to be permanent.

How to Determine the Values

The simplest method is, of course, for the seller to use his judgment as to the value of the service rendered in any particular case; but whenever there are numerous values to be determined, especially if they are to be determined beforehand, this method becomes impracticable, and some test or method of differentiation must be adopted. Things that are physically the same may have different values at different seasons, as ice and fruit. The supply of electricity in summer, as compared with winter, is of this class, and so is the business supplied on any so-called "off-peak" rate.

Things that are physically the same have different values at different places. Coal is of different value at the mine and at the pit, and electricity is of more value in the city than at the waterfall.

Difference in value according to time is limited by cost of storage, and difference in value according to place by cost of transportation.

The tests of value by use are very prominent in the government postal service. The rates for post cards, circulars, sealed letters, etc., are all tests of value, according to use. In electricity the power rate, as distinguished from the lighting rate, is a test of value according to use.

Justifiable Differences

In both the straight meter rate and ordinary flat rates of so much per lamp per month there is a physical difference to both the seller and the buyer so that these rates are justifiable on the value theory.

In considering wholesale discounts as applied to meter rates or rates per lamp per month the committee assumed two cases, although they are sometimes expressed in one schedule: (1) transactions of different size, and (2) several transactions of similar size added together.

There is a complication in electric service that arises from the fact that the cost of breaking up wholesale delivery into retail lots differs very greatly in different places. In the case of the sparsely settled town, the wholesale supply is delivered at some point in the town, as at a substation, and the cost of breaking this up and delivering to the different houses is very high.

On the other hand, a wholesale supply to a big office building might have the same value just outside of the substation as in the case of the sparsely settled town, but in the case of the office building the supply can be broken up and delivered to the tenants at a relatively small expense as compared with the same quantity distributed throughout a small town.

The general conclusion is that wholesale and retail rates are fully justified whenever it is a question of the delivery of different amounts or under different conditions. When each point of delivery is considered by itself, the difference between wholesale and retail costs for delivery of large or small quantities may be very large.

On the other hand, the adding together of several small deliveries at different points in order to make a total for a wholesale discount does not justify as large a differential as when it is a case of different-sized deliveries at single points, although even in the case of several small deliveries added together a certain differential is justifiable on account of the difference in cost or value to the seller by billing, selling, advertising, bad debts, etc., and there is a difference in the value to the buyer for exactly the same reasons.

Minimum Rate

The committee then considers the minimum rate. The service would cost the supplying company about the same per customer and be about the same value to the seller, while such a service would be about the same value to the buyer, whether he used 1 kw-hr or 5 kw-hr. It follows that a minimum charge of some sort is indicated also by the principle of values, although, on the other hand, the psychological advertising worth of making no minimum charge may be of sufficient importance to warrant its omission.

Power

In spite of the numerous definitions of power, this can perhaps best be expressed in general terms as "non-lighting service."

The difference in value as between power service and lighting service, is, so far as the buyer is concerned, a difference of use. There are well-established and generally approved differential rates for charging storage batteries, for cooking, heating, ice-making, etc., in some cases combined and in some cases a separate rate for each class. In all of these cases the difference in value to the buyer is clearly a difference in value according to the use alone, and though the use itself may not affect the value to the seller, yet if there is a difference in cost and value to the seller, when the kind of use specified will produce a better load-factor at the station or greater total output, the difference in rate in these cases is fully justified.

In such rates as off-peak rates, the test is of difference of value to seller, and unless this happens to coincide with a difference of value to buyer they are undesirable.

Long-Hour Use and Demand

It is clear that the size of demand of large customers is a proper factor that may be taken into account in making the rate.

Which demand should be used—as to whether momentary, one-minute, five-minute, half-hour, etc., should be used, whether one demand or several averages, and as to whether a monthly or yearly demand should be used—is something on which companies have clearly no agreement.

Any of them, however, are to some extent a measure of what the buyer would have to invest in a plant and none of them is a perfect test that would apply to all cases.

On the whole, however, it would appear as though yearly demand would be a better criterion of what it would cost the buyer to run his own plant than the monthly demand whenever the ratio between the monthly and yearly demands was different with different customers.

In some cases the connected load is made a factor in the rate. It is, however, clear, that the connected load by itself is, for large customers, no test of the value of the service either of the buyer or the seller; but, on the other hand, it is true that the connected load is to some extent a measure of the demand, and to this extent its use in rate-making may be justified.

Street Lighting

In street lighting the value of service to the buyer is clearly quite different from the value of the same amount of service for ordinary commercial use.

The value to the seller is likewise quite different in the cases where special street mains have to be put in, etc. Where the street service, however, is taken off the regular commercial mains, the value to the seller is the same except so far as affected by the question of total output and as affected by the different service supplied, in the form of different lamps, the cost of turning on and off the lamps, etc., and by the load-factor produced at the station.

When in street lighting all-night service is compared with the moonlight, midnight service in certain towns, there is clearly a difference in value both to the seller and buyer which results in a difference of price, so that the price as between all-night and midnight lighting would never be the same per lamp or the same per lamp-hour, but would be a combination of the two.

In street lighting the value of the service to the buyer will be quite different for large and small lamps. For small lamps the value would be affected by the competition of gas and gasoline. For large lamps the value of the service to the buyer would be affected by the cost of policing where large lamps are not used. The value and cost of the service to the seller would likewise be quite different as between large and small lamps.

Attitude of the Company

In adjusting its rates, a company should frankly say that it must consider the availability of competitive facilities, actual or potential, and that no electric company can ever get more for its service than its competitors ask for equivalent service—its competitors being gas companies, isolated plants, oil companies, natural ice dealers, and all other means of producing service equivalent to that which the electric company supplies.

The electric company should further say that it is not entitled to any more than a fair return on its investment, and that its rates must not be more than it would charge under free but not destructive competition.

The company should then frankly point out that so long as this is true it is not over-charging; and that so long as it gets all it can from its low-rate business, and gets enough in all cases so as at least to cover its additional expense in supplying such service, such low rates never harm, but in the long run benefit the rest of the business and the general public.

And finally, when any new rate is put forward which will develop business that could not otherwise be obtained, such rate, so long as it shows some profit over the added cost, is justifiable and the classes whose business was obtained without the rate have no claim to it, though later they may claim part of some general reduction due to any increased profits that may result.

When extra profits, thus or otherwise obtained, above a fair return warrant a general reduction in rates, no particular class is entitled to such reductions, but they should be made so as to be of most good to the business as a whole, by reaching down into new fields so as to be of most advantage to all the customers.

The appendix is signed by the following members of the committee: Messrs. E. W. Lloyd, chairman; L. H. Conklin, A. A. Dion, R. S. Hale, W. H. Johnson, J. W. Lieb, Jr., W. J. Norton, F. W. Smith, W. H. Winslow and Mike S. Hart, secretary.

What Users Can Afford

Mr. R. A. Philip agrees with the conclusion of the committee that the various rates should be adjusted to the value of the service rendered, giving proper consideration also to the relative cost of service. However, he thinks that of the two definitions of "value of service" given by the committee, first, "the amount which the user would have to pay for the same or equivalent service under absolutely fair but not destructive competition," second, "what each class can afford to pay rather than get along without the service," the second is the better. Mr. Philip says that while competition is the principal factor in determining some rates, there are many cases where the competition is not sufficiently definite to be used as a basis for rate-making, and in such cases a rate somewhere between the limits of what a buyer will pay rather than go without the service, on the one hand, and what the seller can take without incurring a loss, on the other hand, must be chosen by considering additional factors.

Discussion

In opening the discussion on the rate research committee's report, Mr. W. J. Norton, Chicago, one of its members, urged the importance of having rate schedules filed in a uniform manner, declaring that from the standpoint of the public the availability of rate schedules thus filed would be almost as desirable as uniform rates themselves.

Mr. H. Barker, New York, said that central-station tariffs heretofore presented have generally shown an intermingling of cost-of-service theory with a value-of-service basis, although the modern tendency is now toward the adoption of the cost-of-service plan, except where the necessary data are lacking, when recourse must be had to the principle of service value. It is, of course, difficult for state commissions to know intimately local conditions and values. Mr. Barker urged that utility companies seek public approval on the basis of a cost-of-service schedule, distributing their various items of investment cost, maintenance cost and operating cost under the appropriate heads of service to customers, including allowances for contingencies. "Apparently," said the speaker in conclusion, "even when trying to apply the principle of value-of-service as a fundamental process it is after all difficult for rate-makers to get far away from the cost-of-service basis."

A communication from Mr. Arthur S. Knight, Boston, was read by Mr. R. S. Hale, of that city. In his comment Mr. Knight pointed out that the report of the committee will require careful reading to avoid being misunderstood. He interpreted the report to imply that the rate which the buyer is willing to pay for service represents the value of the service to the customer, although such a condition may not be the most favorable for either the company or the public. Lower rates, for example, may operate to increase the volume of business, thus later indirectly benefiting the customer through the reduction of operating costs. If the value to the buyer is to be taken as a basis for rate-making, the whole question of fixing schedules may be taken out of the hands of the companies, said Mr. Knight, since the commissions will feel themselves quite competent to make such estimates of "value to the customer."

Mr. Hale said that certain items which are affected only by the costs to serve a single class of customers should be borne by that class whether incurred as investment or operating costs. Many expenses are, however, of a joint nature, as in the case where two or more classes of customers utilize the same investment. Assuming that a given return is to be earned on such investment, the percentage required should be divided between the customers in proportion to the relative values of the service to each. Such solutions must, of course, be worked out in the light of experience, but in general it will be the aim of the central station to have a given investment used by as many customers as possible, thus rendering small the cost to each, while making up the total return from a number of sources.

Mr. Henry Harris, Pittsburgh, asked whether the principle of value-of-service has yet been recognized by any commission. He suggested that commissions might not accept such a view unless it could be shown that the result would in return redound to the benefit of other customers. Even then, he further intimated, the commissions might demand the utility to justify its own confidence in its claims by arranging an immediate general revision of rates to the other customers thus affected.

Mr. J. C. Parker, Rochester, N. Y., declared that the cost of service and the value of service must always be correlated in the fixing of prices, and he suggested that the committee had been unfortunate in laying too much stress on the subject of value of service. In its anxiety to get business the central station is likely to overlook cost and to approach the limit where the expense of commercial effort plus the cost of rendering the service will make the business undesirable. Any schedule of rates, he declared, must come back to "the acid test of cost of service," if the transaction is to be economically sound. This is essential from the standpoint of the utility itself no less than from the view of the impression to be created on the public.

Mr. E. F. McCabe, Titusville, Pa., propounded a hypothetical question in which two manufacturers having identical requirements were to be served with central-station energy, the installation in one case replacing an isolated plant while in the other it was without previous competition.

Mr. Emil Dellplain, Syracuse, N. Y., declared that it will be hard to convince public service commissions that the principle of "value of service" differs from that of "what the traffic will bear." He conceded that the cost of service is extremely difficult to ascertain since it changes at least twelve, or even 365, times a year. If the new element of "value of service" is to be presented before the commissions with an honest purpose and open mind, Mr. Dellplain declared, he would give it his approval, but he thought it would be difficult to convince the commissions of the justice of the plan.

Mr. L. H. Scherck, Poughkeepsie, N. Y., commented on the lack of street-lighting information in the committee's report. The subject, he declared, is one that should not be neglected, although it is generally "fought shy of." According to the usual plan of fixing street-lighting costs the local city council simply compares the schedule of neighboring cities of like size, although these are themselves often far below cost, owing to ignorance. Mr. Scherck urged that the industry educate itself on street-lighting costs, a subject which, he thought, has been neglected heretofore.

In closing the discussion Mr. E. W. Lloyd said that the principle of "value of service" in rate-making has already been indorsed by the Massachusetts and Wisconsin commissions, while this theory has also entered largely into opinions rendered by other commissions and regulative bodies.

GENERATION AND TRANSFORMATION

Electrical Apparatus

The committee on electrical apparatus, having Mr. L. L. Elden as chairman, presented an eighty-two-page report on the design of recent types of generating and converting apparatus, air-cooling devices, switchboard equipment and protective devices. The design of outdoor and indoor stations, and the elimination of personal and fire hazards in electrical systems were discussed. Important advances in the developments of temperature-measuring devices suitable for use in connection with electrical apparatus were also mentioned. Details of standardization work in general, including the N. E. L. A. participation in the revision of the A. I. E. E. standardization rules, were treated at some length in the report.

Temperature in Electrical Apparatus

A brief method of calculating heat flow in electrical apparatus was outlined in Mr. F. D. Newbury's paper on "Temperature and Its Effect on the Power Capacity of Electrical Apparatus." The author indicated the difficulty of obtaining consistent thermometer indications and explained the wide variations often obtained. The significance of temperature measurement by mercury thermometer, resistance of windings and by thermocouples was shown.

While low temperature has become a criterion of excellence in electrical apparatus, the operating surface temperature is of importance only in its relation to the maximum temperature to which the insulating material can be subjected safely and continuously. Designing engineers are looking forward to the time when surface temperatures can be entirely neglected and sole dependence placed on internal temperature measurements made at the hottest parts.

In most generators very little heat flows through the insulation between coils as they are usually at about the same temperature. A somewhat larger flow occurs between the lower coil and the core, and a still larger flow takes place from the top coil to the slot wedge. Curves were shown indicating the temperature gradient transverse to conductors and along them. The highest temperature may be expected between separate coils or between the bottom coil and the core, as is borne out by actual tests.

Actual measurements in generators showed that temperatures ranging from 100 deg. to 130 deg. C. are not uncommon at the hottest parts.

A point of practical importance brought out by the diagrams and test results is the futility of measuring surface temperatures in large machines with the idea that real information concerning conditions affecting the life of the insulation is being obtained.

Three sources of information are now available from which an estimate of safe temperatures may be made: Measurement of internal temperatures in generators that have been in service with the same coils for a sufficient length of time to represent a reasonably long life; comparative life tests of materials at abnormally high temperatures in order to bring the time of the tests within practicable limits; comparison of losses and surface temperatures of generators that have been in operation a long time, with the same factors of newer generators of similar design and proportions for which internal temperature measurements are also available.

A safe temperature limit of 105 deg. C. was given for treated cotton, paper, silk and similar fibrous materials. A temperature limit of 105 deg. to 125 deg. C. was suggested for combinations of the above materials with mica or similar heat-resisting materials when both classes of materials are depended upon for insulation strength. With combinations of the same materials, but in which mica and similar heat-resisting materials furnish the entire insulation strength, a limit of 150 deg. C. was suggested.

Discussion

Mr. C. W. Stone, Schenectady, N. Y., expressed the wish that the cooling effect of the moisture in the air might be utilized in electrical apparatus. In Germany experiments have been made with water-cooled coils, but it is a difficult mechanical proposition to carry the water near enough to the coils to do any good. The whole question of insulation is a compromise. Thick, fibrous material means low heat transference. If thin insulation is required, other problems arise. In machines of small bulk and large capacity mica with some binding material will probably be used almost exclusively. Designing engineers do not care if the mica burns away, as it will stay in place even under such conditions. The speaker said that greater care should be used in designing end coils for free air passage and advocated getting away from conditions approximating those found in slots. Wide separation of end turns is necessary. There is practically no limit to the temperature at which turbo-alternator fields can be operated, as mica will stand any temperature up to the melting point of copper. In studying temperatures it is desirable to ascertain the degree of heat present between coils and slots in order to get at the real conditions. Engineers are often fooled by thermometer measurements made on the surface of machinery.

Mr. A. S. Loizeaux, Baltimore, Md., cited the deterioration of varnished-cambric installations in 13,000-volt and 4000-volt machines operated in his city, and suggested the possibility of operating temporarily on very high overload, by the use of the thermocouple. Mr. J. E. Kearns, Schenectady, said that the committee is not trying to standardize the form of connections, but merely their nomenclature. The problem of handling overloads is largely up to the station operator, and with the temperature-indicating equipment now available machines can be run much closer to their heating limits than previously. In emergencies where it is necessary to maintain the service at all hazards it is sometimes necessary to sacrifice the life of the insulation by running the machines at very heavy outputs far beyond their reasonable overload capacity.

Prof. E. E. F. Creighton, Schenectady, N. Y., outlined the use of aluminum-cell lightning arresters in connection with commutator machines, to prevent flashing. This practice grew out of early experience in the application of arresters of this type to direct-current circuits. Contrary to many ideas, the latter are subject at times to very severe surges and rises of potential. About 4 amp for each volt of increase of potential above normal will flow in the arrester. Arresters of this type have been used very successfully in connection with 2000-kw synchronous converters, which had a tendency to flash over. The usual practice is one arrester to every 500 kw of machine rating.

Mr. Newbury emphasized the popularity of motor-starting for synchronous machines in England and said that the efficiency of synchronous converters is one of the chief causes of their increased popularity in lighting service. He said that there is a choice in many cases between using circuit-breakers and aluminum-cell arresters in connection with commutator machines, as a circuit-breaker may cause a machine to flash over on a moderate short-circuit, say two or three times its rated current. In closing, the speaker said that most modern machines can be run at very high temperatures, even up to 200 deg., for one or two hours in emergency.

Mr. Elden, in closing, referred appreciatively to the assistance given by Mr. Newbury's paper to the standardization work of the committee.

Report of Committee on Prime Movers

The report of the committee on prime movers, of which Mr. I. E. Moultrop is chairman, occupied more than ninety printed pages and treated the topics of steam-power, water-power and internal-combustion engines. For stand-by service at St. Louis the scheme of building rapid-kindling coal fires (described in the *Electrical World*, Dec. 6, 1913) was found quicker and cheaper than oil-burning. At Boston steam blowers have been used with advantage to secure forced draft on boilers during peak periods, raising the steaming output quickly by 150 to 200 per cent. Cinder particles discharged from the stacks at high draft are collected at New York by impinging the flue gases against a wet baffle plate, the cinders being caught in a water trough. Several stokers have now been in successful use for burning pulverized coal and in the opinion of the committee deserve greater attention. In view of the high cost of the pit necessary for underwater coal storage and the security of properly selected storage coal against ignition, the committee considers the construction of special pits unwarrantable. A more refractory firebrick is needed, as modern boiler practice has already approached the limit of temperatures for clay products.

In condenser design the committee is gratified at noting the larger steam passages allowed. Open-hearth seamless-steel boiler tubes are now being largely specified and are used with success. The application of "efficiency instruments" has not been attended by the results contemplated, for the reasons that the instruments themselves easily get out of order and careful study and comparison of the records is required in order to diagnose troubles. Letters from manufacturers describing recently developed apparatus formed a supplement to the section on steam-power practice.

Under the heading of water-power reference was made to the paper by Mr. O. B. Coldwell presented before the convention. Methods of measuring flow at water-power plants were also tabulated and discussed. While center bearings between runners on waterwheel sets permit of smaller shaft sections, they introduce the disadvantage of inacessibility and involve the danger of not sharing the bearing load. Forced lubrication is required where bearings cannot be reached. The Kingsbury type of thrust bearing has been giving excellent service at the Keokuk plant.

During the past year there has occurred a continued recedence of the gas engine and producer plant in contrast with the remarkable growth and development of the steam-turbine plant. On the other hand, many prominent engine builders have taken up the manufacture of oil engines. European practice is markedly reflected in American oil-engine design. A commercially practicable gas turbine is shortly to be marketed abroad. Five American firms are now making Diesel-type oil engines, and half a dozen others have acquired rights to other types of similar engines. Appendices to the internal-combustion section of the report give information concerning the location of oil engines in the United States, prices of oil, petroleum production, etc.

Discussion

Mr. T. C. McBride, Philadelphia, said that the committee has been duly severe upon the designers of condensers, and that the equipment compared in diagrammatic form in the report is in reality not suited to uniform service. Instead of showing the apparatus with the heads at the same level, the tops of the tail-pipes should be placed at the same level in comparing the relative heights of the apparatus. It is desirable to differentiate between the area required for the exhaust nozzle and the area needed for the distribution of steam to the tubes. In Europe a tendency toward the use of larger exhaust nozzles is apparent in condenser design. With the demand for greater vacua and consequently increased volumes of steam and larger passages, baffle-plates are necessary only to permit the steam to sweep the air through the condenser to prevent the formation of pockets. Condensers designed for rolling-mill service handle sudden large volumes of steam and differ in construction from those suitable for central stations. Mr. McBride said that he anticipates a development of the hydraulic vacuum pump along the lines of the Mueller equipment shown in the report. Closing, he predicted a notable development of oil engines designed to handle crude fuel and especially adapted to American labor and operating conditions. Engines of this type are likely to become useful in handling stand-by service.

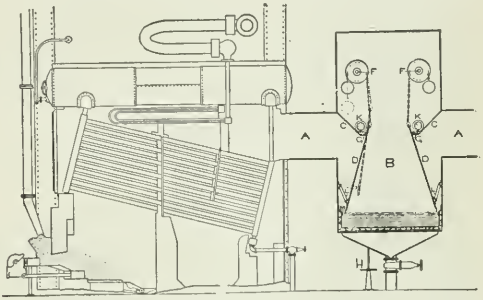


FIG. 1—REMOVING CINDERS FROM FLUE GASES, NEW YORK EDISON COMPANY

Venturi Meters for Water-Power Plants

Mr. Clemens Herschel, New York, pointed out that the Venturi meter is capable of measuring the water requirements of the hydro-electric service within one-twentieth of 1 per cent. This device has been successful for a quarter of a century in water-works plants and is far superior to weirs and home-made methods of measuring water flowage. It is exceeded in accuracy only by the tank method. Venturi meters can be used either on the penstock or at the tailrace as desired; the rate of discharge through the wheel can be set for testing and a constant watch by this device can be kept upon the efficiency of hydraulic prime movers. The registers are still controlled by patents, but in their place the manometer tube and the home-made scale are most convenient. This apparatus is equally well adapted to the measurement of hot water in boiler feeding.

Mr. F. H. Varney, of the Pacific Gas & Electric Company, San Francisco, Cal., said that the present output of the Pacific system is 400,000 kw-hr. per day, of which 50 per cent is delivered by the hydro-electric system. The average load throughout the day is 24,000 kw, and if an emergency demand arises for 10,000 kw to 12,000 kw it can be instantly met by turbo-generators kept floating on the busbars. The normal operating steam pressure is 200 lb., and the boilers are kept hot enough to pick up the load instantly in case of trouble. Each furnace is equipped with oil burners by which the load can be assumed without the loss of a single cycle or a perceptible voltage drop. When a load of the above magnitude is suddenly assumed the steam pressure falls perhaps 40 lb., but the high initial pressure carried renders this of little consequence. The fuel oil is discharged into the furnace hot and in a practically gaseous form.

Selection of Hydraulic Turbines

It was pointed out in the paper on "The Selection of Hydraulic Turbines," by Mr. Charles V. Seastone, that lack of proper data on the characteristics of different types of waterwheels has, to a certain extent, been the cause of installing turbine equipment which is unsuited to the conditions under which it operates. Tests on the smaller-sized waterwheels compared with the actual results of large installed units indicate that the characteristics of different sizes of machines having homologous parts are essentially the same.

Where proper speeds can be secured without increasing unduly the number of turbine runners the horizontal type of waterwheel in ordinary sizes will usually prove more economical in installation and operation. Larger units under considerable head are more desirable in the vertical design as the substructure will usually cost less.

A sufficient number of units should be installed in a station operating under ordinary commercial loads to insure each unit's carrying a reasonably high percentage of its full rated load during the major portion of the time. The reserve unit, if one is installed, should be as small as is practicably possible so that too much equipment representing a heavy investment will not be standing idle. Ordinarily turbine units rated at 125 per cent of their connected generator should be selected so that they can be operated at about eight-tenths of full gate opening. Careful consideration should also be given to selecting units which will operate at high efficiency under a range of heads. Curves were shown indicating how two machines having the same efficiency at a definite load might have widely differing efficiencies above or below this particular load. Other curves showed how machines made by different manufacturers behave under varying heads.

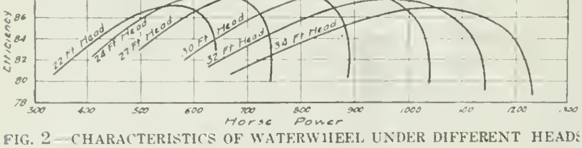


FIG. 2—CHARACTERISTICS OF WATERWHEEL UNDER DIFFERENT HEADS

An interesting method of operating five four-runner turbines was described which allows very flexible operation. The gates of two pairs of runners are operated either individually or together by separate regulating shafts which extend outside the bulkhead wall and are connected to the gate-operating mechanism. These gates may be operated by hand without interfering with the governor control. It will thus be seen that with such an arrangement the number of hydraulic units is practically doubled, with a consequent increased flexibility of operation and efficiency, and without any appreciable sacrifice in efficiency, except in the generators, which is but a small percentage.

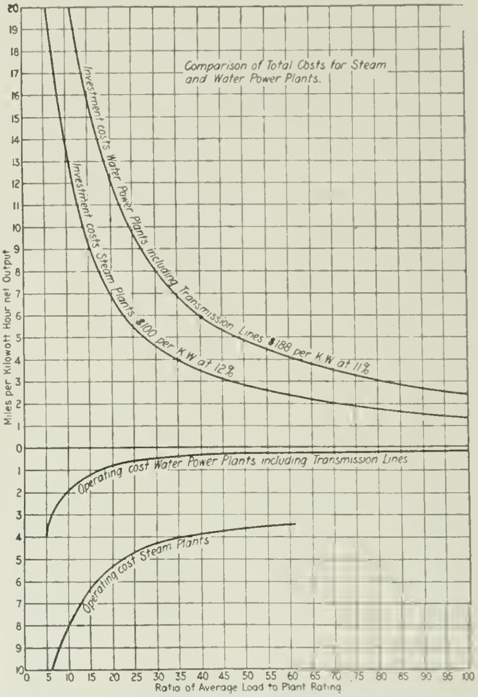


FIG. 3—WATER-POWER PLANT ECONOMICS

Hydroelectric Progress

Mr. T. C. Martin presented a sixty-two-page report setting forth the present status of electric transmission from hydraulic development, discussing in a broad way various aspects of water-power and conservation problems in national and state legislation. Reference was made to the work of the Fifth National Conservation Congress at Washington, D. C., in December, 1913, and an outline was given of the bills proposed by Secretary Lane of the Interior Department and Secretary Garrison of the War Department, under which water-power resources may be developed. Evidences of a more constructive attitude on the part of the government toward hydroelectric development were frequent in the report, and a number of permits granted by the federal authorities were succinctly set forth.

Recent Installations

The last section of the report was devoted to the description in outline of the most recently completed hydroelectric installations and transmissions in this country and abroad, and many points bearing upon transmission-line practice, station design, substation construction, and other practical matters were included. As a résumé of the projects set in motion commercially during the past year the report fulfils a distinct need and presents in small compass data applying to the entire field of hydroelectric transmission.

Water-Power Plant Economics

In a paper on "Water-Power Plant Economics" Mr. O. B. Coldwell presented curves on investment charges and operating costs for steam and hydroelectric generating plants, and discussed steam and watershed, various types of hydroelectric plants, headwork and intakes, types of conduit, penstocks, pondage, main units and generators, and draft tubes and tailraces.

If there is any choice, it is generally preferable to select a stream with a low ratio of flood discharge to minimum flow in order that as much power can be developed as possible without having a large proportion of the equipment lying idle during minimum stream flow. Inasmuch as the majority of streams deliver considerably more water throughout the greater part of the year than is available during minimum stream flow, generating equipment in excess of that capable of utilizing the low flow should be installed. As a valuable treatise on hydroelectric plant economics, Mr. Coldwell recommended Dr. Cary T. Hutchinson's paper on "Economical Capacity of a Combined Hydroelectric and Steam-Power Plant," read at the March meeting of the American Institute of Electrical Engineers and abstracted in the *Electrical World* on March 7.

In making a comparison between the relative merits of several types of plants, consideration should be given to the permanency or life of various structures as affecting depreciation charges, repairs and reconstruction. Dams which do not leak water are essential. Intakes and racks should be constructed with sufficient cross-section to prevent excessive friction loss. The design of control gates, fender booms, splash-boards and spillways was touched upon.

Among various types of water conduits which are in use the paper referred to the construction of the wooden-box type, reinforced-concrete flumes, wooden-stave pipe, steel-pipe, and rock-lined tunnels. A very important feature to consider in designing a flume is the transition from one shape of conduit to another. Unless such junctions are properly designed loss of head will result. The author called attention to the use of electrically operated flume gates for emptying the conduit in case a break occurs below the gate. A bell-mouthed penstock will often obviate a loss in head which may be considerable. Co-operation between purchasers and manufacturers of waterwheels was recommended in order to secure a design most suited to the particular operating conditions.

Whenever water storage can be employed large production economics can usually be obtained. A case was cited where a timber storage dam increased the minimum flow by from 25 to 30 per cent. If plants without storage are operated in conjunction with other plants having forebay pondage, the fluctuations in load can be handled economically by carrying the base load at the plants without ponds.

Numerous devices are used to improve the operation of generating plants. Among those mentioned or described were head-water and tail-water level indicators, water-flow measuring devices, hydraulic and motor-operated valves, water-cooling systems, and overspeed safety devices. Standpipes or pressure-equalizing reservoirs are advisable when long penstocks delivering water at high speed are employed. Synchronous pressure regulators may be used when the cost of a standpipe is prohibitive. A plant should be situated with respect to the tailrace so that full advantage is taken of the draft therein.

Switchboards should be compactly arranged so that the operator can perform all duties from one locality, thereby saving time during emergencies. Electrically operated headgates were advised.

A letter from Mr. Herrmann V. Schreiber, of Sellers & Rippey, Philadelphia, was appended to the paper. The writer suggested other subjects which might be included to advantage in a treatise on hydroelectric plant economics. He also recommended keeping records of water flow in different parts of a plant.

Discussion

Mr. W. N. Ryerson, Duluth, Minn., pointed out that in high-head projects associated with storage capacity the point is reached beyond which the cost of each additional increment of stream flow secured by the enlargement of storage facilities is greater than the cost of auxiliary steam plant or other outside service. The speaker said that the loss of energy in water pipes can be figured along the lines corresponding to Kelvin's law. Mr. A. S. Loizeaux, Baltimore, suggested the value, in some instances, of framing contracts for the purchase of power upon a basis by which the hydroelectric plant may be operated on the peak alone during the dry season, carrying the balance of the service by the auxiliary steam plant. In some cases the latter may thus be run on the day load at a load-factor of nearly 100 per cent.

TRANSMISSION AND DISTRIBUTION

Report of Committee on Grounding Secondaries

Mr. W. H. Blood, Jr., Boston, Mass., presented the report, which urged member companies to explain to water-works companies and municipalities the harmlessness of the water-pipe ground. An inquiry answered by 575 member companies disclosed the fact that only 325 are grounding secondaries. The records show that all of the larger companies adhere to the practice and point out that, in spite of the cost, the smaller central stations cannot afford to take the risk of not falling into line. In many cities the cost of one accident would more than pay the cost of grounding, which is good business apart from the humanitarian aspect.

In 222 locations where grounding to water pipes is allowed only 112 companies make use of this method, the others apparently failing to appreciate the merits of the practice. A total of 131 municipalities have admitted that a ground wire does not injure their piping, and eighty-three privately owned plants have acknowledged the same thing. Driven pipe and cone grounds are entirely unsatisfactory, and the report strongly condemns the continuance of the practice, which is not permitted by the National Electrical Code. Where water meters are located at the curb line, as in some Southern cities, a shunt wire connected around the meter with the usual ground connection in the house is the best practice. The street-railway ground return works out well where one ground connection to a transformer is used.

Discussion

Dr. C. P. Steinmetz said that engineers are agreed that the grounding of secondaries is the only proper method of taking care of the fire and life hazard and that any central station omitting the practice lays itself open to charges of criminal negligence in case of accident. Mr. Dudley Farrand, Newark, N. J., stated that an elaborate report on the safety of grounding secondaries to water pipes had lately been presented to the Public Utilities Commission of New Jersey by Prof. Albert Ganz, and that by a recent ruling the authority of the State to regulate the grounding of secondaries in residences had been upheld as against a municipality. Others who spoke briefly were Messrs. A. S. Loizeaux, Baltimore; C. L. Campbell, Waterbury, Conn.; George P. Roux, Altoona, Pa., and H. Calvert, Philadelphia.

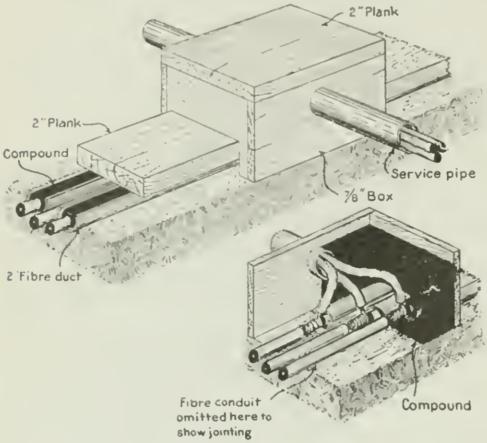


FIG. 4—ORDINARY LINE WIRE LAID IN SPLIT-FIBER PIPE WITH SERVICE CONNECTION

Underground Construction

The report of the committee on underground construction, of which Mr. Philip Torchio was chairman, consisted of six separate contributions on the subjects of alternating-current underground distribution systems, underground transformers, high-tension cable joints, protection of cables in manholes, low-cost underground distributing systems and operating data on high-tension cables.

The first section discussed the practice of using junction boxes, fuses, oil switches and other devices for sectionalizing and interconnecting purposes. As primary cables usually contain several conductors, it is advisable to provide emergency connections which will facilitate restoration of service and safety to workmen during repair when failure in one conductor damages those adjacent to it.

In another section of the report it was declared that underground transformers can be connected directly to the primary mains without automatic protection. Oil switches are frequently installed in the primary connections, however, to provide means for disconnecting the transformer without unbalancing the circuit. The report states definitely that emergency relief valves or vents on transformers are entirely unnecessary, and their omission is recommended, as most of the trouble with underground transformers is caused by their use. Three cubic feet of manhole space per kva of transformer rating was suggested as being sufficient in temperate zones when only a perforated manhole cover is provided for ventilation and moderate-sized units are employed. When 200-kva transformers or larger are installed in spaces less commodious special ventilation must be provided. Natural ventilation is preferred in all cases, but blowers may be installed.

Although considerable improvements have been made in the manufacture of high-voltage cable, the original method of making cable joints, despite its imperfections, is still employed. Results of tests by a large company on a number of 15,000-volt cable joints showed that out of nine splices examined six failed between 50,000 volts and 63,000 volts, one withstood 65,800 volts for four minutes, and two withstood 70,000 volts for twelve minutes. The vacuum process of making joints was recommended.

Tests made recently to determine the relative value of two types of protective cable covering show cement mortar to be superior to asbestos or steel-tape covering. An objectionable feature connected with the asbestos covering is the presence of the iron banding tape, which may become grounded and thus actually become involved in an arc circuit, which condition cannot exist when cement covering is used.

Attention was called to the fruitless efforts which have been made to develop an inexpensive underground distributing system. Among methods of underground construction which are fairly comparable in cost with those on overhead systems are the use of armored cable and split-fiber conduit laid in the bare earth. An installation of 55 miles of lead-covered, steel-armored cable laid bare in earth was described briefly. Eighty per cent of the cable has been in service about four years and only one fault has developed in that time.

COST OF UNDERGROUND EQUIPMENT

CONDUCTORS		APPROXIMATE PRICE PER 1000 FEET		
Number	Size, B. & S Gage	Additional Cost of Steel Tape Armor	Iron Pipe	Fiber Pipe
Two	No. 8	$12.00	$71.00	$31.00
Two	No. 6	45.00	71.00	31.00
Two	No. 4	56.00	112.00	34.00
Three	No. 6	47.00	112.00	34.00
Three	No. 4	59.00	112.00	31.00
Three	No. 1	69.00	146.00	37.00
Three	No. 2-0	80.00	116.00	37.00

A similar relatively inexpensive installation was referred to consisting of ordinary line wire laid in individual fiber ducts filled with insulating compound and buried in the earth. Eight years' service seems to indicate that this construction is satisfactory. The cost of installing was about 75 cents per foot. In drawing-in systems there are some cases where an uninsulated neutral may be employed with a reduction in the cost of construction. The use of a non-insulated neutral is particularly applicable to locations where a single transformer supplies a group of low-tension feeders and

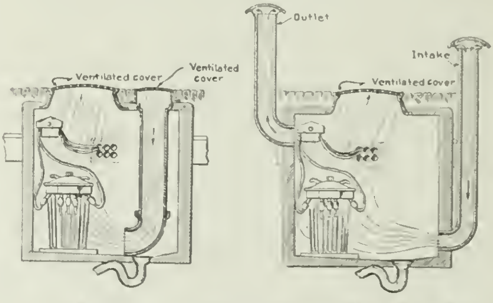


FIG. 5—METHODS OF VENTILATING TRANSFORMER MANHOLES

where the grounding of the secondary system is made at the transformer, with no grounding connections on the customers' premises.

Section six gives operating data on high-tension cables collected from seventeen companies. A marked difference is shown in the thickness of insulation used by them for cables of relatively low voltages, but greater uniformity for high-voltage cables. The maximum allowable loading employed by different companies gives temperatures varying from 90 deg. to 150 deg. Fahr. in the lead sheath, and tests made to supplement this information show that the temperature of the conductor would be as much as 75 deg. Fahr. higher than that of the sheath. Attention was called to the possibility of varying the maximum loading with the seasons of the year. The cable burn-outs for 2300 miles of cable were 14.2 per 100 miles, of which 78 per cent were in cable sections and 22 per cent in joints. The burn-outs were attributed to electrolysis, extraneous injury, sharp bends in manholes, defective cable, badly made joints and surges due to lightning or trouble on overhead lines joined to the underground cables. A majority of the companies apply a break-down test of 150 to 200 per cent of the working voltage to the new lines for an average of five minutes. Only six companies make any break-down tests on old cables, the voltages used ranging from 125 to 200 per cent, applied for five minutes.

Discussion

Mr. Loizeaux questioned the advisability of measuring cable temperatures at joints or near the end of ducts by the apparatus now available for generator temperature readings. Mr. E. Z. Wallower, Harrisburg, Pa., urged eliminating the underground transformer as far as possible. He described several basement substation installations on the distribution system of the Harrisburg Light & Power Company, which the speaker contended practically do away with underground transformers. Each small substation cares for about one-third of the commercial lighting district, and the substations are tied together on their secondary sides, to provide first-class service. They are fed by a three-conductor, 6900-volt, three-phase cable, looped from the main substation of the company, in which is a small high-tension switchboard, provided with reverse-current relays. The transformers in the small substations are connected to single-phase lines, phase-shifting switches being provided.

Mr. R. C. Powell, San Francisco, Cal., submitted a written discussion of the difficulty of manhole operation in districts subjected to severe tides. Fans have been tried in some places for ventilating manholes, but without much success, and as a rule the ventilation of manholes by pipes is not practicable. The insurance companies often object to the attachment of such pipes to buildings. There were six burn-outs last year on the San Francisco system of the Pacific Gas & Electric Company, with over 7000 kw of transformers installed in manholes. Experience shows the necessity for tight covers. Mr. H. L. Wallau, Cleveland, Ohio, said that heating tests of cable run in split tile, in asbestos and cement wrapping showed that the last-named had the best dispersion of heat.

Mr. E. W. Stevenson, New York, pointed out the need of a substitute for paraffine, which shrinks if cooled quickly and admits air. Closing, Mr. Elden said that in his opinion there are serious mechanical difficulties in connection with any proposed installation of heat-measuring devices on underground cables. The satisfactory ventilation of manholes containing 300 kw or more in transformers is a difficult problem. The committee will be very glad to study cable troubles whenever member companies supply it with the necessary information.

Overhead-Line Construction

The committee on overhead-line construction, of which Mr. Thomas Sproule was chairman, presented as its report a revision of the first two sections of the 1911 report, covering primary and secondary line construction. The committee's report is printed in full in a "Handbook on Overhead-Line Construction" prepared by a sub-committee of the main committee.

The handbook contains, in addition to the committee's report, descriptions of the methods and materials employed in overhead-line construction; also the necessary formulas for the electrical and mechanical solution of transmission and distribution problems.

Contained in the handbook are an abridged electrical dictionary and several tables; data on wooden, reinforced-concrete and steel poles and towers; conductor and wire tables; general information on cross-arms, pins, line hardware, insulators, insulator manufacture, insulator characteristics, etc.; information regarding transformers, regulators and lightning in connection with electric circuits and protective apparatus; electrical calculations of alternating-current and direct-current systems; mechanical calculations for wire sag, strength of poles, etc.; general data on wood preservation; recommendations of the National Electric Light Association committee on wood preservation; American and German government data on the preservation of timber; primary and secondary line construction; effects of weather conditions on electrical equipment, and methods of resuscitation.

Attention was also called to a report on joint-pole usage prepared by joint committees of the American Electric Railway Association, the National Electric Light Association, the American Institute of Electrical Engineers, and the American Telephone & Telegraph Company, which will be presented at the fall convention of the first-named association.

Discussion

Following the reading of the report, Messrs. J. F. Gilchrist, Chicago, and H. A. Wagner, Baltimore, congratulated the committee upon the production of its 800-page handbook on overhead-line construction.

Voltage-Limiting Resolution

The following resolution was then introduced by Mr. A. C. Einstein, St. Louis, Mo.:

"Whereas, at the annual convention of the National Electric Light Association in the year 1911 there was presented a report by the committee on overhead-line construction, to which the executive committee then gave its qualified approval, since which time the progress in the state of the art and the continued good work done by the committee have developed recommendations of better practice which the overhead-line-construction committee now presents to this convention, therefore be it resolved, That the thanks of the association are due and extended to the overhead-line-construction committee for its sacrificing and painstaking efforts, and, in view of the later recommendations of that committee, that the heretofore qualified approval of the 1911 report is hereby rescinded, and that the question of voltage limitation shall be eliminated from any recommendations or reports of any committee of this association, by inference or otherwise, with relation to overhead-line-construction practices, and that any such recommendations or specifications to this or previous conventions by any committee shall not be sanctioned by this association."

The resolution was carried by a large majority, and a motion to reconsider it was lost. Advocates of the measure described the difficulties small central stations have encountered as a result of voltage limitations sponsored by the association, in its overhead-line specifications, reports, etc., and pointed out that more advantageous relations with other public utilities are sure to follow its adoption.

Resolution on Overhead Line Construction

At the opening of the third technical session Chairman Sproule of the committee on overhead-line construction introduced the following resolution, which was carried by unanimous vote:

"The committee on overhead-line construction recommends that the approval of Section 3 of the 1911 report be rescinded and that Section 4 of the report be changed to read as per the following:

"1. Scope: These specifications shall apply to overhead electric light and power line crossings (except trolley contact wires), over railroad right-of-way, tracks or lines of wires."

Following this, Mr. A. C. Einstein, St. Louis, Mo., moved the passage of the following resolution, which also went through by acclamation:

"Resolved, That the National Electric Light Association, as an association, believes that no specification for the joint occupancy of pole lines having a voltage limitation feature by inference or otherwise should be approved or adopted as its standard."

Electrical Disturbances in Transmission Work

In a paper on the "Nature of Electrical Disturbances in Transmission Work," by Messrs. D. B. Rushmore and E. A. Lof, the disturbances are divided into those caused by high currents and those caused by high voltages. The destructive effects of high currents may be reduced by increasing the reactance in the circuits by providing external reactors and so sectionalizing the system through selective switching devices that the disturbances will be confined to the smallest possible area. With reference to high-voltage disturbances, the authors point out that the regulation of modern transmission systems is generally improved by providing synchronous condensers with automatic voltage regulators. The field is then adjusted so as to make the condenser take a lagging current at no load and a leading current at full load, the first to offset the effect of the line capacity and the second to offset the surplus lagging-load current. The aluminum-cell lightning arrester protects against high-voltage disturbances occurring between the phase conductors or between the phase conductors and ground. Overhead ground wires are also very generally used to protect the line against atmospheric charges. Means for protecting against disturbances due to high frequency are being studied and investigated, and since these disturbances are liable to damage the interior of transformer windings, the authors say it is advisable to insulate heavily not only the end turns of the windings but the coil groups as well. Inductances and energy-absorbing devices may also be added for further protection.

High-Tension Transmission Systems

Mr. Selby Haar, New York, presented a paper in which were outlined the features of existing transmission plants designed for operation at 70,000 volts or over, as contributed by him in an article published in the *Electrical World* of April 25, 1914. A number of interesting deductions were set forth which were not specified in the original article. The average voltage per mile of these systems is slightly over 1200, the limits being 4590 and 440. It appears probable that the transmission voltage will continue to increase as fast as suitable apparatus can be built. A generator of highest rating in these plants is 18,000 kva. and the smallest is 750 kw. Specified power-factors range generally from 0.80 to 0.90.

From the data on transformers it appears that very large single-phase units are still being installed, apparently owing to the difficulty of transporting large three-phase units. In most cases delta connection is used for at least one of the windings. The longest transmission is about 240 miles, the normal span ranges from 450 ft. to 850 ft., and most lines are strung on double-circuit towers. The hemp center seems to have been supplanted in conductor design. The average spacing of conductors and the number of insulating shoes depends almost entirely upon atmospheric conditions and the topography of the region traversed. Under lightning protection the overhead ground wire is firmly established and electrolytic arresters are widely popular. The arc suppressor is also gaining adherence, and something is being done under the heading of excess voltage protection to prevent the formation of surges by the proper proportioning of switching devices, ground wires and line constants. The use of outdoor switching apparatus is steadily increasing.

LAMPS AND ILLUMINATION

Report of Committee on Street Lighting

This report was presented by the chairman of the committee, Mr. John W. Lieb, Jr., New York. It contains a historical introduction summarizing the work of the committee since 1898, a statement of the fundamental objects of street illumination and a discussion of experimental street lighting upon Intervale Avenue, borough of the Bronx, New York City, with several appendices. Through the courtesy of the municipal authorities the committee has been able to arrange for the installation of a considerable variety of street-lighting equipment which will be studied from many angles. In addition to the usual illuminometer tests the psychological aspect of the subject has been taken up and an entirely new point of view gained in connection with methods of observation. The committee has secured the interested cooperation of Prof. Hugo Munsterberg, of Harvard University, one of the best-known phychologists in America, in mapping out observational methods. These include such points as the ability to distinguish faces of persons on sidewalk, to see irregularities in sidewalk paving, to read print, to see house numbers, to tell time from a watch and to distinguish obstructions, the curb line, vehicles, etc. Tests with observational targets of various types have been made and a large number of photometric observations compiled. Tables of data comparing the test street with an intersecting thoroughfare are included, and a useful feature of the report is a tabulation of street-lighting data for three groups of cities in the United States, classified according to population. A singular result of the target tests is that non-uniform lighting from large sources widely spaced reveals about as many targets as does uniform lighting from smaller sources, closely spaced. The explanation appears to be that in the non-uniformly lighted street the light at most points comes chiefly from one source which dominates all other sources and either lights certain surfaces of the targets much more brightly than other nearby surfaces or else leaves certain surfaces in shadow. Strong contrasts are produced by light which is mainly unidirectional. On the other hand, a light at any point in the uniformly illuminated street is received from a number of sources, none of which dominate to so large an extent. Hence contrasts are smaller. The work of the committee seems destined to advance the state of the art in this important department of municipal lighting.

Following the presentation of the report, Mr. J. W.

Cowles, Boston, Mass., expressed his appreciation of the committee's contribution to methods of investigation in the street-lighting field, and Mr. Lieb said that ultimately tests will be made on streets upon which high buildings with light-distributing fronts are located. The work now under way is certain to last all summer.

At the close of the report the association's moving-picture film, "The Lineman," was exhibited to an appreciative audience.

In reading the paper special attention was called to a method of regulation in which a booster directly connected to a synchronous condenser is connected in series with the transformer, thus giving the plant operator a flexible control of both voltage and power factor, either together or independently.

Report of the Lamp Committee

The report of the lamp committee, of which Mr. Frank W. Smith is general chairman, Mr. Joseph D. Israel being chairman of the sub-committee for the Commercial Section, was this year presented in two parts—one dealing with the general and technical part of the lamp business and the other covering the commercial aspects of the lamp situation.

During 1913 more than 100,000,000 lamps were sold —an increase of 59 per cent over the total sales for 1907 and about 13 per cent over the sales for 1912. During 1913 the output of carbon lamps was less than 11 per cent of the total, about 60 per cent of the entire number being tungsten units. The report included a general description of the new nitrogen-filled lamps and discussed methods of popularizing the use of tungsten units, particularly in the larger sizes. The committee recommended that member companies make free renewals of tungsten lamps, following the policy already initiated by some of the companies beginning with August of last year.

The commercial section of the report discussed the practices of making installations and renewals followed by the principal central-station organizations of the country. The opinion was expressed that the policy of including the 60-watt tungsten unit as a free-renewal lamp will be the means of replacing great numbers of 16-cp graphitized-filament lamps and, owing to the small increase of consumption, will keep installations intact and be the means of increasing the connected load. The report was supplemented by a number of replies received to inquiries regarding lamp installation and renewal practices in cities of 5000 people and larger.

Exhibit of Lighting Units

The committee's exhibit of newly perfected lighting units was demonstrated by Mr. Preston S. Millar, New York. The development of the lighting art has proceeded so rapidly during recent months, said Mr. Millar, that the central-station man now finds himself confronted by an embarrassment of riches in the field of high-efficiency illuminants.

An interesting historical collection first shown by the speaker traced the development of incandescent units from the bamboo-filament lamps of 1880, through the treated carbon-filament lamps of 1892 and the metal-filament units of 1906, to the newest "half-watt" non-vacuum tungsten lamps of 1914. All of these lamps, including the priceless early relics, were shown in actual operation. Other lamps exhibited by the speaker included the smallest 110-volt tungsten lamp commercially manufactured, which is rated at 10 watts; the largest vacuum-type tungsten lamp, 500 watts; the smallest non-vacuum lamp, 400 watts; the largest non-vacuum lamp commercially manufactured, 1000 watts; the smallest miniature tungsten lamp, the "grain-of-wheat" type, which is rated at 0.1 watt, and a very large non-vacuum type tungsten lamp developed thus far in the laboratory only and rated at 2500 watts. Another group of large non-vacuum lamps was exhibited to show the bulb discoloration following 800 hours' burning. The Hewitt method of "ruling" lamp bulbs to secure diffusion was also demonstrated.

As examples of modern large-size lighting units the exhibit included a 10-amp flame-arc lamp (0.5 watt per cp), a quartz-tube mercury-vapor lamp (0.6 watt per cp), a nitrogen-filled tungsten lamp (0.75 watt per cp), a magnetite-arc lamp (1 watt per cp), and a titanium-carbide lamp, not yet marketed, having a power consumption of 0.4 watt per mean spherical cp. Recent improvements in the magnetite-arc lamp, said Mr. Millar, will improve its efficiency by 40 per cent. The maximum attainable theoretical efficiency in the production of yellow-green light (the wave-length to which the retina is most sensitive) has been placed at 65 cp per watt, while for white light perfect efficiency of luminous conversion is represented by 21 cp per watt. In the last year or two long steps have been made in this direction, concluded Mr. Millar, luminous efficiencies having been improved until the present figure of 2 cp per watt has been commercially reached.

Mr. J. W. Howell, Harrison, N. J., pointed out the advantages and economies of standard voltages for lamp operation. The 25-watt and 40-watt tungsten lamps of to-day, he added, are at least "twice as good" as similar lamps of a year ago. This result, which has been brought about by the introduction of chemicals into the lamps, is now being extended to even smaller sizes. The future development of the non-vacuum lamp, said Mr. Howell, will be in the substitution of other gases inside the globe which will reduce the cooling effect on the filament. This change will also make the non-vacuum lamp available in smaller sizes since it will be possible to employ smaller filament diameters. Excepting the difficulties of mechanical construction, there is, he said, apparently no upper limit to the sizes in which these large non-vacuum lamps may be built.

Mr. S. E. Doane, Cleveland, said that as the result of the co-operation of the N. E. L. A. a degree of standardization exists in the lamp industry of this country which is without a parallel elsewhere.

Mr. J. O. Carr, Schenectady, N. Y., asked why the 60-watt lamp should be taken as the dividing line for free renewals. Mr. Norman Macbeth, New York, pointed out the increase in candle-power sizes as revealed by the committee's report. Some companies, he said, have felt the cost of etching lamps to be greater than the outlay due to loss by theft.

Mr. S. G. Rhodes, New York, and Mr. S. B. Burrows, Newark, N. J., also discussed lamp topics briefly.

In closing the discussion Chairman Smith said that the wisdom of the liberal renewal policy of American central stations is attested by the high average candle-power of the lamps produced in this country, 29.4 cp, whereas in Japan, where a different renewal policy is followed, the average lamp produced is only 8 cp. Mr. Israel, chairman of the Commercial Section sub-committee, explained that the replies listed in the supplement were received from sixty-five companies, including both large and small central stations.

Lighting Interurban Highways

The committee on the lighting of interurban highways, of which Mr. G. B. Tripp, of Harrisburg, is chairman, found few data available outside of cities and villages, this class of business having received comparatively little attention. Subsequent investigation indicated that the scheme offers an excellent opportunity for increasing the business of electric-lighting companies, and after an inspection of various forms of lighting and types of fixtures, lamps, appliances, etc., as installed and operating under practical working conditions, the committee reported that more attention should be given to this particular type of lighting. Its observations and correspondence indicated not only lack of information, but also a desire on the part of central station men for facts regarding the latest developments in lighting units suitable for highway purposes. In the opinion of the committee, a non-uniform illumination at low intensities is more desirable for highway lighting, and it recommended that whenever possible and expedient installations include lighting units substantially in accordance with the following classifications: (A) Low-intensity illuminants, 100-cp high-efficiency tungsten lamps with refractors; (B) high-intensity illuminants approximately 300 watts with diffusing globes—(a) luminous-arc lamps, (b) high-efficiency tungsten lamps.

Discussion

Mr. H. H. Newman, Newark, N. J., opened the discussion with the suggestion that companies desiring to promote interurban highway lighting should interest men in their vicinity who have real estate to sell. The real-estate owner or dealer will quickly appreciate the advantages of electric lighting to his property, and as he is usually a man of some prominence in the community, his influence will be found valuable in securing favorable action on the part of county and municipal bodies.

Mr. W. D. A. Ryan, Schenectady, N. Y., described his investigation of a plan to illuminate a state highway from New York to Buffalo. He recommended the use of lamps of 500 cp or 300 cp mounted on 40-ft. concrete poles, and he pointed out the advantages of using some simple form of incandescent unit like the tungsten lamp which operates equally well on the alternating or direct-current service supplied by central stations along the route. Mr. Ryan also gave a graphic description of the elaborate lighting plans for the Panama-Pacific Exposition at San Francisco next year, which will use a total illumination of 2,000,000,000 cp.

Mr. G. H. Stickney, Harrison, N. J., suggested that difficulty might be introduced by making the initial lighting plans too pretentious, and he proposed that at the outset smaller units be installed, later changing these to high-powered lamps if found desirable.

Mr. T. F. Kelly, Dayton, Ohio, reported that his company has several installations of country-highway lighting, each ranging from 1 mile to 3 miles in length. The practice there has been to employ 75-watt lamps at intervals of 300 ft., an arrangement which has apparently been entirely satisfactory to the local public.

Mr. C. Thomas, New York, reported good results from the use of 70-cp series lamps installed at intervals of 110 ft., but these will shortly be replaced by 100-cp nitrogen-filled series units.

Mr. J. W. Cowles, Boston, declared that electric companies have not yet fully appreciated the income obtainable from interurban highway lighting. Rule-of-thumb methods have been used heretofore, but these must now be supplanted by scientific study of the problems involved.

Mr. A. T. Hicks, Trenton, N. J., pointed out that with the ordinary reflector much light is wasted at the sides of the highway.

Mr. Edwin Curry, Joliet, Ill., described the plans for lighting the Lincoln Highway; Mr. S. G. Rhodes, New York, referred to the use of refractors with low-intensity units and Mr. J. G. Learned, Chicago, spoke of the importance of lighting country roadways.

SOLICITING AND UTILIZATION

Greater Problems of the Electric Vehicle

In his prologue to the address by Dr. Steinmetz, Mr. W. P. Kennedy, New York, pointed out the diminishing difficulties now surrounding the introduction of electric vehicles, but insisted that central stations have been slow to perceive and take advantage of the benefits of the vehicle-charging load. He commended the manufacturers for their sustained and energetic efforts, but he urged that administrative ability of the same high order manifested in the electric-lighting and electric-railway fields be introduced into the development of the vehicle industry to concentrate upon a program of effort against which nothing can prevail.

Dr. Steinmetz on the Electric Vehicle

Before an audience which included many keenly interested standing listeners and which remained practically motionless for forty-five minutes, Dr. Steinmetz delivered a brilliant address on the electric vehicle, sketching the future possibilities to be realized by the central-station industry in this field if it seizes the opportunity now confronting it and secures control of the business of caring for this important class of service. The speaker began by drawing a close parallel between the development of the bicycle and that of the automobile. In the case of the former first came the period of initial development; next came the culmination of bicycling as a sport, followed by the decay of the latter and the readjustment of the wheel as a permanent appliance of business.

The decline of bicycling as a sport was due largely to the decreasing price of machines, and the same phenomenon will be witnessed in the automobile field. As the price goes down the exclusiveness of the sport vanishes. So long as automobiling is a sport, car owners will in many cases be willing to make their own repairs and adjustments, but as the automobile becomes more and more a business proposition these features will become more irksome. More bicycles are in use today than ever before; people of small means find the price no obstacle, and the advent of the low-priced automobile is bringing the motor car within reach of persons of very moderate income. Even this year one can see a perceptible falling off of automobile touring as a popular sport.

The steam-driven automobile has passed because it requires too much engineering ability on the part of its owner, and the gasoline car, with its many complications, cannot expect to compete with the electric automobile of the future within the field of the latter. The convenience, comfort and reliable service afforded by the electric vehicle will surely drive the gasoline car from the limited area of service required in town and suburban life. High speed will not be a requirement of the future small electric car, nor will long mileage per charge be necessary. The distances to be covered are too short for the saving in time effected by high speed to be worth while. Even the busy physician rarely exceeds 10 miles to 20 miles per day in his rounds. The electric car is superior to the gasoline car in control and is intrinsically much more reliable.

Dr. Steinmetz said that in response to the demands of the motor-vehicle user of the near future an electric automobile should be available which will cost not over $500, and which should be garaged and cared for by the central station at a cost to the owner of, say, $10 per month. This type of car will not have the luxurious fittings of many present models of electrics, its furnishings corresponding more closely to those of modern low-priced gasoline cars. The speaker estimated that in ten years or less at least a million of these low-priced electric automobiles will be in service in this country, yielding an income to the central-station industry of $75,000,000 per year provided the latter seizes the opportunity now in front of it.

Charging requirements may be estimated at 1,500,000,000 kw-hr. per year, assuming that the battery of each machine received half a charge nightly. To handle this business the central station need invest no money except the moderate sum required to install suitable charging facilities, no additional generating plant being required on account of the off-peak character of the service. Dr. Steinmetz told his hearers that within ten years the electric truck is likely to produce a revenue equal to that of the light business and pleasure car. To-day the electric truck successfully competes with the gasoline truck because limited radius and high speed are not essential in the delivery business and in heavy trucking.

The Central Station's Opportunity

The speaker strongly advised the central station to take full command of the business side of caring for these new motor vehicles, pointing out that if the private garage is left to handle the business the isolated plant is sure to gain a foothold which can be dislodged only with the greatest difficulty, if at all. Better control of the operating side of battery charging can be exercised if the central station handles this service exclusively. The electric automobile of the future as described by the speaker will weigh probably not over 1000 lb.; its maximum speed need not exceed 20 miles per hour and its radius of operation per charge need not exceed 30 miles. Dr. Steinmetz said that the battery exchange system is not adapted to the general requirements of the electric automobile problem, although it doubtless meets the conditions in certain restricted local instances. Assuming that the cost of energy for charging electric vehicles does not exceed 1 cent per kw-hr., there should be a net revenue from this service of at least $60,000,000 per year. Closing, the speaker emphatically urged the central-station industry to put its house in order and get control of this immense business before it has a chance to slip into other hands.

Mr. A. Jackson Marshall, secretary of the Electric Vehicle Association of America, New York, expressed his appreciation of Dr. Steinmetz's address and assured the audience of the desire of the E. V. A. to co-operate in every possible way in the development of electric-automobile service.

"Electrical Salesman's Handbook"

The committee on the "Electrical Salesman's Handbook," of which Mr. Charles J. Russell is chairman, reported the completion of its new handbook, which has been forwarded to all members of the Commercial Section. The data is in loose-leaf form and is divided into the several topics of the salesman and his work, illumination, electric motor applications, and electric vehicles. The pocket binder provided for the convenience of salesmen is supplemented by a desk file for the storage of extra loose-leaf sheets.

In addition to the foregoing, the committee also plans to issue shortly a compilation of data on fans and blowers, a treatise on electric elevators, information on steam heating, data on motor applications, and a section on electric heating and cooking. The committee recommends that manufacturers and member companies arrange their own data sheets in page sizes conforming to the standard specifications of the publications committee.

Discussion

In complimenting the work of the handbook committee, Mr. M. S. Seelman, Brooklyn, testified to the practical value of the production and declared that to his knowledge no other similar book has been produced which can be placed with equal confidence in the hands of all classes of salesmen whether long-experienced or new to central-station sales work. Mr. Seelman urged that sales managers themselves study the handbook in addition to recommending it for use by their selling staffs.

Mr. Norman Macbeth, New York, described the method of indexing the handbook by trades, a scheme which associates subjects by similarity of applications rather than alphabetically by names. Mr. Macbeth deplored the fact that such a small percentage of the total number of central-station commercial organizations is represented in the Commercial Section. He also suggested that the subject of lighting in the home should have more extended treatment in the residence-lighting dummy.

High Load-Factor and Non-Peak Business

Two classes of business of advantage to central-station operation were discussed in the report of the committee on high load-factor and non-peak business, of which Mr. George H. Jones is chairman. The first class relates to those applications which have already been highly developed, including such lines as electric-vehicle charging, ice manufacture, etc. The second class represents industries giving great promise for the future such as electric furnaces, electrochemical processes, etc. Consumption data and actual load curves were presented for amusement parks, bakeries, breweries, brick plants, building construction, cotton mills, dairies, department stores, dredging, vehicle charging, electrochemical loads, flour mills, foundries, electric furnaces, hotels, ice plants, ice-cream manufacture, irrigation, mining, newspaper printing offices, packing houses, pumping plants, stone quarries, electric railways, etc. Descriptions were given of the plants for which data were presented, and the discussion pointed out the desirable load-factor conditions of certain of these applications. Attention was directed to the necessity for the adoption of rate schedules and policies which will enable member companies to secure a larger volume of business the character of which requires the use of electricity at times when the central station can most cheaply furnish it. In the same connection the committee brought up the question of supplying the summer lighting demand of isolated plants which require steam-heating service in winter time. Such short-term contracts seem desirable from the standpoints of both central station and private plant, but against the obvious advantages there must be considered the effects such a policy will have upon other customers of the company, first, in making admission that the central-station company cannot operate economically in buildings where steam is required for heating, and, second, in suggesting to the owners of large installations now using central-station service exclusively that they start up their own plants in the winter months and use exhaust steam for heating.

Discussion

Mr. R. M. Stephenson, Brooklyn, N. Y., said that while it is desirable to shut down isolated plants even during the summer months, there is an objection to this plan in the fact that the central station thus goes on record as admitting that it is cheaper for the customer to operate his private plant during the winter months than to purchase central-station service. Even present central-station customers might conceivably take a suggestion from such an arrangement and similarly start operation of their own private plants in the winter time.

Mr. R. D. Donaldson, Philadelphia, Pa., said that 80 per cent of the power required to drive stone-crushing plants is consumed in turning over the crusher plant itself. It has been his experience that these installations are often fed with rock at only a fraction of their rate of possible output, and he reported that by increasing the speed he has been able to decrease the energy consumption from 0.81 kw-hr. per ton down to 0.45 kw-hr. per ton of rock handled.

Mr. H. H. Holding, Newark, N. J., said that, unfortunately, there generally does not exist enough off-peak business to fill completely the valley of the central-station load-curve. He also questioned whether it would be possible to get manufacturers to change their schedules of operation in order to accommodate the central station with off-peak demand even at advantageous rates for this off-peak service.

Mr. A. C. Smith, Buffalo, N. Y., described the successful use of a new type of Snyder electric furnace which has recently been installed in his city. The demand of this equipment is from 450 kw to 750 kw and its operation comes at such a time that the night "valley" of the load-curve is well filled.

Mr. M. O. Dellplain, Syracuse, N. Y., said that the present tendency toward increased industrial unit efficiency means longer hours for the use of capital as well as shorter hours for labor. Night labor has been generally found inefficient owing to its inferior supervision, lowered vitality due to lack of refreshing sleep, and the effect of dark surroundings. Long-hour operation of industrial processes can be attained, however, by so dividing the working periods into two or more shifts that each set of men will have a part of the night for sleep and a part of the day for work. Such a scheme has been employed successfully in one plant mentioned by Mr. Dellplain, where the capital investment is being operated sixteen to eighteen hours a day, although the men have their shift schedules so arranged that no set is required to sleep wholly by day or to work wholly by night. The speaker proposed that the matter of thus revising working-hour schedules be actively encouraged by central station since in industrial communities it will have the effect of greatly improving the load-factor, due to the off-peak demands for electric motor drive, street-railway service, lighting, cooking, etc.

Mr. J. C. Parker, Rochester, N. Y., described the derivation of a "load-duration" curve, the ordinates of which are marked in kilowatts of demand, while the abscissas represent the number of hours in the year. Such a load-duration curve reveals the fact that while certain classes of business may have excellent load-factors their benefits are completely offset by other demands, which are used for only short periods daily. One-third of the investment of the Rochester company, said Mr. Parker, is worked less than an hour and a half daily. The carrying of this extra peak-load equipment involves a heavy investment charge which must indirectly be paid by the customers.

Mr. R. H. Knowlton, Philadelphia, Pa., declared that the sooner the central station recognizes and announces that there are certain classes of business which it cannot handle to advantage, the sooner will full public confidence be established in its other claims. He suggested a plan of operation by which customers would be discounted for service consumed between March and November, while another discount would be given to those who avoid coming onto the lines during the peak hours of winter days.

Mr. C. F. Pullen, East St. Louis, Ill., said that his company has been successful in getting the business of an isolated plant by omitting the stand-by charge in return for the service rendered by the private plant in starting up and helping to carry the load during winter peaks.

Mr. L. H. Scherck, Poughkeepsie, N. Y., declared that rates are closely related to the subject of getting off-peak business.

Mr. R. H. Tillman, Baltimore, said that local office building plants have found that they could save money during the summer months by purchasing central-station service at its regular rates. At the end of the six-month trial period, however, the customer usually finds it hard to return to the operation of his own plant and a permanent user is thus generally secured for the central station.

Mr. J. W. Ruff, Charleston, S. C., said that the cottonseed-oil mill is one of the desirable long-hour loads from which central stations in the South benefit. Fertilizer factories are operated chiefly during the winter months and thus tend to improve the load-factor.

In closing the discussion Chairman George H. Jones suggested the need of an entire session of the Commercial Section to be devoted to motor-application topics. In reply to an inquiry concerning the relative use of raw water and distilled water in ice plants operated by electric motors, Mr. Jones said that of the seven Buffalo electrically operated ice factories three use the distilled-water system and four make ice from raw water. Of the fifteen Chicago plants thirteen are of the raw-water type and two use distilled water. All of the Brooklyn plants utilize raw water. Energy for ice making is sold in Chicago at a rate of about 1 cent per kw-hour, the customer guaranteeing a minimum load-factor of 65 per cent. Service is supplied under the Commonwealth Edison Company's standard schedule by the terms of which through long-hour operation these ice factories may earn rates as low as 0.87 cents per kw-hour.

Wiring Existing Buildings

The committee on wiring of existing buildings, of which Mr. R. S. Hale, of Boston, is chairman, found on investigation that there is a great deal of business yet remaining to be done in wiring old buildings. At the present time electrical growth is attributable to new buildings, and except in cases of special campaigns only a very small proportion of the possible number of old buildings is being wired yearly. The committee recommends that companies should encourage their solicitors to seek this business and point out that by means of unit prices per outlet contracts may be closed on behalf of the wiring contractor without waiting for a special estimate in each case. Such a plan is already in use in many cities. The article on the successful handling of the small consumer in Europe by Mr. S. E. Doane, published in the *Electrical World* May 23, 1914, forms Part II of the report. Referring to the question of the standardization of plugs and receptacles, the committee points out that the Underwriters are as yet unwilling to take any action, even though their present rules actually have the effect of encouraging the connection of heating devices to lamp sockets when the use of receptacles would be very much better. Because of patents covering plugs and receptacles, the committee has not been able to make progress with the manufacturers looking to the standardization of these devices, and it recommends that its work in this direction be continued. Being asked by a committee of the Commercial Gas Association to take steps toward a standard specification for combination gas and electric fixtures, the committee decided that such specification, except in so far as it is included in the National Electrical Code, would not be desirable.

Discussion

In opening the discussion on the report by Chairman

Hale and the paper by Mr. Doane, Mr. T. I. Jones said that heretofore central-station customers returning less than one dollar per month have been considered undesirable since the cost of reading meters, billing, sending out cut-off men, etc., has been found to average from $1 to $1.50 per month per customer. The solution, however, lies in simplifying billing methods and in the use of an inexpensive current-limiting device by which the cost of the meter and of reading the meter will be eliminated. He suggested a plan by which seashore residents might pay for their lighting in advance for the season at the rate of, say,, $1.50 per month. By installing a flat-rate controller the central station would incur an investment charge of only $2 or so, and would require no further attention to the customer after connecting up his premises.

Mr. E. W. Lloyd, Chicago, declared that the present tendency of the Underwriters will put a limit on the use of electricity by small customers if their practice in requiring expensive construction is continued.

Mr. W. M. Kerr, New York, said that if public-utility companies are to perform their full duty to their communities they must devise some means of reaching the large class of small consumers. This is a social obligation, and next to it service to the small customer has a political significance as well.

Mr. J. E. Latta, Chicago, explained the relation of the Underwriters and the Underwriters' Laboratories to the National Electrical Code. The Code is formulated by a committee on which the N. E. L. A. and other electrical organizations have representation. The Underwriters, he said, desire to encourage the most general use of electricity and entertain no desire to make the cost of electrical construction excessive.

Mr. W. A. Donkin, Pittsburgh, Pa., said that his company now has 3000 flat-rate customers on a controlled basis, the minimum contract taken being for four 25-watt lamps at the rate of $1 per month. Several months ago when the company had only 2600 flat-rate customers an investigation showed that this class of business was then returning $60,000 annually.

Mr. J. C. Weismandel, Brooklyn, N. Y., described the installation bureau of his company. Salesmen are paid on the double basis of salary and commission and are thus encouraged to work among prospective customers at night, on holidays, and at other times when the "prospects" are most easily reached.

Mr. P. H. Kemble, Cincinnati, Ohio, said that of a given number of controlled flat-rate customers at least 30 per cent will soon demand meters, thus becoming permanent and useful users of the company's service.

Mr. L. R. Wallis, Boston, Mass., described his unit wiring offer which has resulted in the wiring of 769 old houses. Under this scheme $14 is charged for the first outlet and the average cost for installation has ranged between $67 and $92.

Mr. R. W. Hoy, Harrisburg, Pa., said that after customers on a controlled flat-rate basis have begun to replace a few burned-out lamps, they soon revise their former plan of burning lamps at all times whether needed or not. About 25 per cent of his flat-rate consumers, he added, have already changed to metered service in order to obtain the enlarged advantages of electric service.

Mr. H. R. Sargent, Schenectady, N. Y., declared that the systems of wiring used abroad would never be approved in this country, although he expressed confidence that a satisfactory form of construction might be devised for use here. The passage of a rule requiring rigid conduit in all cities, as is expected at the next meeting of the code committee, will greatly militate against the use of service by small consumers, he declared.

Mr. T. I. Jones recommended that the manufacturers submit their devices for the comments and suggestions of central-station sales departments before offering them on the market, as many unobserved drawbacks could thus be eliminated before the device reached the customer's hands. Mr. R. R. Young, Newark, N. J., proposed that heating-appliance receptacles be mounted in the wall at a height of about three feet above the floor instead of in the baseboard, following the present general practice which causes tired backs and broken cords.

Mr. A. W. Young, Camden, N. J., described his plan of wiring kitchens and dining rooms on separate circuits of No. 10 copper for the use of heating appliances, while all the other fixtures in the house are served by standard No. 14 size wire. Mr. J. S. Swallow, New York, told of the great number of trouble calls received due to faulty sockets. Mr. W. D. Hodgson, Glens Falls, N. Y., said that tenants moving from house to house often find difficulty in using their electrical appliances in the different receptacles encountered.

Electrical Merchandising and Advertising

The report of the committee on electrical merchandising and advertising, of which Mr. Parker H. Kemble is chairman, described and outlined methods of successful electrical merchandising, the organization and management of commercial departments, store planning, systems of appliance records, methods of purchasing appliances, etc. The sale of appliances by central stations at a fair profit was recommended as a uniform policy, although there was pointed out the necessity of maintaining the co-operation of local electrical contractors and merchants.

Another section was devoted to examples of advertising which contributed to successful appliance sales and campaigns. Order forms were reproduced in detail, and a bibliography of advertising literature of interest to the manager who is required to write his own advertising "copy" was also added.

The report closed with brief notes on the training and handling of a sales force and an enumeration of advertising principles. In the discussion of sales methods particular emphasis was laid on the relations between the sales manager and his men. The manager must be fair and square, it was insisted, and should bestow words of encouragement whenever an occasion can be found. By such simple methods of appreciation the men will be stimulated to the greatest interest and enthusiasm. The language used in talks on salesmanship must be not only simple but on a plane easily understood by the listeners.

Discussion

In discussing methods of selling appliances, Mr. L. D. Gibbs, Boston, urged simplification so far as possible. Trained men, he said, are not required to sell electric irons or the simpler cooking devices. The central station company should endeavor to keep in close touch with its customers.

Mr. F. D. Pembleton, Newark, N. J., declared for a maintained schedule of appliance prices in order that dealers and contractors might share in the sales and so stimulate customers' interest in electrical development.

Mr. J. G. Learned, Chicago, said that through the eighteen salesrooms of his company, which serves a total population of 50,000 people, there have been sold during the year nearly 8000 appliances, including 285 vacuum cleaners, 296 washing machines, 3462 irons, 2316 toasters, and 1489 toaster stoves.

Mr. M. Hart, Chicago, pointed out the beneficial results gained by the company from the policy of instilling in the customer's mind the company's desire to render him service and its interest in seeing that he is satisfied.

Mr. H. H. Newman, Passaic, N. J., recommended that the sales manager show interest in his men and encourage them in their successes and in their failures.

Mr. P. S. Dodd, New York, made a plea for popular advertising of the advantages of electricity in the national magazines, and urged N. E. L. A. members to become subscribers to the Society for Electrical Development and to aid in its forthcoming campaign to interest the public in things electrical the country over.

METERS AND MEASUREMENTS

Report of Committee on Meters

The committee on meters, through its chairman, Mr. P. H. Bartlett, of Philadelphia, presented a 140-page report covering the subject in both technical and legislative branches. A chart is included showing the gist of the meter regulations of many states and an appendix of forty-eight pages devoted to extracts from public utility laws and regulations pertaining to meters. A detailed description was given of the new General Electric type I-14 induction meter, and reference is made to the favorable outlook of the new mercury type watt-hour meter for direct-current service. Owing to standardization of various types of meters costs are tending somewhat lower. Tests are being conducted under the auspices of the committee upon ampere-hour meters of small sizes for direct-current service. The report also includes an illustrated method of making break-down tests upon induction meters, the results of accuracy tests upon 100 old-type direct-current meters, and a discussion of the proposed standardization of transformer, instrument and meter connections, and of shunts. Space was also given to the classification of maximum-demand services, in which great interest is being shown, and brief descriptions were included in the report of recent improvements in meters of Sangamo, Esterline, General Electric, Westinghouse, Ingalls and other designs. The committee welcomes suggestions regarding the advisability of printing future editions of the "Metermen's Handbook" in loose-leaf form. The "Code for Electricity Meters" was not printed in the 1913 proceedings of the association, but can be obtained at the office of the secretary.

Discussion

Mr. J. C. Parker, Rochester, N. Y., called attention to the local disrepute into which operating companies are liable to fall on account of the conflicting rulings of state commissions, in cases where the service exists in more than one state. He suggested the possibility of obtaining help from the committee where adverse legislation is proposed. Mr. G. A. Sawin, Newark, N. J., cited the importance of giving meters proper care. Tests on a number of old induction meters receiving no care showed them to be 15 per cent slow; similar meters with reasonable attention were only 5 per cent slow, while modern induction meters maintained with the greatest care were only 1 per cent or 2 per cent slow. Other speakers were Messrs. F. G. Vaughen, Schenectady, N. Y.; O. J. Bushnell, Chicago; E. F. McCabe, Titusville, Pa.; S. J. Lisberger, San Francisco, Cal., and E. C. Stone, Pittsburgh, Pa. The point was made that it would be helpful to manufacturers if operating companies would be as definite as possible in specifying the time intervals required in demand indicators, and the importance of integrating the load throughout a period long enough to give an idea of the heating conditions was emphasized.

International Measurements and Values

A brief outline of the events leading up to the adoption of an international standard of electrical conductivity for copper was given in the report of the committee on international measurements and values, of which Dr. A. E. Kennelly was chairman. A resistance of 1/58 ohm was adopted for standard annealed copper wire 1 m long and 1 sq. mm in cross-section at 20 deg. C. This value differs only very slightly from the value previously used in England, France, Germany and the United States. The international standard of resistance for standard annealed and commercial copper was appended to the report.

ACCOUNTING METHODS

Accounting Library

The sub-committee on the accounting library, of which Mr. C. L. Campbell is chairman, reported that 7380 new forms from 127 companies have been collected and filed according to the size of the city and the topic of the form. Companies were requested to assist in keeping these files up to date by advising the library of any changes in their forms. The annual reports of various State commissions have been added to the files, and accounting systems prescribed by State commissions are being collected.

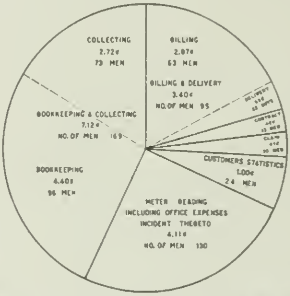


FIG. 6—COST PER BILL RENDERED, COMMONWEALTH EDISON COMPANY

Accounting Question Box

Mr. E. C. Scobell, Rochester, N. Y., presented a resolution made by the Question Box sub-committee favoring the employment of a man to act as secretary to the chairman of the accounting committee, in gathering statistics on forms, keeping files thereof and indexing and tabulating questions and answers.

Discussion

Mr. J. C. Van Duyne, Brooklyn, N. Y., explained the operation of the Brooklyn Edison Company's auditing department council. This council makes it a point at each meeting to discuss questions published in the monthly bulletin and transmit answers thereto to the editor of the bulletin.

Cost and Statistics

The enormous size and increased complexity of metropolitan central-station companies necessitate careful watching of expenses. To this end, as described by Mr. Thomas J. Walsh, the Commonwealth Edison Company has a budget and expense committee, whose duty it is to study and pass on investment budget work and operating expenses. The Chicago company has adopted the standard classification recommended by the National Electric Light Association and has subdivided the accounts to fit its requirements, thus enabling a comprehensive and intelligent analysis to be made of the expenses of the various departments. After the different accounts have been computed on an appropriate unit basis, the results, in the form of both data and statistics, are plotted and typewritten on sheets which show a comparison between the money spent by the departments each month and that for the previous month and also for the corresponding month of the year before. An example of the method of analysis was shown in the chart reproduced on page 1322, analyzing the cost of each bill rendered in Chicago. More than 200,000 bills are there rendered monthly at a total cost of $403,960, or 16.5 cents per bill.

In commenting on the depreciation of electric vehicles Mr. Walsh said that the Commonwealth Edison Company assumes a life of ten years. He believes this life is too low, as there is nothing to depreciate in an electric vehicle except the body.

Discussion

Mr. H. White, Brooklyn, N. Y., spoke of a monthly report in which the total cost of production in the generating stations is subdivided into labor and material expenses and reduced to a kilowatt-hour basis. The report is submitted to the vice-president of the company, who can tell at a glance where economies can be effected. A similar report is made of the substation expenses.

Mr. Peter Junkersfeld, Chicago, Ill., said that the Commonwealth Edison Company reduces its expenses to different unit bases, depending on the department to which the report refers. In some instances a reduction to a kilowatt-hour basis is used, in others, the customer or meter basis is necessary. On line work the reduction may be per mile of wire strung or per pole set. He emphasized the importance of developing accounting methods to give cost-keeping data.

Mr. H. A. Givney, Boston, Mass., expressed the belief that too many companies prepare statistics that are never used, and suggested that the statistics be condensed to minimize the expenses of compilation.

Mr. A. L. Holme, New York, described reports submitted to superintendents of different departments informing them of supply costs charged to their respective departments. The report is compiled from records of supply deliveries, direct purchases and work orders by jobs. He added that the auditing department learns considerable as to the proper classification of accounts by submitting these reports to the superintendents and receiving arguments when the charges are not assessed to the correct department.

Messrs. Homer Niesz, Chicago, Ill., and Herman Spoehrer, St. Louis, Mo., said that expense reports are invaluable in apportioning budgets.

Classification of Construction and Operating Accounts

In a seventy-page report constituting a working handbook of expense classification the committee on classification of accounts, of which Mr. John L. Bailey is chairman, analyzed the principal items of outlay associated with the construction and operation of a modern electric-service system. Detailed lists were given of the items involved in organization, franchise-getting, physical-plant construction, liabilities, assets, income accounts, production, transmission, distribution, utilization, commercial, new business and general expenses and appropriations. Full explanations were given under each account heading as to its inclusiveness, and the subdivisions were carried to a degree of unusual completeness. A few commentary notes were included in the report. One of these emphasized the opposing practices of the New York and Wisconsin commissions with regard to allowing the capitalization of discount on bonds, the former prohibiting and the latter permitting it. The committee is of the opinion that where it is not permitted to capitalize the discount on bonds and the expense of their issue this cost should be charged to an account called "debt discount and expense.'" In this event it is proper to amortize the cost at a proportional rate based upon the life of the security to maturity. In another note it was pointed out that the committee does not approve of the New York commission's distinction between meters in the storeroom and those connected on the consumers' premises, contending that it should not be necessary to make a financial entry every time a meter goes out. If it is the policy of the company to capitalize the cost of setting meters, this cost should be charged to the consumer's installation. Under the heading "Maintenance of Underground Conduits," the committee held that this cost, including both patrolling and inspecting of underground conduits and subways which carry both transmission and distribution conductors, should be apportioned between this and the account provided for transmission underground-conduit repairs. In the scope of items included and the care with which their separation is affected the report is unusually clear and practicable as a working document.

Discussion

Mr. H. M. Edwards, New York, impressed upon the delegates that the classification of accounts when issued must go out as the expression of opinion of the entire electrical industry. As state commissions are awaiting the appearance of the uniform system of accounts, it is particularly important that the classifications should represent accepted practice.

Mr. Frederick Schmitt, New York, expressed the belief that sub-investment accounts should be kept in a separate ledger from the main or balance-sheet accounts.

Mr. H. A. Givney, Boston, believed that hydraulic generating station acounts are entirely too elaborate for small plants. He pointed out that if the classification of accounts were adopted as printed the smaller plants would be required to go to an expense in compilation not warranted by their business. He also suggested appending a description of the method used in classifying the accounts in order that state commissions can obtain a better idea regarding them without studying the details.

Mr. C. L. Campbell, Waterbury, Conn., made a motion, which was passed, that all suggestions made during the discussion referring to the text and not the principles of the classification should be referred directly to the committee. According to the printed classification, poles, fixtures and conduits are not classified separately under transmission and distribution, as this equipment generally serves for both purposes. If the state commissions prescribe a subdivision, Mr. Campbell said that the individual companies can revise the classification to accomplish this result. He suggested further that installation of customers' meters should be charged to construction and not operating expenses.

Mr. Franklin Heydecke, Newark, N. J., informed the delegates that the New Jersey commission makes it optional with the electric-service companies whether the meter-setting should be charged to operating or construction expenses.

Messrs. Givney, Bailey and Campbell expressed themselves as believing that the first installation is a capital account and succeeding installations should be charged to operating expenses.

Mr. Edwards declared that, as some companies prefer to capitalize this expense and others favor carrying it as an operating expense, no set rule should be prescribed for the classification of this account.

Mr. A. L. Holme called attention to the increased labor required in capitalizing expenses and advised handling as many expenses as possible as operating expenses.

Another subject receiving considerable attention was the classification of uncollectible bills.

Mr. Campbell advised marking off uncollectible bills on gross revenue receipts in order that the account may show the actual cash received.

Mr. Walsh said that as the Commonwealth Edison Company must give a certain portion of its revenue to the city, it seemed just that uncollectible bills be deducted from the earnings as indicated in the income account.

Mr. E. C. Scobell, Rochester, N. Y., named several state commissions treating this acount as an operating expense and others prescribing that it be deducted from the income account.

Mr. Edwards called attention to the fact that in all branches of life the debts of the insolvent man must be offset by increased contributions from the prosperous men; therefore uncollectible bills should be treated as an operating expense and not as a deduction from revenue.

The opinion of the meeting on this subject was finally expressed in favor of carrying the account as an operating expense.

While the printed classification of hydraulic generating accounts is rather elaborate, the subdivisions were considered necessary by California companies, as former classifications did not meet their needs.

Mr. Givney said that as contributions for charitable purposes are usually made because the companies consider it good policy and not out of goodness of heart, this account should be charged to operating expenses and should not be deducted from the surplus.

Mr. A. S. Ives, New York, suggested that the dividing line between distribution and service lines should be more clearly defined to facilitate accounting.

In answer to a question raised by Mr. Payne, Boston, Mr. Edwards said that in combined electric and railway stations accounts which are common to both utilities can be classified together and individual accounts should be listed separately.

Mr. C. E. Calder, Wichita Falls, Tex., suggested that accounts relating solely to municipal lighting equipment should be separated from other accounts.

Mr. D. C. Jackson, Boston, said that if a division is to be made between the cost of producing energy for municipal service and other service, it should be done thoroughly or not at all.

Mr. Campbell declared that it is difficult, if not impossible, to separate municipal lighting costs from other production expenses. He also stated that it is very important that the accounting committee express itself as to the proper classification of accounts regardless of commission rulings. Where there is a conflict with commission rulings, a note should be added to that effect.

Mr. C. M. Cohn, Baltimore, Md., expressed the belief that the classified accounts drawn up by the accounting committee should harmonize with those of other associations. He therefore made a motion, which was passed, that the N. E. L. A. accounting committee confer with like committees of the American Electric Railway Association, the American Gas Institute and the National District Heating Association for the purpose of harmonizing the classifications as much as possible.

Prof. Jackson on Appraisals

In his rather intricate paper on "Appraisals of Electric Light and Power Properties" Prof. D. C. Jackson confined his remarks to plants established under fixed or indeterminate franchises. The speaker called attention to important differences in the operation of public service companies and the ordinary businesses with which the general public has become familiar through experience.

The interest on investment in a public utility property is a much larger part of the total revenue than in a mercantile business. Instead of earning a gross annual revenue equal to or exceeding the capital investment, a public service company ordinarily expends a sum of money in establishing its plant and business which is not less than four or five times, and in some cases as much as twelve times, the gross annual revenue that it may expect to receive. This at once multiplies the proportion of the revenue which must go to the investors in case a reasonable return is paid on the investment.

Competition does not introduce any inconvenience in the relations between customer and purveyor in ordinary business, nor is expensive duplication of capital caused by competition where the fixed capital is small. Inconvenience to the customers is often caused, however, where general competition of like public service companies occurs, and duplication of capital is likely to be large and economically indefensible in the case of competing public service companies which give like service.

Electric utilities might gain greater strength with the public, thereby improving their stability, by making annual investment and earnings statements of studied definiteness and completeness whether required to do so by public service commissions or not, and the publication of these statements in the daily newspapers, after the manner of the publication of bank statements, would bring matters before the public mind in a way that no other process can rival.

To bring about the needed confidence between the public and the companies without friction and shock it is of importance that engineering statistics be made more a part of the permanent records of the companies and that the record keeping of the companies become a joint structure of accountants' financial statistics and engineers' physical and production statistics.

Discussion

With the advent of public utility regulation, Mr. W. W. Freeman, Cincinnati, Ohio, said there was a demand for good accounting. The adjustment of rates has further required that the real value of the property regulated be determined by appraisals. The speaker also emphasized that the public should be made to understand that demands for improvements must necessarily be met by increased revenue and consequently higher rates. By requiring detailed accounts of plant expenses the operating expenses of the company will be increased and the public will eventually have to foot the bills. Mr. Freeman added that appraisals will demonstrate that reasonable rates are being charged in most cases.

Mr. Harold Almert, Chicago, called attention to federal activities at Washington which may affect the entire country. The federal commission which is appointed by Congress to regulate the utilities of the District of Columbia has expressed itself in favor of government ownership of all utilities in that district. It is possible that other commissions in the United States may copy any action taken by the commission of the District of Columbia.

Difference Between Accounting Systems

Mr. E. C. Scobell, Rochester, N. Y., read a paper on "Variations in Public Service Systems of Accounting," in which classifications of accounts from several states were compared mainly as to their differences. Plant and equipment accounts differed considerably in the cases considered, but floating capital accounts corresponded more closely as there is less chance for divergence of opinion as to the classification of those items. Attention was called to the provisions in some of these systems for amortization of intangible capital which would be well to follow in the N. E. L. A. classification. Other accounts not included in the association's system were also mentioned. Taxes, uncollectible bills and rentals, which have been the subject of considerable dispute, were classified as operating charges in some states and as income deductions in others. As an appendix to his paper Mr. Scobell presented a tabulated list of accounts investigated. To afford members of the N. E. L. A. an opportunity to study this comparative list of accounts at any time it will be filed in the accounting library.

Replacements, Renewals and Depreciation

Suggestions by the public policy committee for the classification of renewal, replacement and depreciation charges were presented by Mr. H. M. Edwards, chairman of the accounting committee. This matter was investigated by the public policy committee because the classification of these items involved a financial rather than accounting principles. Considerable data were collected in preparing the report, which showed a wide divergence of opinion as to the proper location of these accounts. The committee recommended that the executive committee authorize the accounting committee to refer to these subjects in its standard classification as follows:

Reserve should be created by means of a contemporaneous charge to operating expenses to provide funds to defray the cost of: (a) Necessary renewals and replacements of property retired from service due to normal causes or to obsolescence and inadequacy, the result of advances in the state of the art, improvements in efficiencies, etc. (b) Casualties caused by fire, flood, earthquake, insurrection, riot or any other disaster not covered by insurance and for contingencies.

The average annual cost of renewals and replacements of property should be based on as many years of actual experience as possible. The reserve necessary for uninsured casualties and contingencies must be determined by each company.

The amount of the reserve should not necessarily lie idle in the banks nor should its use be limited to outside investments, but on the contrary should preferably be invested in the property when required. If needed for the purposes of extensions of the business, it should be available.

The raising of additional capital can thus be deferred until such time as the renewal is required for which the reserve was created, when the cash from the new securities can be applied to restore the fund previously invested in new property.

The report recommends that the words "depreciation" and "amortization" should not be used in connection with the accounting systems of public utilities. Renewal and contingent expenses should be classified in a sub-account under the general head operating expenses, general and miscellaneous. To this account should be charged at monthly intervals the monthly proportion of the average annual cost of renewals and replacements of tangible property, and the amount estimated to be necessary to provide a reserve to cover the cost of extraordinary casualties and contingencies. The amount so charged should be concurrently credited to the reserve account, "renewal and contingency."

Renewal and contingency reserve should be classified in a sub-account under the general head "Liabilities, operating reserves." To this account should be credited such amounts as are charged from time to time to "renewal and contingent expense" to provide for the renewal of tangible property at the expiration of its useful life, and a reserve to meet the cost of uninsured casualties and contingencies. When property is retired from service the original cost thereof should be credited to the property account interested, and the said amount less salvage concurrently charged to this average annual cost of renewals and replacements, together with the accruals, if any, thereof; the excess may be temporarily charged to the suspense account entitled "abandoned property" and carried therein until such time as it may be conveniently absorbed by the average annual provision for this purpose.

Discussion

Mr. J. W. Lieb, Jr., New York, chairman of the public policy sub-committee on depreciation, which had direct charge of making this report, said that the subject of the report ranks in importance with that of rates and value of property. Even small companies must consider the subject of depreciation, for all regulatory bodies include it in prescribing a fair return on investment.

Mr. H. A. Givney, Boston, said that as the New Hampshire commission will soon give a hearing on the subject of depreciation it would be advisable to submit to them a copy of the report.

Mr. C. L. Campbell, Waterbury, Conn., made a motion, which was adopted, that the report of the public policy committee be adopted and such portions as desired by the accounting committee be published in the unified classification of accounts.

Accounting for Merchandise Sales

In a paper by Mr. H. B. Lohmeyer was described the system of merchandise sales accounting in use for the past year by the Consolidated Gas, Electric Light & Power Company, Baltimore, Md. This system was developed on the theory that merchandising should be put on a self-sustaining basis and handled as a separate department, with its own income and expense account. Instead of keeping detailed stock cards for each item, the company carries a subsidiary stock record at selling value in totals only, in addition to the regular stockroom account (at cost) carried on the general books. The check is obtained by the following equation: Inventory at beginning of period plus net purchases during period less sales and breakages at end of period, all at selling prices, must equal inventory at end of period. The check falls within two-thirds of 1 per cent.

The author gave a detailed account of the use of stock and purchase records, with reproductions of each. The sales system is a duplicate-ticket plan similar to that in vogue in many large department stores. Eight stores are maintained by the company for the sale of appliances, and the records are departmentalized on a location basis, to ascertain the profit or loss at each store. Ample data regarding the sale of each kind of appliance are deduced by the use of tabulating machines. Every anticipated condition is provided for, including the sale of appliances carried home by the customer, the delivery of apparatus by the company, credits, transfers, instalment purchases, repairs, etc. Statements of daily sales, comparisons of the sales of individual employees on corresponding days each year and close verification of records are interesting features. Expenses are charged under the following headings, often overlooked in electric merchandising: Salaries and commissions of salesmen, salaries of department executives, rent, heat, light, miscellaneous, clerical salaries and expense, proportion delivery department expense, and administrative expense. The net profit is carried to an account known as "Profit on Merchandise Sales" and becomes a part of the regular income account. The system has proved an economy in clerical work and a great help to salespeople and street representatives, its simplicity and directness saving a great deal of time formerly required in making out several different kinds of tickets.

Discussion

Among those discussing the paper were C. E. Calder, Wichita Falls, Tex.; C. R. Price, New Bedford, Mass.; E. J. Allegaert, Newark, N. J.; Herman Spoehrer, St. Louis, Mo.; T. W. Flower, Brooklyn, N. Y.; Franklyn Heydecke, Newark, N. J.

Mr. Lohmeyer in closing the discussion answered questions brought up by these delegates. Some of the points brought out follow:

The gross profit on sales is estimated each month from the selling price and cost, and every six months the books are closed in the customary manner. When computing the expense of conducting the merchandizing department an administrative expense is apportioned. A check on the selling price is secured by passing all sales slips and packages through the delivery department. If articles are sold at a reduced or raised price, "loss" or "mark-up" tickets are filed with the respective sales tickets. All expenses of conducting the merchandizing department are deducted from the gross profit on merchandise sales and not charged to operating expense. All goods are sold at catalog prices.

Suspense Accounts

In a paper by Mr. Frederick Schmitt it was stated that suspense accounts are of two general classes—first, those rightly classified as suspense on account of having uncertain elements, and, second, those commonly representing costs of a definite character, which properly should be called clearance or apportionment accounts. The author described various components of each class, including under the suspense account general suspense and accounts receivable suspense, and under clearance accounts work in progress, storeroom expense, transportation expense, deferred and miscellaneous charges. Under general suspense it is customary in some companies to include cash advanced to employees for expenses to be accounted for later, also cash withheld from wages to satisfy judgments filed against employees. The author held that in dealing with bad debts, whenever doubtful accounts are transferred from current assets to a suspense account which still appears on the books as a contingent asset, a corresponding reserve account should be created by charging operating expenses with an amount sufficient to cover those accounts found irredeemable. By this method the accounts are left on the books at their face value, yet are carried on the balance sheet at not more than their probable worth. The New York Edison Company follows this general plan.

The author also emphasized the value of a work-order system. He discussed storeroom expense at some length, favoring the clearing of such accounts on a constant or percentage basis added to each requisition for material and criticising the elaboration required in such accounting by the Public Service Commission, First District, New York, in the case of companies using the clearing method. Experience shows that the cost of handling supplies bears a definite relation to their value, and that by an occasional adjustment, practice is more satisfactory than where a minute subdivision is attempted, involving such difficulties as the proportional cost of storage of each kind of supply carried, prorating shelving and counter space, building repairs, etc. The author did not look upon cash discounts recovered through prompt payment as a saving or revenue, but held that supplies should be charged at the full price, charging the discount when not taken to profit and loss. Apportionment of transportation costs should be on a rate per hour for the time of use of each vehicle, the actual sum paid being used for vehicles not owned by the company. Discount on bonds is not held to be a part of the cost of acquiring a property, being a virtual interest charge.

Discussion

Mr. A. L. Holme, New York, spoke of the difficulties encountered in apportioning overhead charges if a certain percentage of storeroom expense is not apportioned on each article as it is issued.

Mr. Heydecke advised setting up a monthly reserve to wipe out uncollectible bills. This reserve, he suggested, might be based on a certain percentage of the monthly earnings.

Mr. J. C. VanDuyne, Brooklyn, N. Y., believed that as the amount of uncollectible bills is usually negligible (not more than 0.2 to 0.5 per cent of the earnings) it is not necessary to carry such a reserve.

Mr. Edwards explained the system of mutual insurance carried by New York electric service companies. In comparison with old-line insurance company rates, which may be as high as 15 per cent of the payroll, the mutual insurance rates are only 1 per cent. The success of the mutual insurance scheme is ascribed to the care in inspecting plants and establishing safety-first methods. In Boston, where mutual insurance methods have been perfected to a greater extent, the rates are only 0.25 per cent of the payroll.

Mr. J. L. Bailey, Baltimore, declared that an extremely low rate of 20 cents on $100 exists in Baltimore.

Disbursement Accounts

In an extended paper by Mr. F. A. Birch describing the system used in accounting for purchases by the Philadelphia Electric Company, the advantages of the Hollerith method of tabulation were illustrated and a detailed account was given of the handling of each form designed for purchasing and the distribution of charges to the classification expense accounts. The company receives about 6000 purchase invoices each month, covering supplies bought for construction and operation. With the old-style voucher-register system monthly reports were not completed before the twentieth of the month following the expenditure, at the earliest, but with the use of tabulating machines a saving of from a week to ten days is attained. The forms used are comprehensive and clear-cut, and the author set forth their interdepartmental routing with great precision. A special voucher case has been developed for use where a disbursement is not supported by a purchase invoice. No check book is required in using the voucher check. Verification of bill totals in the tabulating machine is a valuable feature, and instead of keeping details of operating expenses, construction charges and other accounts affected by accounts payable in the voucher register, this information is obtained from the tabulating cards.

The time required to run the accounts-payable cards through the tabulating machine for any month is less by several days than the time formerly needed to add the 140 columns on each of the twenty pages of the voucher register. It is now a matter of but a few moments to assemble and tabulate the vouchers and so obtain complete analysis of any account. The tabulating machines greatly expedite posting to general and auxiliary ledgers and the classification of data desired by public service commissions, boards of directors and executive officers. An example of the detail available from machine cards was given under the handling of customers' deposits. Cards may be sorted to show the amount of guaranteed deposits in different sections of the city, the amounts of deposits received from various classes of business, the denominations of money in which they are received, number of deposits transferred, average length of time a deposit is held, amount of interest allowed on deposits, refunds and many other points. The slight disadvantage of the longer time required to analyze a single account with the tabulating machine as compared with the former method of entering each separate item, with an attached explanation, in a book is offset by the great saving in time required to itemize all of the accounts in books, when particulars regarding only a few are needed and when very probably none will be asked for. It is contrary to the principles of scientific management to prepare a maximum amount of data for hundreds of items when details will be requested for only a very few, and the tabulating machine method is admirably flexible in this connection.

Sorting and Tabulating Machines

In a paper by Messrs. G. L. Knight and C. V. Woolsey was described the use of sorting and tabulating machines on the distribution system of the Edison Electric Illuminating Company of Brooklyn, N. Y., pointing out the adaptation of code numbers to the classification of material and equipment in transmission and distribution and giving in detail code data applicable to inventories. It was pointed out that the use of code numbers greatly simplifies the taking of an inventory, even in cases where a tabulating machine is not considered, saving time and reducing the chances of errors in making transfers. The code is designed to indicate only such characteristics of the material as are required to estimate its unit value in reports of physical property. The code is greatly simplified by using a code number consistent with the material represented. Thus, the code number for a twelve-duct subway consisting of fiber conduit laid two ducts wide and six ducts high in the trench would be 1212. The first two figures (12) indicate the number of ducts in the trench, the third figure (1) represents the kind of conduit (fiber), and the last figure (2) shows the number of ducts width. Examples are given of the use of tabulating cards, summaries and other inventory data in a central-station office in which a complete statistical unit consists of two key punches, a gang punch, with quick-set device, sorter, tabulator and card files. The paper forms a working manual within its field and scope of the code submitted, and the clearness of the illustrations entitles it to be classed as a small handbook for the accounting force interested in the economical handling of both original and periodical transmission and distribution system inventories.

Discussion

In speaking of the economy of employing mechanical tabulation Mr. Birch said that the total cost of getting out 1000 vouchers per month for a system serving 60,000 consumers was about $10,000 a year.

Mr. G. L. Knight, Brooklyn, N. Y., called attention to the fact that a continuous inventory can be kept by a single clerk if forms adapted to use on mechanical tabulators are employed with that system of tabulation.

Purchasing, Storing and Accounting of Coal

The methods employed by one of the New York electric-service companies in the purchase and delivery of its coal were described in the paper on "Purchasing, Storing and Accounting of Coal for the New York Edison Company," by Mr. Charles L. Lehmann. The author took up in logical order the purchasing, transporting storing, testing, insurance and accounting methods. The company's coal-storage plant and lighting system, permitting of night work, were described and illustrated. Sampling and testing of coal for moisture, volatile matter, sulphur and heat content were described. Transportation and cost records were explained in detail, copies of many of the forms being shown.

The company purchases its coal by yearly contract and follows the railroad shipments to tidewater ports. Coal which is not required for immediate use is stored in a yard capable of holding 150,000 tons. At present about 900 tons of coal can be received and stored per day of nine hours, and about 3000 tons can be reloaded in the same time. Extensions are now being made to accommodate 300,000 tons, and facilities are being provided for increasing the daily unloading and reloading rate of 1800 tons and 5000 tons respectively.

MISCELLANEOUS SUBJECTS

Accident Prevention

A helpful résumé of accident prevention from the central-station standpoint was presented by the committee in charge of this subject, of which Mr. Martin J. Insull, Chicago, is chairman. The report outlined the organization of a "safety first" campaign, with practical suggestions as to method of procedure, formation of committees, education of employees, first aid and its limitations. The committee favored uniform reports of accidents, submitting a standard blank for this purpose. An interesting feature was a number of diagrams showing the causes, anatomical distribution and occupations involved in 2670 accidents reported by member companies in the past sixteen months. The more frequent causes were striking or being struck by material, handling tools, wire, glass, sharp edges, lifting or moving material, falling bodies, electric current and falls.

The latter part of the report included a list of standard danger and safety signs, printed in colors, a scenario of the motion-picture film "The Lineman," which is the property of the association and which shows careful and careless ways of working on the distribution system, a compilation of precautionary rules, and various recommendations. Among the latter were the general use by member companies of the material prepared by the committee, which represents the latest views on safety work as adapted to the electrical industry. The motion-picture film may be rented at a nominal charge, and the committee desires full co-operation in every phase of its beneficent activities from all companies and members.

Report of Publications Committee

During the ten months preceding the convention the publications committee, of which Mr. Douglass Burnett is chairman, handled 130,000 publications, bringing the total number issued by the committee during the last two years up to 350,000. Only about 13 per cent of the company membership has, however, taken advantage of the publications offered, although the number of publications covered by each order has practically doubled during the last year.

The publications of the committee are adapted to receive the imprint of the member company using them, or, if desired, the committee will furnish the inside pages, allowing the local company to arrange its own distinctive cover form. In connection with residence business, the committee will shortly issue to member companies its so-called "residence service dummy," and it is therefore urged that each member company prepare a list and send the entire set of descriptive matter to all its prospective customers. An "Electrical Salesman's Handbook" has been issued by the Commercial Section during the year, and the publications committee is at present making an active effort to standardize manufacturers' handbooks so as to be uniform with this N. E. L. A. handbook.

Discussion

In opening the discussion on the report of the publications committee, Mr. J. G. Learned, Chicago, told of the good results his company has obtained by sending to each prospective home builder in its territory the Commercial Section pamphlet "Electricity in the Home," accompanied by a letter inviting the addressee to consider the advantages of electric service.

Mr. L. D. Gibbs, Boston, emphasized the fact that the material contained in the residence-service campaign dummy furnishes complete material for a campaign in a community of almost any size, the arrangement being such as to be entirely elastic and to permit the addition of local addenda if desired. This residence-campaign material, he declared, contains "all the selling power it is possible to put into the printed word and pictured page."

Mr. W. A. Donkin, Pittsburgh, reported the good results obtained by sending out association pamphlets in reply to inquiries received from newspaper advertisements.

Mr. H. L. Hamilton, Baltimore, spoke of the advantages and increased effectiveness of mailing advertising matter consecutively and according to a prearranged campaign.

Mr. Dana Howard, Chicago, said that the fact that only 8 per cent of the residences in this country are wired should leave a fertile field of new business for the public utility companies.

Mr. R. S. Young, Newark, N. J., said that in his opinion the failure to make proper use of association literature is due to the lack of proper machinery for circularizing the "prospects" of central stations.

Mr. H. N. McConnell, New York, said that while in the case of the larger cities weekly distribution of literature might be desirable, a monthly plan of campaign would be found preferable for small towns.

Mr. F. C. Pullen, East St. Louis, Ill., said that one difficulty with the advertising matter produced by the association has been the fact that it is directed at the central-station man and thus interests him rather than the housewife or the prospective customer.

Mr. M. E. Turner, Cleveland, suggested that central stations provide their local contractors with circular matter and encourage them to circularize their "prospects" with this advertising material.

Mr. J. F. Gilchrist, Chicago, insisted that to be effective advertising must have "punch."

Mr. F. D. Pembleton, Newark, N. J., said that every business worthy of the name can be built up and improved by judicious advertising, but he recommended that the central station make its advertising part of its house-wiring campaign, accompanying its printed propaganda with consistent efforts in other lines.

On motion of Mr. J. G. Learned, Chicago, it was voted to designate as "salesmen" men engaged in the selling of central-station service.

Mr. M. E. Turner, Cleveland, also urged further standardization in the names of central-station commercial departments and in the titles of their officials, and to this end a committee on commercial department terminology was appointed by Chairman Jones, consisting of Messrs. Turner, Learned and J. F. Becker, who will suggest uniform appellations.

Education of Salesmen

The committee on the education of salesmen, of which Mr. F. C. Henderschott is chairman, presented an outline of a central-station salesmanship course covering a wide range of topics, in response to the expressed desires of about 100 Class A member companies for the better education of their commercial department employees. The suggested course includes corporate organization, the fundamental principles and psychology of salesmanship, contract forms, order routine, credit information, telephone orders, filing systems, campaigns, engineering data, public relations and studies of company advertisements, as an introductory curriculum for all salesmen, with separate specialized topics appealing to the lighting salesman, the motor-service solicitor, and the merchandiser of appliances. A broad treatment of rates is also added, including such topics as meters, tests, rate adjustments, application of company rates, commission regulations, franchises and municipal competition, and the course also includes a study of wiring systems, insurance regulations, estimates for lighting and motor installations and the study of electrical history, generating and distribution systems and effective speaking and business-letter writing. The committee recommended that lectures given by department heads and sub-heads, with appropriate examinations, form the background of the course, with occasional lectures by outsiders on salesmanship, hygiene, personal manners, etc. The aim is to impart the general principles and technique of machinery and the application of electricity as a motive power, scientific illuminant and all-around modern convenience.

Discussion

Mr. H. J. Leask, New York, contrasted the selling of ordinary merchandise with the sale of electric service, and explained that the man who has had long experience in selling ordinary goods must be trained along entirely new lines before undertaking to show prospective customers the service which his company can render them.

Mr. E. W. Lloyd, Chicago, described his plan of a night school with "rotation" students. The men who attend are employed by day and enter the night school with the approval of their superiors, paying for the instruction received. The type of man who after working hard all day is willing to go to night school and to pay for his instruction promises, said Mr. Lloyd, to become a leader in the central-station organization of the future. The universities and technical schools lack courses in commercial instruction. Their curriculums as now arranged provide men for the electrical manufacturers rather than for the central-station industry; hence it has been necessary for the electric-service companies to organize their own courses of commercial instruction.

Mr. M. Hart, Chicago, testified to the successful results obtained with men trained in the Central Station Institute maintained by the Insull interests at Chicago. New graduates of the institute have been placed in competition with local salesmen of many more years' experience and have proved the value of the institute course by producing three or four times the volume of business that has been secured by their untrained competitors.

Unified Network Transmission System in New Jersey

The Public Service Electric Company serves eleven counties with electricity, reaching a population of 2,000,000—Marion, Elizabeth, Camden and Burlington among the important stations

PROBABLY no state in the Union offers a more desirable field for the economical transmission and utilization of energy from a unified network than does New Jersey. With its excellent transportation facilities and its proximity to New York and Philadelphia, this State has become one of the most important manufacturing commonwealths. Its extensive and varied industries and congested population furnish a diversified demand, making for the economical production and delivery of electrical energy.

Electric Service

Eleven counties stretching diagonally across New Jersey from New York City on the northeast to Philadelphia on the southwest are served with electricity from the lines of the Public Service Electric Company, a subsidiary of the Public Service Corporation of New Jersey. In these counties 178 municipalities, having a total population of 1,948,923, receive electric service; 104 cities are served by electric-railway lines, and 109 cities enjoy all three utilities—electric, railway and gas. Although the railway and electric-service organizations are allied, yet they operate as independent companies. Instead of one company generating and selling energy to the other, both organizations have equipment in the same building and each pays a proportionate part of the overhead charge and the maintenance and operating expenses. The combined output of energy of the two utilities in 1913 was 400,835,989 kw-hr., of which 4,068,200 kw-hr. was delivered to industrial motors and 141,936,243 kw-hr. to street-lighting equipment.

The Public Service Electric Company divides the territory it serves into six divisions: Bergen, Essex, Passaic, Hudson, central and southern. In the central division are the following counties: Union, Middlesex and Somerset; in the southern are Mercer, Burlington, Camden and Gloucester. Geographically these six divisions group themselves into three main sections, the northern, central and southern. The northern and central sections are interlinked electrically, but the southern district operates separately.

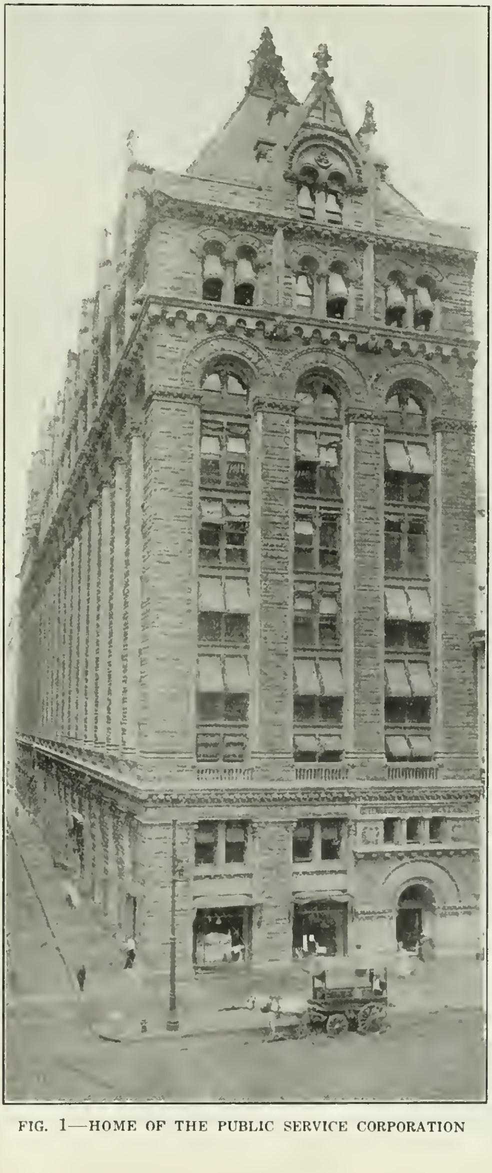


FIG. 1—HOME OF THE PUBLIC SERVICE CORPORATION

The main generating station in the northern division is situated at Marion, several miles east of Newark. Transmission lines connect this station with Newark and radiate from both places in several directions, delivering energy as far north as Ridgewood and as far south as New Brunswick. The station at Marion is supplemented by another at Perth Amboy in the central division.

Before long a new station will be erected near Newark which will have an ultimate rating of 150,000 kw. Only 50,000 kw in equipment will be installed for the present, however. It will be run in parallel with that in the Marion station. The new station will feed all of Essex County and most of the central division, while Hudson, Passaic and Bergen Counties will absorb the output from the Marion station.

The transmission system in the central division, instead of being laid out radially, is in the form of a network. The company's most modern substation, which is at Elizabeth, connects the two districts. Both sixty-cycle and twenty-five-cycle energy are transmitted in the northern division, the sixty-cycle energy being used exclusively for lamp and motor service while the lower frequency is employed for railway service. Only sixty-cycle energy is employed in the central and southern divisions. The energy is transmitted at 13,200 volts except in a few instances in the southern division.

The southern district is less developed electrically than the others, and the transmission system is spread out over a longer stretch without the interlinking network of lines. The main station in this division, which is just being completed, is at Burlington, about midway between the extremities of the system. It is supplemented by generating stations at Camden, Trenton and Gloucester. All of the energy is transmitted at sixty cycles, and except north of Trenton and out of Camden the emf is 13,200 volts. From Trenton 6600-volt lines extend northward to Lawrenceville and Princeton, while the towns of Woodbury, Gloucester, Haddon Heights, Merchantville and Moorestown are supplied with 11,000-volt energy from Camden mainly for the purpose of utilizing equipment which was installed in those places when the Public Service Electric Company took over their management. Of the last-mentioned lines, the one to Haddon Heights and the one connecting that place with Gloucester are single-phase circuits. As the load increases in these sections three-phase, 13,200-volt lines will replace those now installed.

FIG. 2—MAIN-FLOOR ENTRANCE TO OFFICE BUILDING

History of Company's Growth

Many of the public utilities in New Jersey had become practically insolvent prior to the spring of 1903, when the Public Service Corporation of New Jersey was organized to rehabilitate them. On June 1 of that year the company began its business existence, having as its chief subsidiary the Public Service Railway Company, to which all of the railway interests were leased or merged. The various electric light and power properties were operated by the electric department.

The original system consisted of fourteen generating stations, nine substations, 47 miles of 6600-volt transmission lines, and 25 street miles of underground conduit. The generating equipment consisted of 156 generators having an aggregate rating of 40,075 kw, the largest unit being rated at 850 kw. The total output for the first year was 129,614,810 kw-hr.

FIG. 3—MAIN-FLOOR LOBBY IN OFFICE BUILDING

The principal stations in 1903 were Hoboken, Wayne Street, Paterson, Passaic, Orange, City Dock, Elizabeth, Camden and Trenton. The other five were very small stations. It was not until about a year later that the railway stations were officially taken over, although they were operated by the electric department previous to that time.

From the beginning the system expanded rapidly, the smaller generating stations being superseded by substations receiving energy from central generating stations and the suitably located generating stations being re-equipped with standard apparatus except where new stations were erected in their place. Table 1 indicates the growth of the system from year to year.

The first real efforts to establish a large central generating plant were made in 1904, when construction on the Marion station was started. The lighting and motor-service business was slow in growing at first. Lighting substations began to get a foothold in 1905, Orange being one of the first to have such equipment.

FIG. 4—DISPLAY ROOM IN BASEMENT OF OFFICE BUILDING

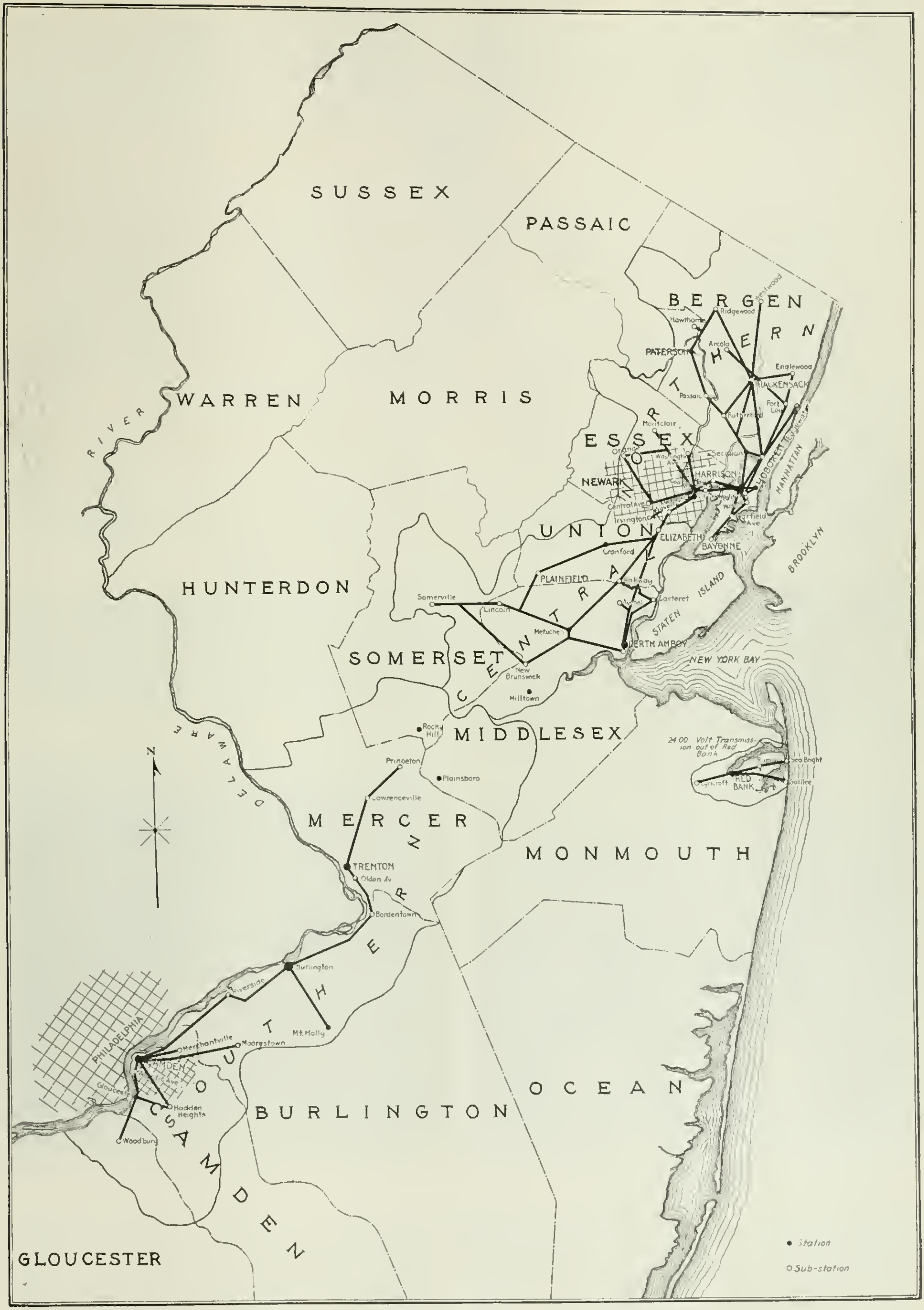


FIG. 5—TERRITORY SERVED BY PUBLIC SERVICE ELECTRIC COMPANY

Up to this time considerable progress was being made in the central division in relocating plants and substituting substations for the small uneconomical stations. The southern division began to develop most rapidly about 1906, when the equipment of the Camden and Trenton stations was increased. The two-phase industrial-motor load increased considerably in 1911, and several substations were established to meet the demand. One of the most important events in 1912 was the adoption of automatic feeder voltage regulators as a permanent feature in the sixty-cycle system.

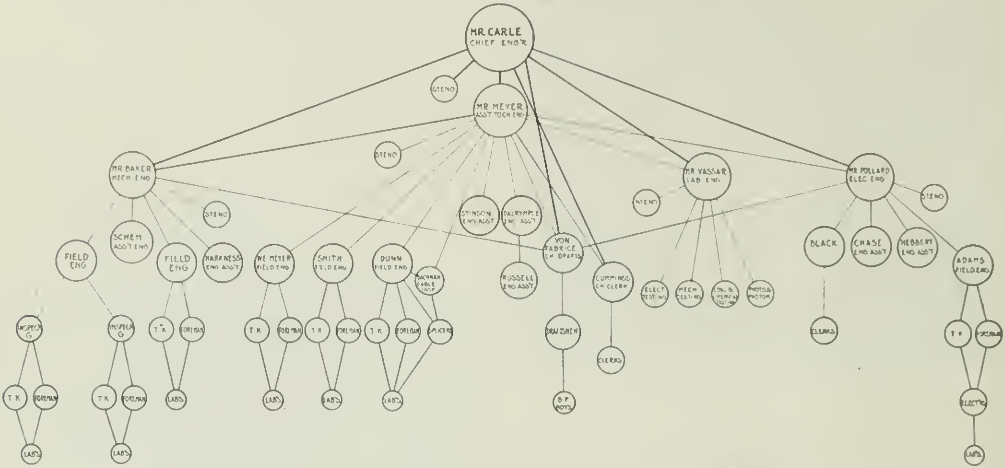


FIG. 6—ORGANIZATION CHART OF ENGINEERING DEPARTMENT

The original electrical equipment of the Public Service Corporation consisted of mixed twenty-five-cycle and sixty-cycle apparatus. To prevent complications in transmission and distribution construction and to simplify station operation it has been the policy of the electric-service company ever since its organization to concentrate gradually the twenty-five-cycle equipment in the Hudson division, where the heaviest railroad load exists, and use only sixty-cycle apparatus elsewhere. In re-designing the system there has been a tendency toward replacing synchronous converters by motor-generator sets and employing large air-cooled transformers instead of the oil-cooled type. To accomplish the end in view—that of having standard equipment occupying as little space as possible—it has been the practice when equipping a small substation to utilize some of the low-rated and older equipment from the larger substations or stations and buy new and higher-rated and more compact apparatus for the standard equipment. Except as circumstances alter the case, the company does not intend to buy any new transformers rated below 1000 kw. It has been found that to install an air-blower system and use air-cooled transformers requires less floor area than do the oil-cooled type, and hence the new transformers are of the former type.

FIG. 7—INTERIOR OF APPLIANCE DISPLAY ROOM AT CAMDEN, N. J.

FIG. 8—INTERIOR OF APPLIANCE DISPLAY ROOM AT ORANGE, N. J.

Diversified and Concentrated Demand

Although forty-fifth in area among the forty-eight states, New Jersey ranks third in density of population (United States Census, 1910), having 337.7 people per square mile. Seventy-five per cent of the people live in cities and incorporated towns of 2500 or over. Nine cities in the State have populations over 50,000, Newark having 347,469 inhabitants, Jersey City 267,779, Paterson 125,600, Trenton 96,815, Camden 94,538, Elizabeth

73,409, Hoboken 70,324, Bayonne 55,545 and Passaic 54,773. There are twenty-three other cities having populations between 10,000 and 50,000, and these thirty-two cities contain 64.7 per cent and 74.3 per cent of the total population and industries of the State.

New Jersey has attained its industrial prominence because of its exceptional geographical location and transportation and coast-shipping facilities. The close proximity of the Pennsylvania coal mines and the markets of Philadelphia and New York have also influenced the growth of the manufacturing concerns. The area of the State is 8224 sq. miles, of which 710 sq. miles is water surface, and 319 miles of the coast are navigable.

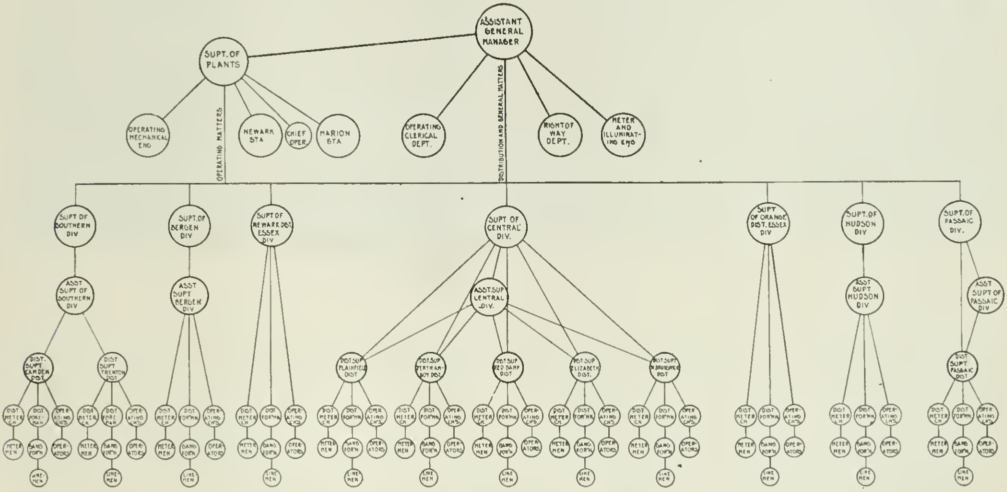


FIG. 9—ORGANIZATION CHART OF OPERATING AND DISTRIBUTING DEPARTMENTS

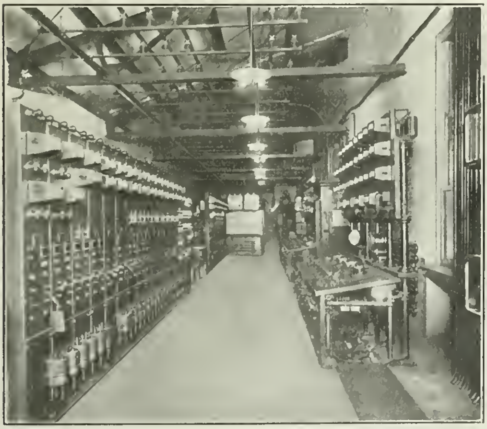


FIG. 10—VIEW OF SWITCHBOARD GALLERY, MARION GENERATING STATION

In the gross value of products manufactured New Jersey ranks sixth among the states. During 1909 8817 manufacturing establishments were in operation, and the total value of their outputs was $1,145,529,000. Raw material for manufacturing cost $720,033,000, making the net value added by manufacture $425,496,000. From 1849 to 1909 the gross value of manufactured products increased from $81 to $540 per capita.

Smelting and refining of copper is the most important industry viewed from the value of the product, but the manufacture of silk goods is pre-eminent in terms of the amount of labor employed. Some of the industries, arranged in order of the capital invested, will be found in Table II.

The last United States Census indicates that in 1909 182,475 hp in industrial apparatus in New Jersey was run by motors. Eighty-one per cent of the electrical energy was generated in private plants and 18 per cent was supplied by the electric-service company. Since then steam engines have been gradually replaced by gas engines and electric motors, and a census taken recently by the Public Service Electric Company of New Jersey shows that the use of motors operated from its lines is on the increase. Of the equipment not operated by central-station energy 88.3 per cent is belt-

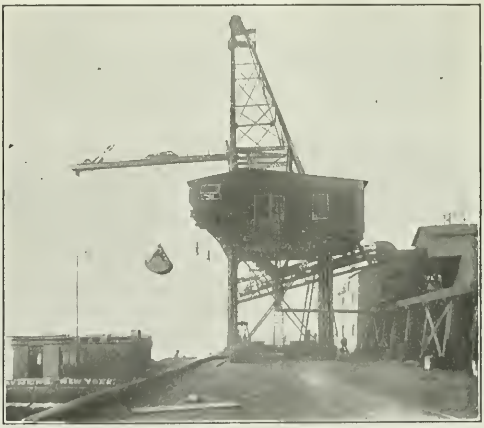


FIG. 11—COAL-HANDLING APPARATUS IN OPERATION, MARION STATION

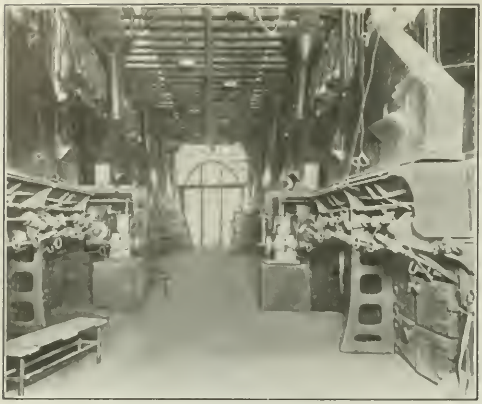


FIG. 12—SECTION OF BOILER ROOM, MARION OPERATING STATION

driven by steam engines and only 11.7 per cent is operated by electric motors fed with energy from private plants.

TABLE I—GROWTH IN GENERATING AND SUBSTATION EQUIPMENT

Year	Generating Stations	Generating Units	Kw Installed	Substations	Synchronous Converters	Kw Installed
1903	14	156	40,075	9	..	..... .
1904	24	...	61,000	18	16	7,600
1905	27	.	75,000	27	34	15,000
1906	27	...	96,000	36	..	40,000
1907	.	...	100,000	38	..	50,000
1908		...	..... .	.	..	......
1909	23	228	105,500	40	63	42,750
				75 ltg., trans.	..	25,000
1910	28	189	124,158	42	73	50,200
				95 trans.	.	28,500
1911	30	193	134,158	46	75	52,700
1912	32	201	147,408	50	84	65,000
				151 trans.	.	74,000
1913	32	203	177,018	56	.	......

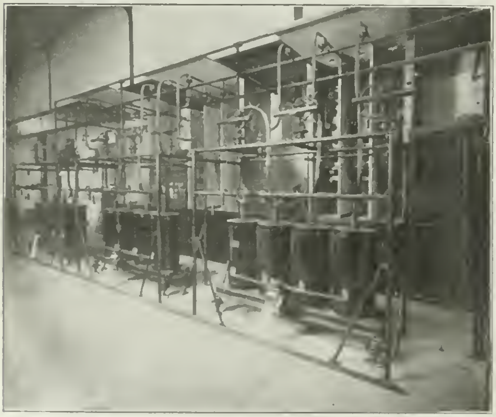


FIG. 13—SUBSTATION LIGHTNING-ARRESTER EQUIPMENT, ELIZABETH

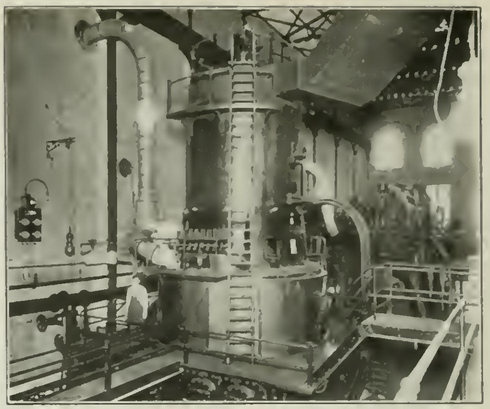


FIG. 14—INTERIOR VIEW OF MARION GENERATING STATION

In December, 1910, a uniform rate schedule was inaugurated, and the following year 9200 hp in industrial motors was added to the company's lines. In 1912 contracts amounting to 16,200 hp were closed for industrial motor service, and in 1913 21,600 additional hp was connected. During the first four months of 1914 the new-business department secured contracts for supplying 17,000 hp in motors, of which 7500 has been connected already, the remainder being under contract for early connection. This makes a total growth in the industrial-motor business of 64,000 hp from January, 1911, to May 1, 1914.

TABLE II—DATA ON NEW JERSEY INDUSTRIES

Industry	Capital Invested	Value of Yearly Output
Oils .	$71,000,000	$99,000,000
Machinery	59,000,000	43,000,000
Chemical products	43,000,000	44,000,000
Brewery products	40,000,000	22,000,000
Silk and ribbon goods	37,000,000	52,000,000
Cigars and tobacco. . .	34,000,000	33,000,000
Rubber.	31,000,000	38,000,000
Electrical appliances	24,000,000	21,000,000

The industries of the State are of various natures, about 25 per cent of the total hp being required in metal

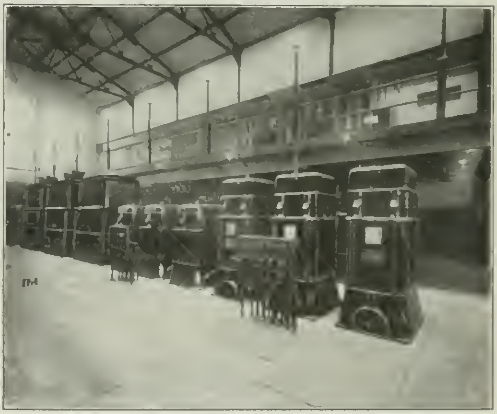


FIG. 15—AIR-COOLED TRANSFORMER EQUIPMENT IN ELIZABETH SUBSTATION

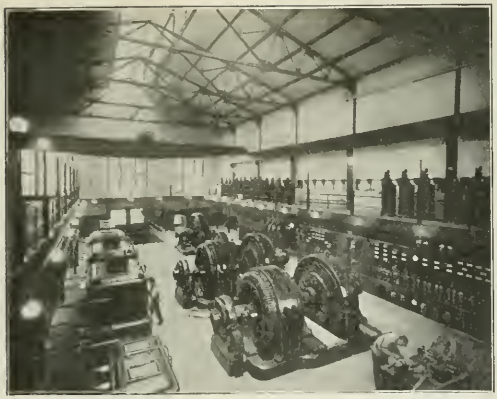


FIG. 16—INTERIOR VIEW OF SUBSTATION AT ELIZABETH

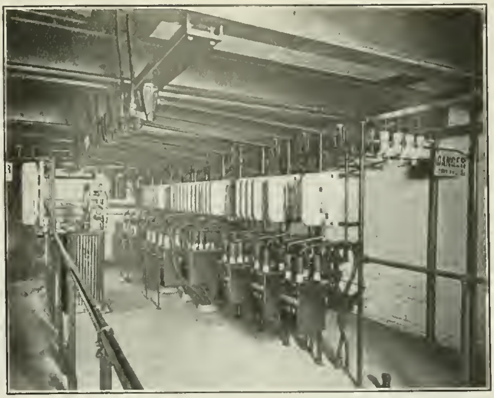


FIG. 18—OIL-SWITCH ROOM IN ELIZABETH SUBSTATION

working and about the same percentage in textile mills. Of the remaining industries, rubber and woodworking each demand about 4 per cent of the energy delivered for this class of service. Approximately 600,000 hp in motors is now connected to the company's lines.

Present Equipment

The electric-service company now utilizes 576 miles of transmission line and 119 street miles of underground conduit. The distribution system is just as extensive, there having been 14,070 miles of wire, 131,232 poles, 16,348 transformers and 96,486 connected meters in use on Dec. 31, 1913. For generating and transforming the energy used in this system the company operated thirty-two generating stations and fifty-six substations. In the generating stations 268 boilers and 203 generators are installed, with an aggregate rating of 177,048 kw.

Largest Generating Station

The largest generating station in the system is on the Hackensack River at Marion, Jersey City, N. J. It was built in 1904, three vertical Curtis turbine-driven General Electric 13,200-volt generators being installed at the first. One of these units (a 3000-kw machine) was designed for sixty-cycle operation to carry lighting loads; the other two (5000-kw units) furnished twenty-five-cycle energy for railway service. The dual system was adopted because the subsidiary companies had already committed themselves to using twenty-five-cycle apparatus for railway work as sixty-cycle converting units were not practicable at that time. The policy of concentrating energy generation in central stations was further carried out at this station by periodic additions to the generating equipment. In 1907 a 3000-kw, sixty-cycle generator was installed; in 1909 the station was extended and two 9000-kva vertical units added (one for railway and the other for lighting), and in 1912 a seventh generating unit, rated at 9000 kva, was erected to carry the local railway load. The station now has 28,000 kw in twenty-five-cycle and 47,000 kw in sixty-

TABLE III—GROWTH OF TRANSMISSION SYSTEM

Year	Miles Transmission	Street Miles Conduit	Kw-hr. Output
1903	47	25	129,614,180
1906	300	50	....
1911	425	87	....
1912	475	101	357,289,241
1913	576	119	400,835,989

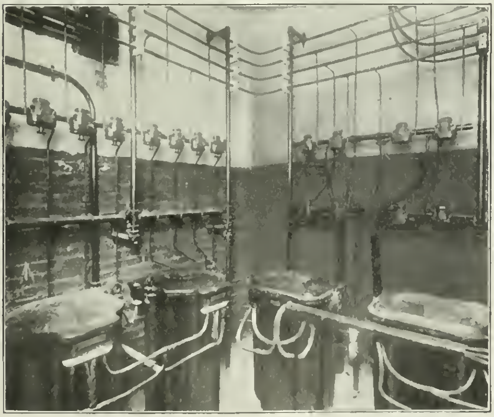


FIG. 17—SUBSTATION-SERVICE TRANSFORMER ROOM AT ELIZABETH

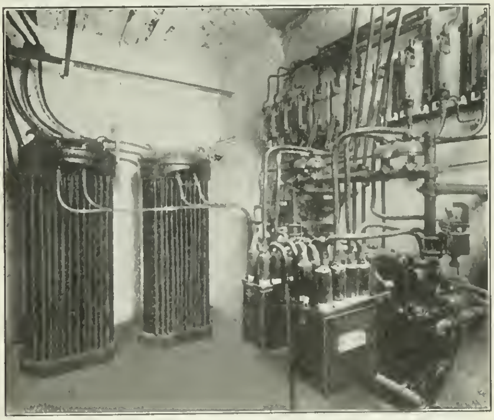


FIG. 19—VIEW OF TYPICAL TRANSFORMER BANK, VAULT CONSTRUCTION

cycle equipment divided up among seven vertical General Electric units and one Westinghouse horizontal-type generator. The horizontal unit, which is a sixty-cycle generator rated at 20,000 kw, is installed in space provided by an extension to the building. At the time (December, 1913) this machine was installed it was the largest sixty-cycle unit in the world.

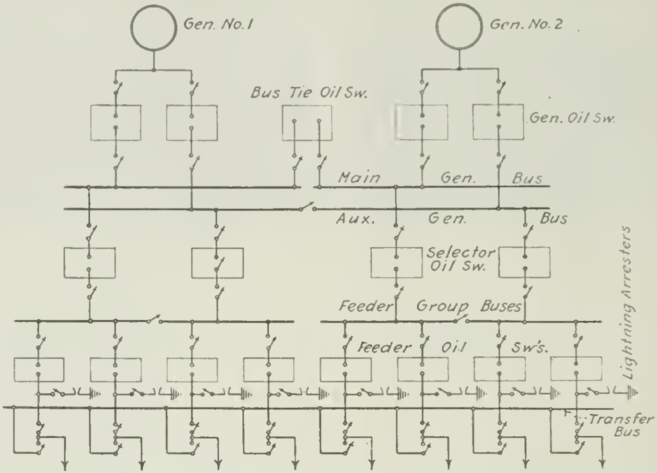


FIG. 20—PORTION OF BUS LAYOUT OF BURLINGTON STATION

The boiler room of the Marion plant has forty-five Babcock & Wilcox boilers delivering steam at 195 lb. pressure and having a total rating of 28,125 boiler-hp. The units are arranged in groups of five along opposite sides of the firing aisles, which run perpendicular to the length of the engine room. Each set of ten boilers is in a compartment by itself and discharges smoke into a stack 225 ft. high. Reinforced-concrete coal bunkers built above the boilers and beneath the roof discharge coal through spouts into the furnace stokers.

Coal for the station is delivered in barges to the dock on the Hackensack River, where clamshell buckets operated from a hoisting tower unload the fuel into a belt conveyor running parallel to the boiler room on the north side.

Load Dispatching

Station operation in the whole northern section is supervised from the Marion generating station.

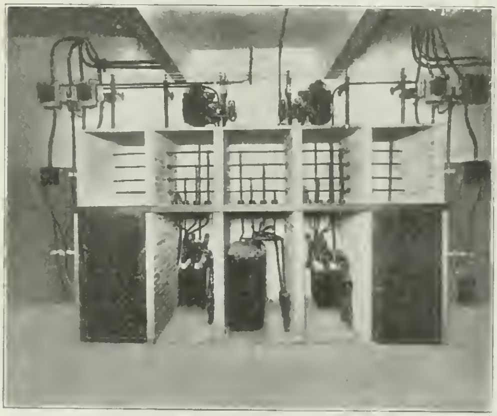


FIG. 21—INTERLOCKED SYNCHRONOUS MOTOR STARTER IN SUBSTATION

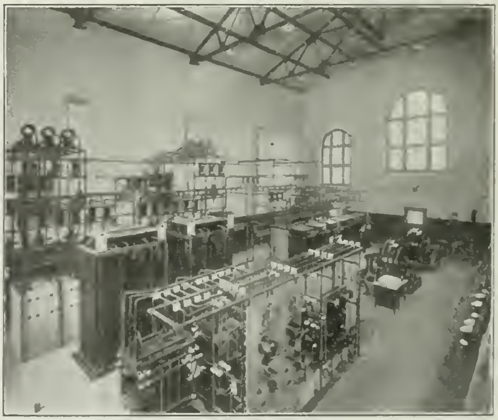


FIG. 22—VIEW OF THE INTERIOR OF THE SUBSTATION AT RIVERSIDE

Energy distribution in the southern division is not complicated or developed enough to warrant a load dispatcher, but as soon as the field is developed a dispatcher will be stationed at the new Burlington station.

One chief dispatcher and three assistants are employed at Marion. Their duties are to arrange for the operation of generators which will supply the demand at the best efficiency, power-factor and load-factor. Load dispatching does not consist alone in keeping the requisite number of units operating, but also in concentrating the generation of energy in as few plants as possible so that the plant efficiency will be maintained at a high value. In the northern system the policy is to operate Marion at as near constant and full load as possible and as peak demands come on to obtain energy from Newark stations and, when absolutely necessary, from the smaller plants in the system. It is usually during railway peak that it is necessary to operate the smaller stations. A load dispatcher under the supervision of the Marion dispatcher is stationed at Perth Amboy in the central division.

Another service which is performed by the load dispatchers is to supervise all tests on underground cables, aerial line and station apparatus, so that no portion of the system is handicapped for carrying its respective load. In "weeding out" cables by high-voltage or ohmic-resistance tests, attempts are made to confine the work to one locality so that if a break-down occurs energy can be delivered over another route. In repairing station apparatus similar precautions are taken to avoid conducting too many repairs in the same district. The load dispatcher, who is at all times informed as to the condition of apparatus, indicates on a diagram of the system just what apparatus requires attention and what machines are undergoing repairs at the time he fills in the chart.

While the southern system will eventually be supplied with energy from a central plant at Burlington, the supply for Trenton and vicinity is at present being furnished by the Trenton station, and energy for Camden and vicinity is being generated at Camden. Cities and towns between these generating stations are served in general from the nearest generating plant through a substation.

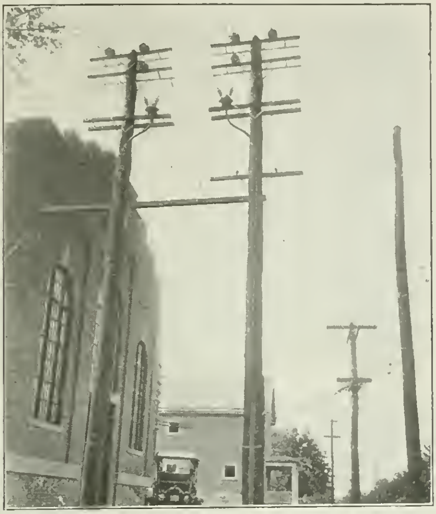


FIG. 23—TYPICAL UNDERGROUND CABLE ENTRANCE TO SUBSTATION

Location of Faults

Owing to the rapid increase in the size of the generating plants and transmission system in the northern part of the State, a serious problem has had to be contended with—that of protecting the system from short-circuits. The interruptions to service from 1910 to 1913 are classified in Table IV. From the figures it can be seen that most of the trouble was caused by insulator and cable failures. For this reason apparatus was installed in the Marion station to secure data on why the faults develop and thereby obtain a basis on which to remedy the trouble. The equipment consists of a high-potential testing transformer, a high-frequency testing transformer, a permanent installation of a resistance recorder, and an arcing-ground suppressor and localizer.

TABLE IV—SERVICE INTERRUPTIONS BY YEARS

Year	1910	1911	1912	1913
Central station..	5	13	12	12
Substation.......	28	21	24	36
Line and cable trouble.	81	114	129	155
Total	114	148	165	203

The test emf used on this system is 26,000 volts for new cable and 20,000 volts for cable in service for some time. The potential is applied for five minutes, between phases and between each phase and ground. The records show that most of the cable faults occur at joints, the reason assigned being trapped air and moisture. High-frequency tests on insulators taken from the lines of this transmission system show that failure is attributable to non-uniformity in the design and manufacture of the insulator. Insulation-resistance tests show that just at daylight on a summer morning the insulation resistance drops to a very low value for a short time. There have been several cases of insulation failure at this time of day, attributed to the fact that the warm morning air striking a cold insulator deposits moisture thereon and causes a flashover. The insulation resistance of the system as recorded on the charts varies between 500,000 ohms and 2000 ohms. During a heavy rainstorm the resistance drops considerably, and it does not rise again until the sun dries the insulators after the storm.

The arcing-ground suppressor and localizer is used to suppress a single-phase arc to ground and to indicate the cable which is at fault. Records show that 90 per cent of the cable failures originate in a single-phase arc to ground, which later develops into a short-circuit. After the suppressor and localizer have operated, a good cable is paralleled with the bad one and the faulty cable taken out without any interruption to the service.

TABLE V—INTERRUPTIONS DURING 1913 CLASSIFIED

	Twenty-five Cycle		Sixty Cycle	
	Number	Per Cent	Number	Per Cent
Insulator failures.	12	22	30	20
Cable failures.........	2	4	21	14
Central-station apparatus.	3	5	4	3
Substation apparatus.. ...	2	4	7	5
Secondary feeder.........	5	9	23	15
Operating mistakes........	2	4	10	7
Storms................	9	17	16	11
Outside interferences....	9	17	22	15
Mechanical breaks.....	0	0	0	0
No apparent cause..	10	18	15	10

Typical Substation

The electric company does not confine its efforts along modern attractive construction to the larger generating stations and substations. Even the smallest transformer station is designed along lines which are a credit to the system. Every effort is made to arrange for convenient operation, and the desire to maintain a station in its most attractive condition is instilled into each operator.

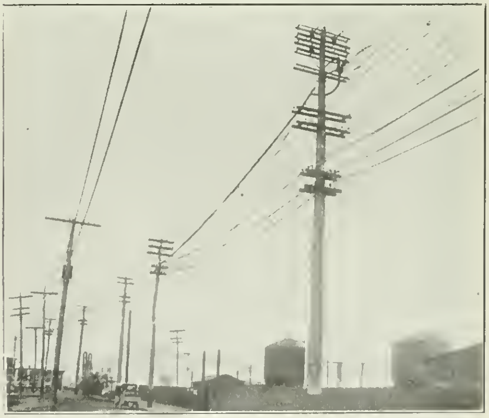


FIG. 24—AERIAL CABLE LEADING TO CAMDEN STATION

The Elizabeth substation, furnishing energy for railway, lighting and motor service, is the latest development in substation construction. It is a model of comprehensive construction, the 13,200-volt lines entering on one side of the building and the low-tension feeders leaving the structure on the other side, both underground and overhead. The high-tension circuits enter the building through specially designed wall entrances consisting of condenser-type bushings inclosed in tile ducts which are supported in slate slabs set at an angle in the wall. No protective hoods are employed to protect the entrances from the weather, the inclined position of the slabs being considered sufficient. In the future high-tension circuits will be conducted to the buildings through three-phase underground cables as is done in some cases now, thus avoiding the use of wall entrances. In the interior of the substation the apparatus is arranged in sequence of energy transformation. The lightning arresters are on a gallery near the incoming lines; the oil switches are on the main floor directly below; duplicate-bus structures are in the basement. Transformers feeding energy to synchronous converters, motor-generator sets and distributing circuits are arranged in a single row on the main floor adjacent to the gallery. They are cooled by air delivered to them through a duct in the basement. Four motor-driven blowers take air either from outdoors or from the station and force it through the transformers into the substation. The room containing the storage batteries for operating the remote-control switches is also ventilated from the air duct. The bus compartments are not in the path of the air draft and hence will not be covered with dust entrained in the air.

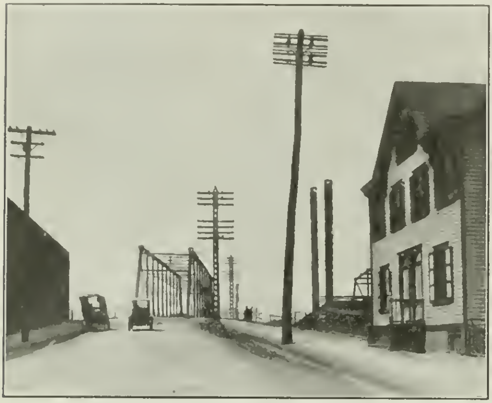


FIG. 25—CROSSING OVER PENNSYLVANIA RAILROAD YARDS AND CANAL

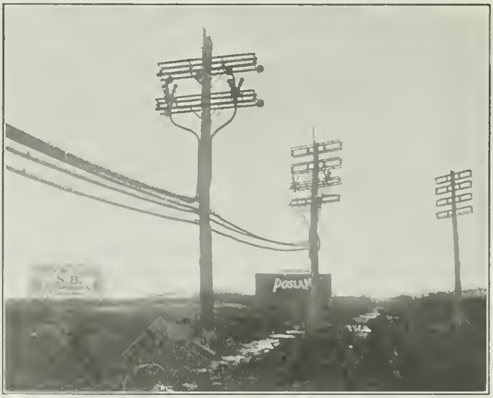


FIG. 26—13,200-VOLT AERIAL CABLE TO AVOID OPEN WORK

Two 1000-kw synchronous motor-generator sets are operated from the 2400-volt bus and one 500-kw and one 1000-kw six-phase converter are fed from their respective transformers. The high-tension buses supplying energy to these transformers are sectionalized so that railway equipment and lamp and motor equipment may be operated independently. All low-tension wiring is inclosed so that there is no exposed wiring in the station. A 2400-volt transfer bus is installed along the low-tension side of the station so that any feeder voltage regulator may be disconnected and the circuit completed through another regulator or connected to the feeder without regulation. One continuous conduit running along the wall back of the feeder regulators contains their control wiring and motor circuit. The circuits emerge at each regulator through special outlets and terminal boxes.

The lighting of the substation is unique and ornamental. Each vertical post in the railing surrounding the gallery is extended above the top rail to support a diffusing glass-globe fixture. Fastened to the girders around the edge of the gallery are bracket fixtures supporting similar bowls. This system of lighting is more practical than having fixtures supported from the roof trusses, and it adds to the attractiveness of the interior. The lamps are controlled from the main floor. An automatic switch near the lamp-control cabinet instantaneously throws the lamps onto the storage-battery circuit in case the alternating-current supply is interrupted. Means are provided for delivering apparatus and supplies at grade and conveying them to any part of the substation by a crane.

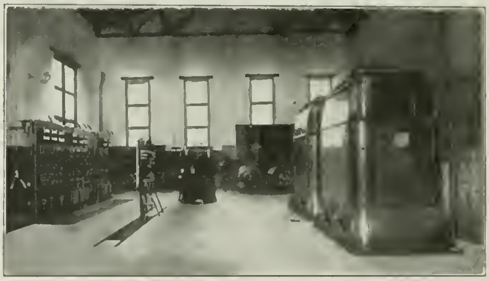


FIG. 27—LIGHTING SUBSTATION IN NEWARK

Latest Developments

Developments in the southern division are interesting because this territory presents particularly desirable conditions for electrical development and has not been canvassed to any great extent heretofore for business. Conditions existing there have considerable bearing on the location of the company's latest and most modern generating station at Burlington. With the formation of the Public Service Corporation of New Jersey, the South Jersey Gas, Electric & Traction Company was leased for a period of 900 years. This property, which included the railway, gas and electric interests, covered a field of operation in a territory about 45 miles in length, extending from Trenton on the north to the cities of Camden and Woodbury on the south, including the cities of Gloucester, Bordentown, Beverly and thirty-seven other municipalities. In addition to this, the company served Bristol, Yardley and Morrisville, in Pennsylvania. During 1913, however, the Public Service Corporation disposed of its Pennsylvania properties so that at the present time the activities of the electric company are wholly confined within the State of New Jersey.

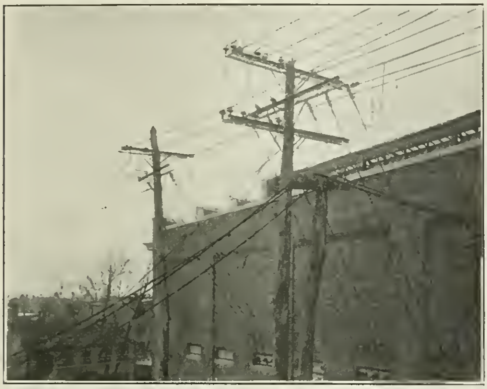


FIG. 28—POLE CONSTRUCTION AT ELIZABETH SUBSTATION ENTRANCE

The population of the territory served increased from 210,000 in 1900 to 310,000 in 1910. Originally there were five generating stations, situated respectively at Camden, Trenton, Mount Holly, Gloucester and Bristol, substations also being maintained at Gloucester, Haddon Heights, Merchantville, Moorestown and Woodbury.

During the period from 1903 to 1911 no extensive improvements to the property were made, other than the installation of additional equipment at Camden, Trenton and the various substations. During 1911 several new local systems were acquired or leased and transmission lines were built connecting them. The acquisition of these new properties increased the number of municipalities served by the electric company in this division from thirty-seven in 1903 to forty-eight in 1912.

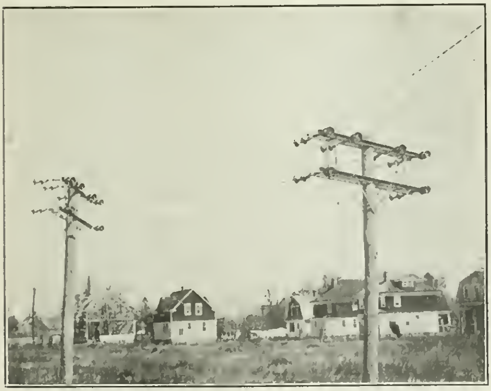


FIG. 29—METHOD OF TURNING AN ANGLE OF 45 DEG.

The combined lighting and railway load of the southern division is over 15,000 kw, which, under expected conditions, will doubtless increase to at least 35,000 kw within the next five years. The load now carried by the Camden stations is approximately 9000 kw, while at Trenton the load has exceeded 3500 kw, the balance being carried by the other smaller stations. Both the Camden station and the Trenton station have reached their practical operating limit, and the apparatus at the other recently acquired stations is not only incapable of properly taking care of the requirements but is inefficient and cannot be depended upon for any length of time without very expensive alterations.

The needs of the situation gave rise to two plans—namely, (1) to increase the station equipment at Camden and Trenton, and (2) to build a generating station somewhere along the Delaware River which would take care of the entire growth of the division.

The situation at Trenton was such that no extensive improvements in the way of additional equipment could be made on account of the lack of water for condensing purposes and the insufficient room for the proper handling and storage of coal. At Camden the question of coal storage was also serious as Cooper's Creek is quite frequently frozen over during the winter months, when coal cannot be transported to the station. While the necessary amount of coal could be obtained in the summer months, the depth to which it would have to be stored, owing to the lack of space, would result in fires from spontaneous combustion; and, even though insured, the loss due to the extra labor required could not be recovered. Water conditions in Cooper's Creek, arising from the exceptionally low tides, have on several occasions caused interruptions to the service. Even though it were possible to make extensions to the Camden station, Trenton would not have been provided for.

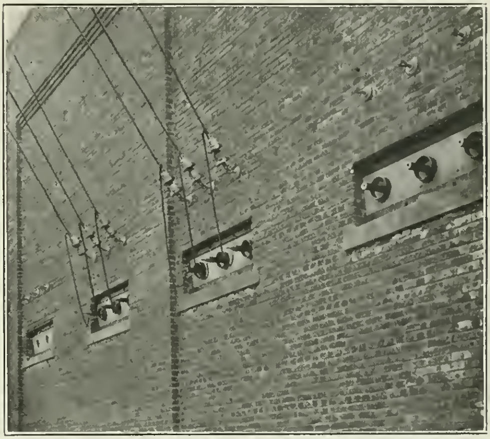


FIG. 30—HIGH-TENSION WALL ENTRANCE AT ELIZABETH SUBSTATION

The distance between Trenton and Camden is approximately 36 miles, and the logical location for a generating station was at the geographical center of this territory, or Burlington, on the Delaware River, where the new station is now being erected.

With the station situated at this place and connected with Camden and Trenton by transmission lines it is possible to take care of the growth in load at Trenton, Camden and the intervening territory. By erecting the station at Burlington, too, the transmission distances were cut in half, permitting the economical use of the transmission voltage now standard in other parts of the system and thus allowing for the interchange of apparatus at any time desired.

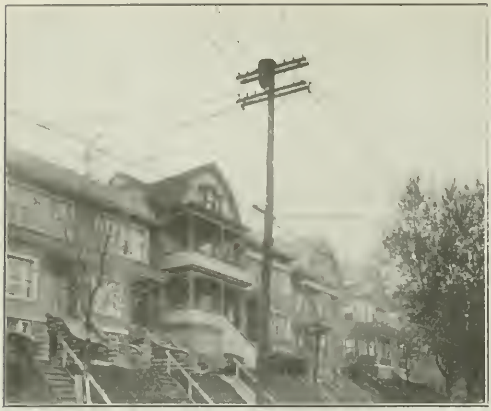


FIG. 31—TYPICAL DISTRIBUTION CIRCUIT, SHOWING SERVICE DROP AND JOINT-POLE USAGE

Burlington Generating Station

The property on which the new station is being erected is on the Delaware River and consists of somewhat more than 8 acres, part of which is submerged during high water. The lower portion of the property will provide ready means for ash disposal for some years to come. The ultimate plans call for a building constructed on the unit system, approximately 200 ft. in width by 300 ft. in length, only the first section of which, however, is now under construction. Two 3500-kva, sixty-cycle, 13,200-volt, three-phase, vertical Curtis turbo-generators units which were formerly at Marion station are being installed. Space has been provided for the installation of a third unit, and the arrangement of the building and main condensing canals is such as to permit an ultimate installation of 10,000-kw horizontal turbine units, with a final station rating of 100,000 kw.

The boiler equipment in the first section consists of six 600-hp water-tube Edge Moor boilers, with space provided for two more. On the opposite side of the firing aisle there is room for eight more units. These boilers will be hand-fired for the present, but provision has been made for the installation of stokers when the size of the station seems to warrant their use. The first installation of boilers will require only one stack, which will be of radial brick construction, having an inside diameter of 14 ft. with a height of 225 ft.

Like many of the other stations, the building will also house substation apparatus, which, for the present, will consist of two 300-kw converters for railway service and two 500-kw oil-cooled transformers for lighting and motor service. The switch house, which consists of four floors, will have space for both generator and feeder reactors, although these will not be installed at present. The outgoing high-tension feeders will be arranged in groups of four, with an auxiliary and transfer bus forming a selective system.

Considerable care is being taken in the design of the switchboard and feeder system, in order to provide as flexible an arrangement as possible, thereby insuring continuity of service; and the design of the station throughout is such as will provide the southern division with a plant superior to any now existing in Public Service territory. The feeder system includes substations at Mount Holly, Riverside, Bordentown, Olden Avenue and Liberty Street, the last two being in Trenton. Two 300-kw rotaries are installed in each of the last two substations.

Substations in Southern Division

The Riverside and Bordentown substations are equipped with two 500-kw oil-cooled transformers for lighting and motor service. Olden Avenue substation, which is in the center of a factory district and which is being built primarily to take care of large contemplated motor-service business, will contain two 1000-kw air-blast transformers.

In the case of the Riverside and Bordentown substations it was desired to keep the cost as low as possible, and as oil-cooled transformers of proper size were available in other parts of the system, it was decided to use them. The installation of this type of transformer also greatly reduced the building cost. At Olden

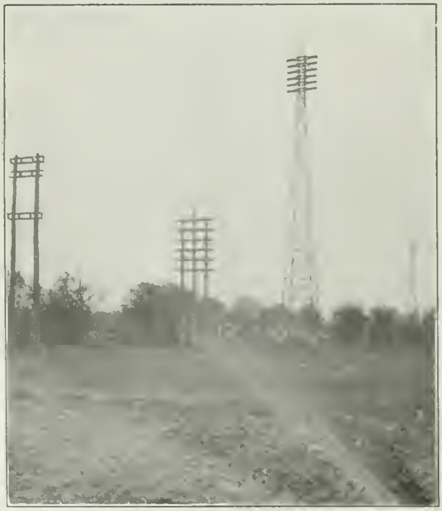


FIG. 32—750-FT. TRANSMISSION SPAN USED IN CROSSING RANCOCAS CREEK

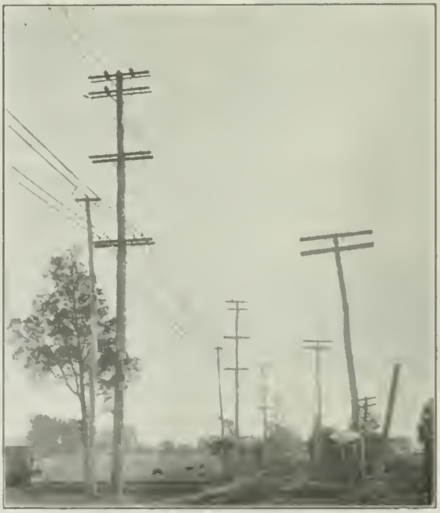


FIG. 33—STANDARD TYPE OF HICH-TENSION RAILROAD CROSSING

Avenue it is expected that a much heavier load will be carried than at either of the other two substations, and for various reasons it was deemed desirable to install air-blast transformers.

The Burlington station will also supply energy to substation apparatus at both Trenton and Camden. As the Camden station is operated at 11,000 volts, auto-transformers are provided to compensate for the difference in voltage in order to allow parallel operation with the 13,200-volt system.

Latest Transmission Construction

The southern division transmission system has required the building of 51 miles of pole line, a large portion of which is on public highway. The lines, with the exception of the circuit to Mount Holly, are of No. 00 seven-strand medium hard-drawn bare-copper wire, with Locke No. 3¾ insulators and metal arms, mounted on wooden poles, most of which are 50 ft. in height. On each side of a telephone or railroad crossover the poles are double-cross-armed, and where possible the poles are guyed straight-away and transverse to the line. When the line extends along an existing or future street right-of-way the poles are set within the curb line in order that they may not have to be moved when the streets are graded or paved. In crossing gullies or depressions the practice is to keep the line practically level from ridge to ridge by employing gradually taller poles in the lower parts of the depression.

Where the poles have to be set in marsh land the butts are usually steadied by cribs made of timbers fastened to the butt at right angles to each other. The strain on poles at turns is minimized by dividing the turn up among several short spans. Each pole on a turn is double-cross-armed and is equipped with spool-type insulators. The pole at which the straight-away line terminates is anchored longitudinally and also side-guyed.

In several cases in the southern division where a straight-away line runs into an obstruction it has been considered advisable to raise the line and pass over the obstruction rather than make an offset. This practice has been followed where possible by using poles of gradually increasing height just before approaching an obstruction and decreasing height in receding from it. The objection to an offset is that it imposes unnecessary strains on the poles and adds complications to the construction.

A bold departure from ordinary line construction is made by the Public Service Electric Company in crossing streams, railroads and other obstructions. Instead of grading the line up to the towers on each side of the obstruction this company runs its line conductors directly up from 50-ft. poles to towers which are 150 ft. to 174 ft. in height. By so doing the maintenance of several high approach poles is eliminated. Besides, the conductors are not subjected to as great a tensile strain when suspended practically vertically as if strung tight in a horizontal plane. About seven high towers with steeply inclined line approaches are employed in the New Jersey system.

Two large steel towers were required in crossing over Rancocas Creek on the Camden Turnpike, the span employed being 770 ft., which is the longest in the system. The towers are constructed of steel 20 ft. square at the base and are high enough to allow a minimum clearance of 130 ft. from high-water line to the lowest wire, this being the requirement of the federal government. The towers are designed to carry twenty-five wires, which will be so spaced as to allow the use of 26,000-volt transmission should this ever become desirable.

The crossing is novel in that a right-angle turn had to be made not more than 150 ft. from the base of one tower. The tower nearest the turn is 176 ft. high and the conductors are stretched from the insulators sus-

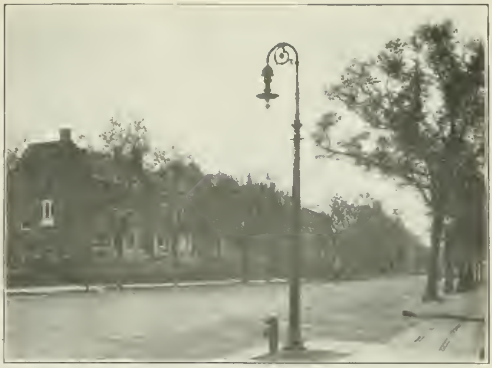


FIG. 35—STREET ON WHICH OVERHEAD CONSTRUCTION HAS BEEN SUPERSEDED BY UNDERGROUND

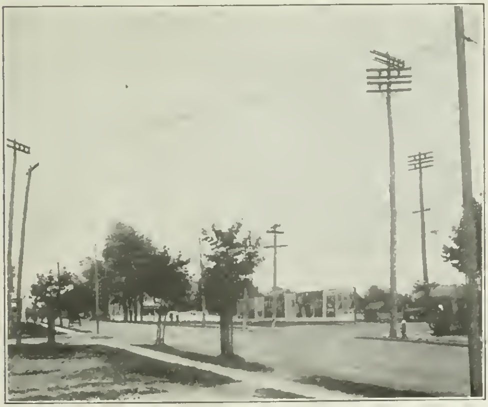


FIG. 34—JUNCTION OF PRINCETON AND TRENTON LINES TO BORDENTOWN

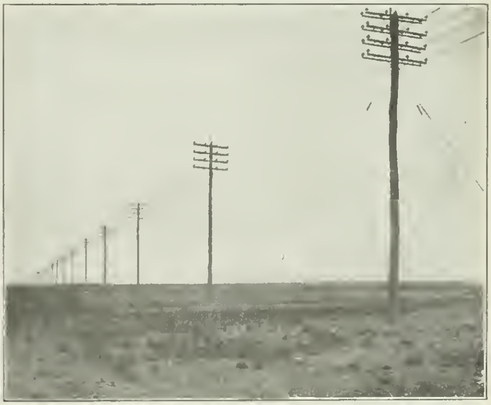


FIG. 36—TYPICAL HIGH-TENSION TRANSMISSION LINE NEAR NEWARK

pended thereon to a wooden bent 88 ft. from the base of the tower and thence to another three-pole frame 8 ft. away. As the right-of-way was limited in width, the next pole had to be offset from the line in a direction opposite to the turn desired, so that conductors were dead-ended in disk insulators and connected with the lines running at right angles to the cross-over span.

On account of the height of the tower it was considered necessary to use a ground wire. This is supported at the apex of each tower and has the same conductivity as each conductor. The ends of the ground wire extend to disk insulators attached to the bents and are connected to earth near them. Aside from ground wires on high towers no others are used on the southern division transmission.

Similar towers supporting thirty-six conductors are used in crossing over Cooper's Creek near the Camden station. Small steel towers are also employed in the vicinity of Trenton, where the line crosses the Pennsylvania Railroad Company's property near the Delaware River and Raritan Canal.

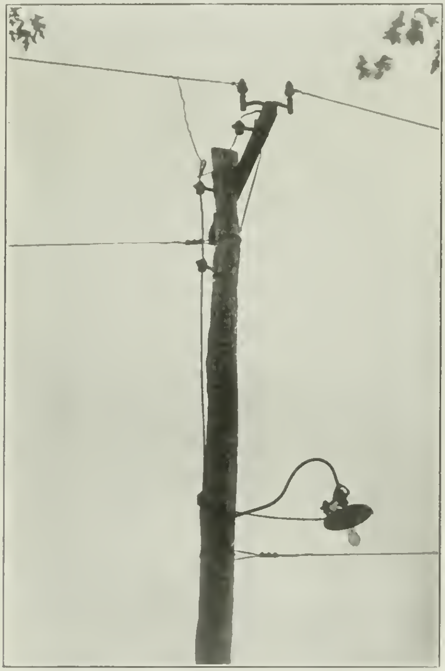


FIG. 37—STANDARD SERIES STREET-LIGHTING CONNECTION

To avoid the use of open high-tension construction entering Camden, and as no underground franchise was held, 13,200-volt overhead cable supported on messenger wire was installed. The cable contains three-conductors, is paper-insulated, and has a jacket of cloth and rubber, over which weatherproof braid and soft steel tape is applied. A covering of jute is provided to protect the steel tape from corrosion. This type of construction is a new departure and more or less of an experiment. If it proves successful, it will have numerous advantages as, owing to its light weight, it will permit the use of standard pole spacing, and with the simplification in this type of construction it will be possible to work on poles carrying live circuits with perfect safety.

Construction in Northern Division

The construction in the northern and central sections is similar to that in the southern division, the same standard specifications applying throughout the whole Public Service territory. Some of the northern section lines are still arranged in a horizontal plane as to phases, but most of the more important lines have been changed to triangular or vertical phase formation to minimize the chance of crosses which would be hazardous because of the enormous amount of energy which would be dissipated in a short-circuit. A ground wire is used on the 13,200-volt lines in the northern division. It is supported on a vertical angle iron electrically connected to the cross-arms. The supports are grounded every fourth pole.

Another installation of aerial cable is made near Newark in passing through the Pennsylvania Railroad yards. To use open work would have required very high towers, which would have been extremely expensive. It was not considered advisable to erect them as the tracks are being continually changed and it is doubtful how long it would be before a tower would have to be moved. Conduit construction would also have been impracticable. Under the conditions aerial cable was employed with 50-ft. pole spacings. The cable contains No. 00 conductors, besides some 250,000-circ. mil conductors, and is insulated like the Camden cable, but it has a lead sheathing inside the jute and steel-tape covering. The cable weighs from 15 lb. to 17 lb. per foot in comparison with 5.5 lb. per foot, the weight of that in the southern division.

Main Office Building

Since the organization of the Public Service Corporation, its main offices have been in the Prudential Life Insurance Building, at Bank and Broad Streets, Newark. The building, which is eleven stories high, is constructed most elaborately from the architectural viewpoint. The exterior is of granite, and the main corridors, halls and assembly rooms are wainscoted in marble. A large variety of electric-lighting fixtures are installed in the building. These serve as an excellent advertisement of the electric company's business.

On the top floor of the building is the main restaurant, while the dining rooms, assembly hall and library are on the floor below. The ninth floor is devoted to executive offices, the eighth floor to law and electrical departments, and the seventh floor to the rest of the electrical department and miscellaneous offices. On the succeeding floors, in the order of their position, are miscellaneous offices, accounting department, general claim department, railway offices, clerical forces, publicity department and showrooms.

There are four high-speed passenger elevators and one freight elevator in the main building and two slow-speed passenger elevators in the extension, where only a three-floor service is required. Three of the four elevators in the main building have a rated carrying capacity of 2500 lb. each. The fourth elevator is of extra heavy type so that it may be used for carrying up safes, parts of vaults and other bulky articles. During the luncheon period from 11:30 to 1 these four elevators carry about 700 persons each way.

New Office Building

Land has been purchased in the center of Newark, facing on Park Place, North Canal and Pine Streets, on which the Public Service Corporation intends constructing a combination street-railway terminal and office building. It will be eight stories high and will cost over $5,000,000. Private rights-of-way have been obtained along which to connect this building with the various lines. The basement will serve as a terminal for cars approaching through a subway, and the ground floor will be devoted to a combination concourse or station and a commercial office for the gas and electric companies. Elevated cars will have their terminal station on the second floor. The upper floors will be occupied by offices, auditoriums, restaurants, etc.

New Business Activities

The new-business department consists of six divisions having from one to ten district offices, each in charge of one division agent. Each district office is supervised by a district agent, who keeps in touch with local affairs. The division agent acts in a supervisory capacity for the whole division and refers matters of a new-business character to the new-business agent.

Four assistants are employed in the main office at Newark to follow up business throughout the State and plan selling campaigns for all of the offices. In addition, there are three general men who travel around the State in order to assist in following up new-business matters. One of these three men is especially qualified as an "industrial power" salesman, another as a "lighting and sign" man and a third as an "electric vehicle engineer." They visit certain territories at definite times and confer with the local men on special cases along their lines. They sometimes accompany the local salesmen on visits to prospective customers when conferences of a technical nature have to be held. These men act as instructors, on many occasions assisting the local agents on matters requiring more than the ordinary technical ability.

The vehicle engineer acts in an advisory capacity, helping purchasers in the selection of cars and in deciding what types are best suited to certain kinds of work. This man also keeps a list of all battery users in the State and has an inspection of their batteries made periodically. If they are not operating satisfactorily, he advises the user as to the cause and also notifies the manufacturer of the battery. In this way the company aims to keep its customers posted on the proper care of vehicles.

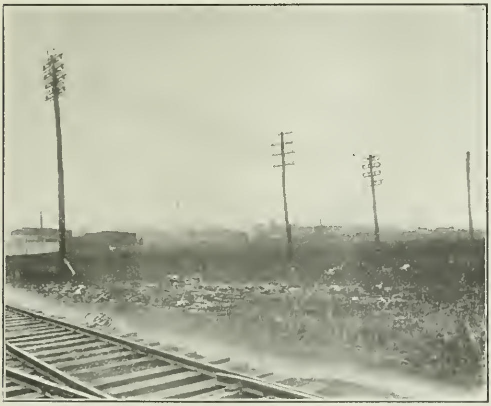


FIG. 38—CURVE AND RAILROAD CROSSING CONSTRUCTION ON 13,200-VOLT LINE

A window decorator is employed regularly to lay out plans for window displays which are sent to the district offices periodically to show how to place appliances so as to get the best advertising effects. The interior display and arrangement of central-station electric shops are also under the supervision of this man.

Some of the offices have been remodelled but in many cases they have been replaced by new buildings which do credit to the system. All of the offices have display rooms.

Advertising matter for distribution among the offices of the entire system is made up in the general office in Newark. Besides the regular addressograph file of customers, the offices have stamped plates bearing the names of non-users of electric appliances. Before every appliance campaign these people are sent attractively illustrated and descriptive booklets on the devices which are being introduced, and in many cases the articles are sold before the demonstrator calls on the prospective customer.

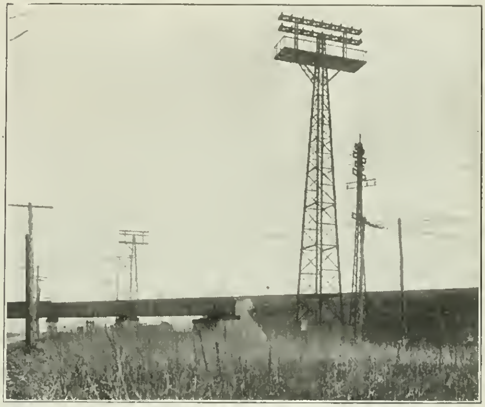


FIG. 39—STEEL-TOWER CROSS-OVER AND EXCHANGE CONNECTION WITH PENNSYLVANIA RAILROAD

Records revised from time to time are kept of every motor user not connected to the electric-service system, and these prospective customers are visited two or three times a year with the intent of securing their business. The company's men conduct tests on private plants to show how central-station service excels. Designs for motor drive are made without charge upon request of firms contemplating the installation of motor-driven machinery. Special prices exist only during the campaign period and are uniform throughout the State. No apparatus is offered for sale by the company until it is first inspected and has passed the recommendation of its laboratories.

Chief among the industries which are coming to the front as regards the use of electricity is the rubber business. Pottery manufacturers also use considerable central-station energy. The business secured so far this year is about 60 per cent in excess of that obtained up to the same time last year.

Laboratories

Unlike most electric-service companies, the Public Service Electric Company has concentrated its switchboard and meter-testing department and its general laboratories in one department. Here coal and building materials are tested and master standard instruments are tested, calibrated and repaired. Master standard meters are received periodically from each operating division and are tested in the laboratories. The meters are then returned to their respective localities and are used in calibrating working standards. By using master and working standards very little duty falls on the master instrument, and hence its accuracy can usually be depended on.

All switchboard and standardizing instruments purchased by the company are tested in this main laboratory before they are distributed through the system. A card-record system is kept of tests on all instruments, and when a record shows that the accuracy of a certain type of meter varies considerably the period between tests is shortened. Induction-type instruments are tested about once a year, and alternating-current watt-hour meters every six months. Direct-current apparatus is tested oftener. This department also has charge of taking photographs of progress during construction.

Organization

The principal officers of the Public Service Corporation of New Jersey, which is the parent company of the Public Service Electric Company, the Public Service Gas Company and the Public Service Railway Company, are: Messrs. Thomas N. McCarter, president; George J. Roberts, first vice-president; John J. Burleigh, second vice-president; Randal Morgan, third vice-president; Anthony R. Kuser, fourth vice-president; Edwin W. Hine, secretary; H. C. Stevenson, assistant secretary; P. S. Young, treasurer; R. D. Miller, assistant treasurer; T. W. Van Middlesworth, assistant treasurer; Frank Bergen, general counsel; E. A. Armstrong, assistant general counsel; L. D. Howard Gilmour, general solicitor; Edmund W. Wakelee, associate general solicitor; Lefferts S. Hoffman, general attorney; H. V. Drown, general claim agent; Percy Ingalls, general agent; George Barker, real estate agent, and John L. O'Toole, publicity agent. Mr. Dudley Farrand is general manager and Mr. Farley Osgood is assistant general manager of the Public Service Electric Company, and Mr. E. J. Allegaert is general auditor. Mr. N. A. Carle is the chief engineer, having Mr. E. B. Meyer as his assistant, with Mr. N. L. Pollard as electrical engineer and Mr. C. H. Baker as mechanical engineer. Mr. F. W. Casler is the general superintendent of plants, and Mr. G. A. Sawin is meter and illuminating engineer. The division-operating superintendents are: Messrs. William K. Vanderpool, Newark; Rudolph Burkhalter, Orange; William A. LaDue, Hudson; Robert O. Bentley, Bergen; William M. Brock, Passaic; J. T. Barron, central, and Paul Lupke, southern.

The board of directors is composed of Messrs. Thomas N. McCarter, George J. Roberts, John J. Burleigh, Randal Morgan, Anthony R. Kuser, Edwin W. Hine, Frank Bergen, Samuel T. Bodine, Walton Clark, Thomas Dolan, Forrest F. Dryden, P. S. Young, J. Horace Harding, William C. Heppenheimer, Lewis Lillie, Horatio G. Lloyd, Uzal H. McCarter, F. W. Roebling, William Scheerer, P. F. Wanser and Edgar B. Ward.

The members of the executive committee are Thomas N. McCarter, George J. Roberts, John J. Burleigh, Randal Morgan, Anthony R. Kuser, Edwin W. Hine, Walton Clark, Lewis Lillie and Uzal H. McCarter.

Subsidiary Companies

Among the companies leased and operated by the Public Service Electric Company are the following: Paterson & Passaic Gas & Electric Company; South Jersey Gas, Electric & Traction Company; Somerset, Union & Middlesex Lighting Company; Gas & Electric Company of Bergen County; United Electric Company of New Jersey; Middlesex Electric Light & Power Company; Nichols Electric Light & Power Company, Nutley, N. J.; Citizens' Electric Light, Heat & Power Company; Princeton Light, Heat & Power Company; Burlington Electric Light & Power Company; Shore Lighting Company; Passaic Lighting Company; Trenton Gas & Electric Company; Central Electric Company; Citizens' Electric Company; Edison Electric Illuminating Company of New Brunswick; Englewood Gas & Electric Company; Edison Electric Illuminating Company of Paterson; North Hudson Light, Heat & Power Company; Paterson & Passaic Gas & Electric Company; Hackensack Gas & Electric Company; Consumers' Light, Heat & Power Company; South Jersey Gas, Electric & Traction Company; Somerset Lighting Company; Plainfield Gas & Electric Light Company; Boonton Electric Company; Bordentown Electric Light Company; Morris & Somerset Electric Company, Morristown, and Cinnaminson Electric Light, Power & Heating Company.

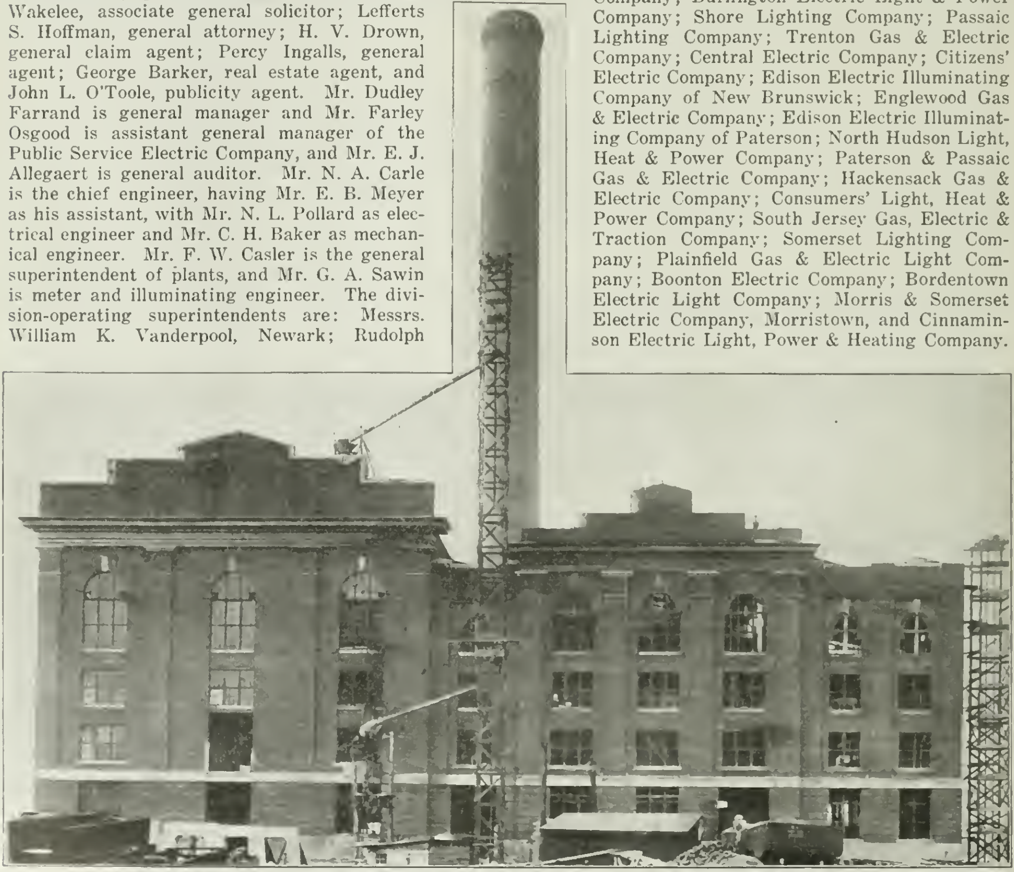


FIG. 40—NEW GENERATING STATION AT BURLINGTON, N. J.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Cost of Electric Cooking at Bismarck, N. D.

The Hughes Electric Company, of Bismarck, N. D., furnishes central-station service in Bismarck, Fort Lincoln and Mandan, N. D., and in Glendive, Mont., and has connected to its lines about a hundred electric ranges, energy to operate which is sold at 4 cents per kw-hr. Herewith is given a compilation of the average bills of these hundred customers for ten months, making a mean monthly cost of $2.83 for electric cooking.

March	$3.09	August	$3.82
April	2.09	September	2.88
May	2.89	October	2.74
June	2.54	November	2.04
July	4.04	December	2.18

The Ice Plant Makes Twenty-Four-Hour Electric Service Possible

In a Texas town with a population of 2000, not far from Fort Worth, there is a combination plant containing 75 kw in electrical machinery and a 12-ton ice-making equipment. Last year the revenue received from the ice plant almost equaled that earned by the electric-lighting service, which was $11,800. Together with the sale of supplies, the ice and electric departments earned $23,000 during the year, and the cost of their actual operation for the same period was $13,000. During the year, however, there were incurred a number of heavy replacement expenses incidental to overhauling the plant, and these brought the total outlay for the twelve months up to $19,000, leaving net profits of $4,000. To replace this plant, using good engineering judgment and avoiding, perhaps, some of the mistakes of the original builders, would to-day cost about $40,000, it is estimated. On this basis the combination plant for the year just elapsed earned about 10 per cent on the investment. To have operated the same plant without the ice auxiliary, even for a few hours nightly, would have resulted in a great loss, as the above figures readily suggest. The addition of the ice plant, however, has made possible the furnishing of electric service twenty-four hours a day, instead of for the minimum hours nightly, and has, moreover, enabled this improved all-day electric service to be rendered at a fair profit to the company.

Sales Department Holds Electric Dinner

Increased activity in all branches of the sales department of the United Electric Light & Power Company, New York, has recently required the addition of a number of new men. With the idea of getting these men acquainted with the older men of the staff, and to familiarize them all with the company's latest plant-operating methods, a tour of inspection was made through the new 201st Street station, after which an electrically cooked dinner was served on the plant-office floor. The dinner was prepared by a local caterer, who used a 6-kw electric range and a 2-kw oven set up temporarily at the station in the chemist's laboratory. The menu was as follows: Grape fruit, cream-of-celery soup, filet of beef with mushrooms and fried potatoes, Roman punch, roast chicken with mashed potatoes, salad, ice cream, coffee and cigars. The oven was also used to heat the dishes preparatory to serving the dinner. About forty sat down at the table. Among those present were Messrs. Frank W. Smith, vice-president; W. E. McCoy, electrical engineer; Joseph F. Becker, sales manager, and H. W. Leitch, plant superintendent. Brief talks were given by the vice-president and the sales manager.

PREPARING AN "ELECTRIC" DINNER

Chicago Company Advertises in Many Daily Papers

Mr. H. A. Seymour, editor of the *Edison Round Table*, published by the Commonwealth Edison Company Section of the N. E. L. A., Chicago, speaking of the newspaper advertising of the company, recently made the statement that the Commonwealth Edison Company is an almost constant advertiser in ten of Chicago's daily papers and in addition uses twenty-six foreign weekly papers within the city and thirty-six other weekly papers which are published outside of Chicago. Extensive and continuous advertising, said Mr. Seymour, has been an important factor in the upbuilding of the company's business.

New Business Offices at Warren, Ohio

While the Trumbull Public Service Company at Warren, Ohio, was undergoing the constructive development described in the *Electrical World* of Jan. 24, 1914, the local organization worked under the handicap of an inadequate office. Recently, however, the company has moved its headquarters into a new building on the public square amid inviting surroundings. Accompanying illustrations show the interior and exterior of the new office.

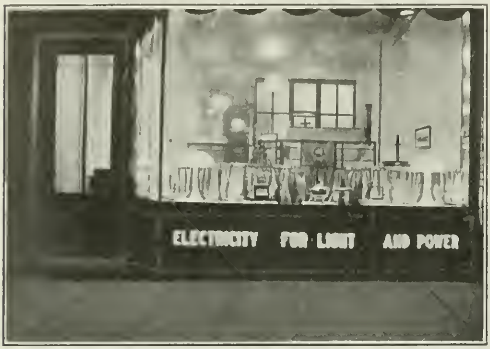


FIG. 1—SHOW WINDOW IN WARREN OFFICE OF TRUMBULL PUBLIC SERVICE COMPANY

Part of the front of the office is used as a display space for appliances. The office of the new-business manager, Mr. W. J. Marshall, is situated near the doorway, the idea in so locating it having been that by frequently seeing each other the new-business manager and the public will become better acquainted. In addition to maintaining a well-lighted show window, the company has utilized to advantage the space below the window by placing there a transparent sign reading "'Electricity for Light and Power," behind which six 150-watt tungsten lamps supply illumination. The interior of the main office is lighted by means of three 500-watt tungsten lamps inclosed in diffusing reflector bowls. Semi-indirect fixtures containing four 150-watt lamps are used to illuminate the private office of Mr. George Daugherty, local manager of the company. Thus the whole arrangement and lighting equipment of the office is of the "up-to-the-minute" kind.

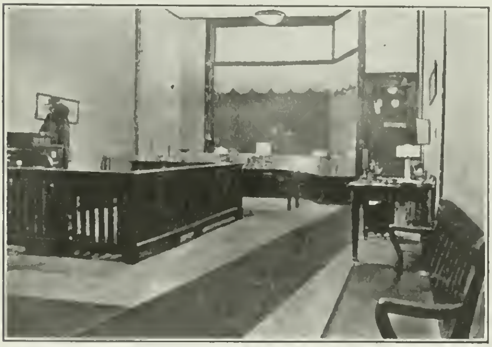
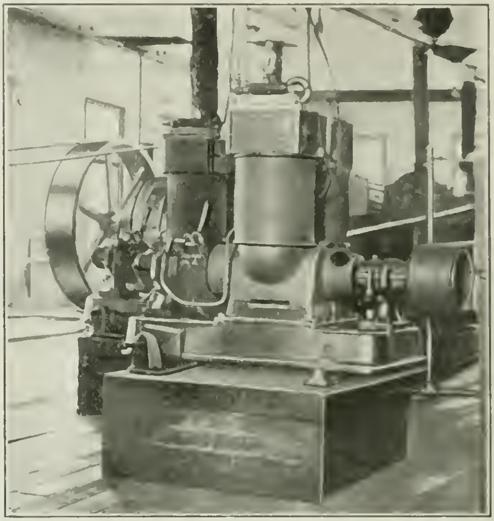


FIG. 2—INTERIOR OF ELECTRIC-SERVICE OFFICE AT WARREN, OHIO

Edison Bipolars in Service Twenty-Eight Years

In the central station at Mount Holly, N. J., are four 25-kw, 125-volt Edison bipolar generators which were installed in 1886 and have been in continuous operation ever since. This installation was the sixth of its kind in the United States. Although the machines are operating practically as well as the day they were installed, they will soon be replaced by modern transforming apparatus fed from the lines of the Public Service Electric Company of New Jersey. The machines are driven in pairs by two simple horizontal steam engines. Each pair is connected in series to feed a three-wire distributing system.



BIPOLAR GENERATOR INSTALLED IN 1886 AND STILL IN USE

Cleveland Conference on New-Business Methods

Under the energetic chairmanship of Mr. Thomas F. Kelly, of Dayton, the committee on new-business co-operation of the Ohio Electric Light Association held its third public meeting on May 22 at the Hotel Statler, Cleveland. Mr. Kelly presided and Mr. George S. Milner, president of the Electrical League of Cleveland, which gave the recent successful electrical exposition in that city, welcomed the visitors. Mr. Milner spoke of the spirit of co-operation among the electrical men of Cleveland under the leadership of the Cleveland Electric Illuminating Company. Mr. D. L. Gaskill, of Greenville, secretary of the Ohio Light Association, spoke briefly, saying, among other things, that Cleveland is the second city in the United States in electrical development. Mr. Kelly said the work of the committee is intended particularly to benefit the smaller companies. One plan is to employ a new-business promoter to go from one town to another, spending perhaps a month in each, the expense to be borne jointly by the companies benefited.

Business-Getting Campaigns in Cleveland

Mr. M. E. Turner, contract agent of the Cleveland Electric Illuminating Company, described, with the aid of pictures thrown on a screen, the effective new-business campaigns adopted by that company to supplement the regular work of the contract department. There are three of these campaigns, one devoted to the wiring of old houses, one to the wiring of small stores and one to securing large motor business. The wiring campaigns have been notably successful, particularly the house-wiring propaganda. Both newspaper advertising and direct mail advertising are used. In the house-wiring campaign a list of about 6000 prospective customers was secured in the spring of the years 1912, 1913 and 1914. To each of these five pieces of mail matter were sent. At the end of the first year 12 per cent of the houses were wired, which was considered an excellent record. The next year the list was revised to bring it up to 6000 again, and at the end of the second year's campaign 20 per cent of the houses were wired. This year's campaign has just been started, but it is believed that at the end of it 33⅓ per cent of the 6000 prospects will have been secured.

The houses on the list of "prospects" are not picked houses by any means, but are scattered all over the city. They are old houses on the company's lines now using some other form of illuminant than electricity. A flat rate per outlet is charged. The customer receives ten months in which to pay, and a deduction of 15 per cent is applied on lighting bills. The business is turned over to wiring contractors. During the last eight years 9335 old houses have been wired in Cleveland. In the house-wiring campaign printed letters are sent out. There are three series of these, one for householders owning and living in their own homes, one for tenants and one for landlords. These letters vary slightly. With the last one a booklet is sent out entitled "Electric Wiring of Old Houses." This booklet tells householders in simple language how to make up their own wiring estimates, based on the number of outlets. A similar booklet printed in Bohemian illustrates the practicability of electric light for the workingman's home. Newspaper advertisements are run at the same time.

In relation to the wiring of small stores the methods employed are similar, although it is more difficult here to make a flat rate per outlet. However, an average has been figured out. The printed matter in this case consists of a series of booklets or folders rather than letters. These folders are convincingly and concisely written. One of them gives a blank schedule or table which may be filled in by the prospect to show the outlets desired. A booklet entitled "Electric Wiring of Small Stores" is sent.

Special solicitation of large power users was begun on April 8 of this year. The method in this campaign is to print daily-newspaper advertisements in the form of interviews with heads of industrial establishments taking the company's service. First, a map of Cleveland was printed in this series of advertisements. On this map the principal generating stations, substations and distributing lines in the industrial area were indicated. In subsequent advertisements accurate and authorized interviews with prominent industrial customers were printed, the name of the man interviewed and his company being given in each case. Many of these interviews make very interesting reading. Some of the important concerns supplied with electric energy for industrial purposes, and contributing interviews, were the Hydraulic Pressed Steel Company, Perfection Spring Company, Standard Tool Company, Acme Foundry Company, Baker Motor Vehicle Company, General Baking Company, Ferro Machine & Foundry Company, Ohio Clay Company and Cleveland Salt Company. Mr. Turner pointed out the weight carried by these authorized interviews from men well known in the industrial world. A series of carefully written personal typewritten letters is addressed to prospective motor-service customers while this newspaper advertising is being published.

Bureau of Standards and Public Utility Regulation

At a luncheon between sessions Dr. Frank A. Wolff, of the National Bureau of Standards, told of the work of that institution. Among other things, he said that a sub-committee of the national commission on electrolysis is about to leave, or has left, for Europe to study conditions there. An investigation of life hazards incidental to electric transmission is under way. Secretary Redfield of the Department of Commerce has proposed that the Bureau of Standards make a study of the fundamentals underlying public-utility regulation, taking the broad national point of view. This study might serve to bring about the co-operation of states and state public service commissions. Indirectly it might be of service in fixing standards for the qualifications of public utility commissioners.

European Central-Station Practice

Mr. S. E. Doane, of Cleveland, chief engineer of the National Lamp Works of the General Electric Company, gave an illustrated talk on "European Central-Station Practice." One point made by some of the foreign companies which Mr. Doane visited (referring to the desirability of getting very small customers) was that every man who votes for a franchise for an electric-service company is entitled to service at a rate he can afford to pay. The small customer must be financed. In Europe the companies that go after small customers seem to pay satisfactory dividends.

Mr. Doane illustrated and described several of the small and inexpensive flat-rate limiting devices which are used with the small-customer service in many European cities. In the discussion Mr. Kelly, of Dayton, said that a limiting device had been tried in Xenia, Ohio. By using it business was secured which would otherwise have been hard to get. The device has given little or no trouble and seems to be successful in that small city. Mr. Kelly mentioned the fact that in Dayton there is an electric meter to every nine inhabitants. Mr. J. C. Martin, of Wilmington, president of the Ohio Electric Light Association, was introduced and spoke briefly.

Illumination as a Business Getter

Mr. E. B. Rowe, of the Holophane Works of the General Electric Company, Cleveland, gave a talk on "Illumination as a Business Getter." Among other things, Mr. Rowe spoke of the almost spectacular street-car lighting of the Toledo Railways & Light Company. Every car is an advertisement for effective illumination. Another point made by the speaker was that by the use of the new gas-filled lamp it might be possible for contractors doing large jobs of construction work to carry on their operations at night as well as in the daytime. In the discussion Mr. Kelly dwelt on the great opportunity for show-window lighting in small towns. He made the interesting statement, in relation to country-highway lighting, that the Dayton company has completed an installation for lighting a stretch of country road, using thirty 75-watt tungsten lamps. Two other installations of this character are planned. The matter was handled through the township trustees. The people living along the road were required to furnish a certain number of house-lighting contracts in order to get a certain number of lamps for lighting the highway. Mr. E. A. Bechstein, of Sandusky, told about a plan for flat-rate show-window lighting, where the circuits are controlled from the switchboard of the central-station company.

Illumination and Wiring

Fountain Sign

Illustrated herewith is an electric sign advertising one of New York's vaudeville houses and designed to represent water spouting out of a fountain and trickling down the center and each side of the illuminated display board. The sign consists of two panels which can be viewed from any place on the street in the vicinity. Surmounting the display board is an imitation fountain from which water is made to appear to spout by lamps supported on arched streamers. The upper part of each display panel bears the permanent advertising text, while the lower section is devoted to changeable texts telling of the programs given in the theater. The sign and flashing mechanism were furnished by Mortimer Norden, New York.

FOUNTAIN SIGN ON NEW YORK THEATER

Automatic Fuse-Testing Machine

By Herbert G. Dorsey

When it is necessary to determine the quality of a large number of fuses considerable time is consumed if the ordinary method of testing is followed. For example, the National Board of Fire Underwriters in its 1913 edition of rules says "they will carry indefinitely a current 10 per cent greater than that at which they are rated, and at a current 25 per cent greater than the rating they will open the circuit without reaching a temperature which will injure the fuse tube or terminals of the fuse block." As these tests may require for different fuses as much as two hours for each fuse, it is evident that if several similar fuses are to be tested at once it will require no longer time to test all than that necessary for the slowest acting fuse, provided one has the ability to make all the records of time and temperature.

Fig. 1 is a photograph of a testing board which was designed to give records for fifteen fuses. The principle of operation is as follows:

The fifteen fuses being in series, the desired current passes through all of them. If any fuse operates, that fuse holder is short-circuited so that the current continues to flow through the remaining fuses, the circuit being open for only a small fraction of a second. When a fuse is inserted in the circuit a stop-watch begins to operate and continues to record time until the fuse operates. The act of short-circuiting the fuse also stops the watch. Back of each fuse is a thermocouple, and the connections are such that a sliding switch at the left-hand side of the board will connect any thermocouple to the galvanometer, and the temperature of any fuse may be measured.

Details of Construction

Fig. 2 shows a plan of a single-fuse, thermocouple and short-circuiting device. 1 is the fuse cartridge in its terminal clips 2 and 3. 4 is a strip of hard copper ¾ in. wide by 1/16 in. thick so placed that in its normal position it is in contact with 3 and the fuse is short-circuited. When spring 4 is pushed up by handle 6, the circuit opens at 3 and 4, the current flows through the fuse, and at the same time steel part 5 slides past the end of the relay armature 7. This steel piece 5 is only a terminal to 4 to prevent the latter from wearing. Armature 7 then locks spring 4 open and also closes contacts 9 on the relay. By following the diagram of connections in Fig. 3, it will be noticed that the relay coil 8 is shunted across the fuse terminals. If now the fuse operates, the full voltage of the circuit will pass through the relay 8, attracting armature 7, which releases spring 4, short-circuiting the fuse terminals and cutting off the current from the relay. At the same time the armature 7 opens the circuit through the contacts 9 and the watch magnet is no longer energized, thus stopping the watch.

Watches

Fig. 4 shows how low-priced watches were converted into electric stop-watches. The magnet 10 was made of a small U of No. 14 soft iron wire wound with about 200 turns of No. 40 B. & S. gage black-enameled wire. Armature 11 was a small, thin piece of soft iron soldered to a phosphorous-bronze wire 12 which had been hammered flat at point 13 before being soldered to its support 14. This wire was No. 30 B. & S. gage and was bent at right angles over the balance wheel of the watch so that when the magnet is not energized the wire touches the balance wheel, stopping the watch. When the magnet is energized the wire is drawn away from the balance wheel, at the same time giving it a slight motion so that the watch runs as long as its circuit is closed. The thin brass frames holding the magnets and armatures were soldered on the watch plates near the main spring pinion with low fusing solder and the case lids were cut away so that a circular cup could be soldered in. This allows the watch to be closed up with the exception of a small hole in the middle

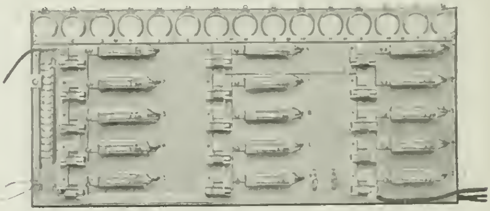


FIG. 1—TESTING BOARD

through which was passed one end of the magnet winding, the other end being grounded on the magnet frame. In a recess cut into the board the watches are held by a screw passing through the ring, which is turned back over the top of the board, and by a long thin brass strip at the bottom, as shown in Fig. 1. This brass strip being in contact with all the watches serves as a common return circuit for all their magnets. These magnets average about 33 ohms each, and the total current required from a single storage cell when all are operating is about 1 amp. The watches are heated only a slight amount by this current. The watches are easily wound and reset by the stems, which project above the board. The second hands can of course be reset only by closing the circuit until the second hand is at zero.

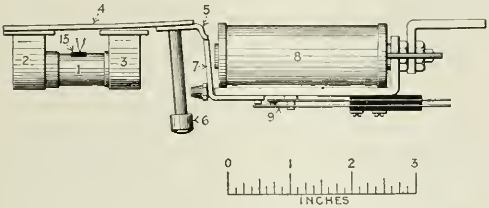


FIG. 2—SINGLE-FUSE, THERMOCOUPLE AND SHORT-CIRCUITING DEVICE

Relays

The relays are regular telephone relays of 500 ohms resistance which open one pair of contacts when the armature is attracted. Being of such high resistance, the current shunted from the fuse is negligible, and when the fuse opens its circuit the relay operates almost instantly on either alternating or direct current. Even with 220 volts, it would be several minutes before they would burn up in case the short-circuiting device should fail.

Thermocouples

The thermocouple back of each fuse was composed of copper and German silver wire, the only reason for using these metals being that they were the most easily obtainable at the time. The two wires were soldered together to a small piece of thin copper about ¼ in. square and were bent in such a manner after they came through the board that this piece of copper rested against the fuse tube. The copper, being bent to the same curvature as the fuse tube, made sufficient contact to attain the temperatures of the tube very quickly and gave readings more reliable than can be obtained through the ordinary mercurial thermometer. All of the German silver wires were led to a common point, which was connected to the copper wire leading to the sliding switch at the left of the board as shown in Fig. 1. The extra wires of the thermocouples were led to the individual contacts of the switch so that as the slider was moved along the square bar which formed its support it in turn made contact with any one of the thermocouples. Of course, the temperature as thus determined is only the difference between the fuse temperature and that of the room, but as the latter was taken as the zero point in calibrating the thermocouples, the indicated temperatures of the fuse would be its actual temperature plus or minus however much the room temperature had varied from its time of calibration. Excepting in cases of extremes of room temperature, this difference is too slight to be of importance in fuse testing.

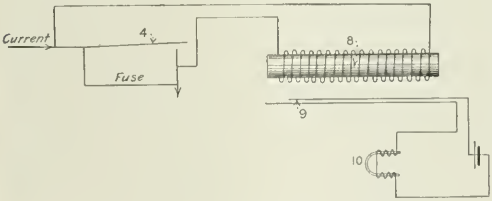


FIG. 3—DIAGRAM OF CONNECTIONS

Results

The operation of this testing outfit has proved very satisfactory during the few months it has been in use. Many hundreds of fuses have been tested and the time saved is very great. After the fuses are inserted, the relays set and the current turned on, it is only necessary then for an assistant to watch the ammeter and regulate the rheostat occasionally when the supply voltage varies to keep the current constant. Whenever a fuse operates its temperature is taken by reading the galvanometer. After all the fuses have operated the times are recorded and a new lot of fuses inserted. If a large number of the same capacity are to be tested as soon as the first one operates, its watch may be reset, a new one inserted, and the process continued until all are tested.

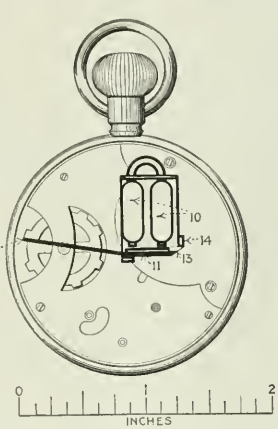


FIG. 4—METHOD OF CONVERTING ORDINARY WATCH INTO ELECTRIC STOP-WATCH

Although this fuse-testing outfit was built for a total of fifteen fuses, it is evident that it could be extended to any reasonable number, or the same idea could be used for two or three fuses if one cared to build it for such a small number.

If larger fuses were to be tested, of course the parts would have to be much heavier in order to stand the greater current, and if many fuses of high amperage-carrying capacity were to be tested, a low voltage would be desirable in order to economize energy. The winding of the relay would have to be of lower resistance so that it would operate on a lower voltage when the fuse burned.

The testing board is mounted at a convenient height and at a safe distance from the wall like a switch panel. Above are mounted large rheostats and below are smaller ones which may be thrown in series or parallel, so that on a 220-volt circuit any current from 1 amp to 50 amp may be obtained. Thus the apparatus is available at any time for fuse testing, and without the fuses the circuit is ready to supply any current up to 50 amp for experimental purposes.

Letter to the Editor

Resistivity on Trial

To the Editors of the Electrical World:

Sirs:—"Resistivity," alias "volume resistivity," alias "mass resistivity," alias "X resistivity," is on trial—or shall we say are on trial? The case against "resistivity" is ably presented in Circular No. 31 of the Bureau of Standards, which should be read by everyone interested in the subject, and when quoting the definitions of resistivity there given it should be clearly understood that this is done merely for the sake of exposition and not in criticism of that most valuable discussion or of its most important features. We are here concerning ourselves with the questions of what resistivity is and whether the term "resistivity" shall stand for a general idea comprehending the so-called volume resistivity and the so-called mass resistivity or whether the term shall be restricted to the meaning of the so-called volume resistivity.

The definitions for resistivity given in Circular No. 31 are descriptive rather than precise. For instance, it is there stated that "Resistivity is definable in the most general way as the resistance of a unit specimen." Such a definition is objectionable, because it is liable to the interpretation that resistivity is a resistance. From this point of view the definition is inaccurate in the same way as it is inaccurate to state that density is the mass of a unit volume, whereas it is preferable to say that density is the mass per unit of volume. Of course density can be measured by the mass of a unit volume just as resistivity can be measured by the resistance of a unit specimen, but there is no necessity for suggesting in the definition that resistivity is a resistance. Further than this, the definition for resistivity above quoted is inadequate, as it is evidently necessary to know more of what is meant by "a unit specimen." The resistance of a unit specimen may be of any value whatever unless the form or configuration of the unit specimen is specified, in addition to having an understanding as to the surfaces between which the resistance is measured.

In another place it is stated that "Resistivity is simply the property of unit *quantity* of a substance." This, of course, cannot be taken as a serious definition of resistivity, for resistivity is a property of the substance itself and is not dependent upon the unit quantity of it, although a unit quantity, when other conditions are given, may be employed for measuring the resistivity.

What then is resistivity? Without attempting a formal definition, the idea of what resistivity is may be approached as follows: The resistance of a circuit depends on the length of the circuit, the cross-sectional area across the circuit, and a certain innate property of the substance composing the circuit. It is this innate resistance-determining property which is generally known as resistivity. Resistivity in this sense is an innate property of the substance which determines the resistance of a circuit, the other determining factors being length and cross-sectional area.

Now, are there any other kinds of resistivity? For instance, instead of selecting length and cross-sectional areas as two of the factors determining the resistance of a circuit, can one select either mass and length or mass and cross-section and consider the remaining resistance-determining factor as a kind of resistivity?

That this might be done in the case of linear circuits of uniform cross-section may be shown as follows:*

For (homogeneous and isotropic) linear conductors of uniform cross-section we have the two fundamental equations

$$R = \rho \frac{l}{s} \qquad (1)$$

$$d = \frac{m}{ls} \qquad (2)$$

ρ being the so-called "volume resistivity" and d the density. If equation (2) be used to eliminate s from equation (1),

$$R = \rho d \frac{l^2}{m} = \delta \frac{l^2}{m} \qquad (3)$$

where δ (or ρd) is the so-called "mass resistivity." Similarly, if equation (2) be used to eliminate l from equation (1),

$$R = \frac{\rho}{d} \frac{m}{s^2} = X \frac{m}{s^2} \qquad (4)$$

where X (or $\frac{\rho}{d}$) is a kind of resistivity to which no name has been given. It is related to a gram mm² standard of a substance in the same way that the volume resistivity is related to the "meter mm²" standard and the mass resistivity is related to the "meter gram standard."

Although there appears to be no demand for a term corresponding to this X resistivity, yet it seems to have a right to exist in much the same way as the term "mass resistivity" is justified. If instead of metallic wires we were accustomed to deal with metallic sheets conducting from face to face, then X resistivity would have suggested itself instead of "mass resistivity."

An inspection of equation (1), (3) and (4) might tempt one to name, for convenience, these three kinds of resistivity respectively: Resistivity (ρ); density resistivity, ($d\rho$); per density resistivity $\frac{\rho}{d}$.

There are a good many reasons why these terms are not satisfactory, but it is helpful, just for the moment, to think of them in that way. It is to be noted that the factor density d, like ρ, is an innate property of the substance itself. Therefore ρ, $d\rho$ and $\frac{\rho}{d}$ are all innate properties of the substance. Also they are all quantities of a kind similar to ρ. (They are all point-functions and of the same type as ρ since d is always a *scalar* point-function.) Therefore there is some justification for classing them under one common term.

Nevertheless, it must be admitted that the use of the term "resistivity," in an extended sense, is unsatisfactory. It would seem preferable to retain the term "resistivity" in its most widely used significance, as referring to "volume resistivity," and invent an entirely new term for "mass resistivity." For instance, it might be termed "resistation," not because that it is a very good term for it, but because it is better to give it almost any distinctive name rather than have confusion introduced by using the well-established term resistivity in an ambiguous sense. The ambiguous use of the term resistivity would compel the use of the cumbrous term "volume resistivity" for a definite idea of frequent occurrence and of wide application which has heretofore been represented by the concise and well-established term "resistivity."

Custom and usage, as an argument against any change for the better, should not have any more consideration than is absolutely necessary, but in the case of resistivity there is but one well-established meaning for the term and there is no sufficient warrant for the meaning to be changed.

Perth Amboy, N. J. Tracy D. Waring.

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*The analogy here given between resistivity in its customary sense and the other two so-called kinds of resistivity breaks down for other forms of circuits. The so-called mass resistivity and X resistivity are of restricted usefulness.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

An Oil Can That Failed to Lubricate

A 100-kw induction regulator had been in uneventful and satisfactory operation on the circuits of a certain Southern power plant for about eight months when suddenly and without warning it burned out When the rotor was removed for inspection, one coil was found badly charred, but attention was attracted by a long worn place which extended part way around the rotor structure. Searching in the dark depths of the stator tank for the cause, a badly mashed oil can was finally brought to light, the can having evidently fallen into the machine while on the erecting floor at the factory. The remains of the oil can bore the initials of its former owner, and the manufacturer when communicated with was able to place the guilt for the accident and promptly furnished the customer with a receipted bill for the repairs to the apparatus.

New System of Battery Charging for Garages

At the recent annual meeting of the Chicago Section of the Electric Vehicle Association Mr. D. M. Simpson, engineer for the Electric Storage Battery Company, gave an illustrated talk descriptive of the new garage system of constant-potential storage-battery charging for lead batteries. By this system the battery is put on charge normally at 2.3 volts per cell without any resistance in the circuit. The current draft is heavy at first, but tapers off automatically, the battery taking energy at all times in proportion to the lead sulphate in its plates. This system, which is spoken of as practically automatic, was referred to by Mr. Simpson as a valuable improvement in the practical operation of charging stations for electric vehicles.

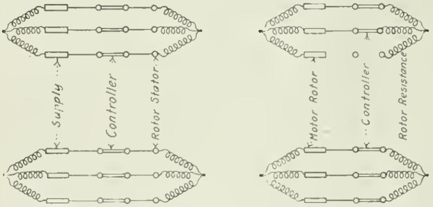
The system is not adapted for use in private garages charging only one or two cars, owing to the high rate of current demand during the first few minutes of the charge. This would increase the maximum-demand charges per kilowatt-hour. However, in garages charging a large number of cars, putting the individual cars on charge at intervals enables the operator to reduce the maximum demand of the plant lower than that required by the old system of charging. This is due mainly to the fact that the few cars put on charge during the earlier part of the evening will be practically charged and taking current at a very low rate about midnight when the greatest number of cars are being charged. Also, those cars coming in the garage after midnight can have the greater part of the charge restored before the usual time for delivery of the car to the customer. In this, as in all other cases, the weekly "equalizing" or "overcharge" must not be omitted.

It is claimed for this system that there is some saving of energy, the amount depending on the character of the plant. It is also said that batteries under this method of charging will have a longer life. This is perhaps to be expected, as by this system excessive gassing is avoided, and without excessive gassing the temperature of a battery in good condition will not, it is said, go more than 15 deg. above the temperature of the room.

In garages using motor-generator sets the desired voltage may be changed by adjusting the field of the generator. Where direct current is obtained from a 110-volt circuit the desired voltage may be obtained by the use of counter cells.

Starting-Torque Control

The torque of a given slip-ring polyphase induction motor depends, among other things, upon how many of the rotor circuits are completed through the brushes and resistor. The starting torque is greatest when all of the rotor circuits are active, the circuits under this condition being said to be balanced. Ordinarily any controller used for operating an induction motor closes the stator circuits on the first marked controller position, as indicated in both Figs. 1 and 2. On the next marked controller position the controller closes the circuit through either two of the rotor coils and corresponding resistors of a three-phase motor or through three of the rotor coils and corresponding resistors, as indicated respectively in Figs. 1 and 2. In the first case the rotor circuits are said to be unbalanced. The balanced connection gives greater starting torque than the unbalanced connection. This fact affords an easy method of increasing or of decreasing starting torque, if the proposed change happens to be in the right direction. An inspector had to decrease the starting torque of a motor that was starting a winding drum too suddenly. At the time of installation everything was stiff; the voltage was normal and the starting impulse was right. It had been gradually increasing both on account of the connected load having limbered up considerably and on account of added service transformers having increased the applied voltage. As it was undesirable to change either the winding gears or the voltage and as all of the rotor resistance available was in use, the inspector changed the resistor wiring from the balanced connection of Fig. 1 to the unbalanced connection of Fig. 2. The change gave about the desired result and had the advantage of being easy to change back again should decrease in the service voltage ever make such a change desirable. In this and in similar cases an open circuit in the rotor is used to advantage, but its effect does not extend beyond the first controller notch. In case of an open circuit due to a fault, however, the effect would be active on all notches and the full torque possibilities of the motor would not be realized.



FIGS. 1 AND 2—WIRING DIAGRAMS

Locating High-Tension Trouble with Exploring Coil

Locating punctured insulators which do not allow sufficient current to flow to trip circuit-breakers, but only enough to demoralize telephone service in a community, is a pastime at which many central-station employees have put in weary hours. Recently, however, the Iowa Railway & Light Company, Cedar Rapids, has discovered that on its delta-connected 33,000-volt system such trouble may be traced by using an exploring coil attached to the ordinary head-type telephone receiver. Proceeding along the line from the power station, the troubleman merely places the coil against each pole, wearing the receiver on his head, and if the pole is noisy then tries the next. In this manner the entire line is patrolled until the troubleman passes a point at which the telephone receiver and the exploring coil detect no sound. This gives the information that the seat of the trouble rests upon the last pole visited. In speaking of the company's experience with the system, Mr. John M. Drabelle, electrical engineer, says that the scheme has been quite successful, enabling the company to trace such insulator failures with much greater speed and surety than with any other method.

Economical Working of Steam Plants

The following extracts from a paper on "Mill Steam Plants" read by Mr. A. G. Hosmer at the ninety-sixth annual meeting of the National Association of Cotton Manufacturers at Boston, Mass., are of interest to central-station operators and power engineers.

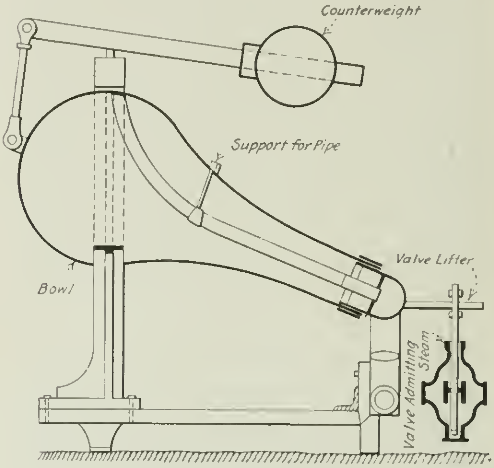
Operating boilers below their rating may be conducive to long life and low repairs, but such practice means the loss of the economies due to high-duty service. In a typical water-tube boiler where additional power was needed in a plant affording no space for more equipment the steam output was more than doubled by the installation of a grate having about twice the area of the original unit. Only a slight drop in efficiency resulted during the maintenance of the intense fires required. Forced or balanced draft is particularly useful in utilizing cheaper grades of fuel, as any intensity of air pressure can be obtained, and in one plant familiar to the author it has proved of great assistance in handling the harder grades of bituminous coal which are burned with difficulty in furnaces having a moderate natural draft.

A boiler operating at 175 lb. pressure, having a temperature of about 380 deg., cannot be exposed to gases cooler than about 400 deg. without losing heat. Temperatures much less than 100 deg. higher than the boiler surface are inadvisable. An economizer is therefore useful in saving heat between boilers and chimney. The idea that a high temperature in the flue is indicative of excessive waste is pretty well dispelled by the efficiency shown by boilers under test with gases leaving them at 600 deg. or 700 deg.

Where pure condensing water is available, a great improvement can be made in a mill plant by installing surface condensers and piping the circulating water directly to the dye house or converting departments. By substituting this water for the usually cold supply, which seldom exceeds 40 deg. in winter, a gain of 70 deg. to 80 deg. in temperature can be realized at once, according to the vacuum required. A warm-water system of this kind supplied by a surface condenser can be drawn upon for feeding the boilers and, on account of the entire absence of oil from the engines, is much superior to the discharge from a jet condenser, which is often used for this purpose. The allowable depth of a furnace which can be successfully fired by hand is about 8 ft. An expert fireman can, by carefully retaining the fresh coal in front of the clear fire while the volatile matter burns away, greatly reduce the amount of smoke.

Remedying Operating Trouble with Steam Trap

A tilting steam trap on the heating system of the Springfield (Ill.) Light, Heat & Power Company formerly gave considerable trouble owing to breaks occurring on the drain elbows and on the drain pipe itself.



TILTING STEAM TRAP

Constant jarring of the long unsupported drain pipe was thought to be the cause of the trouble. Accordingly the bowl was tapped and a supporting member suspended from the shell of the bowl at about the middle of the drain pipe. After the hole which had been bored in the shell was plugged the trap was replaced in operation and since has given no trouble.

Variation of Inductance with Size of Conductor

The inductance of a circuit consisting of two No. 10 wires spaced 18 in. is greater than that of a circuit of No. 1 wires spaced the same distance. What causes this difference if the actual difference in the areas will not account for it? H. M.

The inductance of the circuit of No. 10 wires is greater than that of the No. 1 wires because for any chosen amount of current in the wires a greater number of lines of force is produced between the wires when the diameter is small than is true when the diameter is large. At any given distance from the center of the wire the current in the conductor produces around the conductor a magnetic field which varies in density inversely with the distance from the center of the conductor carrying the current. The flux within the area of the conductor drops off from a relatively high value at the circumference to zero value at the center. When a conductor of small diameter carrying a certain value is substituted for a conductor with large diameter carrying the same total amount of current, the total flux surrounding the current is greater when this current is concentrated in the small conductor than it is when spread out over the large conductor.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Polyphase Commutator Machines for High Speed and Low Frequency.—VERDURAND.—A paper read before the International Society of Electricians in Paris. Polyphase commutator generators yield alternating currents of low frequency at high speeds; for instance, while in order to produce an alternating current of fifty cycles with ordinary alternators the speed must not be over 3000 r.p.m., it is possible to get currents of that frequency from a commutator alternator at speeds of the order of 10,000 r.p.m. Since the weight and size of a machine vary approximately in reverse ratio with the speed, the possibility of using high-frequency machines is of importance. The author shows that the field of commutator generators revolves with a speed which can be regulated simply by modifying the phase of the exciting current. Such generators are self-exciting. When such machines are loaded a variation of frequency is produced which is proportional to the load current and also depends on the power-factor of the circuit; but this factor can be rendered negligible by proper design, at least for normal frequency.—*Bull. Soc. Internat. des Elec.*, March, 1914; *Revue Elec.*, May 15, 1914.

Commutation.—ARTHUR MANDL.—The author discusses the conditions of commutation of a direct-current motor with interpoles at normal speeds. He determines experimentally the air-gap flux below the interpole and shows that if the commutation is to be good there must exist a real flux passing through the air-gap. If the air-gap below the interpole is free from any flux, we have the case of an exact compensation of interpole and armature ampere-turns and the commutation is considerably below normal.—*Elek. u. Masch.* (Vienna), May 10, 1914.

Armature Winding with Two Commutators.—A note on the conditions under which the voltages at the two commutators become equal with reference to a recent paper of Pichelmeyer.—*Elek. u. Masch.* (Vienna), May 17, 1914.

Generation, Transmission and Distribution

Gas Power Plant.—An illustrated article on the electric equipment of the power plant of the Metallurgical company of Pont-à-Vendin. The old equipment comprises three 800-kw generators driven by gas engines operated on coke-oven gases. The company is now erecting eight blast furnaces, each producing 250 tons of pig iron per day, also an open-hearth plant and a Bessemer plant with five converters. For the present only three blast furnaces and three converters will be installed. The new electric-power plant contains five gas engines all driven by blast-furnace gases. Three of them drive generators of 2800 kva each and two alternators of 5600 kva. The pressure is 5000 volts and the frequency fifty cycles.—*La Revue Elec.*, May 15, 1914.

Induction Regulators.—ZEDERBOHM.—The author points out that in order to keep the voltage constant in extended transmission systems rapid regulators must be provided in the power plant, besides induction regulators (drehtransformatoren) at the main feeding points. The principle of the induction regulator, its mechanical construction, the automatic method of voltage regulation, and the maintenance of the regulator are described by means of diagrams and illustrated by examples.—*Elek. Kraftbet. u. Bahnen*, April 14, 1914.

Traction

Mountain Railway.—W. GYAROS.—An illustrated article on the equipment of the Überetscher road near Bozen, in Southern Tyrol, with a 1200-volt direct-current system. The road has considerable grades. Three-phase energy is transmitted at 10,000 volts from the power plant to a substation near the center of the road where direct current at 1200 volts is generated. The equipment of the substation, overhead line, rolling material, etc., is described and illustrated.—*Elek. Kraftbet. u. Bahnen*, April 14, 1914.

Constantinople Street Railway.—An article on the opening in 1913 of the first portion of the electric street railway in Constantinople. The energy is obtained from a combined lighting and traction station in the form of three-phase energy at 9600 volts. This is changed into 600-volt direct current in three substations.—*Elek. Kraftbet. u. Bahnen*, May 14, 1914.

Installations, Systems and Appliances

Electricity Supply in Paris.—According to the former system of electricity supply, Paris was divided into six districts, each of which obtained energy from a station in the district and on a system which as often as not differed from that in the adjoining districts. The systems employed were continuous current of the five-wire type at 440 volts, continuous current of the three-wire type at 220 volts, and continuous current of the two-wire type at 110 volts. There was also the alternating-current system of the single-phase type at 3000 volts with transformers on the consumers' premises, and a two-phase supply, the two last being in the outer districts of the city. In order to develop a unified scheme both engineering and political difficulties had to be overcome. It is now fairly certain that all the energy necessary for present and immediate future requirements of the city will shortly be obtained entirely from two large stations which have been erected on the outskirts of Paris by the Compagnie Parisienne de Distribution d'Electricité. This company was formed by a decree of the City Council in 1907, and on Jan. 1, 1914, took over the existing undertakings, paying the old companies for their generating plant and such equipment as did not revert to the municipality. The municipality obtained the mains free of charge in accordance with the terms of the old concessions. The company's concession is for twenty-seven years and expires in 1940. The company pays a royalty of $4 per km ($6.67 per mile) of street where the mains are laid. It pays rent for the old generating stations and mains, this rent being reckoned at 10 per cent on the gross receipts, depending on the amounts by which the annual gross receipts exceed those for 1908. A proportion of the surplus profits, after paying all charges, including dividends, is payable to the city on a sliding scale which is based on the amount of dividends paid.

The municipality also obtains its energy at a rebate of from 30 to 35 per cent. The consumers are protected by a tariff fixed by the terms of the concession. This specifies that the maximum price is 10 cents per kw-hr. for lighting and 6 cents for motor service plus rentals for meters and internal-service lines. This tariff is subject to revision at the end of the first three years, or at any time thereafter if the cost of production is considerably reduced by the discovery of some new process. At the expiration of the term of concession in 1940 the whole of the plant and works becomes the property of the city free of charge, while the city has power to terminate the agreement in 1924 or thereafter on certain terms. The new stations will generate two-phase currents at 12,300 volts and a frequency of forty-two, and will supply energy to a number of substations in various quarters of Paris. Of the two new generating stations, one (the Nord) has been erected at St. Ouen and the other (the Sud-Ouest) at Issy-les-Moulineaux. The total rating of these two stations is 150,000 kw, while the connected load in Paris in 1912 was 226,890 kw, the kilowatt-hours sold during that year being 76,461,411. The average price obtained was 11 cents per kw-hr. The Nord station has been designed for an ultimate rating of 150,000 kw, though at present only eight turbo-alternator groups are installed, each with a rating of from 10,000 kw to 15,000 kw. The article is to be concluded.—London *Electrician*, May 8, 1914.

Wires, Wiring and Conduits

Wiring Rules.—The conclusion of the new set of rules of the German Association of Electrical Engineers for wiring material, such as fittings, plugs, fuses, hand-lamps, etc.—*Elek. Zeit.*, May 7, 1914.

Insulators.—An illustrated article on recent advances in the principles of design of insulators.—*La Revue Elec.*, May 1, 1914.

Electrochemistry and Batteries

Electric Furnaces.—E. F. Northrup.—An illustrated article in which the author expresses the opinion that in order to obtain the highest temperatures in an electric furnace the use of a vacuum furnace is a step in the wrong direction, and that it would be better to aim at obtaining a furnace in which the pressure might be made very great and the atmosphere made absolutely inert by electrically heating comparatively large masses of graphite to a moderate temperature. One may then obtain the desired maximum temperature by a rapid input of a large amount of energy in a small and centrally located resistor unit. The object is obtained by the author by the use of a cascade adjustment to his electric graphite furnace. This device easily melts tungsten and gives a temperature, without perceptible depreciation of the graphite resistor unit used, which certainly exceeds 3000 deg. C. It is placed in and fills the chamber of the high-temperature graphite furnace. The large furnace is first brought to a temperature of approximately 1600 deg. C., and then by means of a switch the energy (obtained from the same transformer) is transferred to the heating element of the device. This heating element is a slotted tube of regraphitized Acheson graphite. The internal chamber, which acquires a perfect black-body temperature, exceeding 3000 deg. C (or less if desired), is 15 cm. As the temperature is produced in steps falling from a maximum temperature in the inner chamber to a lower temperature in the furnace chamber (into which the device is readily fitted or removed), the author calls it a "cascade" attachment. The arrangement of the furnace is described and some results obtained with it are given.—*Met. and Chem. Eng'ing*, May, 1914.

Welding.—T. T. Heaton.—A paper read before the British Institution of Mechanical Engineers on some modern methods of welding. The author first discusses electric welding systems, namely, the Benardos arc-welding system, the Strohmenger-Slaughter system and the Thomson-Houston contact-welding system. He then takes up acetylene welding and compares it with electric welding.—London *Electrician*, May 15, 1914.

Thermo-Galvanometer.—A note on a recent (British) Physical Society paper on a new type of thermo-galvanometer. The puff of air from an orifice in an air chamber when the air within is suddenly heated is utilized in this instrument to deflect a small suspended vane. The current to be measured is made or broken through a heater of small thermal capacity in the air chamber, and the outrush or inrush of air through the orifice delivers an impulse to the vane. The disturbing effects of extraneous heat and pulsations of external pressure are eliminated by a compensation method. In one instrument of this type the sensibility was 4 mm per microwatt and the extremity of the throw of the vane was attained in two seconds.—London *Electrician*, May 1, 1914.

Telegraphy, Telephony and Signals

Submarine Cable Circuits.—An article on experiments made to obtain a greater output from the telegraph and telephone submarine cables connecting England with Ireland and Continental Europe. Disturbances in submarine telegraph cables due to stray currents, etc., have been one of the chief difficulties in connection with successful cable telegraphy. The disturbance is very much more marked when the submarine cable contains more than one circuit, because any change of current in one circuit obviously induces a current in each of the neighboring circuits, with the result that the sensitivity of the receiving apparatus has to be reduced sufficiently to avoid the effects of these induced currents. Speaking generally, this reduction in sensitivity reduces the working speed to about half of what it should be. With the view to avoiding this reduction of speed in working, experiments are being made with metallic-circuit working and superposed circuits, as indicated in Fig. 1. This represents a four-wire cable and shows how four circuits entirely free from inductance disturbance from each other can be obtained. Circuits 1 and 2 work on ordinary metallic loops; circuit 3 is superposed on circuits 1 and 2; circuit 4 is superposed on circuit 3. There are thus three loop circuits and one earthed circuit. The latter, although the equivalent of a single-wire circuit, is not subject to any inductive disturbance from the other three. It is well known that a loaded cable can be constructed, either on the coil or continuously loaded principle, to give three independent double-wire telephone channels in a four-wire cable. The interesting point about the experiments which are now being carried out, however, is the extension of the principle so as to obtain a fourth independent loaded circuit in such a cable. Fig. 2 shows

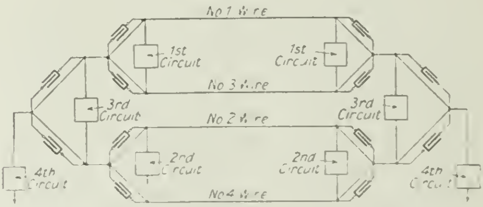


FIG. 1—WIRING DIAGRAM

two ways of achieving this object. The diagram represents a four-wire coil-loaded telephone cable. Circuits *AA*, *BB* and *CC* are worked on the usual phantom scheme and are loaded in the regular manner. Circuit *DD* is obtained by working in parallel through all the four wires. If the phantom coil combination at each loading point consists of two separate loading coils (one coil in each pair of wires and two windings on each coil), then all the windings in circuit *DD* will be inductive as well as in *AA*, *BB* and *CC*, and therefore the four circuits will be loaded. The scheme also applies to a continuously loaded cable. As an alternative to tapping off the earth circuit at 4, the arrangement shown in dotted lines may be adopted for this circuit, *E* and *E* being inductive impedances in series from 1 to 2, but non-inductive in parallel from 3. If this latter method be adopted, the transformers in circuit *C* may theoretically be dispensed with, but there is an advantage in retaining them for practical reasons. Experiments on a coil-loaded cable between England and Ireland and a continuously loaded cable between England and France have given excellent results, and telephone circuits are now working on this system.—London *Electrician*, May 8, 1914.

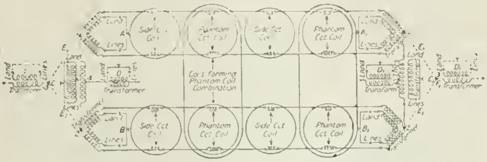


FIG. 2—WIRING DIAGRAM

Long-Distance Telephony.—E. F. PETRITSCH.—A report of a lecture giving a review of the problems of telephony over long distances with special reference to the loading of telephone lines and to the use of telephone relays.—*Elek. u. Masch.* (Vienna), May 10 and 17, 1914.

Wave Detectors.—P. R. COURSEY.—In the case of the oscillation valve detectors invented by Mr. J. A. Fleming, if the second differential of the characteristic or volt-ampere curve is plotted, it bears a considerable resemblance to the curve of sensitiveness of the valve to wireless signals. The tests described in this article were undertaken with a view to finding out whether any similar relation could be traced in other detectors than the valves, such as the crystal receivers so commonly employed in the wireless stations of to-day. The detectors examined in this manner were: Carborundum, electrolytis, galena, molybdenite, "Perikon" (zincite-chalcopyrite), tellurium-aluminum, zincite-bornite and others. In the majority of cases the second differential of the characteristic gives a good indication of the sensitiveness of the detector, as in the case of the oscillation valve, but some detectors, notably the galena and electrolytic, seem to show that there are other actions at work which may oppose the one depending on the curvature of the characteristic. Since this also occurs with one of the electrolytic detectors, it perhaps points out that this other action may be electrolytic in nature.—London *Electrician,* May 8, 1914.

Wireless Telegraphy.—P. BOUVIER.—A mathematical article in which the author describes a method for calculating wireless-telegraph stations in which the phenomenon of primary resonance is utilized. Practical tables permit carrying out quickly the numerical calculations. Some numerical examples are added to the article to aid in making the method clear.—*La Lumière Elec.,* April 4, 1914.

Book Reviews

WORK, WAGES AND PROFITS. By H. L. Gantt. New York: The Engineering Magazine Company. 312 pages, 27 illus. Second edition. Price, $2.

The author's experience as consulting engineer to numerous large manufacturing organizations lends this little treatise a particular interest. The book is full of intelligent comments, emphasizing the tendency to waste and improvidence, and its value lies to no small extent in an appreciation of economic conditions and facts which a theoretical author could never have possessed.

INVESTIGATING AN INDUSTRY. By William Kent. New York: John Wiley & Sons, Inc. 126 pages. Price, $1.

Mr. William Kent's book attempts to deal with a diagnosis of the diseases of management. It is prefaced by a very able introduction, written by Mr. Henry L. Gantt, which may be summed up as saying that recognition by a board of directors of the mistakes in management is usually not made until the returns have become unsatisfactory, and when this state of affairs has been attained it is radical and revolutionary steps which appeal to a board of directors, rather than the conservative elimination of weak places by a slow process. It is the old story of the two extremes to which human nature is prone. The great fault of all books which attempt to tell the manufacturer why he is unsuccessful lies in the fact that he, perhaps, is aware of the reasons, but that the human factor with which he has to deal does not often give him the opportunity to avoid his difficulties. Mr. Kent's little book is interesting as an essay on a much-talked-of subject.

WORKMEN'S COMPENSATION AND INDUSTRIAL INSURANCE UNDER MODERN CONDITIONS. By James Harrington Boyd. Indianapolis: The Bobbs-Merrill Company. Two vols., 1622 pages. Price, $9 for set.

This valuable work deals judiciously with the operation of legislative measures in the different states of the Union in regard to the compensation of workmen and industrial insurance. The first five chapters deal with the distinctions between the common law, employers' liability laws, workmen's industrial insurance laws and workmen's compensation laws relating to the compensation of workmen injured in the course of their employment. A historical review of the development of workmen's industrial insurance and compensation laws is then given, followed by a description of the German plan. Compulsory industrial insurance as practised in Germany is submitted for review. The remaining chapters deal with foreign compensation laws, with the Washington workmen's insurance act, the Ohio workmen's insurance act, and the compensation acts of Wisconsin, New Jersey, California, Nevada, Kansas, New Hampshire and Massachusetts. In the second volume the compensation acts of Illinois, Michigan, Rhode Island, Arizona and Maryland and the federal compensation act are treated of. In Chapter XXV problems common to the various American statutes and statutory definitions of workmen are discussed. Chapter XXVII deals with injuries for which compensation is allowed, and later chapters deal with the amount of compensation. The concluding chapters of this volume deal with the British workmen's compensation and national insurance act of 1911 and the German workmen's insurance code of July 19, 1911. The book is a very thorough compilation and should prove of great value on the shelves of every corporation officer or lawyer.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Lighting System in Hotel Dining Room

Both direct and indirect lighting are being used in the illumination of the dining room of the Bellevue-Stratford Hotel, Philadelphia, which is called the "palm" room. Straight-filament tungsten lamps placed in the coves provide the indirect illumination. Direct light is also obtained from the candelabra shown mounted on the tall upright stands. The brilliancy of the latter lighting is toned down by means of soft-brown-silk shades. The object of combining the subdued direct illumination with the indirect, it is said, is to relieve the impression of coldness which is sometimes encountered in indirect lighting and to rest the eyes with the soft color effect obtained.

PALM ROOM, BELLEVUE-STRATFORD HOTEL

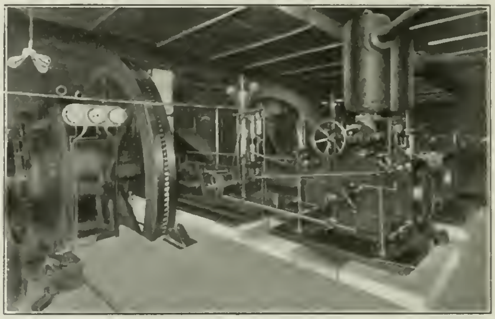
The straight-filament lamps used in the installation are known as the "J-M Linolite" and were manufactured by the I. P. Frink Company, New York. The H. W. Johns-Manville Company, New York, installed these lamps.

Corliss Engine Installation in Lytton Building, Chicago

In the plant of the Lytton Building, Chicago, the main engines are two Nordberg 19-in. by 32-in. by 42-in. cross-compound Corliss engines, driving 400-kw Crocker-Wheeler direct-current generators. These units are shown in the accompanying illustration.

The governors used on the engines are of the inverted, weighted, isochronous type. The governor is driven by pulley and belt through gears which run in oil. The safety device consists of a latch supporting the fulcrum of the counterpoise levers. When the belt idler drops, this latch is released and the dead weight pulling the fulcrum of the lever down moves the knock-off cams into position of zero cut-off. Connection from the governor to the knock-off cams is through a parallel motion.

The engines are equipped with long-stroke gear in which oscillating slotted cams, shown in the illustration, are used instead of the customary stationary cams. These cams have two concentric circular slots of different radius joined by a transition slot. When the roller of the hook is in one of the cam slots the valve is released. The whole mechanism is oscillated from the wrist plate by the customary valve arm and the cams receive a second oscillating motion from a small knock-off eccentric on the engine shaft. The point of cut-off is controlled from the governor by changing the center of oscillation of the cams, thus changing the time of the stroke when the roller passes through the transition slot. This long-stroke valve gear is designed to reimburse the flywheel with energy by taking steam for full stroke until full control is obtained by the governor.



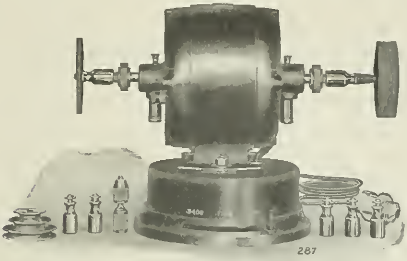
CORLISS ENGINES IN LYTTON BUILDING, CHICAGO

The low-pressure cylinder of the engines is fitted with long-range gear, which is oscillated by a knock-off eccentric similar to that used on the high-pressure cylinder. The connection from the governor crosses beneath the engine and changes the position of one side of the oscillating parallelogram and of the cut-off of the low-pressure valves through an adjustable range of the high-pressure cut-off. The electrical equipment of the Lytton Building was described in the *Electrical World*, July 5, 1913.

Alternating-Current Dental-Lathe Motor

An alternating-current motor designed to operate small lathes for dental and similar service is being placed on the market by the Robbins & Myers Company, Springfield, Ohio. The motor is rated at 1 6 hp and is built for operation with sixty-cycle current at 110 volts or 220 volts. A speed-changing device in the base gives speeds of 1750 r.p.m. and 3400 r.p.m. The motor will also operate on fifty-cycle circuits at speeds of 1400 r.p.m. and 2900 r.p.m. The end heads of the motor are solid and completely inclose the motor, protecting the working parts from dirt. The rotor is of the clutchless type. The starting winding is cut out automatically when the motor comes up to speed.

The following special attachments are used with each motor: 10 ft. of black reinforced cord and a plug for attaching the motor to a lamp socket; a right-hand tapered chuck for the buffing wheel; right-hand and left-hand chucks for grinding wheels with 0.3125-in. hubs; a thirty-ply buffing wheel, 3 in. in diameter; a carborundum wheel, 3 in. in diameter, with a 0.25-in. face and a 0.3125-in. bore; a brush wheel, 3 in. in diameter, and a three-step V-grooved pulley with pitch diameters of 1.4375 in., 1.9375 in. and 2.375 in. for a 0.3125-in. round belt. A set of Ritter chucks may also be used if desired. This set consists of three right-hand and three left-hand flange chucks for the grinding wheel with hub diameters of 0.25 in., 0.3125 in. and 0.375 in.; a left-hand taper-threaded chuck for buffing wheels, and an adjustable chuck for drills, burrs, etc.



DENTAL-LATHE MOTOR

Cable Clamps with Long Service Record

The cable clamps shown in the accompanying illustrations are part of an installation of 500 clamps made during the year 1909-10 for the Union Railway, New York. Since that time no outlays have been made for maintenance.

In Fig. 1 is shown an installation at Boston Road and Hoe Avenue which is of interest on account of the vertical arrangement of cables on poles. The cable is 500,000 circ. mil in size. The insulation is partly removed from the conductors as shown in the left of the illustration, this being brought about by the fact that when the pole was replaced in 1910 it was not possible to put it exactly in the same place as the original pole. No maintenance charges have been made on these clamps. The bolts and clamps have not rusted, as galvanized clamps were used.

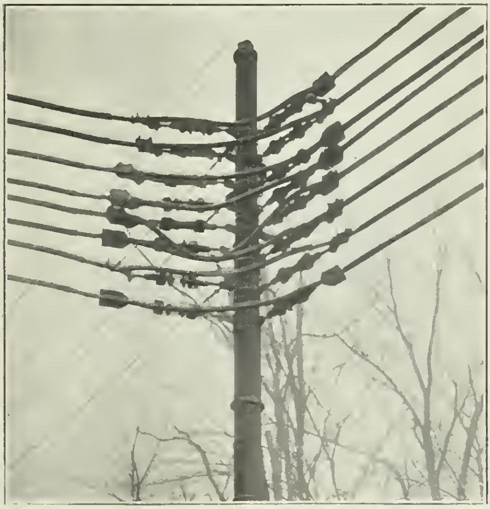


FIG. 1—CLAMPS HOLDING VERTICAL CABLES

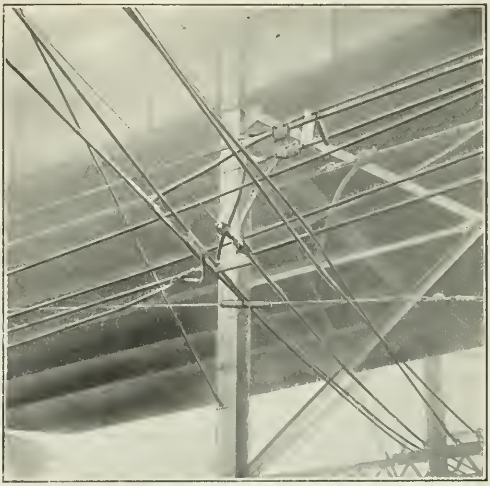
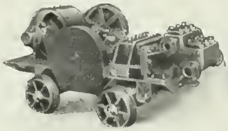


FIG. 2—CORNER TURN OF CABLE

A corner turn of 500,000-circ. mil cable made in the air by means of cable clamps is shown in Fig. 2. Owing to the length of the span, which is 170 ft., it is almost impossible to pull the cables taut enough to separate them, and it was on this account that the wooden block shown was used. This installation was considered temporary, although it has served its purpose well up to date, and the holding power of the clamps has apparently been unimpaired. The clamps used in these installations were manufactured by W. N. Matthews & Brother, St. Louis, Mo.

Portable Mine Pump

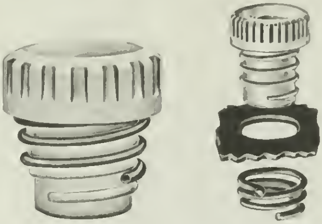
A 4-in. by 6-in. portable triplex electric pump is being placed on the market by the Goulds Manufacturing Company, Seneca Falls, N. Y. This pump is of the outside-guided type. It is so made that suction or discharge can be taken from either side. The machine has an output of 65 gal. per minute and is designed to pump against elevations up to 500 ft. The truck upon which this pump is mounted is constructed entirely of iron and is fitted with adjustable axles which can be used on any gage of track. All working parts of the pump are thoroughly covered by guards to protect them from grit and falling rocks and to prevent injury to the life and limbs of the workmen. No part of the pump or motor projects below the truck platform, and therefore there is no danger of any part catching in débris between the tracks.



PORTABLE ELECTRIC MINE PUMP

Bushings for Outlet Boxes

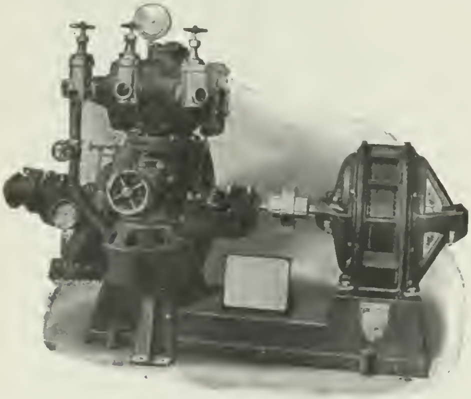
The wire-insulating bushings for outlet boxes and cabinetwork shown in the illustrations are being placed on the market by the Multi Refillable Fuse Company, 723 Fulton Street, Chicago. These bushings consist of threaded porcelain bodies made in sizes to fit standard steel-box knockouts, and are clamped securely in place by the threading on the helical spring which engages the threads of the porcelain.


INSULATING BUSHINGS FOR OUTLET BOXES AND CABINET-WORK

These bushings, the manufacturers claim, will not work loose under continued vibration because of the resiliency of the spring, which relieves the direct jar on the porcelain. The coil springs are tempered and oxidized, so that they will not be affected by rusting. The small prong shown on the inner side of the coil facilitates the removal of the spring when it is desired to withdraw the bushing.

Centrifugal Fire Pump

Among some of the characteristics said to be desirable in a small fire pump are large capacity for the floor space required, small weight, low first cost, simplicity of construction and operation, ability to maintain a steady pressure at the discharge, and adaptability for direct connection to electric motors or steam turbines.


TWO-STAGE CENTRIFUGAL FIRE PUMP

The two-stage centrifugal fire pump illustrated herewith has, according to the manufacturer—the Gould Manufacturing Company, of Seneca Falls, N. Y.—all these advantages. The pump has a lifting capacity of 750 gal. per minute and is designed to maintain a pressure of 100 lb. per sq. in.

The casing of this pump is made of close-grained cast iron and is uniform in thickness. It consists of two castings only, and it is horizontally divided on a plane passing through the center of the shaft. Both suction and discharge nozzles are cast integral with the lower half. The upper and lower halves of the casing are bolted together and are maintained in accurate alignment by means of taper dowel pins. By removing the upper half the impellers and shaft as well as the water passages of the pump are entirely exposed. This permits the pump to be inspected or dismantled without breaking either the discharge or suction-pipe connections. The impellers are of the inclosed type and are made of phosphor bronze. A heavy bedplate of cast iron is provided for supporting the pump and the driving unit. This bedplate is heavily beaded at the bottom and is fitted with lugs for anchor bolts. The coupling between the pump and driving unit is of the flexible type. This coupling is so designed that the pump shaft may be removed without disturbing the position or alignment of the driving unit.

Electric Vacuum Cleaner

The vacuum cleaner shown in the accompanying illustration is being placed on the market by the Sterling Machine & Stamping Company, Wellington, Ohio. In order to bring the price of this machine down to a low figure, the construction has been made simple, and instead of aluminum castings used in other machines put out by the above company steel stampings have been used wherever possible. The shoe is 12 in. long and is equipped with a revolving brush which picks up ravelings and lint. The suction is direct, there being no metal between the carpet and the fan. The fan is of aluminum cast in one piece. The switch is attached to the handle, and a quarter turn to the right starts or stops the motor. The dust collector is made of a dust-proof fabric which can be laundered when soiled. This collector is attached to the machine with an air-tight connection. The shoe is fitted with four small wheels. The cleaner is only 6 in. high and weighs 8 lb.

ELECTRIC SUCTION CLEANER

Single-Unit Post for Incandescent Lamp

The ornamental lamp-post illustrated herewith is for use with nitrogen-filled tungsten lamps. The lamp is inclosed in a large outer globe. Air passes through ventilation holes in the globe holder, then goes upward around the lamp socket and lamp and out through holes in the top ventilator. These holes are protected with perforated metal which keeps the insects out. The ventilator is so designed that most of the light rays in the vertical direction are reflected downward, only enough being thrown above the lamp to light the façades of buildings. Most of the light is thrown below the lamp, where it is required in lighting the sidewalks and streets. Either 750-watt or 1000-watt multiple lamps or any of the types of series street lamps may be used.

The base of the post is 16 in. in diameter and 17 in. high. The height of the post to the bottom of the 16-in. globe is 10 ft., and to the top of the ventilator 11 ft. 10 in. This post is of cast iron. The ornamental post and the ventilator described are being manufactured by the George Cutter Company, South Bend, Ind.

Electric Dishwasher

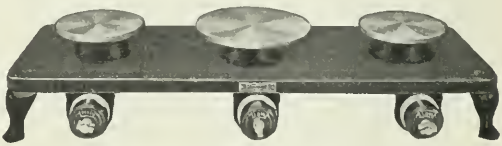
In the electric dishwasher illustrated herewith dishes, glasses and silverware are cleansed by water played upon them under pressure from a center cylinder and circulated by means of a motor-driven centrifugal pump. The dishes do not move, and as the pressure of approximately 6 lb. per square inch maintained is insufficient to shift the dishes in the racks made to hold them, all danger of breaking, the manufacturers claim, is eliminated. Only six quarts of hot water are required for washing one lot of dishes. This water is circulated over the dishes at the rate of 30 gal. per minute.

The machine consists of a nickel-plated copper tank in which racks containing the dishes are set and beneath which on a platform supported by legs are placed a directly coupled centrifugal pump and a 0.25-hp motor. The pump operates at 3600 r.p.m. The pump discharges the water into a cylinder which threads into a flange on the pump. This cylinder is 18 in. high and has many holes which are staggered and through which the water is distributed to all parts of the tank. The intake for the pump is directly alongside the cylinder, and the water draining from the dishes returns to the pump through a screen which is held in place by the pump suction and which removes all food particles before the water is again returned to the dishes. The machine is designed so that the water may be introduced from the top by means of a water receptacle or hose, but it is most efficient when directly connected to a hot water main and a drain. When no permanent connection is desired this washer is equipped with casters. The weight of the apparatus complete is approximately 100 lb.; its over-all height is 34 in. and its diameter 24 in. This machine is being made by the Electric Dishwasher Company, 40 Pearl Street, Buffalo, N. Y.

ELECTRIC DISHWASHER

Electric Disk Heater

The disk heater shown herewith is made in two-stove and three-stove combinations, using 6-in., 7-in. or 8-in. disks. It is equipped with a lock-on device by means of which the utensils are locked to the stove, thus insuring perfect contact and obviating waste of heat between the stove and the utensil. The construction is rugged, and the method of mounting the disks on the frame is designed to prevent the waste of heat by conduction. All the heat, therefore, goes into the cooking, the frame remaining cool. All parts are easily accessible for cleaning. The wires and connections are protected from accidental interference by a special type of stove mounting. Each stove is regulated by a three-heat snap switch. This device is being placed on the market by the Simplex Electric Heating Company, Cambridge, Mass.



THREE-STOVE ELECTRIC DISK HEATER

Portable Loading Device

A portable loading device for meter testing, consisting essentially of a constant-potential transformer with low-voltage secondary and resistors connected in the secondary circuit, is being manufactured by the States Company, Hartford, Conn. The transformer is built for connection to any circuit of ordinary voltage, the primary being wound in sections for multiple or series connection so that the same load may be used on circuits of different voltages. The transformer being of the constant-potential type and having no resistance in series with the primary, the core magnetization is constant at all loads and abnormal wave-forms are thus avoided. The control is by means of the resistors connected to the secondary of the transformer. The resistance is of a value determined by the current desired, and each resistor is connected in circuit by means of a single-pole knife switch. When in use the resistors are in multiple so that the current may be adjusted to its desired value by using the switches selectively.

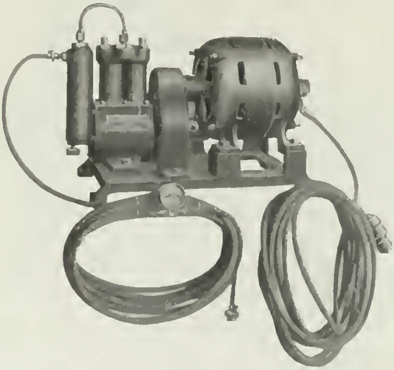
The value of the current at any time may be found by taking the sum of the numbers marked on the switches closed. This amount will vary slightly owing to potential drop in the leads, contacts and instrument windings, but with reasonable care in making connections it may be relied upon as sufficiently approximate for the purpose of testing watt-hour meters when a rotating standard is employed. When an indicating wattmeter is used as a standard the load can be closely adjusted. The load steps are by 0.25-amp increments from 0.25 amp to the full rated output of the transformer.

PORTABLE LOADING DEVICE FOR METER TESTING

The secondary current when testing all forms of commercial watt-hour meters is substantially in time-phase with the emf impressed on the shunt windings of the instruments, the conditions being equivalent to those obtained with an actual load with a power-factor greater than 97 per cent. Many watt-hour meters are used in connection with series and shunt instrument transformers for measuring energy at high voltages. With the 5-amp apparatus shown herewith, these meters, the manufacturers claim, can be tested in service position by connecting the load to the shunt transformer and testing as a 5-amp meter, provided the shunt transformer has a rating of 50 watts or more.

Pump for Inflating Automobile Tires

The equipment illustrated herewith is used for inflating automobile tires. It consists of a two-cylinder pump and a small electric motor which are mounted on a frame. Twenty feet of reinforced-rubber air hose with pressure gage attached and 20 ft. of lamp cord with plug are furnished with this apparatus. No tank is required. The operation is simple, consisting of attaching the end of the hose to the tire valve, turning on the switch and then turning it off again when the gage shows that the desired pressure has been obtained. It is claimed by the manufacturers that this master garage pump, as it is called, will completely inflate a 37-in. by 5-in. tire to 90-lb. pressure in less than three minutes. No rubber packing rings are used and the delivery of pure air entirely free from oil is said to be insured.



MOTOR-DRIVEN PUMP FOR INFLATING AUTOMOBILE TIRES

This pump is being made by the Hartford Machine Screw Company, Hartford, Conn. It is operated by a General Electric motor.

Brass-Shell Sockets

Brass-shell sockets equipped with automatic locking rings are being made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. These sockets are rated at 660 watts for 250-volt circuits. The automatic locking ring is designed to replace the iron set screw hitherto used for securing the socket to the fixture. This locking ring, the manufacturers claim, makes it possible to attach the sockets securely on fixture nozzles even when socket covers or husks are used. The cap is made of heavy brass. The fiber insulation for the cap is attached to the porcelain body. Two locking nibs are provided on the cap and they engage with slots in the brass shell. These nibs extend inward; the possibility, therefore, of mutilating and destroying these nibs when buffing the cap is said to be small. A cord grip is provided for use with the pendent sockets. This cord grip does not require any threading through or twisting of the conductors. The conductor terminals are secured to the binding screws, which are placed far down on the socket and are upset so that they cannot be lost. Push-button operation is used with the pendent sockets.

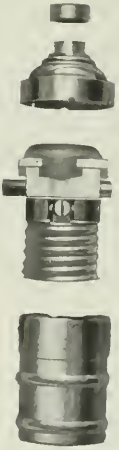


FIG. 1 — EXPLODED VIEW OF PUSH-BUTTON BRASS-SHELL SOCKET

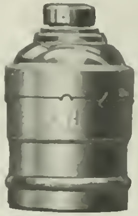


FIG. 2 — KEYLESS ELECTROLIER SOCKET

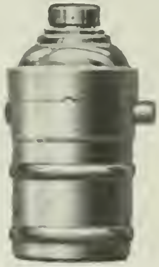


FIG. 3—PUSH-BUTTON BRASS-SHELL SOCKET

These brass-shell sockets have been approved by the National Board of Fire Underwriters.

Jobber, Dealer and Contractor

Sign Showing Emblem of Electrical Development Society

The accompanying illustration shows how the Electrical Construction & Machinery Company, of Rock Island, Ill., has made use of the emblem of the Society for Electrical Development to advantage. The sign is 24 in. by 30 in. and is made of copper. It faces both streets and back of it are four 25-watt lamps which burn from dusk until 10.30 each night. The society is naturally anxious that its members shall make the widest use of the emblem, and certainly the Electrical Construction & Machinery Company, of Rock Island, has set an excellent example.

HOW AN ILLINOIS COMPANY MAKES USE OF THE EMBLEM OF THE ELECTRICAL DEVELOPMENT SOCIETY

Contractors Co-operate in Electric Show at Tulsa, Okla.

The Public Service Company of Oklahoma, in conjunction with four representative contractors and dealers of Tulsa, recently conducted the first electric show ever attempted in the State. The dealers and contractors co-operating were the Deshon-Davidson Company, the Dodge Electric Company, the Tulsa Electric & Construction Company and the Electric Supply Company.

Using the grill room of the Hotel Tulsa as the scene of the display, booths were fitted up for each dealer, two being occupied by the exhibits of the central-station company. Very little newspaper or other advertising was done, but announcements and printed invitations were sent to all present and prospective residential lighting customers of the Public Service Company in Tulsa. Ten thousand persons accepted these invitations, and most of them stayed long enough to enjoy the electrically cooked dainties served by eight young ladies, members of the department of domestic science in the Tulsa High School.

Of the two booths occupied by the central-station company, one represented a modern kitchen equipped with an electric fireless cooker, electric lamps and baseboard receptacles for fans and irons. The other booth was labeled "The Old Way," and the antiquated methods of kitchen work were typified by an old wood stove, kerosene lamps and palm-leaf fans.

Mr. J. L. Ferry, new-business manager of the Tulsa company, reports that the show was a huge success in every sense. Many sales were made outright and numerous others resulted in the week following the close of the exhibition.

Co-operation Between Indianapolis Supply Men and Central Station

An arrangement by which the Merchants' Heat & Light Company of Indianapolis becomes the sponsor for practically all of the larger electrical appliance houses in that city has just been made public with the establishment of a showroom for all types of electrical household supplies in the downtown offices of the Merchants' company on South Meridian Street. To six of the larger electrical supply houses in the city show space has been given in the office of the Merchants' company, through which all consumers supplied by that company are required to pass to pay their bills or to make new contracts. Practical demonstrations of the use of each appliance are being given daily, and the exhibit is to be continued indefinitely.

Already unusually large sales records have been built up by the companies through this arrangement. Electric sweepers, washing machines, stoves, heaters, hotplates, fans, percolators, toasters, ovens, chafing dishes and many other types of electrical devices are on exhibition, and there is a constant display of warm fudges, biscuits, rolls, bread, cake and many other delicacies, cooked on electrical devices, to tempt the customer of the electric company.

Each of the six companies has the outside display windows of the electrical company for a week, in rotation, and the most attractive features of their inside display are placed in this window.

Officials of the Merchants' company, in explaining their purpose in thus stimulating the trade in these electrical appliances, said they had held many conferences with local supply houses and the net result of these conferences had been that a campaign of "electrically educating" the people of the city had been undertaken. Education as to the low costs and high values of the electric fan in the home, for instance, is to be one feature of the campaign, the management of the electric company said; and, of course, every new appliance purchased brings new consumption onto the books of the electric company. The officials of that company say they will continue their co-operation with the electrical supply houses indefinitely.

The local houses, some representing foreign companies, which already have joined with the electrical company in the novel co-operative scheme follow: Varney Electric Supply Company, Western Electric Company, Sanborn Electric Company, Indianapolis Electric Supply Company, F. H. Cheyne Electric Company and Hatfield Electric Company.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Electric Plant Damaged Slightly by Fire.—The plant of the Apple Electric Company, Dayton, Ohio, was damaged slightly by fire recently. The operation of the plant was not interfered with to any great extent, and shipments have been made regularly since the fire occurred.

Reservations for Pittsburgh Chamber of Commerce Trade Tour.—Among the firms having engaged reservations for the Pittsburgh Chamber of Commerce annual trade tour are the Doubleday-Hill Electric Company, the Westinghouse Electric & Manufacturing Company and the Western Union Telegraph Company.

Orders for Gas-Electric Motor Cars.—The General Electric Company received an order recently for several gas-electric motor cars from a large Western railroad system. These cars are said to be used considerably in the West on branch lines where traffic is light. The demand for this type of transportation in the East has never been very great.

Motor Manufacturers Busy.—The Bell Electric Motor Company, Garwood, N. J., is reported to be receiving a number of orders from central stations and contractors for its compensated type of polyphase motor, described in the *Electrical World* Dec. 20, 1913. Business in the vicinity of New York City for this company is said to be particularly good.

Electric Terms for the Baseball "Fan."—Pass & Seymour, Inc., have got out three neat cards containing the playing schedules of the three major baseball leagues, together with scoring diagrams. Printed on these cards besides the pure advertising matter are such captions as "A service sure to make a strike," "Make a hit with your trade," and "Talk the 'shurlock' and steal a base on your competitor."

Motors for Paper Mills.—Orders for motors to be used in operating paper-mill equipment have been placed with the Westinghouse Electric & Manufacturing Company by the following companies: S. D. Warren & Company, West Brook, Maine, five 150-hp, 315-r.p.m. motors for driving a Jones-Jordan machine and J. E. Henry & Sons, Lincoln, N. H., one 125-hp, 375-r.p.m. motor for driving a Jones-Jordan machine.

Stationary Vacuum Cleaning Apparatus.—The Thurman Vacuum Cleaner Company, St. Louis, Mo., is placing on the market a stationary vacuum cleaner which is sold for $150, and which is cheaper than similar types of machines previously put out by the above company. This machine is particularly well adapted for hotels and office buildings. The number of sales recently of this and other types of cleaners, it is reported, is quite large.

Standardization Rules of the Electric Power Club.—The second edition of a booklet containing the standardization rules of the Electric Power Club has been issued recently. The list of members given contains nearly all the large motor manufacturers of the United States. As these rules are the result of good engineering thought, they are said to be unanimously accepted by the members of the club and by other manufacturers as well.

Solenoid Switches for Hotel Service.—Solenoid switches manufactured by the Hart Manufacturing Company, Hartford, Conn., for the automatic control of lamps in hotel guest rooms are being installed in the Morrison Hotel, Chicago, and in the new Statler and Fuller Hotels, Detroit. L. K. Comstock & Company are the electrical contractors for these three hotels. A number of orders have also been received lately by the Hart Manufacturing Company for its remote-control switches.

Manufacturer of Flash-Lamps Doing Well.—The Beacon Miniature Electric Company, 108 Duane Street, New York, manufacturer of small flash-lamps and flash-lamp accessories, is doing a good business and, although only established since Oct. 1, 1913, its space for manufacturing purposes is being doubled. This company has recently placed on the market a new flash-lamp with an improved contact device. The "Aladdin" batteries used with these flash-lamps are made by the above company.

Westinghouse Company Gets Series-Tungsten Lamp Contract.—Although all companies bidding submitted identical prices on the series high-efficiency tungsten lamps to be supplied to the Sanitary District of Chicago, the contract was awarded to the Westinghouse Lamp Company as the lowest bidder on the compensators and globes also included in the order. The prices on the lamps ranged from $4.50 each for the first 2000 to $3.655 each if the order amounted to 10,000 units. Under a similar schedule, the price of the compensators and globes ranged from $13.60 to $13.45.

Turbine Contract Awarded to General Electric Company.—On May 27 the Sanitary District of Chicago awarded the contract for a 4000-kw, 2300-volt steam-turbine and generator unit with a Worthington condenser and motor-driven accessories to the General Electric Company. Four bids were placed by the General Electric Company on this apparatus, each bid carrying a different type of condenser. The purchase price of the apparatus is $53,724. The total cooling surface of the condenser specified is 7000 ft. and the speed of the unit is 3600 r.p.m. Transformers rated at 1667 kva are to be used with this apparatus.

Motion-Picture Machine for Entertainment and Educational Purposes.—A motion-picture machine designed particularly for amateurs which adapts itself very well for use in homes or schools or factories is being placed on the market by Pathé Frères, Paris, France. Mr. Willard B Cook, manager of the American distributing department, with offices in the Æolian Hall, New York, states that more than 10,000 machines have been sold in Europe, and since its introduction in America last fall some 200 have been sold here. The machine has been approved by the National Board of Fire Underwriters. A special non-inflammable film is used. Three models of these so-called "pathéscopes" are being made; one is hand-driven and the other two are designed for use with alternating current and direct current.

Storage-Battery Company's Business Good.—The business of the Willard Storage Battery Company, Cleveland. Ohio, it is reported, has been quadrupled in the past four years. Mr. F. S. Gassaway, district manager in New York, states that this increase is due in good part to the continual efforts of the company to give reliable service. Service stations are maintained in all the important cities of the United States and in many foreign cities. Considerable attention is given to the education of its customers regarding the proper usage of storage batteries. Booklets are printed in English, German, French and Spanish with full directions for taking care of the batteries. The Willard storage battery is used on a number of different types of gasoline automobiles as a part of the electric starting equipment, and more than 80 per cent of the American makes are said to use this battery. It is being used to a considerable extent also for the lighting of railroad cars and the propulsion of electric vehicles. In regard to the battery equipment of most electric vehicles, Mr. Gassaway declares that the batteries are not made heavy enough. The conditions with a light battery and a heavy truck, he states, are the same as those with a lean horse and a heavy truck—they are both overworked and cannot give proper and reliable service.

Exhibits at District Heating Convention.—During the Rochester convention of the National District Heating Association on May 26-28 several manufacturers made exhibits. Following is the list: American District Steam Company, North Tonawanda, N. Y., steam specialties, models of underground construction, condensation meter, souvenir pocket match holder, etc.; V. D. Anderson Company, Cleveland, models of steam traps, separator, etc.; Armstrong-Cook Company, Pittsburgh; Bigelow Company, New Haven, model of Bigelow-Hornsby water-tube boiler; Central Station Steam Company, Detroit, models of condensation meter, expansion joints, etc.; H. and M. Division of Taylor Instrument Companies, Rochester; Jenkins Brothers, New York, valves; H. W. Johns-Manville Company, New York, pipe coverings and heat insulation; Michigan Pipe Company, Bay City, Mich.; National Air Cell Covering Company, New York; Warren Webster & Company, Camden, N. J., specimens of valves, traps, etc.; A. Wyckoff & Son Company, Elmira, N. Y.

Growth of New England Central-Station Business.—Reference has already been made to the present rate of expansion of the central-station industry in the Atlantic States and Central States as indicated by official returns for March of this year. Returns from New England are now available for companies supplying electric service to the cities of Boston, Worcester, Springfield, Lynn, Cambridge, New Bedford, Providence and Hartford, and which between them are responsible for at least 35 per cent of all the energy produced in the six New England States (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut). The total income from the sale of energy for these companies was $1,093,502 for March, 1914, against $1,020,996 for March, 1913, an increase of 7.1 per cent, while the total energy output of these companies grew in the same period from 30,192,934 kw-hr. to 32,516,426 kw-hr., an increase of 7.7 per cent. It is hardly safe to regard these figures as characteristic of the present rate of central-station expansion in New England, since official returns for February for identically the same companies showed a materially higher rate of expansion, as indicated in Table I. A word of explanation should be given of the fact that March shows an increase in output accompanied by a falling-off in income. The discrepancy is simply a matter of the method of central-station metering and accounting. March has three more days than February. For this reason, although during March the daily average of station output steadily decreases, yet the aggregate output of kilowatt-hours shows a marked increase over February. Published figures for income, on the other hand, hardly ever relate strictly to any calendar period, but are based upon a total of all the meter readings taken during an arbitrarily selected period which does not correspond accurately to the calendar month. Actually the daily average sales of energy usually decrease more or less uniformly during the spring months, and the average daily output probably decreases in about the same ratio. Taking the month of February, however, the output reported is usually for a period of twenty-eight days, while the income reported is usually for thirty days and takes in a part of January as well as February. This makes the official February income disproportionately high as compared with the output, although the discrepancy automatically adjusts itself to some extent in March; and the result for the latter month is a reported income disproportionately low as compared with the output. For the month of April it may be expected that the New England companies will report a decrease in both income and output as compared with the March figures; and it may be expected that the rate of increase for 1914 over 1913 will be nearer the February figures of 11 and 10.6 per cent. Meanwhile, from the 1912 census figures it is possible to compute fairly closely the total income and output of all the central stations in New England for March, 1913, and accepting the *Electrical World* expansion constants as correct, it may be estimated that the gross income of all the companies in that territory grew from $2,720,000 in March, 1913, to $2,910,000 in March, 1914, and the energy output from 86,000,000 kw-hr. to 92,600,000 kw-hr. These totals may be compared with those previously given for the Atlantic and the Central States. Assuming that for the entire central-station industry of the United States the March, 1913, gross income was $28,750,000 and the output 1,142,000,000 kw-hr., it will be seen that the remaining sections of the country—the Pacific Coast States and the Mountain States—are responsible for only some 12.5 per cent (income) and 25 per cent (output) of the total business. In those sections of the country a kilowatt-hour of electrical energy seems to have only one-half the earning power which it is known to hold in the East. To summarize all the March data which have now been received by the *Electrical World*, it may be noted that complete returns for both energy output and gross income have been rendered by companies or groups of companies operating in widely scattered sections of the country which furnish service to eighty-two of the first hundred cities, one of which shows revenue for March from the sale of energy in excess of $2,000,000, one other in excess of $1,000,000, and five others in excess of $500,000. These companies show sales for March, 1914, of $16,891,235 against $15,559,191 for March, 1913, an increase of $1,332,044, or 8.7 per cent; while the energy output of all the generating stations subsidiary to these companies was 730,843,220 kw-hr. for March, 1914, against 642,291,906 kw-hr., or 13.8 per cent. It may safely be stated that March, 1914, showed an increase in energy sales over March, 1913, of at least $2,500,000 for the entire central-station industry. For March the demonstrated increase is $2,500,000, and the required new capital must be at the very least $12,000,000.

TABLE I—MONTHLY GROSS INCOME AND ENERGY OUTPUT OF EIGHT LARGE NEW ENGLAND COMPANIES

	Gross Income from Sale of Energy			Total Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
February.	$1,197,778	$1,079,490	11.0	30,095,631	27,217,230	10 6
March...	1,093,502	1,020,796	7 1	32,516,426	30,192,934	7.7

TABLE II—INCOME AND OUTPUT FOR ATLANTIC, CENTRAL AND NEW ENGLAND STATES (ESTIMATED)

	Gross Income			Energy Output, Kw-hr.		
	March, 1914	March, 1913	Per Cent Increase	March, 1914	March, 1913	Per Cent Increase
Middle Atlantic .	$10,300,000	$9,717,000	6.1	314,500,000	292,500,000	7.5
South Atlantic..	1,798,000	1,615,000	11.3	104,500,000	85,170,000	22.8
Central..	12,374,000	11,133,430	11.2	441,700,000	391,585,000	12.8
New England	2,910,000	2,720,000	7 1	92,600,000	86,000,000	7 7
Total.	$27,382,000	$25,185,430	8.8	953,300,000	855,255,000	11.5

NEW YORK METAL MARKET PRICES

	May 26		June 2	
Copper	Bid	Asked	Bid	Asked
Standard spot*	13.70	14.12½	13.50	14.00
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*.....	63 3 9		62 6 3	
Prime Lake	14.25	to 14.50	14.12½	to 14.37½
Electrolytic	14.10	to 14.20	13.95	to 14.05
Casting	13.90	to 14.00	13.80	to 13.90
Copper wire base........	15.25	to	15.25	to .....
Lead	3.90		3.90	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter....	7.00		7.00	
Spelter, spot	5.10	to 5.20	5.10	to 5.20
Tin, spot	33.15	to 33.35	30.25	to 30.65
Aluminum:				
Prompt delivery	17.75	to 18.00	17.75	to 18.00
Future	17.75	to 18.00	17.75	to 18.00
*OLD METALS				
Heavy copper and wire.....	12.62½	12.87½	12.62½	12.87½
Brass, heavy	8.50	8.62½	8.50	8.62½
Brass, light	7.37½	7.50	7.37½	7.50
Lead, heavy	.....	3.90	.....	3.90
Zinc, scrap	4.00	4.15	4.00	4.15

*COPPER EXPORTS

Total tons to June 2..2,140

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*From daily transactions on the New York Metal Exchange.

Corporate and Financial

California Power Company to Increase Stock.—A special meeting of stockholders of the Northern California Power Company has been called for July 17 to authorize an increase in the capital stock. It is proposed to issue $2,000,000 of 6 per cent preferred stock, of which $500,000 is to be issued and sold at once. Subject to approval by the Railroad Commission of California, the stock will be offered to shareholders at 80.

Michigan Northern Power Company Bonds.—Yard, Otis & Taylor and the People's Trust and Savings Bank, of Chicago, are offering at 95 and interest first mortgage 5 per cent gold bonds of the Michigan Northern Power Company. The bonds are dated July 1, 1913, and are due July 1, 1941. Of the $4,500,000 authorized, $2,000,000 are outstanding. The bonds are guaranteed, principal and interest, by indorsement by the Union Carbide Company and are a first lien on 1200 acres of land and a modern hydroelectric development on St. Mary's River at Sault Ste. Marie, Mich. The replacement value of the development has been placed at over $6,000,000. The power plant contains forty-two waterwheel units, each designed to have a capacity of 500 hp.

Dallas Electric Company Notes.—Stone & Webster and the Old Colony Trust Company, of Boston, have offered for sale at 96¾ and interest $1,500,000 Dallas Electric Company three-year 5 per cent notes dated June 1, 1914. The notes are callable at par and interest on thirty days' notice. The proceeds will be used to retire floating debt and for extensions to carhouses, shops, tracks, cars, power station and distributing systems. During the year ended March 31, 1913, 34.4 per cent more people were served by the railway and 43.6 per cent more by the light department than for the year ended Dec. 31, 1905. During the same period the gross earnings increased 141 per cent and the net earnings 155 per cent. The ratio of total capitalization to gross income decreased from 8.9 to 1.2 to 1 in the 1905 year to 5.7 to 1 in the year ended March 31, 1913.

Interstate Electric Corporation Holdings.—A. E. Fitkin & Company, New York City, have issued a booklet describing the properties of the Interstate Electric Corporation. The properties of the corporation consist of gas and electric light plants and water-works situated in communities in Pennsylvania, Kansas, Missouri and Texas and serving a population of about 50,000. The corporation was formed under the laws of Virginia. Roosevelt & Thompson, engineers, are associated with the corporation in connection with the operation of the various plants and have the supervision of all improvements and extensions. Recently the corporation has added the Great Bend Water & Electric Company, Great Bend, Kan., and the Hoisington Electric & Ice Company, Hoisington, Kan., to the plants already controlled at San Angelo and Laredo, Tex., Trenton, Mo., and Corry, Pa. In the near future the corporation intends to purchase other plants, having, finally, a large transmission system. The subsidiary Corry City Electric Light Company was organized in 1903. It has a five-year lighting contract with the city dated in 1913. So far no attempt has been made to serve industries, but on completion of the new steam-turbine electric station a start will be made in this direction. The Trenton Gas & Electric Company has two contracts with the city, one for arc and incandescent street lighting and one for white-way lighting. The gross electric light revenue per capita was $5.83. The San Angelo Water, Light & Power Company has city contracts for street lighting and for water.

Portland Railway, Light & Power Company Operations.—Gross earnings of the Portland (Ore.) Railway, Light & Power Company for the year ended Dec. 31, 1913, were $6,723,742, an increase of 1.2 per cent over 1912. Operating expenses, including taxes, were $3,298,310, a decrease of 0.9 per cent. Net earnings were $3,425,432, a gain of 3.4 per cent. Interest charges amounted to $2,008,601, an increase of 14.1 per cent. The surplus was $1,416,831, a decrease of $135,575. Franklin T. Griffith, the president, says in the annual report that the small increase in gross earnings is due principally to the business depression in the Pacific Northwest and throughout the country generally, although it is somewhat affected by the fact that comparison is made with a year during which revenues were received from the Salem Railway and the Willamette Falls Railway, both of which were sold in 1912, and by the further fact that poor weather conditions in June during the "rose carnival" resulted in decreased earnings from that source. Taxes continue very high. There was a heavy increase in fixed charges, due to the completion of the Mount Hood hydroelectric plant and the transfer of the interest charge on this investment from the construction accounts to the operating accounts. On account of the decrease in surplus the dividend on the capital stock, which had been paid at the rate of $5 per share per annum from December, 1912, was reduced to the rate of $4 per share per annum on Dec. 1, 1913. In October the company was awarded a three-year contract for all the city lighting in Portland. The importance of this contract is shown by the fact that 327 arc lamps were added to the lines during 1913, while it is estimated that the increase during 1914 will be almost as great That the electric business of the company has been widely developed is shown by the fact that on Dec. 31, 1913, the company served 42,063 lighting and motor-service customers, compared with 38,415 in 1912, and 12,294 in 1907. This is believed to be the largest number, in proportion to population, served by any company operating in a large city in the United States. In addition, the city of Portland has, with two exceptions, more consumers of electricity per capita of population than any other large city. The application of scientific management was continued, covering the operation of the lighting and motor-service department and its many divisions, the railway shops and maintenance-of-way department. Mr. Griffith says that it has been stated by those competent to judge that the company has gone further with the introduction of efficiency principles than any other public utility corporation in the country, and the results have been so satisfactory that the work is being extended to include practically all of the departments. C. M. Clark, chairman of the executive committee, makes the following statement on business conditions: "While the financial results of operation for the year have not been entirely satisfactory, they are probably as favorable as could be expected under the circumstances. It is particularly unfortunate that the depression in Portland should have come at a time when the company was prepared to handle even more than the normal growth of business. From 1905 to 1911 the growth of Portland was rapid and it was difficult to keep up with the requirements for increased facilities in the street-railway business and increased capacity in the lighting and motor-service business. Your company necessarily prepared for a continuance of this growth and, owing to the fact that during the past two years this rapid growth has not continued, the company is temporarily in a position of having greater equipment than necessary to handle its business, resulting in a large increase in interest charges without a compensating increase in revenue. The city of Portland has also been overdeveloped and large amounts of money have been expended in anticipation of the continued rapid growth in the population, with the inevitable result of heavy increases in taxation. The taxes assessed against your company have increased with all others and have helped to make up the total increase in fixed charges. The capital expenditures required during this year will be small. The development of Alaska and the opening of the Panama Canal should prove helpful in restoring to Portland the prosperity which characterized its growth in the decade preceding 1912. In addition, there are a number of local reasons for increased earnings, such as the development of the lighting and motor-service business in the Willamette Valley, including the sale of power to the Willamette Valley Southern Railway Company and the Southern Pacific Company. The overdevelopment of the territory and of your company is temporary only and may soon be changed into a condition where the capacity of the company will be fully required to meet the demands of a new period of growth and development. Even during the past two years there has been a steady growth and improvement in Oregon and in Portland, and the agricultural, financial and industrial conditions are sound and stable. The management of your company is competent, efficient and as economical as is consistent with good service. The physical condition of the property is excellent, and in all respects the management is fully prepared to fulfill its obligations."

Business Notes

The H. W. Johns-Manville Company announces that its Duluth office has been moved to larger quarters at 327 West First Street.

The Kennedy Manufacturing Company, of Chicago, is the new name of the company formerly called the Kennedy-Vanderhoof Company.

The Western Wood Preserving Company, of Los Angeles, Cal., announces the removal of its office and factory to larger quarters at 2108 East Seventh Street. R. J. Bird is president of the company.

M. B. Wheeler, for several years general manager of the Tel-Electric Company, Houston, Tex., has resigned that position and opened an office as manufacturers' agent at 1015 Union National Bank Building, Houston.

The Electrical Storage Battery Company announces that Nelson B. Hazeltine, formerly sales manager for the Adams-Bagnall Electric Company in Philadelphia, has joined its sales organization, making his headquarters at 100 Broadway, New York.

The Davidson-Lewis Metal Products Company, Inc., of 101 Park Avenue, New York, was organized recently by George Davidson, formerly with the U. T. Hungerford Brass & Copper Company, New York, and Robert P. Lewis, formerly of the Blake & Johnson Company, Waterbury, Conn.

The Phoenix Electric Lamp Company, Inc., of Brooklyn, N. Y., has absorbed the United Electric Lamp Company. The office of the latter company at 253 Thirty-sixth Street has been retained. J. H. Rees, former manager of the United Electric Lamp Company, has been made general manager of the Phoenix Electric Company, Inc.

New Industrial Companies

The Peerless Electric Vacuum Cleaner Company, of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 by H. Bohn, William H. Klee, S. J. Deustch, A. E. Klein and I. J. Rothschild.

The Sevison Electric Company, of Elkhart, Ind., has been chartered with a capital stock of $10,000 to manufacture and deal in electrical equipment. The directors are M. E. Crow, J. B. Fitch and L. J. Sevison.

Henderson & Shaw, of Boston, Mass., have filed articles of incorporation with a capital stock of $10,000 to do an electrical contracting business. The incorporators are Albion W. Shaw, James A. Henderson and Guy L. Weymouth.

The United Light Company, of Cincinnati, Ohio, has been chartered with a capital stock of $5,000 to deal in gas and electrical supplies. The incorporators are Williard H. Odell, William R. Divers, Albert D. Alcorn, Grace and Frank Cooper.

The Klingelsmith Electric Truck Company, of Portland, Maine, has been incorporated with a capital stock of $500,000 to manufacture and deal in motor trucks, etc. A. F. Jones is president and A. A. Richards, treasurer, both of Portland, Maine.

The Kingsland-Tess Electric Fly Catcher Company has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $50,000 and proposes to manufacture fly-catching apparatus. The incorporators are W. Boyd, W. I. N. Lofland and W. F. P. Lofland, of Dover, Del.

The Producer Gas-Electric Corporation has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $500,000 and proposes to manufacture gas engines, machinery, etc. The incorporators are J. F. Curtin, H. F. Kleist, of New York, N. Y., and J. M. Satterfield, of Dover, Del.

The Zenith Wire Company, of Jamesville, N. Y., has been incorporated with a capital stock of $100,000 by W. A. Beattie, H. V. Hulison, of Syracuse, and H. Hotaling, of Jamesville. The company proposes to manufacture and deal in electric coils and accessories used on automobiles, general plating, wooden novelties, copper wire, etc.

Trade Publications

Insulator.—Type X strain insulator, made by the Ohio Brass Company, Mansfield, Ohio, is the subject of a recent large folder issued by the company.

Automobile Supplies.—Dealing with automobile supplies both of electrical and other types, Catalog No. 35 of the Central Electric Company, 326 South Fifth Avenue, Chicago, sets forth 160 pages of information interesting to automobile owners and dealers.

Pumping Machinery.—The American Steam Pump Company, Battle Creek, Mich., has assembled within an attractive cover twenty-three of its recent bulletins. Pumps for a wide variety of purposes are illustrated and described, each bulletin being devoted to a special type.

Fans.—The Western Electric Company is mailing a large poster on which are illustrated pictures of suggested window displays for dealers, fac-similes of lantern slides that are offered free to dealers, and other advertising helps that will aid them in creating sales for electric fans.

Lighting Glassware.—A folder is being mailed by the Gleason-Tiebout Company, 71 West Twenty-third Street, New York, referring to its "Albedoglas" bowls. These bowls are said so to modify the light of a tungsten lamp as to produce approximately the equivalent of daylight.

Panels.—Battery-charging panels for two-wire systems, 50 volts to 250 volts, are described and illustrated in Leaflet 3719 issued by the Westinghouse Electric & Manufacturing Company. These panels are for lighting and electric-vehicle charging. Typical diagrams of connections are shown.

Oil Switches.—Type I oil switches made by the Westinghouse Electric & Manufacturing Company are described and illustrated in Leaflet No. 3745. This type of oil switch is intended for use on direct-current or alternating-current series lighting circuits and for controlling small inductive loads.

Mica.—Meirowsky Brothers, 106 Broadway, Jersey City, N. J., have issued a well-printed catalog of sixteen pages referring to their chief product, mica. Interesting information on mica is followed by brief illustrated descriptions of this material in various forms and for different purposes. The catalog contains also a price list.

Ice Making.—The United Ice Improvement Company, 50 Church Street, New York, has issued in pamphlet form a "Practical Talk on Refrigeration," by W. Everett Parsons, in which are pointed out how losses occur, how they may be avoided, and how the efficiency of ice plants may be increased by means of the Parsons "quick-freeze" system.

Motors.—"Doing the World's Work" is the title of a neat little pamphlet issued by the Robbins & Myers Company, Springfield, Ohio, which refers to the work of the small motor made by this company. The many uses in the home, factory and shop to which this small motor can be put are referred to, and some miniature illustrations are printed for showing its wide application.

Molded Insulation.—In an eight-page booklet issued by the Stevenson Company, Wilkinsburg Station, Pittsburgh, Pa., illustrations are shown of Stevenson molded insulation and other molded parts applicable to a wide range of uses. It is said that this insulation combines dielectric properties with lightness, high finish and mechanical strength. Many parts made from the insulation are illustrated.

Rope.—The Blue Book of Rope Transmission, published by the American Manufacturing Company, Noble and West Streets, Brooklyn, New York City, is a practical treatise on rope transmission. Actual examples of rope drives now in service are illustrated, and the descriptions of the varied conditions under which this form of transmission is used are interestingly brought forward. The illustrations are many and excellent.

Electric Trucks.—The General Vehicle Company, Long Island City, N. Y., in a thirty-two-page pamphlet gives interesting information as to its gratuitous co-operative advertising service for central stations. Sample advertisements are reproduced. This service is offered in order to stimulate local interest in electric vehicles. Several pages in the book are devoted to drawings of vehicles used by prominent merchants in all parts of the country.

Personal Mention

Mr. J. C. Ingle, formerly general superintendent of the Keokuk (Ia.) Electric Company, has been promoted to the position of manager of that organization.

Mr. A. D. Ayres, formerly manager of the Keokuk (Ia.) Electric Company, has resigned to accept a position with the Linde Air Products Company of New York City.

Mr. W. Crighton Harris has resigned from the engineering firm of Crighton Harris & Company to become chief engineer of the Titan Storage Battery Company, of Newark, N. J.

Mr. R. L. Flannigan, formerly superintendent of the electrical department of the Quincy Gas, Electric & Heating Company, has been appointed electrical inspector for the city of Quincy, Ill.

Mr. Fred D. Clark, formerly assistant superintendent of the electrical department of the South Penn Oil Company of Folsom, W. Va., has been appointed superintendent vice Mr. A. Clarke resigned.

Mr. Thorndyke Harvey, formerly commercial engineer of the Texas Power & Light Company of Dallas, Tex., has been appointed commercial agent of the Kansas Gas & Electric Company, of Wichita, Kan.

Dr. A. Stansfield, professor of metallurgy at McGill University, Montreal, sailed for Europe on the steamship *Canada* on May 16 to investigate for the Dominion government the operation of electric iron furnaces in Sweden and Norway.

Mr. W. A. Reiber, director and secretary of the Citizens' Light, Heat & Power Company of Johnstown, Pa., has received a leave of absence. During the leave of absence Mr. Reiber will manage the General Construction Corporation, 14 Wall Street, New York City, which will engage in construction and engineering work for public utilities.

Mr. Joseph Johnson, Fire Commissioner of New York City under Mayor Gaynor and campaign manager for Mr. Edward E. McCall, chairman of the Public Service Commission, First District, New York, when the latter ran for Mayor on the Tammany ticket last year, has been appointed chief of the Bureau of Transit of the Public Service Commission, First District, New York, at $7,500 a year. The post was formerly held by an engineer.

Prof. Francis Bacon Crocker, well-known author, educator and engineer and past-president of the American Institute of Electrical Engineers, has received the honorary degree of master of science from his Alma Mater, Columbia University, from which he was graduated with the class of 1882. The master's degree was conferred on May 29 in connection with the celebration of the fiftieth anniversary of the founding of the School of Mines.

Mr. H. R. Wetherell, the new president of the National District Heating Association, is superintendent of the steam-heating department of the Central Illinois Light Company, of Peoria. He grew up, so to speak, in the former Peoria Gas & Electric Company, predecessor of the Central Electric Company, under the tutelage of Mr. R. S. Wallace. He has been an active member of the National District Heating Association for several years, and was second vice-president when elected president.

Mr. Gano Dunn, president of the J. G. White Management Corporation and past-president of the American Institute of Electrical Engineers, received the degree of master of science from Columbia University on May 29 in connection with the celebration of the fiftieth anniversary of the founding of the School of Mines. Mr. Dunn was graduated with the class of 1891 and, prior to joining the J. G. White organization, was chief engineer and vice-president of the Crocker-Wheeler Company, of Ampere, N. J.

Mr. James Walter Gillette, who for the past six years has been general manager of the Fort Smith (Ark.) Light & Traction Company, has accepted the position of sales engineer for the Electrical Engineers' Equipment Company, Chicago, Ill. Born June 28, 1871, and educated in the Middle West, Mr. Gillette has had extensive engineering experience with electrical manufacturing companies and central-station companies both in the United States and in South America. At the sixth annual convention of the Arkansas Association of Utility Operators in May, 1913, he was elected president of that body. Mr. Gillette is also a member of the American Institute of Electrical Engineers.

Mr. Arthur L. Mudge, who for some years was chief electrical engineer for the Toronto offices of Messrs. Smith, Kerry & Chace and in charge of the electrical engineering work of the Electric Power Company of Toronto, has engaged in consulting engineering work, including the preparation of reports, valuations and designs, supervision of construction and advice generally with reference to hydroelectric developments, transmission and local distribution systems, street lighting, energy contracts and industrial applications of electricity. Mr. Mudge will continue to have offices with Messrs. Kerry & Chace, Ltd., with whom he has now become associated as manager of their electrical department in the Confederation Life Building, Toronto.

Mr. Chauncey Eldridge, one of the advisory committee of three under whose supervision the Kansas City, Clay County & St. Joseph Railway, Kansas City, Mo., was built by the Wyandotte Construction Company, has resigned from Tucker, Anthony & Company to undertake wireless-telegraph work at San Francisco, Cal. Mr. Eldridge, who was with Tucker, Anthony & Company for about thirteen years, assisted in the construction of the Canton-Akron lines, the Columbus, Buckeye Lake & Newark Railway, the Columbus, Newark & Zanesville Railway, the Mesaba Railway, the Hartford & Springfield Street Railway, the Hartford, Rockville & Manchester Tramway and numerous waterworks. He was a member of the executive board of the Kansas City, Clay County & St. Joseph Railway, but has now been succeeded by Mr. P. L. Saltonstall, the president of the company.

Obituary

Santos J. Rubira, for many years head of the gas and electric company in Mobile, Ala., now controlled by H. M. Byllesby & Company, died May 4, at the age of eighty-two. Born in Spain, Mr. Rubira came to New York in 1870 and five years later migrated to Mobile.

J. A. Sandford, Jr., electrical engineer for the R. Thomas & Sons Company, East Liverpool, Ohio, died in that city on May 21, following an operation in the City Hospital. Mr. Sandford was born in Ware, Mass., Oct. 17, 1879, and was a graduate of the Worcester Polytechnic Institute.

Sir Joseph Wilson Swan, inventor of the incandescent electric lamp, died in London on May 27. He was almost eighty-six years old, having been born in Sunderland, England, Oct. 31, 1828. Sir Joseph spent many years of his life in experimenting with electric lamps and in 1879 succeeded in producing an incandescent lamp. His first lamp (1860) had a carbon filament which he made by packing a strip of thin cardboard with powdered charcoal in a crucible and subjecting it to great heat. This was placed in a glass bulb from which the air was afterward exhausted and a current of electricity applied from wet batteries. His commercial lamp had filaments of cotton threads parchmentized by the action of sulphuric acid. He was the inventor of many other electrical devices, including a miner's safety lamp and an electric meter. Sir Joseph was also widely known as the inventor of the dry plate for photographic uses. He was educated at a private school and received the degree of doctor of science from Durham University. Although a chemist by profession, he was not without honor in other walks of life. He was past-president of the Society of Chemical Industry, past-president and honorary member of the Institution of Electrical Engineers, past-president of the Faraday Society, vice-president of the Senate of University College, London, and life governor of the college. To him were awarded the Hughes medal of the Royal Society for his invention of the electric incandescent lamp and various improvements in the practical applications of electricity in 1904, the Albert Medal of the Royal Society of Arts in 1905, the Progress medal of the Royal Photographic Society, and the gold medal of the Society of Chemical Industry. He was knighted in 1904.

Construction

New England

FITCHBURG, MASS.—Plans are being prepared by the Fitchburg Gas & El. Co. to extend its transmission lines to Ashby and Townsend, where the company has recently secured franchises.

SOUTH HADLEY, MASS.—The town of South Hadley has entered into a contract with the Gas and Electric Department of the city of Holyoke by which the municipal electric plant in Holyoke will supply electricity to operate the local municipal electric system.

SPRINGFIELD, MASS.—Plans are being considered by the city officials and Prof. Clifford for a new lighting system for Court Square. It is understood that the present cluster lamps will be replaced with new magnetite arc lamps. An order for 50 additional arc lamps for the business section will be presented to the City Council.

PASCOAG, R. I.—The taxpayers have voted to contract with the Rhode Island Pwr. Transmission Co., a subsidiary of the Connecticut River Pwr. Co., for electricity to operate the municipal electric-light system for a period of 20 years, and to appropriate $8,000 for the installation of equipment to utilize the energy here.

GROTON, CONN.—The Water and Light Commissioners are contemplating erecting a transmission line to Groton Long Point to furnish electrical service. The cost of the work is estimated at $3,000. Bids for construction of line have been asked for.

NEW LONDON, CONN.—The Connecticut Pwr. Co., of New London, is extending its lines to Goshen, Great Neck, Pleasure Beach and Millstone to furnish electrical service in those places.

NORWALK, CONN.—Bids will be received by the district committee, third district, of the the city of Norwalk, at its office at the power station, East Norwalk, Conn., until June 10 for construction of power plant complete and furnishing equipment. The units involved will embrace not less than two 75-hp gas engines and gas producers, two 50-kw generators, switchboard and other equipment, with optional proposals on 100-hp gas engines with corresponding producers, generators, etc. Complete plans and specifications can be obtained on application to the district committee, East Norwalk, or to Joseph B. Rider, consulting engineer, 29 Broadway, New York, N. Y. William H. Sniffen is chairman of committee.

Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until June 8, for installing electric euipment in new Public School 48, on Eighteenth Avenue, between Sixtieth and Sixty-first Streets, borough of Brooklyn. Blank forms, plans and specifications may be obtained or seen at the above office and also at the branch office, 131 Livingston Street, Brooklyn.

BUFFALO, N. Y.—Plans have been completed for the erection of a substation to be erected at 70 Benton Street for the Buffalo General El. Co., at a cost of about $20,000.

GOVERNOR'S ISLAND, N. Y.—Bids will be received until June 16 for rewiring and furnishing new electrical fixtures in various buildings on Governor's Island. Information furnished on application to department quartermaster.

NEW YORK, N. Y.—The Public Service Commission has awarded contracts for two tunnels to Brooklyn and the crosstown line in Canal Street, Manhattan. The contract for the construction of tunnels was awarded to the O'Rourke Engineering Construction Co., and to Booth & Flinn, on their combined bids of $12,444,725, of which $5,974,809 is for the Brooklyn Rapid Transit tunnel, and $6,469,916 for the Interborough tunnel. The Underpinning & Foundation Co. secured the contract for building the Canal Street crosstown subway for $1,822,494.

NIAGARA FALLS, N. Y.—The Board of Public Works has awarded the Buffalo & Niagara Falls El. Lt. & Pwr. Co. a contract to light the city for a period of five years from Jan. 1, 1914. The present street arc lamps are to be replaced with new magnetite arc lamps within the next two years.

PORT JERVIS, N. Y.—The Port Jervis Lt. & Pwr. Co. has purchased a site on which it will soon erect a new power house, to cost about $100,000. The company has secured the contract to furnish electricity for lamps and motors at the Otisville Sanatorium, and also has decided to extend the electric railway system to Milford.

CALLENSBURG, PA.—Steps have been taken by the Clarion River Pwr. Co. toward the construction of three dams on the Clarion River. Preliminary surveys along the river are being made by C. C. Frick, civil engineer, of Kittanning. The company has begun work on the construction of an office building in Callensburg, where headquarters will be established.

CARBONDALE, PA.—The Council has awarded the Scranton El. Co., of Scranton, a contract for lighting the streets and public buildings for a period of five years. The present arc-lamp-lighting system will be replaced with incandescent street lamps. The company also agrees to furnish electricity for a police alarm system that the Council is considering installing in the near future.

PHILADELPHIA, PA.—The contract for the construction of the transmission station in Chestnut Hill, at Moreland and Germantown Avenues, for the Philadelphia El. Co. has been awarded to Charles Gilpin. The building will be 50 ft. by 80 ft., and will cost about $50,000.

PITTSBURGH, PA.—The Pittsburgh, Butler & Harmony Ry. Co. has begun work on the construction of a new power plant in the old organ works at Morado. This plant, when completed, will furnish electricity to operate the cars on the new line from Ellwood City to Beaver Falls.

SAYRE, PA.—Contracts have been placed by the Sayre El. Co. for two 750-kw turbo-generators and a 300-kw motor-generator set.

MERCHANTVILLE, N. J.—The Common Council has approved a measure providing for the installation of new 32-cp and 80-cp lamps on Maple Avenue and 32-cp lamps in other sections of the borough.

TRENTON, N. J.—The Public Service El. Co. is contemplating the construction of a new substation on Adeline Street, which will furnish service in the Chambersburg district.

WOODBURY, N. J.—Bids will be received by the City Council until June 16 for lighting the streets of the city for a period of three or five years. Arthur Starr is city clerk.

MILFORD, DEL.—A permit has been granted for the erection of an addition to the power house of the L. D. Caulk Co., manufacturer of dental supplies. C. C. Buck, Main Street, Camden, N. J., is the architect.

ELKTON, MD.—The Wilmington & Philadelphia Trac. Co., of Wilmington, is reported to have entered into a contract with the Home Mfg. Lt. & Pwr. Co., Elkton, to furnish electricity here. The transmission lines will be extended from Newark.

FREDERICK, MD.—The Hagerstown & Frederick Ry. Co., of Frederick, is negotiating for the purchase of the property of the Frostburg Illg. & Mfg. Co., which furnishes electricity in Frostburg and vicinity. The railway company is reported also to be negotiating for a water-power development of 50,000 hp rating near Cumberland. The company is still undecided whether to purchase this development or to build a large plant in Cumberland and transmit electricity to its patrons in Allegany County.

FAIRMONT, W. VA.—The Monongahela Valley Trac. Co., of Fairmont, has contracted with the Consol. Coal Co., of Fairmont, to supply additional electricity to operate its system. The Consol. Coal Co., it is reported, will begin work on the installation of a 1000-kw gas-engine-driven generating unit, orders for which have already been placed. R. L. Kingsland is superintendent of the power and mechanical department of the coal company. James O. Watson is general manager of the Monongahela company.

FOLLANSBEE, W. VA.—Work will soon begin on the addition to the electric-light plant at the mill. A new turbine will be installed, also a dry vacuum pump and an air compressor, to be used in connection with the new mills now under construction.

EMORY, VA. — Edmundson Brothers have secured the contract to build a hydroelectric power plant on river about 3 miles from Emory. The proposed plant will furnish electricity for lamps and motors in nearby towns.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 8 for repairs to the mechanical equipment at the United States Treasury, Winder and Butler Buildings, Washington, D. C. For details see proposals columns.

WASHINGTON, D. C.—Bids will be received at the office of the United States Reclamation Service, 605 Federal Building, Los Angeles, Cal., until July 14 for furnishing one vertical, alternating-current generator for the Salt River project, Arizona. For particulars address the United States Reclamation Service, Los Angeles, Cal., or Washington, D. C. F. H. Newall is director.

North Central

ADRIAN, MICH.—Bids will be received by Rolla L. Taylor, treasurer of the Board of Control of the State Industrial Home for Girls, until June 16 for electric wiring in the new hospital addition about to be erected. C. F. Matthes & Son, of Adrian, are the architects.

BOYNE CITY, MICH.—The Boyne River Pwr. Co. is planning to replace the present street-lighting system with new arc lamps.

CLARKSTON, MICH.—Edwin Denby, of Detroit, has applied to the Town Board of Independence for a franchise to erect an electric distributing system in the township of Independence.

DETROIT, MICH.—Plans, it is reported, are being prepared by William F. Goodrich, architect, 310 Sun Building, for a summer hotel (800 rooms) at Grosse Point Shores. A power plant will be erected in connection with the hotel.

DETROIT, MICH.—Bids, it is reported, are now being received for the electrical work in connection with the new building for the Farrell estate on Griswold Street, 12 stories high, 100 ft. by 122 ft., at a cost of $250,000. Rogers & Bonnah are the architects.

DETROIT, MICH.—The contract for the erection of a substation at Moran and Milwaukee Avenues, 50 ft. by 130 ft., for the Edison Illg. Co. of Detroit, has been awarded to Albert A. Albrecht & Co., of Detroit. The Albrecht company will also erect another substation for the Edison company at Hyde and Waterloo Streets, same dimensions.

DETROIT, MICH.—The Detroit Edison Co. is reported to have purchased the plant of the Murphy Pwr. Co., corner of Wayne and Congress Streets. By this transaction the Edison company has secured complete control of the steam-heating, electric and power service in the downtown section of the city. A new power house, it is understood, is to be erected at the corner of Congress and Cass Avenues.

DETROIT, MICH.—The contract for general electrical equipment, including a new transformer house, for the cold-storage plant of the People's Ice Storage Co., on Grand Avenue, has been awarded to the John Templeton Co. The Templeton company also secured the contract for general electrical equipment for the six-story building for the H. R. Leonard Furniture Co., at Woodward and Columbia Streets.

EAST JORDAN, MICH.—The East Jordan Lt. & Pwr. Co. expects to install within the next 30 days one tandem compound Ideal engine with condenser belted to a 100-kw Bullock generator for light load outfit; also to purchase about 1000 ft. of 2200-volt, three-wire and four-wire conductor. L. G. Balch is superintendent.

FLINT, MICH.—The board of managers of the Hurley Hospital has decided to ask the City Council for an appropriation of $9,000 for the installation of a new power plant at the hospital.

FREMONT, MICH.—Within the next three months the Board of Electric Light and Water Works Commissioners expects to purchase one 150-kw or 200-kw, three-phase, 60-cycle, alternating-current generating unit complete; also within the next six months to purchase one car load of 30-ft. (7-in.-top) cedar poles. H. W. Schoolmaster is superintendent.

ISPHEMING, MICH.—The City Council has authorized an expenditure of $5,955 for the installation of ornamental lamps and asphalt construction.

WATERFORD, MICH.—Application has been made to the Town Board by Edwin Denby, of Detroit, to erect transmission lines to distribute electricity in this town.

CANTON, OHIO.—Plans are being considered by Mayor Stolberg for replacing the present arc lamps now in use for incandescent cluster lamps mounted on iron standards throughout the city.

CANTON, OHIO.—The Canton El. Co. has been granted a permit to erect a one-story brick and transformer house at its plant on Third Street, to cost $4,000. W. C. Anderson is general manager.

CINCINNATI, OHIO.—Electrical machinery and equipment will be installed in the garage which will be erected for the Fischer Auto & Service Co. at 916-920 Race Street. The cost of building and equipment is estimated at $50,000.

CINCINNATI, OHIO.—An electric power plant, it is reported, will be installed in connection with the new addition to the plant of the Western Methodist Book Concern, which is to be erected by the Ferro Concrete Co., of Cincinnati.

CINCINNATI, OHIO.—Considerable electrical equipment, including motors, etc., will be used in the annex to the Christ Hospital, which is to be erected in the near future, at a cost of about $200,000. E. E. Shipley, chairman of the hospital committee, has charge of the matter.

CINCINNATI, OHIO.—The Ford Motor Car Co., of Detroit, Mich., has awarded the general contract for the construction of its assembling plant in Cincinnati to the Irwin-Leighton Co., of Philadelphia, Pa. The cost of the plant is estimated at about $250,000. A large amount of electrical equipment will be required.

DAYTON, OHIO.—An electric power plant, it is understood, will be installed in connection with a large apartment house to be erected by the Gaddis Apartment Co., recently incorporated with a capital stock of $125,000.

DAYTON, OHIO.—The Ohio State Tel. Co. (newly organized) will make improvements and extensions to its service in Toledo, involving an expenditure of about $300,000. A large number of wires will be placed underground.

DAYTON, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 26 for the installation of two electric passenger elevators, three hydraulic lifts and a pumping plant in the United States post office and court house in Dayton. For details see proposals columns.

ELYRIA, OHIO.—A resolution has been introduced into the City Council authorizing all wires on Broad and Court Streets and Middle Avenue placed in underground conduits. The installation of a cluster-lamp lighting system in the principal thoroughfares is also under consideration.

FREMONT, OHIO.—Judge Garver has authorized Budd Jones, receiver for the Sandusky River Pwr. Co., to issue receivers' certificates to the amount of $50,000, the proceeds to be used for improvements to its water-power plant south of Fremont.

LOGAN, OHIO.—Investigations are being made by Arthur D. Foster and Francis R. Weller, who recently purchased the Logan electric-light and power system from the Aracoma Coal Co., for the purpose of selecting a site for the new power house to be erected here in the near future. Arrangements, it is understood, have been completed for the erection of a new generating station and other improvements to the service.

MIDDLEPORT, OHIO.—The Village Council has granted the Mutual El. Lt. Co. an extension of its franchise for a period of 25 years and a 10-year contract to furnish electricity to the village.

NEW CONCORD, OHIO.—Bonds to the amount of $2,500 have been sold by the town of New Concord, and arrangements will soon be made for the installation of a small electric plant.

NORWOOD, OHIO.—Bids, it is reported, will soon be asked for electric work in the new city hall. Other contracts have been awarded.

OSBORN, OHIO.—The municipal electric-light plant has been purchased by the Dayton Pwr. & Lt. Co. for $3,500. The local plant, it is understood, will be dismantled and used as a substation by the Dayton company.

POMEROY, OHIO.—The City Council has granted the Mutual El. Lt. Co., of Middleport, a franchise to furnish electricity for lamps and motors in Pomeroy.

UPPER SANDUSKY, OHIO.—The Hardin-Wyandot Ltg. Co., through a taxpayer, has secured a temporary injunction against the Mayor and other officials, restraining them from selling the issue of $25,000 in bonds authorized for the installation of a municipal electric-light plant.

YOUNGSTOWN, OHIO.—H. W. Jones, consulting engineer, of Cleveland, has been engaged to prepare preliminary plans for a municipal electric-light plant for this city and also to devise and prepare plans for a new street-lighting system for the city.

LOUISVILLE, KY.—The Louisville Gas & El. Co. is extending its transmission line from Anchorage to Crestwood, a distance of 12 miles. The company proposes to furnish electricity to light the streets and residences of several small towns along the line. It will also probably furnish electrical service to the Kentucky Confederate Home at Pewee Valley.

BURLINGTON, IND. — Earl Hearn, owner of the local electric-light plant, has applied to the Public Service Commission for permission to sell his plant to the Indiana Rys. & Lt. Co., of Kokomo, for $3,500. The Indiana company will furnish electricity to operate the local plant from its high-tension transmission lines.

CHICAGO, ILL.—The Chicago Tel. Co. contemplates an expenditure of $750,000 to improve its telephone service between Chicago and North Shore towns and inland points in Lake, Cook and McHenry Counties. About 10,000 miles of new line will be erected.

CHICAGO, ILL.—Bids will be received by the clerk of the Sanitary District of Chicago, Room 700, 910 South Michigan Avenue, Chicago, until June 11, for furnishing alternating-current synchronous-condenser apparatus for a continuous capacity of not less than 2000 kva or more than 2500 kva. For details see proposals columns. Thomas A. Smyth is president of board of trustees.

CLINTON, ILL.—A special election will be held on June 10 to vote on the proposal to make a contract with the Clinton Gas & El. Co. to furnish electricity to operate the pumping station of the municipal water-works system for a period of 10 years; also to vote on the proposition to issue $2,000 in bonds to construct and equip a 12-in. well at the municipal water-works.

GEORGETOWN, ILL.—The contract for construction of the new township school has been awarded to Herbert B. Kranel, at about $36,000. Contracts for lighting, heating and electrical work will be let separately and will amount to about $9,000.

GREAT LAKES, ILL.—Bids will be received at the Bureau of Yards, Navy Department, Washington, D. C., until June 13 for construction of two 400-ft. steel towers for the radio station at the naval training station, Great Lakes. Plans and specifications may be obtained upon application to the bureau upon deposit of $10, to be refunded upon return of same. H. R. Stanford is chief of bureau.

PLANO, ILL.—Preparations are being made by the Illinois Northern Utilities Co. for the installation of a new street-lighting system in Plano to cost about $10,000. The plans provide for incandescent lamps erected on 4-ft. goose-neck fixtures on poles 16 ft. above the street level, maintained by overhead wires. The work will be done by the company. L. E. Marshall, of Dixon, is general superintendent.

PRINCETON, ILL.—The City Council is reported to be considering two propositions to increase the output of the municipal electric-light plant. One is to install another generating unit in the municipal electric-light plant and the other is to contract with the Spring Valley Utilities Co., of Spring Valley, to erect a transmission line into the city.

QUINCY, ILL.—The Citizens' Water Works Co., of Quincy, is contemplating the installation of electrically driven pumps in its pumping plant and purposes to secure electricity from the plant at the Keokuk dam to operate the same.

MERRILL, WIS.—The report of the special lighting committee recommends that the Council contract with the Merrill Ry. & Ltg. Co. for a period of 10 years and that an engineer be engaged to prepare plans for a street-lighting system and to superintend the installation of same.

UNION GROVE, WIS.—The contract for the construction of the new electric-light plant in Union Grove has been awarded to the Globe El. Co., of Milwaukee.

BARNESVILLE, MINN.—Arrangements are being made for the installation of an incandescent street-lighting system, consisting of 34 standards mounted with five-lamp clusters (one 60-watt and four 40-watt lamps), to be maintained by underground wires, to cost about $2,500. Bids have already been received for the work. H. H. Pierce is superintendent of the municipal electric-light plant.

CARLTON, MINN.—Plans, it is reported, have been approved by the Village Council for improvement of the street-lighting system,which include the installation of many new lamps.

CLINTON, MINN.—At a special election held recently the proposition to grant a franchise for the installation of an electric-light system was carried.

HASTINGS, MINN.—Within the next 12 months the Hastings El. Lt. & Wtr. Pwr. Co. expects to build an 80-ft. concrete dam and install generating machinery and equipment; also to purchase two turbines, two generators and two waterwheel governors. The property of the Hastings El. Lt. & Wtr. Co. has been purchased by the River Falls Pwr Co. The main office of the company is at Hastings.

HASTINGS, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until June 15, for construction of infirmary cottage No. 9 and the superintendent's residence, State Asylum, at Hastings, including general contract work, heating and ventilating, plumbing and electrical work, in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capital Bank Building, St. Paul. Bids will be received collectively and separately Plans may be seen at the St. Paul and Minneapolis Builders' Exchanges, at the office of the superintendent of the institution, Hastings, and at the office of the State Board of Control, State Capitol Building, St. Paul.

HIBBING, MINN.—L. A. Larson, engineer, of Duluth, estimates the cost of a new municipal electric-light plant at $150,000.

PAYNESVILLE, MINN.—Within the next few months the Water and Light Commission expects to erect a water tank and tower, probably steel. John H. Haugen is recorder.

PRINCETON, MINN.—The Building, Light and Water Commission is expecting to erect within the next eight months about eight blocks of distribution line and a tower for city water supply; also to purchase within the next 30 days a water tank and tower. O. B. Randall is superintendent.

SLAYTON, MINN.—It is reported that Victor Klinger has submitted a proposal to install an electric-light plant in Slayton

ALTOONA, IA.—The Gibson El. Co. expects to purchase within the next three months poles, wire, street hoods and reflectors for the new incandescent multiple street-lighting system. G. T. Gibson is proprietor.

CORWITH, IA.—The town of Corwith contemplates securing electricity from the plant in Humboldt, provided the intermediate towns of Livermore and Luverne also vote favorably on similar propositions.

DES MOINES, IA.—If the franchise being prepared by Emil G. Schmidt, president of the Des Moines Ry. Co., is approved by the City Council, extensions and improvements will be made to the city railway system, involving an expenditure of $1,500,000 within the next three years.

EARLVILLE, IA.—Plans are being prepared by Nash & Co., of South Bend, Ind., for the construction of a municipal electric-light plant and pumping station.

GREENE, IA.—The Greene El. Lt. & Pwr. Co. has recently installed a 200-amp-hr. chloride accumulator storage battery. R Miner is secretary

HARCOURT, IA.—At a special election held recently the proposal to grant the Central Iowa Lt. & Pwr. Co., of Boone, Ia., a 20-year franchise to furnish electricity for lamps and motors in Harcourt was carried.

BLUE SPRINGS, MO.—At an election held recently the proposal to grant Nickols & Cannon a 20-year franchise to construct and operate an electric-light plant in Blue Springs was carried.

BOWLING GREEN, MO.—The Pike County El. Lt. & Pwr. Co., of Bowling Green, expects to purchase within the next 12 months one carload of poles, 5000 ft. No. 8 and No. 10 wire and 20 meters. C. K. Lee is manager.

CLARENCE, MO.—The City Council is considering the question of calling an election to submit the proposal to issue bonds for the purchase of a new engine and generator for the municipal electric-light plant. Don McIntire is superintendent.

JOPLIN, MO.—Within the next 30 days the Empire District El. Co., of Joplin, is expecting to erect a transmission line to Columbus and Scammon, Kan., a distance of 13 miles; also to erect a 750-kw substation in Scammon. George E. Hayler, Jr., is general superintendent.

KANSAS CITY, MO.—The Metropolitan St. Ry. Co., of Kansas City, it is reported, will install a 10,000-kw turbo-generator set in its power plant, for which a contract has been awarded.

KAHOKA, MO.—Within the next four months the Board of Public Work expects to erect a new power house, 70 ft. by 30 ft., and to purchase one 60-hp boiler, one 90-kw, single-phase, 60-cycle generator, one 150-hp to 200-hp engine, a motor-driven centrifugal pump, water heater, car load of poles and a series street-lighting system. On May 26 the city voted to issue $11,000 in bonds for extensions to the municipal lighting system. A. H. Frazer is superintendent.

MOBERLY, MO.—The Moberly Lt. & Pwr. Co. expects to purchase two General Electric 50-lamp rectifier, 4-amp sets within the next 30 days. J. C. Reighard is manager.

OAK GROVE, MO.—Application has been made to the City Council by W H George for a franchise to install an electric-light and ice plant in Oak Grove.

ST. LOUIS, MO.—Within the next six months the Laclede Gas Lt. Co., of St. Louis, expects to install overhead and underground feeder lines; also to purchase boilers, generators and exciters, coal, coke and ash-handling machinery, underground conduit, cable, etc. George B. Evans is assistant general manager and chief engineer.

ST. LOUIS, MO.—The Laclede Gas Co., of St. Louis, has begun work on its new by-product coke plant, the first unit to be of 56 ovens. The project will include the erection of a gas holder of 1,000,000 cu. ft. capacity, a water-pumping station, a central power plant, ammonia tanks, and machine. The cost of the entire work is estimated at $3,000,000.

SALEM, MO.—The Salem Lt. & Pwr. Co. is expecting to purchase a 20-kw generator, posts and also some electrical appliances, including vacuum cleaners, cooking apparatus, etc. W. P. Elmer is general superintendent.

UNIVERSITY, MO.—The University City Improvement Association has appointed a committee to make investigations as to the feasibility of establishing a municipal electric-light plant in University.

SIOUX FALLS, S. D.—Plans, it is reported, have been prepared for a new street-lighting system in Sioux Falls.

WESSINGTON, S. D.—The Town Council has voted to install a municipal street-lighting system in Wessington.

ASHLAND, NEB.—Within the next six months the Ashland Lt., Mill & Pwr. Co. expects to install a 60-hp to 75-hp gasoline or oil engine as auxiliary to water-power plant. F. E. White is secretary and treasurer.

FREMONT, NEB.—The City Council is considering the question of installing a heating plant in connection with the municipal light and power plant. The cost of the equipment is estimated at $40,000.

NORTH BEND, NEB.—The installation of a municipal electric-light plant is under consideration.

NORTH PLATTE, NEB.—Within the next six months the North Platte Gas & El. Co. expects to erect a new power house complete and to purchase a complete series incandescent street-lighting system, consisting of 15 lamp standards; also to purchase within the next two months two 300-hp water-tube boilers and two engine-driven alternators having a rating of about 800 kw. C. R. Morey is manager.

PAWNEE CITY, NEB.—Within the next two months the city of Pawnee City expects to erect 30 miles of transmission line and to build within the next three months a brick chimney, 100 ft. high; also to purchase within the next six months one 100-hp high-speed engine. T. H. Lawrie is superintendent.

SUPERIOR, NEB. — Preparations are being made by the Southern Nebraska Pwr. Co., of Superior, for the construction of a power plant on the Republican River, near Superior. The equipment will include two Murray boilers, of 150 hp each, Murray Corliss engines, two 40-in. and two 35-in. "Samson" waterwheels, one Lombard waterwheel governor for the 40-in. waterwheels, one Rock Island waterwheel governor and one 250-kw General Electric generator. The company now furnishes electricity in Superior, and when the plant is completed it will extend the service to about 20 other towns. Both steam and water plants will be enlarged, but plans are not yet completed. A. C. Arends, of Omaha, is engineer in charge of work. D. Guthrie is president.

VALENTINE, NEB.—The City Council, it is reported, is considering issuing bonds for repairing dam and placing the electric plant in operation.

VALLEY, NEB.—Within the next few months the village of Valley expects to purchase a regular supply of street lamps and a few coils of Nos. 8 and 10 weather-proof wire. Albert C. Hedburg is village clerk.

COLDWATER, KAN.—Bids will be received by W. F. Baker, city clerk, until June 25, for furnishing material and installing machinery in the municipal electric-light plant and water-works as follows: (1) For furnishing and installing one 100-hp oil engine; (2) one 75-kw generator, switchboard and instruments for generator, one 25-hp motor and equipment for pump; (4) one 10,000-gal. fuel-oil storage tank. For details see proposal columns. L. A. Baldwin is engineer for the city.

McPHERSON, KAN.—Within the next two months the electric light and water works commissioners expect to install oil burning equipment in the municipal electric-light plant. Philip R. Dunton is superintendent.

Southern States

CLINTON, N. C.—The local electric-light plant was recently destroyed by fire, causing a loss of about $7,000. The town will be without electric service until the plant is rebuilt.

KINSTON, N. C.—At an election to be held June 23 the proposal to issue $100,000 in bonds, the proceeds to be used for improvements to the municipal electric-light plant, roads and street works, will be submitted to the voters.

TYRON, N. C.—The Tyron El. Ser. Co. is extending its transmission line from Tyron, N. C., to Landrum, S. C. Material for this extension has been purchased.

McBEE, S. C.—Preparations are being made by W. L. McCoy for the installation of an electric-light plant, contracts for which will be let about June 15. The plant will be situated on Cedar Creek. The equipment will include a Leffel waterwheel. About 50 100-watt lamps and 750 20-watt lamps will be used. Reported in the issue of May 30 that a dam was being built on Cedar Creek preparatory to installing an electric plant.

COLUMBUS, GA.—The management of the Swift Spinning Mills has closed a contract for energy with which to operate its mills. The mills will be equipped with electrically driven machinery throughout.

ST. MARY'S, GA.—The St. Mary's Ice & Lt. Co., recently incorporated, contemplates the installation of an electric-light plant the latter part of the year. The company is now building an ice factory. S. C. Townsend and others are interested.

SAVANNAH, GA.—The Savannah Ltg. Co. is reported to have engaged the Schofield Engineering Co., of Philadelphia, Pa., to design and supervise the remodeling of power plant and substations. Additional equipment (to cost about $200,000), it is reported, will be installed.

DELRAY, FLA.—The Council has decided to submit the proposal to issue bonds for an electric-light plant and water-works system to the voters.

GULFPORT, FLA.—The City Council has granted F. J. Davenport and associates a 30-year franchise to construct and operate an electric-light and power plant and water-works system in Gulfport.

KISSIMMEE, FLA.—Preparations are being made to install an engine and generator in the municipal electric-light plant. Equipment, it is understood, has been purchased.

MELBOURNE, FLA.—Work will soon begin on the installation of an electric-light system in Melbourne, bonds for which have recently been sold.

CAMDEN, TENN.—J. S. Madey & Son, of Mayfield, it is reported, contemplate the installation of an electric-light plant in Camden.

BAY MINETTE, ALA.—The installation of electric-lighting and water-works systems in Bay Minette is under consideration.

BIRMINGHAM, ALA.—The Birmingham Ry., Lt. & Pwr. Co. has entered into a contract with the Alabama Pwr. Co., under which the former will use energy generated at the plant at Lock 12 on the Coosa River. The contract will go into effect as soon as the tower transmission line is completed.

FOLEY, ALA.—The Swanstrom Brothers' Mill Co., of Foley, it is reported, contemplates the installation of an electric plant to furnish electricity for lamps and motors for its mill.

GADSDEN, ALA.—The City Council has granted the Alabama Pwr. Co., of Birmingham, a franchise to erect a transmission line on Second Street in Oak Park addition to enable the company to furnish electricity to the steel mills of the Gulf States Steel Co.

VICKSBURG, MISS.—The city of Vicksburg has awarded the Vicksburg Lt. & Pwr. Co. a new contract for street-lighting for a period of five years, under which the company agrees to replace the 226 incandescent lamps of 60 cp with 80-cp lamps, also to install at its own expense before Dec. 1, 1914, 31 ornamental posts, each carrying three-lamp clusters. C. G. Johnson, is manager of the Vicksburg company.

HOT SPRINGS, ARK.—The Railroad Commission has granted the Ouachita Pwr. Co. of Arkansas permission to construct a hydroelectric power plant on the Ouachita River, about 6 miles from Hot Springs. The company proposes to develop from 6000 hp to 7000 hp at its principal power dam, which will be situated about 1¼ miles from the Rock Island track, from Lawrence station and Essex Park race track, and to locate a large cotton mill near its power plant. The remainder of the energy generated at the plant will be transmitted to Hot Springs, Benton, Malvern, Little Rock and other points within a radius of 150 miles.

STUTTGART, ARK.—A petition has been presented to the City Council favoring municipal ownership of the water and light plant. The Council has passed an ordinance forming an improvement district to finance the plant.

WASHINGTON, ARK.—The Haygood Seminary Lt. & Trac. Co., of Washington is installing an electric plant to furnish electricity for lighting the streets, and for residential and commercial lighting, and also for motors in Washington. All the equipment has been purchased excepting a 20-hp oil engine. M. Betton, of Washington, has charge of the engineering work. R. Carter is president.

ABITA SPRINGS, LA.—The City Council is reported to be considering a proposal submitted by a local company to furnish electricity for lighting the town.

HENRYETTA, OKLA.—The contract for construction of power house, it is reported, has been awarded to Paul E. Meeting. The Tonkawa Construction Co. has been awarded the contract for equipment for plant.

DALLAS, TEX.—The Dallas El. Lt. & Pwr. Co., it is reported, is planning to enlarge its power plant and place its wires underground in the downtown district, at a cost of about $1,000,000. The Stone & Webster Management Association, of Boston, Mass., is general manager.

DALLAS, TEX.—Plans are being prepared by the Northern Texas Utilities Co., of Dallas, for the construction of a power plant to furnish electricity in several towns, contracts for which will be awarded in about 60 days. W. C. Woodlief, Box 1615, Dallas, is engineer in charge; Hiram Grosman is president.

NIXON, TEX.—The installation of an electric-light plant in Nixon is under consideration. C. D. Pucket is reported interested in the project.

SAN ANGELO, TEX.—The San Angelo Wtr., Lt. & Pwr. Co. has inaugurated a new-business department and would like to receive prices and catalogs on signs, motors, electrical appliances, etc. W. A. Guthrie is general manager.

SEGUIN, TEX.—Preparations are being made by the Guadalupe Pwr Devel. Co. for the construction of five power dams on the Guadalupe River immediately, the first to be located 6 miles below Seguin and the other four at points further up the stream. These five dams, it is estimated, will develop about 10,000 hp. Nine other dams will be built within the next eight years capable of developing 20,000 hp. The company has been granted a permit by the State board of engineers for the construction of these dams, and also the right to the power that is produced by damming water above the level of the stream. Large storage reservoirs will be erected. Electricity will be transmitted to towns and cities in southwest Texas, including San Antonio. Guy C. Simpson, of San Antonio, is engineer in charge.

SONORA, TEX.—Contract, it is reported, has been awarded by J. D. Eaton & Son, owners of the local water-works system, to the West Brook-Broome El. Co., of San Angelo, to install an electric-light plant, to cost from $5,000 to $7,500.

Pacific States

MOLSON, WASH.—Application has been made to the County Commissioners of Okanogan County by David Moore for a franchise to erect transmission lines along the county roads of Okanogan County and the streets of Molson and also to operate a water-works system in Molson.

POMEROY, WASH.—The Pacific Pwr. & Lt. Co., of Portland, it is understood, will begin work immediately on improvements to its local electric plant.

REPUBLIC, WASH. — Application has been made to the Commissioners of Ferry County by F. M. Shields and M. McKain, of Spokane, for a franchise to erect an electric transmission line from Republic to Danville, a distance of 35 miles, to cost approximately $75,000. Energy will be secured from the plant of the West Kootenai Pwr. Co. at Bonnington Falls, B. C.

SPOKANE, WASH.—Petitions have been filed for a new ornamental lighting district, to include the entire length of First Avenue from Bernard to Cedar Street. The plans provide for the erection of ornamental iron posts carrying luminous arc-lamps.

NEHALEM, ORE.—The installation of a municipal electric-lighting system in Nehalem is under consideration.

RIDDLE, ORE.—It is reported that W. Vaughn, owner of the Geer box factory in Riddle, is contemplating the installation of an electric plant, to turnish electricity for lighting the streets of the city and for commercial and residential lighting.

GREENVILLE, CAL.—The Indian Valley El. Lt & Pwr Co., of Greenville, has filed an application with the State Railroad Commission, asking the commission to modify an order made in September, 1912, authorizing the company to issue $81,535 in bonds. The company has issued none of the bonds and wishes now to enter into an agreement with the Great Western Pwr. Co. to take energy at the Big Meadow dam, 13 miles distant from the main station of the Indian Valley company. The agreement, if authorized, will require an outlay of $20,396 for the erection of a transmission line between Greenville and the Big Meadow dam. The company is to change its name to the Plumas Lt. & Pwr. Co., under which name it wishes to issue $80,000 in bonds.

LOS ANGELES, CAL.—Application has been filed with the State Railroad Commission by the Midland Counties Public Service Corpn., of Los Angeles, formerly the Coalinga Wtr. & El. Co., for authority to issue $650,000 in capital stock. Of this amount $410,000 will be used for refunding purposes and $237,627 for new construction.

OAKLAND, CAL.—The Vernon-Rockridge Improvement Club has filed a petition with the City Council asking permission to install 36 electroliers along College Avenue for 13 blocks in the center of the Vernon-Rockridge district and requesting the city to pay for maintenance of the lamps. The cost of the electroliers and lamps is estimated at $4,000, which the club agrees to pay.

REDLANDS, CAL.—The State Railroad Commission has granted the Coachella Valley Ice & El. Co., of Redlands, permission to use the franchise granted by Riverside County to erect electric transmission lines to Coachella and the Imperial Valley. The company has also received authority from the commission to issue $300,000 in bonds.

SANTA BARBARA, CAL.—A petition has been presented to the City Council by A. C. Olney, representing the Chamber of Commerce, asking for the establishment of an assessment district for ornamental lamps on State Street.

SAUSALITO, CAL.—The Board of County Supervisors has granted the Pacific Gas & El. Co. a franchise to erect transmission lines to distribute electricity in Marin County, particularly in Bolinas and in Willow Camp.

BOISE, IDAHO.—Preparations, it is reported, are being made by the Overlook Mining & Development Co. for the construction of a hydroelectric-power plant on its property, about 80 miles from Boise City.

GRANGEVILLE, IDAHO.—Preparations, it is reported, are being made by Supplee & Adams to construct a power plant on the American River, to furnish electricity to the mines in this section and for lighting purposes in Elk City.

SANDPOINT, IDAHO. — Negotiations have been closed between the Northern Idaho & Montana Pwr. Co., of Sandpoint, and the Northern Pacific R. R. Co., whereby the former will furnish electricity to the railway shops of the Northern Pacific company at Kootenai for a period of five years. The contract will take effect as soon as connection can be made by the power company.

WEISER, IDAHO.—We are informed that the Adams County Lt. & Pwr. Co. does not contemplate developing a water-power site on Rush Creek, as reported in the issue of May 9, and is not connected with Weiser in any way. Its place of business is in Cambridge. B. Gustad, of Cambridge, is president and general manager.

PHOENIX, ARIZ.—Surveys of the transmission lines of the Falls Pwr. & El. Co., it is reported, have been completed and work will soon begin on the erection of the system, which will consist of 8 miles of 4000-volt main line and 17 miles of 2200-volt, secondary line and local service for both lamps and motors at 110 volts.

BOZEMAN, MONT.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 20 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Bozeman. Drawings and specifications may be obtained from the above office or from the custodian of site at Bozeman. O. Wenderoth is supervising architect.

HELENA, MONT.—The Helena Lt. & Ry. Co. is expecting to purchase within the next four months several electric ranges, washing machines and dishwashers. C. A. Bernier is superintendent of electrical department.

SACO, MONT.—The Moore Tel. Co. is contemplating the installation of a municipal electric-lighting plant with sufficient output to maintain 1000 lamps. The plant, when completed, will be turned over to Harry F. Eline.

TORRINGTON, WYO. — Bonds to the amount of $5,000 have been voted to establish an electric light and power plant. Earle H. Reid is city clerk.

KERSEY, COL.—The Home Gas & El. Co. has applied to the Board of Trustees for a franchise to furnish electricity in Kersey for a period of 20 years.

LAHONTAN, NEV.—Bids will be received at the office of the United States Reclamation Service at Fallon, Nev., until June 25 for the lease from the United States of the electric power plant at Lahontan, Truckee-Carson project, Nevada. For particulars address the United States Reclamation Service at Washington, D. C.; Fallon, Nev., or 605 Federal Building, Los Angeles, Cal. A. P. Davis is chief engineer.

CARRIZOZO, N. M.—Plans, it is reported, are being prepared by J. H. Fulmen of the Eagle Mining Co., of Parsons, for the erection of an electric power plant to furnish electricity to operate the machinery in the mines recently acquired by the company, and for a crushing and concentrating plant.

Canada

ATHABASCA, ALTA.—The Mayor has authorized the fire, light and police committee to prepare a report relative to the installation of an electric-lighting system in Athabasca. It is proposed to install the system this year.

EDSON, ALTA.—The town of Edson, it is understood, will soon begin work on the installation of a municipal electric-light plant for which bonds to the amount of $45,000 have been issued.

RED CLIFF, ALTA.—Preparations are being made for extension of the street-lighting system, to cost about $6,000, contracts for which will be let in June. The plans provide for the erection of 100 ornamental iron posts (made by local manufacturer). J. Ellisknith is town engineer.

PRINCE RUPERT, B. C.—The City Council has authorized an expenditure of $34,709 for extensions to the municipal telephone system, and $10,189 for extensions and improvements to the municipal electric-lighting plant. Bids for material and installing same will soon be called for.

REVELSTOKE, B. C.—The contract for water turbine for the municipal hydroelectric-light plant has been awarded to Esher, Wyss & Co., of Vancouver, at $10,300, and for generator, exciter and switchboard to the Canadian Electric Co., at $6,993.

VANCOUVER, B. C.—The J. Z. Lajoie Co., a subsidiary of the Canadian Northern Ry. Co., it is reported will develop the Lajoie Falls to generate electricity to operate trains through the tunnel of the Canadian Northern Railway.

BATHURST, N. B.—Plans are being prepared by the Bathurst Pulp Co. for the construction of a large pulp and paper mill, to be equipped throughout with electrically operated machinery. The power plant will be equipped with three 750-kw, 550-volt alternating-current generators. Mr. McDiarmid, of the Montreal Lt., Ht. & Pwr. Co., of Montreal, is consulting engineer.

PORT HAWKESBURY, N. S.—A movement is under way to establish an electric-light plant in Port Hawkesbury. The Northern Atlantic Fisheries Co. has a 50-kw outfit at its cold-storage plant and it is proposed that the company install a lighting system for the town.

DUTTON, ONT.—The Town Council is reported to be considering the installation of a hydroelectric system.

HAGERSVILLE, ONT.—The Village Council is considering extensions to the electric-lighting system.

NEW TORONTO, ONT.—The application of the Brown's Brass Rolling Mills for 300 hp to operate its mills has been granted by the Hydro-Electric Power Commission of Toronto.

TORONTO, ONT.—Contracts have been awarded by the Hydro-Electric Power Commission of Ontario for the construction of distribution stations in Creemore, Port McNicol, Waubaushene, Strathroy and Tilbury.

TORONTO, ONT.—The Toronto Board of Control has authorized the Toronto Hydro-Electric system to prepare a report on the proposition of establishing a municipal steam plant. It is proposed to sell steam for heating purposes and also to provide a source of power for emergency purposes for the water-works and hydroelectric systems.

COTEAU LANDING, QUE.—The Cedar Rapids Mfg. & Pwr. Co. and the Cedar Rapids Transmission Co., of Coteau Landing, has applied to the Governor-in-Council for authority to erect a transmission line across the St. Lawrence River, joining the line of the St. Lawrence Transmission Co.

MONTREAL, QUE.—At the suggestion of the city officials Mr. Parent, superintendent of lighting, will prepare a report on the cost of installing an electric plant with sufficient output to maintain 500 street lamps for the central district.

THREE RIVERS, QUE.—The installation of an ornamental street-lighting system is being considered by the City Council. The plans provide for arc lamps erected on ornamental iron standards.

ASSINIBOIA, SASK.—The Village Council is considering the installation of a municipal electric-light plant. Murphy & Underwood, of Saskatoon, are engineers.

SASKATOON, SASK.—Tenders will be received by the City Commissioners of Saskatoon until June 20 as follows: (A) For two 4,000,000-gal. motor-driven centrifugal pumps, with switch panels and starting equipment. (B) one turbine-driven centrifugal boiler-feed pump, complete with steam separator, gages and tools; (C) one 75-kw motor-generator exciter; (D) one 600-kw rotary converter and transformers with switchboard panels, etc.; (E) three 400-kw transformers and switch gear equipment; (F) for 17,700 ft. of 11,000-volt cable, partly armored, lead-covered, and partly lead-covered only, and for laying, jointing and connecting up the same; (G) 1 mile of 2200-volt, four-core, 211,600-circ. mil cable and for installation of same in conduit; (H) 9000 ft. of 500,000-circ. mil single-conductor, double-braided weatherproof cable. Specifications, instructions to bidders and forms of tender may be obtained from E. Hanson, city electrical engineer, Saskatoon. F. E. Harrison is Mayor.

WOLSELEY, SASK.—By-laws providing for extensions to the electric-lighting system, etc., will soon be submitted to the ratepayers.

New Incorporations

DOVER, DEL.—The Southern Utah Pwr. Co. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $600,000. The company proposes to distribute electricity for lamps, heat and motors. The incorporators are E. P. Bacon, H. V. Hoyt and O. P. M. Biereach, of Boise, Idaho.

CHICAGO, ILL.—The Central West Electric Co. has been incorporated with a capital stock of $5,000 by Max W. Zabel, Albert A. Radtke and H. A. Jones.

FULTON, KY.—The Pub. Ser. Co. of Western Kentucky has been incorporated with a capital stock of $140,000 by J. H. Boughton, W. C. Morehead and H. L. Lowe. This company is a consolidation of Fulton El. Lt., Ht. & Pwr. Co., of Fulton, and the Hickman El. Ice & Wtr. Co., Hickman.

RENO, NEV.—The Beaver River Pwr. & Plant Co. has been incorporated with a capital stock of $100,000 by H. R. Waldo, George F. Halliday, O. P. McBiersach, E. P. Bacon and H. V. Hoyt.

VERNON, N. Y.—The Tyler Lt. & Pwr. Co. has been granted a charter with a capital stock of $500. The incorporators are Mary E. Tyler, George E. Capes and Edwin E. Morris.

HASKELL, OKLA.—The Haskell Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by C. W. Marston, J. O. Dowdy and R. B. Harris.

DELL RAPIDS, S. D.—The Dell Rapids Lt. & Pwr. Co. has been incorporated with a capital stock of $20,000 by N. C. Draper and others.

MEXIA, TEX.—The Mexia Wtr., Lt. & Pwr. Co. has been chartered with a capital stock of $140,000. The incorporators are W. P. Cook, Joseph Nussbaum and O. H. Brannon.

RICHMOND, VA.—The American Wtr. Wks. & El. Co. has been granted a charter with a capital stock of $25,000,000 for the purpose of owning, operating and building water and electric plants. The officers of the company are: H. Hobart Porter, of New York, N. Y., president; Henry H. Pearce, of New York, N. Y., secretary, and Charles L. Scott, of Hempstead, N. Y., treasurer. The headquarters of the company will be in Richmond.

HAMILTON, ONT., CAN.—The Skootamatta Pwr. & Devel. Co. has been incorporated with a capital stock of $300,000 by H. D. Petrie, S. L. Heaton and M. E. Smith.

Directory of Electrical Associations, Societies, Etc.

Alabama Light and Traction Association. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala.

American Association for the Advancement of Science. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

American Electric Railway Accountants' Association. Secretary-treasurer, E. B. Burritt, 29 West 39th St., New York.

American Electric Railway Association. Secretary, E. B. Burritt, 29 West 39th St., New York.

American Electric Railway Engineering Association. Secretary, E. B. Burritt, 29 West 39th St., New York.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Electro-Therapeutic Association. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

American Institute of Consulting Engineers. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual meeting, Detroit, Mich., June 23-25, 1914.

American Physical Society. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

American Society of Refrigerating Engineers. Secretary, William H. Ross, 154 Nassau St., New York City.

American Society for Testing Materials. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

American Society of Heating and Ventilating Engineers. Secretary, Edwin A. Scott, 29 West 39th St., New York.

American Water Works Association. Secretary, J. M. Diven, 47 State St., Troy, N. Y.

Arkansas Association of Public Utility Operators. Secretary, W. J. Tharp, Little Rock, Ark.

Association of Edison Illuminating Companies. Secretary, Geo. C. Holberton, Pacific Gas & Electric Co., San Francisco, Cal.

Association of Iron and Steel Electrical Engineers. Secretary, W. T. Snyder, McKeesport, Pa.

Association of Railway Electrical Engineers. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, 112 West Adams St., Chicago.

California Electrical Contractors' Association. Secretary, W. S. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

Canadian Electrical Association. Affiliated with N. E. L. A. Secretary-treasurer, J. H. Larmouth, 610 Confederation Life Bldg., Toronto, Can. Annual meeting, Montreal, Que., June 24-26.

Colorado Electric Club. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

Commercial Section, N. E. L. A. Secretary, J. F. Becker, 1170 Broadway, N. Y.

Eastern New York Section, N. E. L. A. Secretary, C. S. Van Dyck, Schenectady, N. Y.

Electric Club of Chicago. Secretary, Fred M. Rosseland, Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

Electrical Contractors' Association of Greater Boston. Secretary, R. S. Hale, 39 Boylston St., Boston.

Electrical Contractors' Association of Massachusetts. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

Electrical Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

Electrical Contractors' Association of the City of Chicago. Secretary, M. N. Blumenthal, 179 West Washington St. Meets at noon on the second and fourth Wednesday of each month at 424 South Wabash Ave.

Electrical Contractors' Association of State of Missouri. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

Electrical Contractors' Association of Wisconsin. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

Electrical Credit Association of Chicago. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

Electrical Credit Association of Philadelphia. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa.

Electrical Salesmen's Association. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

Electrical Supply Jobbers' Association. General Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

Electrical Trades Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

Electric Vehicle Association of America. Executive secretary, A. Jackson Marshall, United Engineering Societies Building, 29 West 39th St., N. Y. Sections in New England, Chicago, Philadelphia and Washington.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

Faraday Electrical Association. Secretary, W. J. Collins, 1129 Masonic Temple, Chicago. Meets at noon on the first and third Wednesday of each month at Planters' Hotel.

Gas, Electric and Street Railway Association of Oklahoma. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

Georgia Electrical Contractors' Association. Secretary, J. M. Clayton, Atlanta, Ga.

Hydroelectric Section, N. E. L. A. Secretary, S. A. Sewall, 29 West 39th St., N. Y.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh. Annual meeting, Cleveland, Sept. 21, 1914.

Independent Electrical Contractors' Association of Greater New York. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

Independent Telephone Association of America. Secretary, W. S. Vivian, Grand Rapids, Mich.

Indiana Electric Light Association. Secretary, Thomas Donahue, Lafayette, Ind.

Indiana State Electrical Contractors' Association. Secretary, George Skilman, Indianapolis, Ind.

Institute of Operating Engineers. Secretary, L. Houmiller, 29 West 39th St., New York.

Institute of Radio Engineers. Secretary, E. J. Simon, 71 Broadway, N. Y.

Internal Combustion Engineers' Association. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex.

International Electrical Congress. Secretary-treasurer, Preston S. Millar, 80th St. and East End Ave., New York. Congress, San Francisco, Sept. 13-18, 1915.

International Engineering Congress. Secretary-treasurer, W. A. Cattell, Foxcroft, Building, San Francisco, Cal. Congress, San Francisco, September, 1915.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 9-11, 1915.

Iowa Electrical Association. Affiliated with N. E. L. A. Secretary, W. H. Thomson, Des Moines, Ia.

Iowa Electrical Contractors' Association. Secretary, M. T. Humphrey, Waterloo, Ia.

Iowa Street and Interurban Railway Association. Secretary, H. E. Weeks, Davenport, Ia.

Jovian Order. Jupiter (president), W. N Matthews, St. Louis, Mo.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

Kansas Gas, Water, Electric Light and Street Railway Association. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan.

Louisiana Electrical Contractors' Association. Secretary, J. J. Ziegler, 227 Bourbon St. Meeting every Wednesday, Audubon Building, New Orleans.

Maine Electric Association. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

Michigan Electric Association. Affiliated with N. E. L. A. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich. Annual convention, Detroit-Thousand Islands, June 17.

Minnesota Electric Association. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

Mississippi Electric Association. Affiliated with the National Electric Light Association. Secretary - treasurer, H. F. Wheeler, Hattiesburg, Miss. Next annual meeting, Hattiesburg, April 12-14, 1915.

Missouri Electric, Gas, Street Railway and Water Works Association. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

National Arm, Pin and Bracket Association. Secretary, J. B. Magers, Madison. Ind.

National Association of Electrical Inspectors. Secretary - treasurer, Wm. L Smith, Concord, Mass.

National District Heating Association Secretary, D. L. Gaskill, Greenville, Ohio.

National Electric Light Association. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

National Electrical Contractors' Association of the United States. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago. Annual meeting, June, 1914.

National Fire Protection Association. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass Open meeting, New York, March, 1915.

National Independent Telephone Association. Secretary-treasurer, J. B. Earle, Waco, Tex.

Nebraska Section, N. E. L. A. Secretary-treasurer, S. J. Bell, David City, Neb.

New England Electrical Credit Association. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Section, Electric Vehicle Association of America. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass

New England Street Railway Club Secretary, H. A. Faulkner, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New England Section, N. E. L. A. Secretary, Miss O. E. Bursiel, 149 Tremont St., Boston, Mass. Annual meeting, Narragansett Pier, R. I., Sept. 2-4.

New Orleans Electrical Contractors' Association. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

New York Electric Railway Association. Secretary, Charles C. Dietz, 239 W 39th St., New York.

New York Electrical Credit Association. Affiliated with the National Electrical Credit Association. Secretary, Franz Neilson, 80 Wall St., New York.

New York Electrical Society. Secretary, G. H. Guy, 33 West 39th St., New York. Annual meeting, New York, June, 1914.

Northwest Section, N. E. L. A. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash.

Northern White Cedar Association. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

Oregon Electrical Contractors' Association. Secretary, F. C. Green, 291 East Morrison St., Portland, Ore. Annual meeting, Portland, June 8-9.

Pennsylvania Electric Association (State Section N. E. L. A.). Secretary-treasurer, S. C. Pohe, Bloomsburg, Pa.

Railway Signal Association. Secretary treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

Society for Electrical Development, Inc. General manager, J. M. Wakeman, 29 West 39th St., New York.

Society for the Promotion of Engineering Education. Secretary, Prof. H. H. Norris, Ithaca, N. Y.

Southeastern Section, N. E. L. A. Secretary-treasurer, A. A. Wilbur, Columbus, Ga. Annual meeting, Isle of Palms, Charleston, S. C., Aug. 19-21, 1914.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Manchester, Vt

Western Association of Electrical Inspectors. Secretary, W S. Boyd, 76 West Monroe St., Chicago, Ill.

Western Society of Engineers, Electrical Section. Secretary, J H Warder, 1737 Monadnock Block, Chicago.

Wisconsin Electrical Association. Secretary, George Allison, 1410 First National Bank Bldg., Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 26, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y]

1,097,626. System of Electrical Signaling. E. A. Hummel, St. Paul, Minn. App. filed Oct. 29, 1908. Synchronizing a series of clocks from a master clock.

1,097,640. Thermostatic Circuit Controller; W. L. Jacoby, Larchmont, N. Y. App. filed Feb. 12, 1913. For fire-alarm systems; protected against dust and moisture.

1,097,644. Calling Device; W. Kaisling, Chicago, Ill. App. filed April 26, 1911. For two-wire or metallic-line telephone systems.

1,097,651. Measuring Apparatus; M. E. Leeds, Philadelphia, Pa. App. filed Nov. 18, 1912. Wheatstone-bridge principle.

1,097,679. Electromagnetic Switch; W. M. Scott, Philadelphia, Pa. App. filed June 15, 1910. For remote-control systems.

1,097,680. Electromagnetic Switch; W. M. Scott, Radnor, Pa. App. filed March 8, 1912. Electro-responsive means releases contact member from mechanical control.

1,097,699. Electric Alarm and Fire Escape; F. C. White, Jr., Denver, Col. App. filed July 5, 1912. Rope-ladder system with alarm.

1,097,736. Electrical-Receptacle-Attaching Device; J. S. Stewart, New York, N. Y. App. filed Dec. 18, 1912. For attaching lamp receptacles to sign plate.

1,097,742. Double-Current Generator; F. H. Wade and W. E. Bauerle, Oak Park, Ill. App. filed April 24, 1912. For converting single-phase generator into double-phase generator.

1,097,760. Intercommunicating Telephone System; S. A. Koltonski, Boston, Mass. App. filed Nov. 10, 1911. Substitution of the holding coil for the telephone set is effected automatically.

1,097,789. Typewriting Machine; T. Cahill, New York, N. Y. App. filed Oct. 17, 1900. Electric typewriter with means to prevent printing one character on top of another.

1,097,801. Electrolytic Converter for the Transformation of Alternating Currents into Continuous Currents; A Heinz, Paris, France. App. filed Oct. 22, 1913. Employs circular electrode of lead alloyed with antimony.

1,097,810. Driving Means for Electric Locomotives; G. Lundholm, Vesteras, Sweden. App. filed Jan. 30, 1914. Double-crank system of drive from motor to wheels.

1,097,823. Alternating-Current Motor; S. Sparrow, St. Louis, Mo. App. filed May 13, 1911. Commutator type, automatically assuming characteristic resembling that of shunt motor.

1,097,826. Electrolytic Cell; C. P. Townsend, Washington, D. C., and E. A. Sperry, Cleveland, Ohio. App. filed Dec 5, 1903. For electrolysis of solutions. (Fifty-five claims.)

1,097,859. Membraneous or Diaphragm Transmitter for Submarine Sound Signals; H. Hecht, Kiel, Germany. App. filed July 7, 1913. Electromagnetically operated tuning fork attached to skin of vessel.

1,097,861. Toll-Operating Circuits; E. E. Hinrichsen, Alexander, Ill., and J. F. Toomey, New York, N. Y. App. filed Nov. 18, 1911. Tandem trunk system.

1,097,867. Selector Switch for Automatic Telephone Exchanges; F. R. McBerty, New Rochelle, N. Y. App. filed Feb. 26, 1910. Improved mounting for parts of selector switch.

1,097,868. Automatic Telephone Exchange Selector; F. R. McBerty, New Rochelle, N. Y. App. filed July 23, 1910. For rapidly effecting interconnection of a large number of lines.

1,097,871. Electric Flashing Device, T. J. Murphy, Rochester, N. Y. App. filed May 17, 1910. Flashing arc controlled by simple switch.

1,097,872. High-Tension Device; T. J. Murphy, Rochester, N. Y. App. filed May 17, 1910. Rotatable disk electrodes.

1,097,873. Electric Oscillator; D. M. Palmer, Los Angeles, Cal. App. filed June 24, 1913. For operating semaphore signal.

1,097,883. Roller Contact for Electric Welding Machines. K. Schmarje, Frankfort, Germany. App. filed March 13, 1913. Cooling system for large roller contacts.

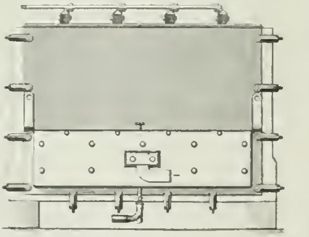
1,097,884. Automatic-Alarm Lock; M. Sheinman, New York, N. Y. App. filed May 15, 1913. Alarm circuit closed when lock is tampered with or door forced open.

1,097,895. Spot-Welding; E. Thomson, Swampscott, Mass. App. filed May 10, 1913. Welding automatically effected by simply feeding in the sheets to be spot-welded.

1,097,910. Electric Flashlight; W. Broad, Beaver Falls, Pa. App. filed June 25, 1913. Has refillable semi-dry cell battery.

1,097,927. Automatic Telephone-System Selector; F. R. McBerty, New Rochelle, N. Y. App. filed Feb. 10, 1910. Terminals supported in rigid relation to the brushes.

1,097,954. Motor-Driven Vehicle; G. R. Wadsworth, Cleveland, Ohio. App. filed Aug. 24, 1912. Electric "compensating motor" is cut into service at certain engine speeds to assist the internal-combustion engine, thus eliminating reduction gearing.



1,097,826—Electrolytic Cell

1,097,960. Telephone Repeating Device. D. H. Wilson, New York, N. Y. App. filed Jan. 2, 1913. Embodying amplifying device with primary and secondary coil and two induction coils.

1,097,964. Fuse; W. C. Banks, New York, N. Y. App. filed Sept. 5, 1913. Inclosed type with "glass wool" surrounding ends of fuse strips.

1,097,974. Receiver for Wireless Communication; W. Harrison, Brooklyn, N. Y. App. filed Aug. 27, 1903. Responsive effect of a number of separate antennas and separate wave detectors is rendered cumulative.

1,098,015. Selective Switch System. F. E. Case, Schenectady, N. Y. App. filed Aug. 7, 1908. For cars on roads operating at different potential in different localities.

1,098,016. Water Gage; S. E. Caughey, Moline, Ill. App. filed June 18, 1913. With electrical indicators and signal.

1,098,031. Motion-Picture Camera; A. C. Forsberg and H. C. Schlicker, New York, N. Y. App. filed Jan. 6, 1914. With steam generator to prevent "static" marking of the film.

1,098,039. Spirit Level; A. W. Kibler and J. J. Pennington, Butte, Mont. App. filed Jan. 10, 1914. With built-in lamp for illuminating it in dark corners.

1,098,052. Magneto Machine. E. Podlesak, Tiffin, Ohio. App. filed July 21, 1911. For ignition purposes.

1,098,085. Pistol Flashlight; J. Block, Brooklyn, N. Y. App. filed Sept. 12, 1913. Casing in hinged half sections resembling automatic pistol.

1,098,112. Signaling System for Electric Railways; A. D. Hughes and T. H. Hertzog, Washington, Pa. App. filed July 17, 1912. For automatically controlling lights on overhead trolley system.

1,098,120. Cabinet; V. F. Larson, Detroit, Mich. App. filed Dec. 4, 1913. Bath cabinet with lamps adjustable therein toward and away from patient.

1,098,133. Pantograph Trolley; S B. Stewart, Jr., Schenectady, N Y. App. filed Sept. 10, 1908. Supplemental spring mounting permits contact to have movement independent of trolley structure.

1,098,134. Motor Controllers. F. T Taylor, New York, N. Y. App. filed July 28, 1909. For removing and then reinserting the regulating resistance.

1,098,192. Electric Rail Bond; B. H. Thompson, North Adams, Mass. App. filed March 8, 1913. Spring-pressed bonding devices seated in cavities in abutting rail ends.

1,098,204. Current-Distributing Network. G. Wolff, Berlin, Germany. App. filed Oct. 1, 1912. Means for automatically separating the main conductors in sections from one another as soon as fault in insulation occurs.

1,098,211. Electric Sign; W. W. Arnold, Hamilton, Ohio. App. filed July 9, 1910. Keyboard-controlled advertising sign.

1,098,226. Magneto; W. Casey and I. Lesses, Kingston, Ontario, Canada. App. filed Feb. 15, 1913. High-tension, entirely inclosed waterproof structure.

1,098,231. Electric Accumulator Plate. G. O. Davies, Harrow, Eng. App. filed Feb. 2, 1914. Has reinforcing slats of light material such as wood.

1,098,242. Electric Horn Switch; J. E. Foulks, Jr., New York, N. Y App. filed Dec. 12, 1912. Contact ring beneath steering wheel, which may be moved without taking hand from wheel.

1,098,246. Housing for Electromagnets; E. Gengenbach, New York, N. Y. App. filed Jan. 11, 1913. Made of sheet metal.

1,098,291. Swivel Connector. G. W. Oakes, Kokomo, Ind. App. filed Oct. 10, 1912. Quickly assembled construction for preventing tangling of conductors about apparatus to which they are attached.

1,098,338. Cleaning Metal Surfaces; C. H. Thompson, Stourbridge, Eng. App. filed May 20, 1913. Bath of chloride, sulphate or nitrate solution through which alternating current is passed.

1,098,345. Generation of Polyphase Alternating Electric Currents of Varying Frequencies; W. P. Durtnall, Herne Bay, Eng. App. filed Nov. 1, 1909. For providing speed regulation of motor propelling a vehicle.

1,098,357. Process of Treating Wood for Storage-Battery Separators; J. M. Skinner, Philadelphia, Pa. App. filed Dec 26, 1912. Immersing in aqueous solution of sodium sulphide.

1,098,361. Flywheel Magneto for Explosive Engines; E. S. Huff, Detroit, Mich App. filed April 27, 1908. Permanent magnets on flywheel co-operating with coils on engine structure.

1,098,362. Burglar Alarm; T. H. Nelson, Chicago, Ill. App. filed July 15, 1912 May be "set" with window adjusted in any position.

13,739 (reissue). Portable Rheostat for Welding Apparatus; J. M. Yount, San Francisco, Cal. App. filed Oct. 15, 1913. Original patent No. 1,046,708, Dec. 10, 1912. Portable rheostat casing with line taps and covers, which may be raised for ventilation purposes.

Electrical World

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Development of Foreign Trade That we need governmental assistance in the development of foreign trade is the substantial argument of the paper read by Mr. Oudin before the first national foreign trade convention, held in Washington last week. The abstract of the paper by Mr. Oudin, published in our issue of June 6, pointed out the fact that friendly intercourse and commercial treaties with over-sea countries, maintained through co-operation of the government, constitute the main door to foreign trade. Legislative and administrative branches of our government can do a large work for manufacturers and the country generally if they will be guided by right commercial principles. The administrative branch of the government can do more than it has done in the past if Congress provides it with necessary funds for commercial representatives abroad. Even without more funds, however, administrative officials can accomplish more than they have done in the recent past by retaining efficient representatives abroad and refusing to turn out trained men so as to give the spoils of office to newcomers. The legislative branch of the government can do much by distinguishing in trust regulation laws between interstate and foreign commerce. It should destroy all restrictions preventing agreement among manufacturers on foreign trade. In doing business with foreign countries our manufacturers have to meet combinations of European manufacturers that are authorized by law. No matter what this government does to prevent combinations in interstate trade, it should not prevent combinations with respect to foreign trade. The lawmakers should see that the laws promote foreign trade.

Street Lighting by Special Assessment Private street-lighting systems are maintained in large number in American cities. Generally they are installed by merchants on business streets as an advertising attraction, although this is by no means universally the case. Use is almost always made of incandescent lamps supported singly or in clusters on posts of medium height placed at or very near the curb line. Usually the electrical energy and the maintenance service are supplied by an electric-service company. Sometimes an association represents allied property owners, and sometimes the individuals deal directly with the company. This method of lighting for special or advertising purposes has been unquestionably of great value to the community affected by the general street illumination. However, the success of the plan depends on co-operation among a group of business men, and this concerted action must be practically unanimous; otherwise there will be irregularity in the spacing of the lamps with frequent comparatively dark spots. Under these circumstances it is argued that, taking a leaf out of the book of these group-lighting installations and carrying the idea a step farther, commercial street lighting should be supplied under a special-assessment system and paid for by the owners of the abutting property. There seems to be no objection to this proposal which cannot be urged with equal force against the building and maintenance of pavements or sidewalks. The special illumination gives added value to every foot of property within the area lighted. The system proposed would seem to be equitable and permanent. It is probable that under a properly worked-out special-assessment system depreciation on equipment other than the lamps and accessories would not be more than 4 per cent. The city can borrow money at a rate not greatly in excess of 4 per cent. Under a special assessment system the ample lighting of the entire street would be the object sought. Energy for the regular city or police lighting and the special lighting might be supplied from the same system, and they would supplement each other.

Attack on a Public Utility Commission Sometimes the best answer to a vicious attack is silence. In other cases an answer is wise. One of these cases is the attack of the Minnesota Home Rule League on the regulation of public utilities by the Railroad Commission of Wisconsin. This league has published a book which purports to give "an analysis of the system and the results." It really reviews certain cases with the idea of making the efficient and fair-minded Wisconsin commission seem hostile to the public interest. The underlying motive of the booklet appears to be to promote municipal ownership. The league is opposed to public regulation because it believes that regulation prevents public ownership. Between the attitude of the Wisconsin commission and the attitude of the Minnesota Home Rule League there can be no union. Their positions conflict. The policy of the one is not reconcilable with the policy of the other. The Minnesota league would evidently have, if it could, entire freedom of action on the part of a city to deal with its utility. It would permit the city to distress and force the utility to the point at which the court would intervene on the ground of confiscation. It regards the control of utility securities as the concern of investors alone, and not of the general public. It criticises the Wisconsin commission for raising rates in some cases. Would it be so unfair as to refuse an increase in rates if revenues are inadequate?

The league finds fault because the commission is not abjectly in favor of the thing for which the league stands. Why the Wisconsin commission cannot promote home rule ought to be tolerably clear. It was created to take from the cities a power of home rule which the cities had abused and to set up instead a state power to decide the issues between company and city. It cannot harass utilities without regard to the rights of the company because the law was not created to provide a body to be a mere agent for distressing the company. If the commission is true to the law under which it was created and to the judgment of the public represented in that law, it must decide without bias for either side the issues before it. If there is a redeeming clause in the booklet, it is the grudging admission that "nothing but the integrity and high personnel of the commission saved it from being open to the suspicion of direct collusion" with one company. But the booklet does not carry through its forty-six pages, as it should, the evident conviction of its writers as to the "integrity and high personnel" of the commission. Because it so grossly misrepresents the attitude and work of the commission the campaign and erroneous statements of the league should not be allowed to go unanswered.

Progress in Radiotelegraphy

A large part of a paper by Mr. H. Diesselhorst on recent radiotelegraphic progress, read before the annual convention of the Verband Deutscher Elektrotechniker, in Magdeburg, deals with methods for generating continuous oscillations at the sending station. These consist broadly of arc methods, alternator methods and transformer methods. The arc methods aim to set up continuous oscillations in a secondary circuit from pulsatory currents in a primary circuit containing the arc. They have the advantage that the electron streams in the arc have immense mobility, or extremely small inertia, and hence are able to respond to impulses of very high frequency. Their difficulties lie in the way of controlling sufficient power for long-distance radiotelegraphy.

The alternator methods include the method of direct high-frequency generation developed by Fessenden and Alexanderson in this country, and also the method of mixed generation and frequency raising developed by Goldschmidt in Europe. These methods have the advantage of definitely impressing continuous forced oscillations on the sending antenna. Their difficulties are found in increasing their power, since enlarging the machines means increasing their mechanical and electrical stresses in rapid proportion. The step-up frequency transformer methods depend upon nursing some harmonic frequency into prominence. This may also be done in conjunction with specially designed freak-harmonic alternators. This is the most recent direction of experimental advance and seems to be very promising. Sooner or later, it is to be hoped that machinery can be built for the generation of hundreds of kilowatts at a frequency near to 100,000 cycles per second.

It is suggested that reflection of waves from a high-level discontinuity layer in the atmosphere may be capable of producing interference phenomena whereby the intensity of received signals may alternately wax and wane as the waves expand. By noting, at a given range, the wave-lengths of maximum and minimum received intensity, the height of the reflecting layer may be estimated. In a particular case this height is worked out to be about 100 km. An acoustic analogue to the electrical reflection phenomenon is discussed. Indications are given of an acoustic reflection produced by a discontinuity layer of atmosphere about 70 km high, and it is stated that the sound-wave due to an explosion of dynamite at the Jungfrau station in the Alps in November, 1908, was found to be reinforced in this way. At least, it has been claimed that the distance at which the explosion was heard could only be accounted for in such a manner.

The Salmon River Power Plant

It is a pleasure to record the story of the new hydroelectric plant established through the development of the resources of the Salmon River, which flows westward from the Adirondacks into Lake Ontario. The stream is interesting in that it drains a basin of exceptionally large rainfall. The hydraulic engineer, in investigating the possibilities of the country, finds some curious variations in the condition of rainfall and runoff. It is well known that the rainfall is markedly different in different parts of the country, but it is a less familiar fact that within comparatively short distances the rainfall may change in a very conspicuous degree. For instance, in the Salmon River drainage basin the fall rises to 60 in. annually, nearly 50 per cent greater than the ordinary fall in New England. The result of this situation is that the Salmon River is exceptionally good for hydroelectric development.

A concrete dam across the river valley backs up the water for some eight miles with a storage capacity of over 2,500,000,000 cu. ft. The site for the power house is about two miles down stream, where the available head is 245 ft., exceptionally high for this part of the country. The gates at the dam, by the way, are operated by a 25-hp Pelton wheel, which is somewhat out of the usual line of practice. The conduit for the water begins with a 600-ft. tunnel through a ridge and then continues for a little more than a mile and a half with wood-stave pipe 12 ft. in diameter having staves nearly 4 in. thick. Next comes 1200 ft. of steel pipe 11.5 ft. in diameter and 5/8 in. thick. This pipe, which is housed over and protected against freezing, leads down to the head-works for the penstocks, which are perhaps the most interesting feature of the plant, consisting of a transverse distributing pipe more than 200 ft. long and a gigantic surge tank 50 ft. in diameter and 80 ft. high, with a hemispherical bottom adding 25 ft. more to the height. The whole is mounted on columns until the roof is over 200 ft. above the ground, so that it tops the crest of the dam above. A 12-ft. riser connects the distributing pipe with the surge tank through a special arrangement of ports which adds friction enough to damp the surging.

From the distributer to the power house the water is carried in four 8-ft. penstocks, each equipped with a very ingenious motor-driven gate mechanism operated from the station. Each penstock leads to a 10,000-hp horizontal turbine equipped with a heavy flywheel and driving a 5600-kva generator at 375 r.p.m. The generators are 6600-volt, three-phase machines designed for twenty-five cycles, inasmuch as the plant is to feed energy into the Niagara system at Solvay about 42 miles distant. The electrical equipment is somewhat conventional except that a very ingenious system of voltage regulation, fully described in the article, is in use. The transmission line itself, which is operated at 60,000 volts, is carried on rigid square steel towers, 44 ft. in height to the lowest insulator. There are two circuits, each of stranded hard-drawn copper No. 4-0 equivalent. The whole system has been designed with special reference to working in parallel with the Niagara system as part of the general equipment of the Niagara, Lockport & Ontario Power Company. This use made necessary special attention to regulation, which gives to the new plant a claim much stronger than usual to detailed study.

The London Electrical Supply Situation

Elsewhere in this issue there is presented a most instructive review of the London electrical supply problem by Mr. Haydn Harrison, who has made a careful study of electrical affairs in the metropolis for many years past. The situation in London is indeed a curious one, owing, perhaps, to what from the American point of view is the singular constitution of London from the standpoint of civic affairs. The world's metropolis is an agglomeration of municipalities with many local rights rigorously preserved yet with a general unity for certain administrative purposes. In each of the varied districts electrical supply has grown up according to local conditions, sometimes under the ownership of the municipality, sometimes as a private enterprise of the sort familiar here. In whichever way the enterprise has developed it has found itself rigorously limited in extent by the confines of the particular quasi-independent municipality in which it has more or less flourished. The situation is something as if Chicago were to be served by completely independent plants, each working in a single ward, part operated by the local authorities and part by private enterprise. The parallel would be perhaps nearer if one reckoned a separate plant for every voting precinct, for there are about seventy generating stations in the London territory, all save a very few being totally independent of any of the others.

In the sixty-five separate undertakings considered by Mr. Harrison use is made of thirty-one different systems of generating current, twenty-one distributing voltages, eight different frequencies, and, further to confound the situation, there are fifty methods of charging for the output. The municipal plants in the group are naturally jealously guarded, for political reasons, and privately owned systems are expending the minimum amount in improvements for the simple reason that under the acts of Parliament the London County Council has the right to purchase, if it so desires, in 1931. As a matter of fact, some of the private and municipal enterprises, even those operating over a territory of only two or three square miles, are well administered and profitable, and supply electricity at very moderate rates. Nevertheless, on the whole, the situation is fatal to economy, and several attempts toward unification have been made. The most notable of these is the one now in hand for which Messrs. Merz and McLellan have just made a report to the London County Council. This report has already been somewhat discussed in our columns. The fundamental purpose of the present project is to furnish from a single generating station energy in bulk to the various undertakings, and eventually to unify the system of supply so as to improve not only the generating but the distributing conditions. Mr. Harrison indicates that such a plant might have an output rating of 500,000 kw in perhaps ten generating sets, and would be situated far enough down the river from London to get the fullest advantage of the waterfront in the delivery of coal. That there is ample margin for the success of such an undertaking is shown by the statement that on the average the working expense per kilowatt-hour in London is 2.2 cents.

The total rating of the existing stations is 307,000 kw, but inasmuch as the sales per head of population amount to only 48.5 kw-hr. annually, it is very evident that nearly double the equipment rating just noted would be required for a development of electrical service comparable to that of New York or Chicago. On such a scale the operating costs in the generating station would obviously be very low, especially since under London conditions an unusually high diversity-factor is to be expected. It therefore should be possible to operate such a plant at an extraordinarily high load-factor with a corresponding economy. As to the methods of carrying out this proposal, Mr. Harrison is of the opinion that the suggestion made in the report of general municipal ownership of the larger project, the details of operation being left in the hands of private authorities, may lead to something practicable. At all events, the time is ripe for radical improvement, and some way should be found of bringing the various public and private undertakings together to obtain the advantages of a bulk supply generated at a far lower cost than is now possible even in the most economical of the existing stations.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Decision in St. Mary's River Case

The international joint commission in the case of the Michigan Northern Power Company and the Algoma Steel Corporation announced its decision at Ottawa on June 4. The companies, which have large power plants on the St. Mary's River at Sault Ste. Marie, will be allowed to use a much larger quantity of water and will therefore enlarge their developments materially. The companies will be allowed to divert 30,000 cu. ft. of water per second from the river, and the total development will be over 100,000 hp. The judgment of the commission indicates that the commission and the two governments recognized that the water of this and all other boundary streams is to be conserved primarily for navigation and only incidentally for the development of energy.

Electricity in Motion-Picture Exhibit

At the second annual motion-picture exposition held at the Grand Central Palace, New York, June 8 to 13, one of the most interesting features was the studio erected especially for producing motion-picture acts. The films were developed soon after the plays were rehearsed and then the pictures were shown in small theaters provided for the purpose. The lighting equipment for this studio consisted of 104 mercury-vapor lamps and two so-called "targon" filament lamps made by the Cooper Hewitt Electric Company. Another noteworthy exhibit was that of the United Electric Light & Power Company. An electrically lighted model of the 201st Street station was shown with the coal-handling equipment kept continually in operation. Miniature trains were made to pass by the plant. Several electrically operated motion-picture machines and miscellaneous electric appliances were also shown in this booth. Various types of arc lamps for exterior lighting were on display in a booth maintained by the Koerting & Mathieson Company. Different kinds of electrically operated motion-picture machines were also exhibited by various manufacturers.

Early Patent Legislation Not Probable

According to statements made at the office of Representative Oldfield, chairman of the patent committee of the House of Representatives, there is little likelihood of any legislation in regard to patent matters at this session of Congress. The calendars are jammed full of bills, and it is the intention of leaders in Congress to permit no legislation not on the program.

Hearings which have been in progress for the past month before the committee on the bill providing for the registration of designs have been completed for the present, although it is announced that they may be resumed later.

The committee is still hearing those who desire to speak on the general bill, known as the Oldfield bill, providing for the revision and codification of the patent statutes. Mr. William H. Ingersoll testified on June 10 in regard to his views on the maintenance of resale prices. Attorney Edmunds, counsel for the A. B. Dick Company, who carried the "mimeograph" case through the Supreme Court, appeared before the committee on June 13 to speak on the maintenance of resale prices, and also on the binding clause of contracts under which manufacturers of patented articles can require persons to use their accessories.

No hearings are scheduled for next week. It is stated at Mr. Oldfield's office that no one connected with the electrical industry has asked to be heard on any of the various features of the two bills, although the committee would be glad to hear any one so connected who may desire to be heard.

Representative Metz, of Brooklyn, N. Y., has introduced a bill providing that patent rights shall continue only nineteen years after being granted.

Strike at Westinghouse Plant

A number of the employees of the Westinghouse Electric & Manufacturing Company and the Westinghouse Machine Company went out on a strike on June 5. The strike was declared primarily on account of the refusal of the management to recognize the demands of the Allegheny Congenial Industrial Union, a newly formed labor organization. The plants of the companies at East Pittsburgh are partly shut down as the result of the strike.

The following official statement in regard to the situation was issued on June 5 after the men went out on strike:

"A part of the working forces of the Westinghouse Electric & Manufacturing Company, the Westinghouse Machine Company and the Pittsburgh Motor Company failed to report for duty this morning. The officers of these companies state that owing to the falling off of business, which began to affect them last November, it was necessary to make a reduction either in the working forces or in the working hours, and in order to give employement to as many as possible the working hours were shortened from fifty-four to forty-five hours a week.

"Since a large proportion of the workers are not in a position to realize how serious this falling off of orders has been, some dissatisfaction has arisen. The company has even provided additional work for the men by making up a large stock of various classes of standard apparatus, which is at present on hand."

It is the belief of the management that the trouble will not last long.

The trouble began on the afternoon of June 4, when a committee of employees of the Westinghouse Electric & Manufacturing Company called on Mr. H. P. Davis, vice-president, and presented a petition. The committee asked that the company reinstate men laid off and discharged since Feb. 1, 1914, in place of hiring new men, eliminate all bonus systems, premium systems and piece-work systems, and arrange during slack business seasons to alternate the lay-offs for a short period only and to reinstate all employees whose temporary lay-offs would not hamper or interfere in the proper operation of the plant.

Mr. Davis, after reading the petition, asked the members of the committee whom they represented. He was informed that they were employees belonging to Local No. 1 of the Allegheny Congenial Industrial Union. He told them he could not deal with their organization but would consider their request as employees of the company. After about an hour of discussion the members of the committee were told that their petition could not be granted.

On the following morning without further notice, and, it is stated, with no reference of the matter to the whole body of workmen or to the membership of the so-called union, the strike was called by circulars handed to the men as they came to work. Only a small number of persons responded to this call. However, the location of the works made it easy to start processions and men with banners and horns marched by the shop windows. This, together with the opportunities for conference at the noon hour, led a large portion of the men to go out before the day was over. The next morning when the whistle blew the streets surrounding the works were packed with a crowd of strikers, largely of the foreign element and the younger men. These strikers with threats and violence succeeded in driving off nearly all employees who tried to enter the works, except those who were needed for the protection of the shops from fire and violence.

The company has made no effort to push the resumption of operations, although the gates have been open every day as usual and several hundred employees have succeeding in entering and attending to work. It is believed that a very large proportion of the men will return to work as soon as the turbulence on the streets adjacent to the works has been quelled and they feel it safe to do so. The public authorities by the exercise of skill and forbearance have succeeded in avoiding serious rioting and are rapidly gaining complete control of the situation.

Public Ownership Movement in District of Columbia

The committee on the District of Columbia of the House of Representatives voted on June 6 to report favorably to the House the Crosser bill providing for public ownership and operation of the electric railways in the District of Columbia. The vote in the committee is said to have been nine to eight.

During the hearings on this bill before the committee Mr. F. C. Henderschott, manager of the bureau of education of the New York Edison Company, appeared as a witness on behalf of the National Electric Light Association to protest against the passage of the measure. Mr. W. D. Kerr, director of the Bureau of Public Service Economics, also appeared as a witness. A number of witnesses appeared on behalf of the American Electric Railway Association.

The report of the public policy committee of the National Electric Light Association, presented at the convention in Philadelphia last week, condemned the proposal for public ownership of the electric railways in the District of Columbia. The committee characterized the movement in Washington as one of the most serious of recent developments toward government ownership and operation. It is understood that this is but the first step toward the acquirement of all the public utilities of the city of Washington and the District of Columbia and their future operation as well as ownership by the national government. The movement is one of the most serious political and economic import. Obviously, it would be no more possible for private capital and employment to compete with the unlimited resources of the national government in transportation or the manufacture and sale of gas or electricity than it would be for private effort to compete with the resources of the government in the manufacture and sale of clothing or of food or any of life's necessities, the availability of which is a matter of far greater human importance. The principle underlying the one underlies all, and the committee expresses the hope that upon proper consideration of the matter Congress will defeat this movement. The committee urges members to get in touch with their representatives in Congress and present to them the serious political and economic consequences that are bound to follow an undertaking of this nature.

Illuminating Engineering Society Officers Elected

The report of the committee of tellers of the Illuminating Engineering Society on the results of the recent annual election, presented to the council of the society June 11, showed that the following national officers had been elected for the ensuing year:

President, Dr. A. S. McAllister; vice-presidents for two years, Messrs. F. A. Vaughn and C. A. B. Halvorson, Jr.; general secretary, Mr. Joseph D. Israel; treasurer, Mr. L. B. Marks; directors for three years, Messrs. Ellice M. Alger, Harold Calvert and V. R. Lansingh.

Chicago Section: Chairman, Mr. W. A. Durgin; secretary, Mr. H. B. Wheeler; managers, Messrs. Harry S. Gradle, M. G. Lloyd, F. A. Pinckney, Edward G. Pratt and Herman V. Willman.

New York Section: Chairman, Mr. Norman Macbeth; secretary, Mr. Clarence L. Law; managers, Messrs. George W. Cassidy, Norman D. Macdonald, H. B. McLean, Frank E. Wallis and Percy S. Young.

New England Section: Chairman, Dr. Louis Bell; secretary, Mr. S. C. Rogers; manager, Messrs. C. M. Coles, J. W. Cowles, Walter B. Lancaster, H. F. Wallace and R. C. Ware.

Pittsburgh Section: Chairman, Mr. G. W. Roosa; secretary, Mr. S. G. Hibben; managers, Messrs. W. A. Donkin, H. S. Hower, Harold Kirschberg, E. B. Rowe and R. H. Skinner.

Philadelphia Section: Chairman, Mr. H. A. Hornor; secretary, Mr. L. B. Eichengreen; managers, Messrs. James Barnes, Douglass Burnett, George S. Crampton, R. B. Ely and F. H. Gilpin.

Dr. A. S. McAllister, the newly elected president of the society, is editor of the *Electrical World*.

Congressional Action Likely on General Dam Amendments

Representative Adamson, chairman of the House committee on interstate and foreign commerce, has succeeded in getting his bill which proposes to amend the general dam act into a privileged position on the calendar of the House, and announces his expectation that it will be passed at the present session of Congress.

Nothing remains to be done in regard to the bill, so far as its legislative status is concerned. The subject of amending the dam act, as well as of conservation, will be the next one to be considered on the floor of the House, following the passage of the usual appropriation bills for the expenses of the government. Mr.

Adamson informs the *Electrical World* that as soon as the appropriation bills are out of the way he will call up his bill. Owing to the privileged position he has obtained for it, it must come up.

It is stated in Washington that as soon as this bill is called up the general subject of water-powers, hydroelectric plants, conservation and correlated subjects will be taken up in general debate on the floor of the House. Representative Adamson's bill is the result of conferences and agreements with the Secretary of War, and it represents the views of the administration as to what should be done in regard to the matters it covers, as arrived at by President Wilson and his Cabinet.

Trust Legislation in the Senate

The United States Senate is about to engage in consideration of anti-trust legislation which is expected to continue for two months.

The certainty of this legislation became known when the Senate committee on interstate commerce decided on June 6 to report favorably the Newlands federal trade commission bill. The father of that measure announced that he intended to have it made the unfinished business of the Senate following the passage of the canal tolls bill. The "unfinished business" of the Senate means that a bill so declared is brought up every day until acted upon, and in the case of this bill it is also further announced that it is open to amendments of any sort. There is little question that many will be offered. The bill does not go into the subjects of interlocking directorates, holding companies or railway capitalization, but amendments dealing with these questions can be proposed and must be voted upon.

The House of Representatives on the night of June 5 passed three anti-trust bills—the Clayton omnibus anti-trust measure, the House judiciary committee substitute for the Rayburn railway capitalization bill and Representative Covington's interstate trade commission bill. Action on these bills in the House came rather unexpectedly. The result showed the actual position of Republicans in the House. Only one Democrat voted against the Clayton bill, Representative White, of Ohio. Forty-three Republicans and sixteen Progressives voted for the Clayton bill with the Democrats.

The Clayton bill, which has been informally approved by President Wilson, was referred to the Senate judiciary committee, where the committee will certainly have it under consideration for at least several weeks. The other two bills also went to committee.

Any of the provisions in the three bills passed by the House may be tacked on to the "Newlands substitute," ordered favorably reported from the Senate interstate commerce committee. Senator Newlands will lead the fight in the Senate for the passage of the anti-trust legislation. He will be opposed in leadership by Senator Brandegee, of Connecticut, who, with a number of other senators on both sides of the Chamber, is opposed to any anti-trust legislation during the remainder of this session of Congress.

The "Newlands substitute," now known as the "federal trade commission bill," provides for a commission of five, not more than three of whom shall be of the same political party, to be appointed by the President, each to have a salary of $10,000 a year. The bill authorizes the commission to investigate from time to time the organization, business, financial condition, conduct, practices and management of any corporation engaged in interstate commerce, and its relations to other corporations, associations and individuals.

Senator Brandegee, in a statement made in Washington in regard to the measure, said in part: "In view of the widespread business depression and the apprehension which prevails in commercial and financial centers, I regard the projection of these questions concerning the further inspection and regulation of business by the federal government at this time as a grave mistake."

With reference to the three bills passed by the House of Representatives, Representative Mann, of Illinois, issued a statement in Washington in which he said in part: "There is nothing in any of the Democratic anti-trust bills that will build a fire that is now out, start a factory or in any way encourage business.

"These measures are repressive. There was a demand for legislation supplementary to the anti-trust law that would permit business to be conducted without uncertainty as to its rights. The Clayton bill adds to and does not remove any of the uncertainty that now exists. If enacted into law, it will do a great deal of harm. The interstate trade commission bill represents an evolution in the plan evolved in the office of the commissioner of corporations. It may serve a useful purpose by bringing business and the government into closer relationship. The Clayton bill is dangerous. No one can do business under that bill without having the penitentiary face him all the time. Every business transaction will be left liable to a criminal charge."

Mr. Insull on Illinois Commission and Welfare Work

In his annual report as president of the Public Service Company of Northern Illinois Mr. Samuel Insull refers to the new Public Utilities Commission of Illinois. He also describes at length welfare work for employees in which the company has engaged. Mr. Insull says that the new Illinois commission law "will doubtless cause some operating inconvenience for a time, but no serious difficulties are anticipated, and the ultimate result should be beneficial both to the public and to the company. The company's service is rendered in fourteen counties and in 144 municipalities, with varying ordinance requirements, and eventually regulation by one body must naturally tend toward a larger degree of uniformity."

A service annuity system to make provision for faithful employees was put into effect on Dec. 1, 1913. It is administered by a committee of five composed of the president of the company as chairman, the secretary of the company as secretary, ex officio, and three other members to be appointed annually by the board of directors. These three for the first year are Messrs. Frank J. Baker, vice-president; Charles A. Munroe, vice-president, and George H. Lukes, general superintendent.

Upon his request, if approved by the committee, any employee of fifty-five years of age and thirty years of service shall be retired with an annuity. Upon his request, if approved by the committee, any employee of sixty years of age and twenty years of service shall be retired with an annuity. Any employee of sixty-five years of age and fifteen years of service shall be retired with an annuity unless for a special reason the directors shall continue any such employee in active service without an annuity.

The amount of the annuity proposed to be paid each year to a retired employee is 1½ per cent of the average annual pay of the employee during the particular five consecutive years of service when the average pay was the highest, multiplied by the number of years of service, the annuity in no case to be less than $300.

The company also established about Dec. 1, 1913, an employees' savings fund for the twofold purpose of encouraging thrift on the part of the employees and of facilitating their acquisition of stock in the company. Any employee of the company who has been in the service of the company for one year or longer may become a subscriber. Each subscriber is required to pay into the fund during his subscription period 3 per cent or 5 per cent of his salary, as he may elect, such payment to be made semi-monthly. A committee, consisting of Messrs. Samuel Insull, Edward P. Russell, Frank G. Logan, Frank J. Baker, Charles A. Munroe, William A. Fox and George H. Lukes, was appointed by the directors to take charge of the fund as trustees. The board has sold to the employees' savings fund committee and turned over to its members as trustees $1,000,000 of the company's common capital stock, to be paid for from time to time under the terms of a written agreement as the savings of employees shall accrue.

Underground-Conduit Developments in Montreal

Substantial progress is being made in conduit construction in Montreal under the supervision of the Montreal Electric Commission, which was organized by an act of the Quebec Legislature of 1909 for the purpose of removing all overhead wires in the city with the exception of trolley contact wires. The commission consists of Dr. L. A. Herdt, of McGill University, chairman; Mr. R. S. Kelsch, representing the various public utility companies in the city, and Mr. de Gaspé Beaubien, representing the Quebec Public Utilities Commission, all being consulting engineers charged with the broad supervision of the problem of underground-conduit construction, the operation and maintenance of such structures, and the taking over of existing overhead lines and conduits in the establishment of a comprehensive system. The work being done at Montreal is one of the first instances where a municipality of 500,000 inhabitants has embarked upon a program of such scope upon the basis of a legislative act, and it is of particular interest in relation to the engineering and operating problems involved.

The members of the commission were appointed in 1911, and the first meeting of the board was held in the fall of that year. Additional powers necessary to give the commission complete control of the wire situation in the city were obtained from the Legislature in 1912, and the latter part of that year was occupied in engineering work involving studies of underground-conduit problems in Montreal and elsewhere and the preparation of plans, specifications and contracts for the initial installation. Construction was begun in the spring of 1913, and at present work is being pushed along the two major axial thoroughfares of the city, St. Catherine and Bleury Streets. About 687,000 ft. of duct have been laid in the former and 180,000 ft. in Bleury Street and Park Avenue. In general the main conduit consists of 3½-in. square tile duct, 3½-in. fiber duct being used in the construction of laterals and services. The district at first to be covered consists roughly of an area about 3.5 miles long and 1 mile wide, including the business center and adjacent residential sections.

The commission will lease its ducts to utility companies upon a duct-feet rental basis not yet announced, and similar systems of transmission and distribution will be placed in adjoining ducts. The rental will be set at a figure which will cover all fixed and operating charges on the conduit system. An initial appropriation of $5,000,000 has been granted the commission, and all plans and specifications are approved by the Public Utilities Commission of Quebec before the award of contracts. The last-named body also acts as a board of arbitration in case of an appeal by any party in interest. Neither the city nor any company has the present right to install overhead wires, the Electrical Commission having sole jurisdiction over all wire and conduit work. It is believed that this arrangement will greatly reduce the burden of street openings experienced in cities of large size in which conduit is installed and maintained by the companies.

Plans are now being prepared in the offices of the board for placing underground wires throughout the entire business district. In general, three types of manholes are to be used—drain manholes, placed at street crossings and intersections; service manholes, usually 250 ft. apart, and containing connections for from two to six service pipes, depending on the demands of the local buildings, and transformer manholes. A maximum of thirty-two ducts per conduit has thus far been installed, and it is expected that cable pulling will begin early in the present month. The Bell Telephone Company of Canada maintains its own system of conduits by a charter provision, but all other utilities, including the local railway, power, telegraph and signaling systems, are to lease appropriate space in the city duct system. Contracts are awarded for various sections of the work upon a purely competitive basis. Occupants of buildings taking service from the companies using the ducts are required by ordinance to have their buildings wired to permit an underground service entrance in each case.

Corporation Industrial and Vocational Schools

The United States Commission on Industrial Relations is holding a series of hearings in New York City. Among those who have given testimony during the last week bearing particularly on the subject of industrial education and vocational schools are Dr. Charles P. Steinmetz, chief consulting engineer of the General Electric Company, and Mr. Arthur Williams, general inspector of the New York Edison Company.

Testimony of Dr. Steinmetz

Dr. Steinmetz testified on June 1. From his experience as consulting engineer, as university professor and as past-president of the board of education of his home city, Dr. Steinmetz has come to the conclusion that vocational training should not be a part of the school curriculum in the grades of the public schools, but it should begin after the pupil has been graduated from the general education course of the public school.

The general education or instruction in all those subjects which the young citizen of to-day must have, and which is necessary before the pupil can begin to specialize in learning a trade, entering a business or learning a profession, has been given and is still given today very satisfactorily by the public-school system of the country. Dr. Steinmetz therefore does not believe that there is any call for a reorganization of the public-school system. The need is for an extension of the public-school system.

The part of the education which follows that of the grade schools consists in the learning of a trade, etc. This part has been taken care of in former times by private interests, in the form of apprentice boys and similar educational methods. By the constant development of modern industry, this apprentice clause, and with it all the chances of this second private education, have been wiped out, and the unsatisfactory situation which confronts society to-day is not a failure of the general education system, but it is the collapse by reason of the corporate industrial development of the special training and preparatory work for trade or profession.

In the opinion of Dr. Steinmetz, here as in all cases where private enterprise fails, it is the duty of the community or society to step in and provide what private enterprise cannot do or has become incompetent to do, that is, provide the means of educational training or the teaching of an industry. The time devoted in the grade schools to general education is altogether too short, and to sacrifice more of this time to teaching a trade or profession would be suicidal. Vocational training and industrial education should not enter into a grade school at the sacrifice of the educational and manual training and domestic science, which are a part of modern general education.

Taking only immediate possibilities, Dr. Steinmetz does not think the feasibility of the idea that society should contribute for sustenance of the pupils should be considered now, but he would allow the pupil at fourteen years of age to accept employment and earn a living or as large a part thereof as possible, provided that the employment is such as to contribute to some extent to education, and provided also that a part of the time is still devoted to education. In other words, he would make a law providing that the school age extend to the completed eighteenth year of the pupil, but that at fourteen years of age those pupils who can show that they or their parents need the income, who can bring a certificate from the superintendent of schools showing that they have passed a certain definite minimum grade, and who can bring a certificate from the health physician showing that they are physically fit to enter industries, would be free to enter employment, with a limitation that during the week a certain number of hours, say five as a minimum, must be set aside for educational work. The employer must agree also and the employment must be of a kind approved by the school system of the location.

There is one serious difficulty with such a scheme where it is applied to the age from fourteen to sixteen years. These children would not be able to find any employment because the employers would prefer persons above sixteen years free from these limitations. This is the reason why Dr. Steinmetz believes that such a law when applied to the age from fourteen to sixteen would fail, while it would succeed when applied to the age from fourteen to eighteen.

Dr. Steinmetz added that there is a very strong tendency in the larger centers of population to establish trade apprenticeship schools and corporation schools. He is the vice-president of the National Association of Corporation Schools. Many industries are operating corporation schools and apprenticeship courses. Modern corporate industries are based on extensive division of labor, and in an apprentice course, which of necessity must combine various classes of labor, they have relatively short intervals. Such a course has no place in modern industry and cannot be combined with modern industry, but is inherently of the outside.. It is a philanthropic institution, a measure whereby the corporation endeavors to train skilled workmen. There are three different methods by which the training for a trade, business or profession can be accomplished. The first is by the independent vocational schools or industrial schools. The second method in industrial training is the apprenticeship course of the industrial corporation. This is somewhat more efficient economically, but the experience with such apprenticeship schools in his company, said Dr. Steinmetz, is that the wage which can be paid to the apprentice is extremely low—so low that as a rule there is considerable objection, apparently justified, from labor unions and others against working therefor. At the same time the work of the apprentice does not pay, owing to the relatively short time when the apprentice can be kept at the same class of work. The short period which he can use for his acquired skill is not sufficient to pay for the loss in giving him the skill. In these schools the apprentices do a little of all kinds of work, while within the big corporation there is a strict subdivision of labor. That again makes the apprentice school rather inefficient, so that even at the low pay given the apprentice, economically it is not a paying proposition for the corporation. Therefore it is undertaken and can be expected from the corporation only for the purpose of training a larger number of skilled workmen, but not as a part of the regular business. While the old apprenticeship system in the days of small production was productive, the apprentice in early days paid by his work for his keep and whatever he earned, and a great deal of it was profitable then. It is not so any more.

To encourage private corporations to maintain and extend apprenticeship courses some inducement will have to be made to the corporations. Dr. Steinmetz believes the inducement could be offered by recognition of these apprentice courses as continuation schools, in short, by accepting the apprentices as coming within the line of the pupils from fourteen to eighteen years of age, under such supervision as would guard against abuse of this privilege.

The third method of taking care of industrial training is by allowing the pupil between fourteen and eighteen years of age to enter the industry with some limitations. Either five hours a week of schooling would be given by instructors or teachers of the public-school system of the city or, if so desired, the factory or industry combined might provide a teaching staff giving those five hours of instruction. In most places the schools and school organization is the strongest of all public organizations and least affected by politics in its unsatisfactory sense. Dr. Steinmetz expressed himeslf as being in favor of compulsory vocational schools.

Testimony of Mr. Williams

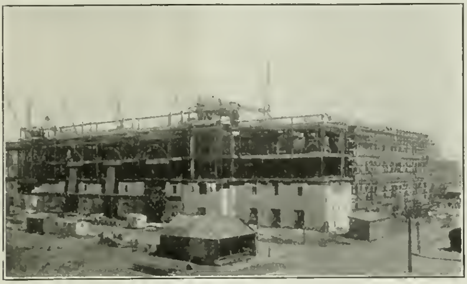
Mr. Williams testified on June 2 as president of the National Association of Corporation Schools. He said that large corporations like the Edison company naturally attract a high grade of men to their service. The company started a school about seven years ago which has been so successful in effecting a personal development of the attending employees that the work has been extended. Education can be given satisfactorily on technical, commercial and accounting lines.

Mr. Williams outlined the scope and purpose of the National Association of Corporation Schools, the membership of which is composed of companies that have schools for employees. The purpose of this association is not to encroach on any educational movement in existence now but to promote education in the ranks of industrial workers. Mr. Williams emphasized the importance of some kind of education for industrial workers. He thinks that the results obtained in the industrial or vocational schools are very much better than those that resulted from the old apprenticeship system. As a good workman is not necessarily a good teacher, a trained teacher should be used.

Mr. Williams believes that the development of schools of this character will lead in time to a new line of activity for teachers. He declared that industrial schools pay handsomely in increased efficiency. Corporations which conduct such schools have to justify the expenditure for them on the ground that they are in the interest of efficiency. However, the employee gets a very much greater benefit than the employer.

Civic Center for San Francisco Conventions

Contrary to the prevailing opinion, most of the large conventions which will go to San Francisco next year will not be held in the grounds of the Panama Pacific International Exposition, but in a civic center in the heart of San Francisco, at the corner of Hayes and Market Streets, right back of the city hall. The exposition authorities gave the city of San Francisco $1,000,000 toward the erection of a permanent civic center which would serve for convention purposes, the city itself providing the site, so that the civic center when complete will represent an outlay of approximately $2,000,000. The building is shown in its present state in the accompanying illustration. It will contain a main hall, seating 10,000 people, and nine other halls and committee rooms, seating from 250 to 1200 people, according to the arrangement of the sliding partitions separating the rooms. The building covers a square block and will have six elevators. It is within short walking distance of all of the leading hotels of San Francisco and about ten minutes' ride from the exposition grounds.



CIVIC CENTER IN SAN FRANCISCO

New York Electrical Society

At a meeting of the New York Electrical Society on June 10 the following officers were unanimously elected for the year: President, Mr. Frederick A. Scheffler; vice-presidents, Messrs. Bernard Rowntree, George Weiderman, Sr., and O. A. Kenyon; secretary, Mr. George A. Guy; honorary treasurer, Mr. James H. McGraw, and treasurer, Mr. Henry J. Hoeltge.

Following the business session, Mr. William P. Kennedy, consulting transportation engineer, New York, spoke on the topic, "The Electric Vehicle in New York City," and the Electric Vehicle Association's moving-picture film, "Selling an Electric Truck," was shown.

In his address Mr. Kennedy emphasized the sturdy and standardized construction of the electric vehicle, which he characterized as a sort of "dirigible street car," pointing out that, unlike the gasoline car, the component parts of the battery-propelled vehicle are merely slight adaptations of electrical apparatus which has been used in the industrial and railway fields for many years. The speaker prophesied the coming of the cheap electric passenger vehicle, although the "electrics" of to-day, he said, are sold at an average price of $3,000 on account of the luxurious fitting demanded and expensive methods of selling. Passing to commercial trucks Mr. Kennedy cited figures to show that each horse stabled in the city represents a potential electric-truck consumption of 10 kw-hr. to 20 kw-hr. per day for the local central station if electric trucks were used to replace horse-drawn wagons and drays.

Electrical Features of St. Louis Pageant and Masque

Beginning May 28 and continuing until June 1, the outdoor historical theatrical performance known as the "Pageant and Masque of St. Louis," given in the Missouri metropolis, rivaled in magnitude anything of similar character ever attempted in the United States. The production drew an attendance which various authorities estimated at 600,000 to 750,000 persons for the several performances. Approximately 7500 citizens of St. Louis made up the cast. Situated in the pit of an immense natural amphitheater, the 580-ft. by 200-ft. stage was visible from the old World's Fair grounds at Forest Park.

Lighting the Mammoth Stage

Perhaps the best tribute to the successful design of the temporary illumination for this production is found in the remarks of spectators, who frequently observed that they saw nothing unusual electrically. From hidden sources light was concentrated upon the players from foot-lamps, special reflectors and search lanterns. The fore part of the stage was illuminated with 91 amber, 91 red and 187 white 250-watt tungsten foot-lamps, and there were four wing strips of similar white lamps, each containing twelve units. Across the lagoon which bordered the stage in front 197 bank foot-lamps in special reflectors illuminated the water and the bank upon which the stage was built.

From the roof of the Art Museum at the back of the natural amphitheater four 24-in. search-lanterns projected their rays upon the players during the performance and upon the vast crowd during changes of scenery. Of the six 18-in. search-lanterns employed two were situated in a shelter across the lagoon and two in small mounds in front of the stage. There was also one search-lantern in each of the 40-ft. control towers at the ends of the stage. In addition to these large lanterns numerous other 6-in. spot lamps were arranged so that their beams could be used to accentuate the figures of the chief characters.

Features of Electrical Construction

Economy in installation was one of the watchwords in the construction of the electrical equipment. By using seven wooden-barrel-type water rheostats as dimmers for the heavy bank of foot-lamps the expense of purchasing large resistors was avoided. The stage electricians manipulating these lamps claimed that the operation of the dimmers was entirely satisfactory, only a slight, but to the audience imperceptible, flash occurring in the lighting when the moving electrode struck the bottom of the barrel.

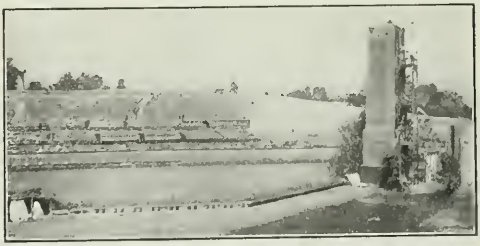


FIG. 1—CONTROL TOWER AND ARRANGEMENT OF LAMPS ON STAGE

Energy for the bank foot-lamps across the lagoon was necessarily fed to them by submarine cable, as overhead wiring was undesirable. Although the distance from the switchboard in the tower to the lamps was less than 100 ft., the shortest available piece of

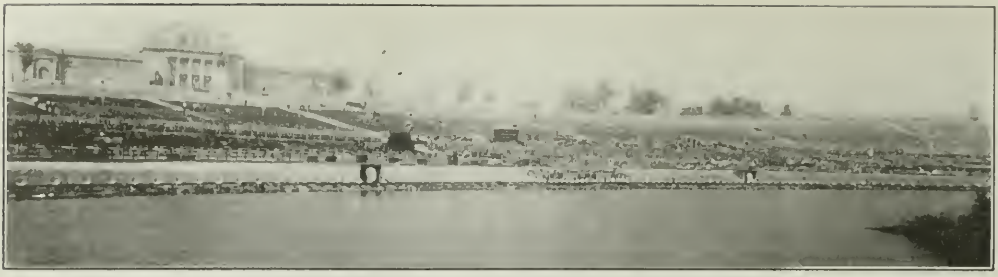


FIG. 2—PORTION OF NATURAL AMPHITHEATER FACING STAGE

250,000-circ. mil cable measured 800 ft. To avoid cutting this cable the extra length was looped back and forth beneath the water of the lagoon out of sight and out of harm's way.

Of the spectacular lighting ideas the Great Bear constellation and the "shooting star" produced the most comment. The "Great Bear," or "dipper," consisted of a large electric sign arranged on a hinge and equipped with a block and tackle so that it could be lowered from the spectators' view except when in use. A flasher produced realistic twinkles in the stars. The "shooting star" necessitated the sacrifice of a 250-watt lamp each night when a husky stage hand hurled the lighted unit from the high back drop. A tungsten-lamp star sliding on a wire was first attempted, but the effect with this was imperfect. The only application of the electric storage battery in the pageant occurred in the illumination of a cross which was carried about the stage by some of the characters.

Telephone Aids to Prompt Operation

Control of the entire lighting installation was centralized in one of the 40-ft. towers. Here a combined alternating-current and direct-current switchboard, laid out with its switches in positions analogous to the apparatus they controlled, was under the watchful eye of the director of electrical effects. With a head-type telephone the director controlled the movements of all electrical operators.

Three telephone circuits leaving the director's position in the tower carried multiple connections to the operators of different groups of lamps. Each operation was numbered so that a key number spoken to anyone on a circuit was audible to all. Thus each of a group knew what others were doing and were about to do. The speed with which these operators, also wearing head-type telephones, responded to the orders of the director was indeed remarkable. The fire and police telegraph department of the city also installed direct telephone communication with the control towers.

Energy for the lighting was supplied entirely from the mains of the Union Electric Light & Power Company through two transformer and motor-generator substations, one, a 255-kw station, being situated behind the stage, and the other, a 50-kw station, being in the Art Museum. In the larger substation behind the stage extra transformer units stood ready in case of breakdown, and one of these, a three-phase unit, had its neutral wire permanently connected with the circuit and the other leads were prepared in sufficient lengths to reach any transformer of the installation. Had trouble occurred these wires with their lugs already soldered in place could have been substituted in about fifteen minutes for those of the transformer which had failed.

Credit for the design of the wiring and illumination of the "Pageant and Masque of St. Louis" is due Mr. A. I. Jacobs, supervisor of city lighting, and his assistant, Mr. Ralph Toensfeldt. The actual construction contract was let to Mr. William A. Corroa and carried out under the direction of his foreman, Mr. H. P. Cherry. The personnel of the committee on lighting and wiring was as follows: Chairman, Mr. A. I. Jacobs; vice-chairman, Mr. Charles J. Sutter; secretary, Mr. George McD. Johnson, and Messrs. Frank Adam, Ell C. Bennett, A. C. Einstein, Charles L. Holman, Arthur Schading and William B. Smith.

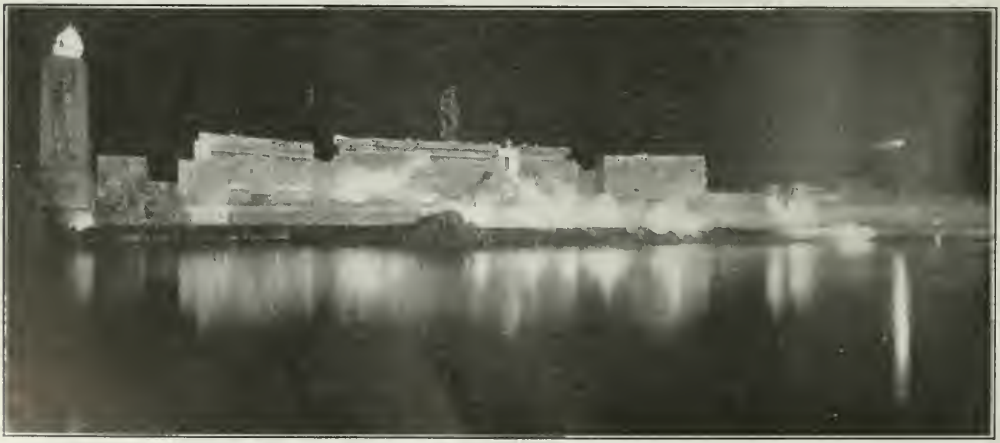


FIG. 3—THE MASQUE—THE GREAT STAGE ILLUMINATED BY NIGHT

Public Service Commission News

Indiana Commission

The Public Service Commission of Indiana is to issue its first annual report soon. An analysis of rates for lighting and motor service will be included. The rates, which were made in the various classes of cities under conditions that existed before the public service commission law became effective, show a wide discrepancy. However, many conditions are to be taken into consideration, members of the commission say, that affect these discrepancies appreciably. Under the commission's classification of cities Class C towns have populations of less than 3000. Necessarily the rates for these towns appear to be high when compared with Class A cities, which have populations of 10,000 and over.

The rates that the report will show in the larger cities are interesting. Indianapolis has now two sets of rates, one put into effect by the Indianapolis Light & Heat Company and the other by the Merchants' Heat & Light Company, which recently took over the People's Light & Heat Company. A complete revision of Indianapolis lighting rates is promised, however, by the commission.

Commission members say they will attempt through the process of regulating each schedule to make the entire State uniform with regard to classes of properties, except where the local conditions of capital invested and property used and useful for the public make uniformity out of the question.

California Commission

The Crescent City Light, Water & Power Company has filed a complaint with the Railroad Commission against George H. Keller and Hobbs, Wall & Company in which it is alleged that Hobbs, Wall & Company are selling electricity to various people in Crescent City contrary to the terms of the public utilities act. It is alleged that the firm of Hobbs, Wall & Company is a lumber concern and not a public utility corporation, but that it has assumed the right since 1905 to sell electricity to the municipality in competition with the Crescent City company.

The Calistoga Electric Company has filed an application with the Railroad Commission asking that an order be made granting it a certificate of public convenience and necessity authorizing it to serve inhabitants and consumers in Napa County north of an east and west line extended through Bale Station, in Napa County. The territory at present is occupied by the Napa Valley Electric Company.

Idaho Commission

During the hearing before the Supreme Court of Idaho in the action of the Idaho Power & Light Company and the Beaver River Power Company against the Public Utilities Commission, which denied to these companies the right to enter territory already served by existing companies, Mr. J. B. Hawley declared that the creation of a commission with power to establish a monopoly is against the welfare of the State; that the Legislature has attempted to delegate to the commission its lawmaking power, and that the commission is a court and unconstitutional because it conflicts with the government divisions into legislative, judicial and executive branches.

It was contended before the court that the Idaho Power & Light Company had secured a franchise at Twin Falls before the commission was created; that the company had done work preparatory to entering Twin Falls before the commission was created, and that a provision in the law excepts power companies from regulation by the commission so far as competition is concerned but not as to regulation of rates. It was also argued that the commission's acts tend to retard the development of the State.

New York Commissions

In connection with the pending valuation of the property of the New York Telephone Company in the State of New York by the Public Service Commission, Second District, a committee has been engaged by the company to make an independent valuation. The members of the committee have been directed to act entirely independent of the company and to be as conservative in their work as if they were acting for a private plant. The committee is as follows: Messrs. F. B. H. Paine, chairman; H. Hobart Porter, Russell Robb, H. P. Gillette, and Gen. George H. Harries. As the committee wanted to have one of the leading officials of the company associated with it, Mr. J. A. Stewart, the general manager, will serve as a member.

New Jersey Commission

The Board of Public Utility Commissioners has dismissed the complaint of Max Taub, Hoboken, against the Public Service Electric Company because of the refusal of the company to furnish him electric service. Such refusal was admitted by the company but was held to be justified by the failure of the complainant to provide for the grounding of secondaries inside his premises, as required by the company's rule. This cost, the complainant held, should be borne by the company. In its decision the board states that the right of the company to adopt rules and regulations in the conduct of its business and require compliance therewith as a condition precedent to furnishing service is undoubted, and, further, that it finds nothing in the case to lead it to change the general rules regarding the grounding of secondaries of transformers put into effect by its orders of Dec. 9, 1913. The board also states that house wiring includes the running of the inside ground wire and that the cost thereof should consequently be defrayed by the consumer.

The board has issued an order suspending an increase in the rates of gas and electricity by the Newton Gas & Electric Company. The board has ordered a public hearing to consider the reasonableness of the proposed increase in rates. The company, which has been in the hands of a receiver since 1910, claims that the increase is essential for proper service and to meet its expenses, and that the year 1913 shows a deficit of $14,000.

The board has granted permission to the Vulcan Electric Light, Heat & Power Company and the Neptunus Water Company to separate stipulated property now held by them jointly.

Ohio Commission

A reorganization of the appraisal department has been announced by the commission. The board will consist of Messrs. L. G. White, electrical engineer, and C. V. Critchfield and George X. Cannon, telephone experts.

New Hampshire Commission

Some changes will be made in the tentative uniform classification of accounts for electric utilities as the result of a hearing held before the Public Service Commission of New Hampshire on May 26. The tentative classification provides for four classes of companies as follows: Class A, companies having average annual operating revenues exceeding $25,000; class B, companies having average annual operating revenues exceeding $10,000 but not more than $25,000; class C, companies having average annual operating revenues exceeding $3,000 but not more than $10,000; class D, companies having average annual operating revenues of $3,000 or less.

Current News Notes

Electrical Show at Memphis, Tenn.—Under the auspices of the local Jovian League an electrical show will be held in the Lowenstein Building, Memphis, Tenn., during the week of June 15.

* * *

Prize Competition, Society for Electrical Development.—The Society for Electrical Development, Inc., is offering eight prizes to employees or members of the society for the best story, article or report on any subject pertaining to commercial electricity. There is one prize of $250, one of $150, one of $50 and five of $10. The competition closes Sept. 1, 1914.

* * *

Honors for Past-Presidents of the A. I. E. E.—Four of the past-presidents of the American Institute of Electrical Engineers have received honorary degrees recently. Mr. C. O. Mailloux, present incumbent, and Mr. L. B. Stillwell, president during 1909-10, received the honorary degree of doctor of science from Lehigh University. Mr. Gano Dunn, president during 1911-12, and Mr. Francis B. Crocker, president during 1897-8, received the honorary degree of master of science from Columbia University on May 29.

* * *

Dinner to German Electrochemists.—Prof. Hans Goldschmidt, of Essen-Ruhr, Germany, president of the German Bunsen Society, and widely known as the inventor of the aluminothermic process and of electrolytic detinning, and Prof. Paul Askenasy, of the Institute of Technology of Karlsruhe, editor of the *Zeitschrift für Elektrochemie*, were the guests of honor at an informal dinner given on June 8 at the Chemists' Club by the New York Section of the American Electrochemical Society. Dr. C. G. Fink, chairman of the section, presided, and speeches were made by Dr. Goldschmidt, Dr. Askenasy, Dr. L. H. Baekeland, Dr. J. W. Richards and Dr. Alexander Smith.

* * *

French Capital Interested in Mexican Power-Plant Option.—Addressing the members and guests of the Chicago Electric Club on June 4, Mr. Robert J. Kerr, civil governor of Vera Cruz pending the arrival of the United States Army, said that during his recent trip from Vera Cruz to Havana he had spoken with a French capitalist who had been investigating an option on the Necaxa power plant of the Mexican Power Company (described in the *Electrical World* April 18, 1914). This concern is now controlled by British capital, and it was intimated that the option quoted a figure considerably below the original cost of the installation. The general impression seems to prevail, said Mr. Kerr, that the bulk of foreign capital invested in Mexico belongs to large syndicates and trusts; but this is not the case, for 75 per cent of all foreign capital in Mexico is coming from the small investor.

* * *

Research Work at Nela Laboratory.—Dr. C. E. Mendenhall, professor of physics at the University of Wisconsin; Dr. Knight Dunlap, associate professor of psychology at the Johns Hopkins University, and Dr. W. E. Burge, assistant professor and acting head of the department of physiology at the University of Illinois, have accepted invitations to carry on research work during the coming summer in the Nela Research Laboratory (formerly known as the Physical Laboratory, National Electric Lamp Association). Dr. Willibald Weniger, of the Oregon Agricultural College, has also been secured for special research work during the summer, and Mr. A. F. Wagner, of Purdue University, has been appointed to a temporary assistantship in the laboratory for a part of the vacation period. A research fellowship in ophthalmology in the laboratory has been established for the year 1914-15. The fellowship carries with it an honorarium of $700 and is open to men sufficiently advanced in specialized medical training to carry on an independent investigation of some problem having to do with the effects of light and attendant radiation on the eye. There has recently been established in the laboratory a section of applied science in addition to the section of pure science which was established over five years ago. These sections will be separate and distinct.

* * *

SOCIETY MEETINGS

Pennsylvania Electric Association.—The next annual meeting of the Pennsylvania Electric Association will be held Sept. 8, 9, 10 and 11 at Eagles Mere, Pa., the scene of the first convention of the association.

* * *

Electrical Credit Men Will Meet at Buffalo.—The annual convention of the National Electrical Credit Association will be held at the Hotel Statler, Buffalo, N. Y., on June 20. No stated program has thus far been arranged for the meeting. Officers of the association are: President, Mr. Charles M. Wilkins, Partrick, Carter & Wilkins, Philadelphia, Pa.; vice-president, Mr. Frank M. Pierce, Manhattan Electrical Supply Company, Chicago, and secretary and treasurer, Mr. Frederic P. Vose, 140 South Dearborn Street, Chicago.

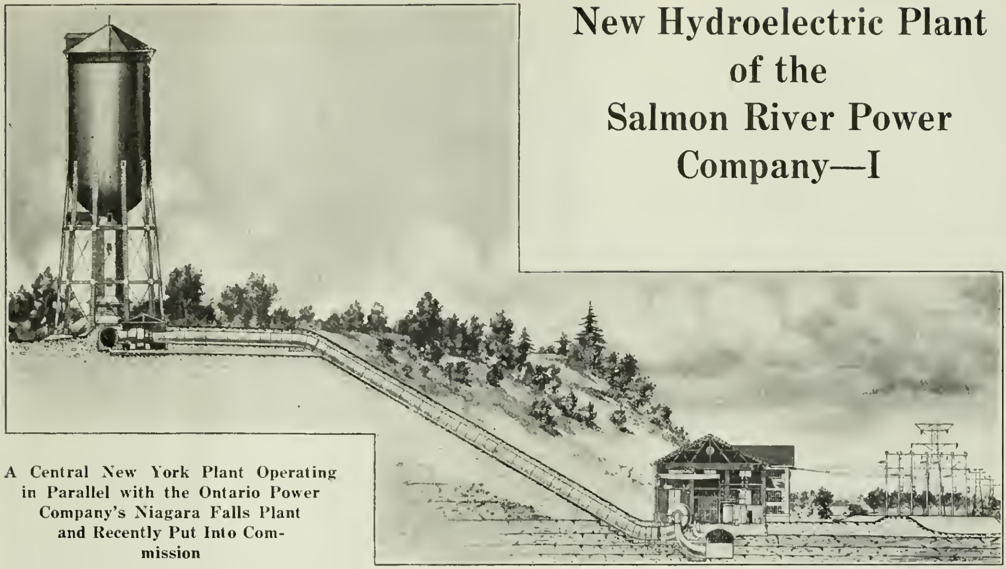
* * *

Joint Jovian and Electric Club Meeting in Chicago.—Members of the Electric Club of Chicago, accepting an invitation of the Chicago Jovian League, met with the latter organization at its regular Monday luncheon June 8. The speaker of the day, Major Carl F. Hartman, chief signal officer of the central department of the Signal Corps, United States Army, spoke on electricity in the army in war and in peace. He sketched briefly the operations of electrically driven machines in gun factories in times of peace, and placed much stress upon the maintenance and construction of lines of communication for an army in the field. One of the facts learned by the army officers is that a single-conductor ground-return circuit gives better service than a double-conductor insulated twisted-pair circuit. A polarized relay has been developed to reduce the weight of necessary batteries for telegraph work. Cavalry maneuvers are reported to the commanding officer by means of small radiotelegraph sets.

* * *

National Association of Corporation Schools.—The second annual convention of the National Association of Corporation Schools was held at Philadelphia from June 9 to 12. The sessions were held at the new auditorium of the Curtis Publishing Company. A number of men connected with the electrical industry were on the program. Among those who were expected to take part in the proceedings were the following: Messrs. Arthur Williams, New York Edison Company; C. A. S. Howlett, General Electric Company; F. C. Henderschott, New York Edison Company; C. P. Steinmetz, General Electric Company; M. W. Alexander, General Electric Company; R. J. Watson, Westinghouse Electric & Manufacturing Company; W. M. Skiff, National Lamp Works; S. W. Ashe, General Electric Company; C. R. Dooley, Westinghouse Electric & Manufacturing Company; J. C. Robinson, New York Edison Company; William H. Tolman, American Museum of Safety, and Dr. C. A. Lauffer, Westinghouse Electric & Manufacturing Company.

New Hydroelectric Plant of the Salmon River Power Company—I



A Central New York Plant Operating in Parallel with the Ontario Power Company's Niagara Falls Plant and Recently Put Into Commission

The Salmon River Power Company was organized to develop the power of the Salmon River, a stream which flows from the foothills of the Adirondacks in a westerly direction through the northern central part of New York State into the eastern end of Lake Ontario. While the length of the stream is only 44 miles, it drains a watershed remarkable from the hydraulic standpoint in that over a tributary area of 190 square miles there is an average annual rainfall of about 60 in. In addition, the river falls 650 ft. in the 17 miles between Stillwater and the lake and more than 400 ft. in a distance of less than 8 miles. At Salmon Falls the drop is 110 ft. While the flow of the stream is somewhat irregular, the valley above the Salmon Falls is of a form suitable for storage purposes. Moreover, the location of the site is such as to enable the power company to dispose of the entire output of the plant to the Niagara, Lockport & Ontario Power Company, which has leased the property in perpetuity and acquired all its capital stock. The latter company draws its supply at present from the plant of the Ontario Power Company at Niagara Falls and from its own steam plants at Lyons and Auburn. It can utilize the full output of the new plant to advantage in combination with the other three.

Next to the Niagara River the Salmon River is the best source of water-power in the State of New York. Its commercial possibilities for this purpose and as a source of water supply for Syracuse and for waterways through the central part of the State have been under consideration for a long time. In 1889 Mr. J. J. R. Croes, a consulting civil engineer of New York City, studied the river with a view to its utilization as a source of supply for Syracuse, about 40 miles away. He found the cost to be prohibitive. In 1898 the United States Board on Deep Waterways made surveys of a Salmon River basin with the view of building a dam a short distance above the Salmon Falls. This project was designed to supply water for a section of a deep waterway from the ocean to the lakes, following the Oswego and Mohawk Rivers route. A map showing the plan, dated 1899, can be found in a comprehensive report submitted in 1900. In the fall of 1900 the United States Geological Survey established the first stream-gaging station on the river at Fox's Bridge, where regular measurements were carried on for a considerable period. Other studies of the stream flow were made later by private parties.

Power Developments

Numerous small water-powers for local purposes had developed along the river, and of these a census was made in 1908 by the New York State Water Supply Commission. A year later the Oswego County Light & Power Company applied to the Public Service Commission for permission to issue securities to build a 15,000-hp plant. This was given soon thereafter, and the sale of $2,353,000 in 5 per cent fifty-year bonds out of a total issue of $4,000,000 was authorized. The company was also allowed to issue common stock of a par value of $750,000. The rights of this company were later acquired by the Salmon River Power Company, which is now completing the construction of a 30,000-hp plant.

The new company made a complete set of surveys in the spring of 1911 and followed this work in the fall by making numerous borings and test pits. On the basis of the data thus obtained the dam was located near Stillwater at a point about one mile above the Falls where the river banks form ideal abutments. A site for

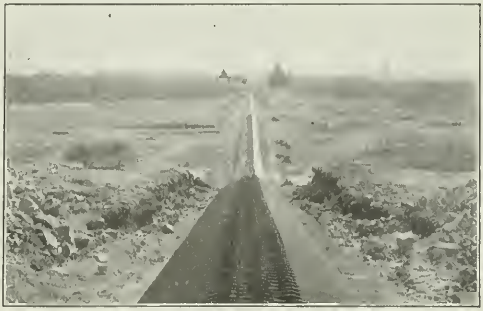


FIG. 1—WOOD-STAVE PIPE LINE

the power house was selected 2 miles below, where a branching of the riverbed furnished an excellent natural tailrace.

The Hydraulic Works

From the hydraulic standpoint the features of interest are the concrete dam and spillway situated near Stillwater, the artificial lake about 8 miles in length and 5½ square miles in area, impounded by it, the 2-mile conduit of wood-stave and steel pipe, the distributer in which the conduit terminates, the enormous and novel surge tank, the Johnson valves in the penstocks, the penstocks themselves, the turbines and their governors, and finally the tailrace. With the aid of the illustrations a comprehensive view of these parts of the installation can be readily obtained and only the salient features need special description.

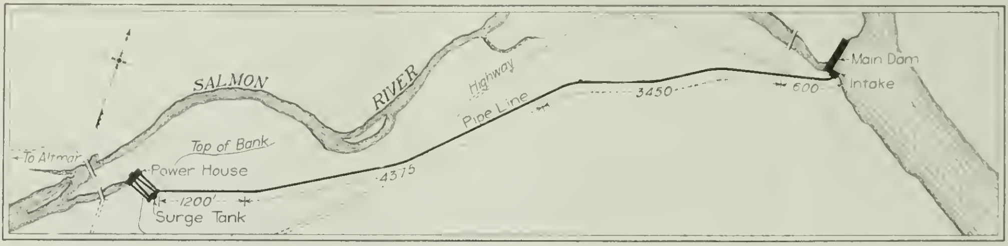


FIG. 2—MAP OF SALMON RIVER HYDRAULIC DEVELOPMENT

From the Reservoir to the Penstocks

The Salmon River is of the kind found all through the lake district of central New York. The riverbed is at the bottom of a narrow valley with rather steep hills rising on both sides. At places the valley widens considerably, as, for example, just above Salmon Falls; at others it narrows into a gorge with steep banks, as at Stillwater. By the location of a dam at the latter point with a crest at an elevation of 935 a large area was submerged with little loss of property, as the valley is sparsely settled. Only a dozen or so of dwellings, including several on the edge of the village of Redfield, and a few miles of highway had to be relocated. The height of the dam crest is limited to about 935 unless more extensive dikes are built to prevent diversion of the water into the watershed of the streams draining into Oneida Lake, several of which take their rise on the south side of a narrow ridge which parallels the Salmon River closely on the south.

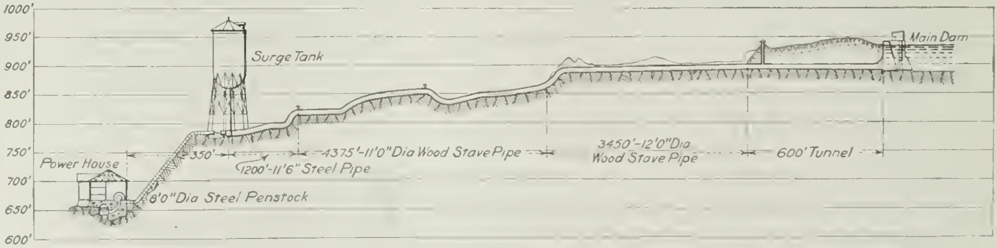


FIG. 3—SECTIONAL ELEVATION, SHOWING RELATION OF DAM, PIPE LINE, SURGE TANK AND POWER HOUSE

Fig. 2 shows the location of the dam and the artificial lake, which has a capacity of 2,600,000,000 cu. ft. with the dam crest at 935, and, at the average rate of flow of the stream, about twenty days are required to fill it. With the crest at this height the average net head produced at the power house less than 2 miles away is 245 ft.

The present temporary crest is at elevation 924, but during the present year it will be raised to elevation 935. Keyways are provided in the temporary spillway to tie the future concrete cap to the present structure, the crest being temporarily formed with a wooden apron. On the down-stream face of the dam is a 25-hp Pelton wheel for the gate drive, connected by long shafting and bevel gearing to a longitudinal shaft in the gatehouse. By means of clutches the gate-raising mechanism is connected to this shaft.

The conduit connecting the dam and the power house consists of five sections, a 600-ft. reinforced concrete-lined tunnel drilled through rock, a 7825-ft. length of wood-stave pipe, a 1200-ft. length of steel pipe, a steel distributer and four short penstocks. The topography of the country between the dam and the power house, which is situated at Bennett Bridge, is such that an open canal could have been used. The pipe line, however, was found to be cheaper.

The tunnel was necessary at the dam end of the line to pierce the southerly ridge previously referred to. It is lined with concrete not less than a foot in thickness with circumferential reinforcing rods closely spaced, and it has an inside diameter of 12 ft. The wood-stave pipe continues at the same diameter for 3450 ft., the diameter being reduced to 11 ft. for 4375 ft. more. The staves are of kiln-dried Douglas fir cut not less than 3⅝ in. thick for the 12-ft. pipe and 4 in. for the other. They are joined end to end by means of galvanized-iron keys and are held circumferentially with bands of ⅞-in. and 1-in. steel rods. Each band is in three sections, all united by cast-iron clamps. In soft ground the pipe was supported on timber cradles, but otherwise it was laid directly on the surface. It was coated on the outside with Avenarius Carbolineum and afterward back-filled to about one-half its height. Relief valves were inserted at intervals to preven undue pressure when emptying the pipe, and to serve as air outlets when filling, and drains were placed at all low points. The engineers selected wood pipe for that part of the conduit in which the pressure was not too great because, in the cold climate of the region, it is cheaper than steel pipe when the latter is properly protected from freezing. Fir was used because it is an excellent wood for pipe not subjected to alternate wetting and drying in that it remains tight, does not rot and is reasonable in price.

The steel-pipe section is 1200 ft. in length and 11½ ft. in diameter. It is connected to the wood pipe through a slip expansion joint packed with oakum and lead wool. Special attention was given to the material in this pipe, which was specified as open-hearth steel containing not over 0.05 per cent sulphur and between 0.3 and 0.6 per cent manganese. The phosphorus was limited to 0.06 per cent if the steel was made by the acid process and 0.04 per cent if by the basic process. The thickness of the pipe is ⅝ in. throughout. The steel pipe was mounted on concrete saddles 20 in. thick and spaced about 14 ft. apart. It was laid in a shallow well-drained trench and a 6-in. sewer tile was molded in the bottom of each saddle to facilitate drainage. The pipe was housed over with a substantial structure of framing and boarding continued down to the ground level. The roof, of 1-in. boards, was covered with a layer of roofing paper. Trap doors were placed in the roof over all manholes.

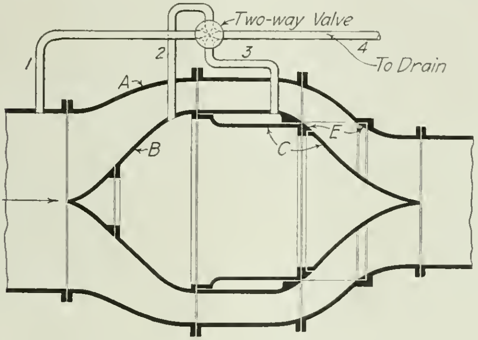


FIG. 4—JOHNSON HYDRAULIC VALVE

From Distributer to Tailrace

The more novel features of this plant are found in and near the power house. On the crest of the ridge just behind are not only the most conspicuous but also the most original elements of the hydraulic equipment. First there is the distributer, a 12-ft. steel pipe 210 ft. in length and joined at one end to the pipe line in a huge concrete anchor block. The other end is closed by a bulkhead. The elevation of the bottom of the distributer is 775 ft., or 160 ft. below the crest of the dam.

From the center of the distributer a 12-ft. riser branches off to a surge tank. This enormous T-connection requires reinforcing from side to side, and this is provided by a 9-in. bolt, 25 ft. long, with bearing washers for the nuts 4 ft. in diameter. The surge-tank riser joins the distributer with easy curves, but a novel and cheaper connection is made to the penstock intakes, 8 ft. in diameter. This is a simple flanged and riveted joint, which would, without some modification, produce eddies and loss of head. To prevent such, wooden fillers suitably rounded off are secured around the mouths of the intakes inside the distributer.

The distributer is a steel pipe, ⅝in. thick, inclosed in concrete.

The surge tank, built by the Kennicott Company of Chicago Heights, Ill., is the largest of its type yet constructed. It consists of a cylindrical shell, 50 ft. in diameter and 80 ft. high, surmounting a hemispherical bottom which adds 25 ft. to the height. Its capacity is, therefore, 1,400,000 gal. The tank is supported on ten columns with heavy concrete footings. It and the riser are housed in with a framed wooden structure providing a surrounding air space which can be heated when necessary from a small house below. The top of the roof of this structure is 205 ft. above the ground, and the top of the tank is high enough above the crest of the dam so that if the flow of the water in the pipe line were suddenly interrupted its energy would be absorbed by the rise in level in the tank without overflow.

An important feature of the surge-tank riser remains to be mentioned. With a 12-ft. riser opening into the bottom of the tank there would not be friction enough to absorb the energy of a surge, which would therefore tend to set up oscillations. To provide for the damping of such oscillations, a smaller pipe is mounted inside the tank, connected directly to the riser below and terminating in a funnel near the top. The rest of the mouth of the riser at the bottom of the tank is covered by a ring in which small ports are provided. In action, therefore, a surge produces a rise in the small pipe and some flow through the ports. The head in the small pipe then forces the surplus water through the ports and equalizes the pressure gradually. This process is technically termed "differential action" and is an invention of the hydraulic engineer of the Ontario Power Company, Mr. R. D. Johnson.

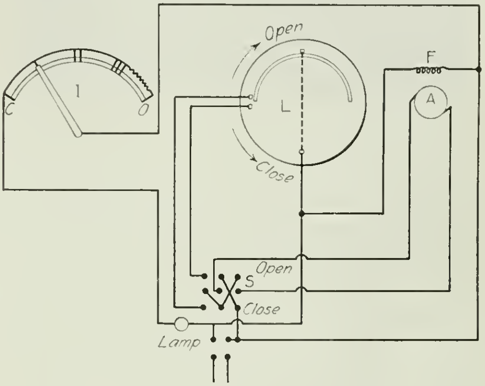


FIG. 5—WIRING DIAGRAM, HYDRAULIC VALVE CONTROL

The four 8-ft. penstocks are connected to the intakes through valves of a type which represent a comparatively new development in hydraulic practice. They operate under a head of nearly 154 ft. The type of valve used is also the invention of Mr. Johnson, manufactured by the Wellman-Seaver-Morgan Company. The valve is shown herewith, with part of the piping, and in diagrammatic section. It consists of a casing *A* supporting an internal stationary shell *B* pointed against the direction of water flow. A hollow plunger *C*, movable in the shell, carries a bronze ring *E*, which seats on a second ring *E*. The motion of the plunger is controlled by a two-way valve through piping as shown in the figure. The piping has four parts. No. 1 is tapped into the penstock, No. 2 into the space behind the plunger, No. 3 into a space between the plunger and the shell, while No. 4 discharges to the air. The operation of closing the valve consists in opening pipe 1 into pipe 2 and pipe

3 into pipe 4, putting pressure behind the plunger and gradually seating it. To open the valve pipe 1 is opened into pipe 3 and pipe 2 into pipe 4. The plunger can be stopped in any position, and an indicator, mechanically connected with it, shows its position. The two-way valve is motor-driven with electrical control on the main switchboard, the circuits being as shown in another figure. The motor *FA* is started by means of the triple-pole, double-throw reversing switch *S* and stopped by the limit switch *L*, operated by the mechanical indicator *I*. The switchboard operator needs to know that the valve is being operated properly, although he is not concerned with its exact position. To give him a rough indication, a pilot-lamp circuit is closed at the quarter position of the indicator *I*, once for quarter, twice for half, and three times for three-quarters open. In the closed position the lamp shines brightly, but in the open position it is dimmed by means of resistance.

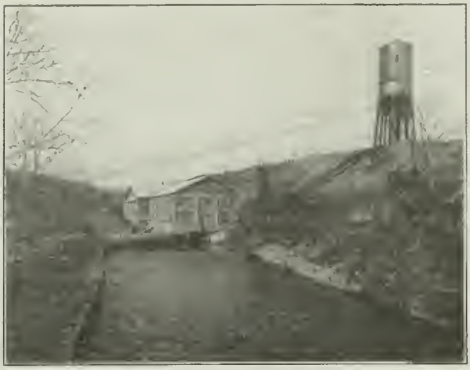


FIG. 6—SURGE TANK, POWER HOUSE AND TAILRACE

Below the valve houses are the four 8-ft. penstocks, anchored above and below in heavy concrete blocks, and laid in trenches and entirely back-filled. The steel plates vary in thickness from ½ in. on the upper horizontal portion of the penstocks to ⅞ in. at the lower end where they enter the power house.

The 10,000-hp Turbines

The four turbines are of the Francis horizontal, single-spiral, double-discharge type of 10,000-hp rating each. They are provided with outside, balanced wicket gates operated by Lombard governors. These machines have guaranteed efficiencies of 82 per cent at full load, 85 at three-quarters load, 80 at half load and 70 at quarter load. The specifications on governing permit not more than 15 per cent increase in speed above the normal value of 375 r.p.m. on the sudden removal of full load, 6 per cent for half load, 3 per cent for quarter load, and 1.5 per cent for tenth load. The turbines are provided with heavy flywheels to assist in governing and to facilitate the operation of the electrical equipment of the plant in parallel with the Niagara, Lockport & Ontario Power Company's system. The turbines are provided with relief valves operated by the governors, so that the sudden checking of over-speed cannot result in an excessive rise of pressure.

The discharge of the turbines is conducted to the tailrace through short concrete draft tubes, entering at an obtuse angle to prevent eddies. In fact, on its entire journey from reservoir to tailrace the water is led with as few turns as possible and around easy curves. The tailrace is directly under the power house, which is built over the bed of a branch of the river that previously carried water at times of flood and was with little expense transformed into a tailrace. The exit of the tailrace from the building is closed by a curtain wall which prevents the ingress of cold air. The old river-bed, below the building, was cleared out for a distance of several hundred feet, and the banks were reinforced with dry-laid stone walls.

The Power House

The power house is a simple structure consisting of reinforced-concrete pilasters connected with heavy concrete beams. The panels are filled with red brick outside and sand-lime brick inside. The roof, supported on steel trusses, is 3 in. thick, of gypsum composition reinforced with steel cables and rods. This is the Metropolitan Fireproofing Company's system and was installed by the Keystone Fireproofing Company. The roof is covered with an asphalt coating overlaid with several layers of asbestos felt. One purpose in the use of this particular type of roof was to secure a fireproof base to which tile could be nailed in case it was later found desirable to add a tile roof. The gypsum roof is very light and was easy to place.

The building is rectangular with a projecting feeder bay. The interior is open to the roof and, with the exception of a gallery about 12 ft. above the main floor on the feeder-bay side, forms one great room. It is served by a 40-ton Shaw electric crane with main and auxiliary hoist all driven by 250-volt direct-current motors. The crane has a 38-ft. span and the runway covers the entire length of the building.

Coming now to the foundations of the building, the construction already briefly referred to is especially interesting in that the intake pipes, the draft tubes and the discharge tunnel are all directly under the building, embedded in or formed of concrete which rests on solid rock. The arrangement of draft tubes, tunnel, etc., is shown in the accompanying plans and sections. They are laid out in this way to insure simplicity of construction and reliability of operation.

Electrical Features of the Power Plant

Each of the four electrical generating units consists of a 375-r.p.m., 6600-volt, twenty-five-cycle, three-phase generator with exciter mounted on an extension of the shaft; three 2200-kva, single-phase, twenty-five-cycle transformers with a normal ratio of 6600 volts to 34,650 volts, with high tension in star, giving 60,000 volts line voltage; a 6600-volt, 1200-amp, triple-pole, single-throw, type "C" oil circuit-breaker, automatic for reverse power, and the necessary connecting cables and

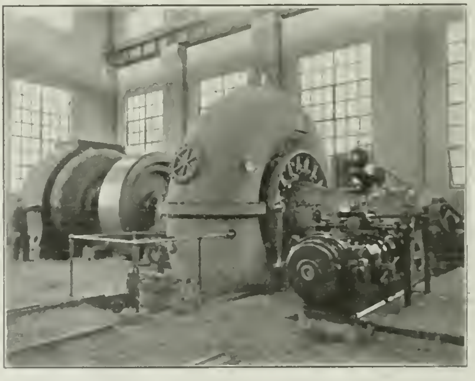


FIG. 7—NO. 1 UNIT, POWER HOUSE

auxiliaries. Each unit is thus as nearly self-contained as possible, with all parts placed conveniently near together.

The Generators

The generator is of standard form except that the pole faces are furnished with damping grids and the shaft is made exceptionally rugged on account of the use of the heavy flywheel. It is of the semi-inclosed type, and the method of ventilation is interesting in that all the cooling air may be discharged through a single large opening in the top of the frame. It is designed to operate either as a generator or as a synchronous condenser, the plant being meant to be used both for energy generation and for voltage and power-factor regulation. The generator is rated at 5600 kva at 6600 volts and 85 per cent power-factor, and it is designed to carry 20 per cent overload. It is capable also of operating at full current output up to 7500 volts.

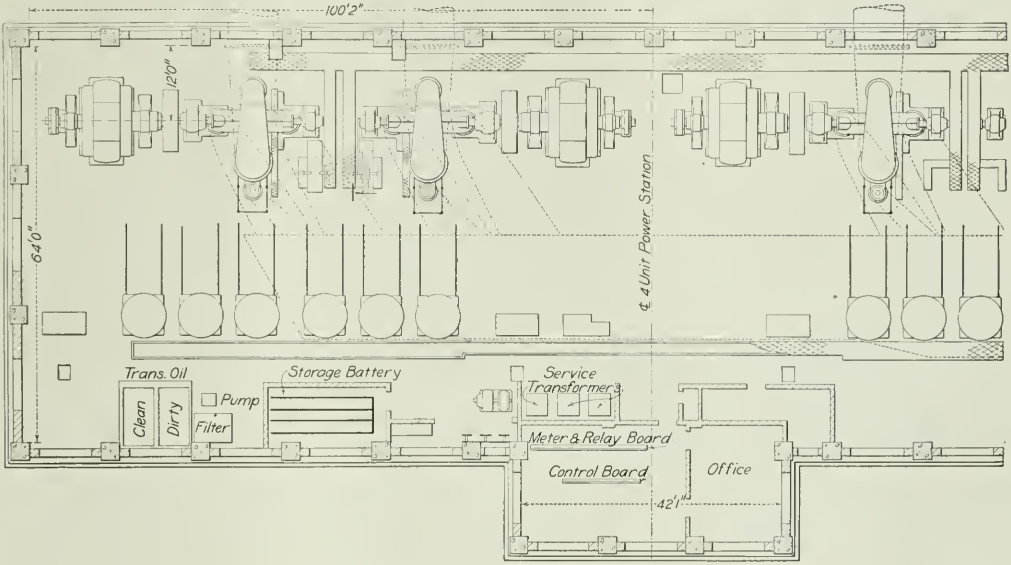


FIG. 8—PLAN OF MAIN FLOOR OF POWER HOUSE

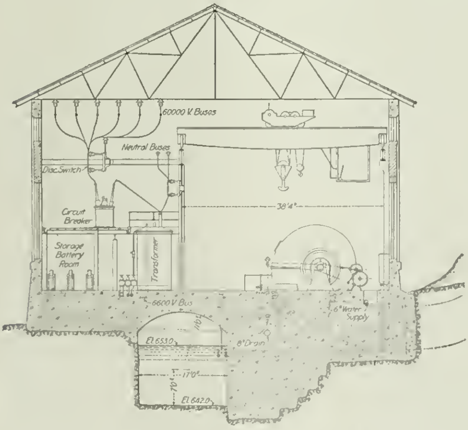


FIG. 9—CROSS-SECTION THROUGH POWER HOUSE

On account of the special nature of this plant, the specifications call for high efficiency at half and quarter load. The accompanying table shows the required values.

The regulation of the generators was designed to be such that the plant should operate successfully in parallel with that of the Ontario Power Company at Niagara Falls. The limits allowed at 20 per cent overload were, for 100, 90 and 80 per cent power-factor, 12, 25 and 28 per cent respectively. The liberal allowances are naturally associated with low values of short-circuit current, the limits being ten times normal full-load current on instantaneous and one and three-fifth times on steady short-circuit. The variation in wave-form also was limited to 5 per cent for any load within the capacity of the generator having a power-factor of 80 per cent or higher.

EFFICIENCY DATA ON SALMON RIVER GENERATORS

Volts	Power-Factor	PER CENT EFFICIENCY AT INDICATED PERCENTAGES OF FULL-LOAD CURRENT				
		25	50	75	100	120
6600	100	89.6	93.8	95.1	96.1	96.4
6600	85	87.3	92.2	94.0	95.0	95.5
7500	85	86.1	90.8	93.2	94.5	....

Excitation for each generator is furnished by a separate directly connected shunt-wound exciter, each generator requiring from 125 amp and 125 volts at no load, normal voltage, to 235 amp and 245 volts at 7500 kva and 7500 volts. The exciter is adapted to voltage and power-factor control by the Tirrill regulator.

The weight of the complete generator and exciter is approximately 110 tons and that of the rotor about 40 tons.

London's Electric Energy Supply

By Haydn Harrison

To those who have not had an opportunity of studying the history of the electricity supply in London it must be incomprehensible how a city of such magnitude should still be catered for by a large number of comparatively small undertakings, many of which are out of date and inefficient.

These concerns are owned by both private companies and local public authorities. Some of the former have been in operation for nearly thirty years, and some of these stations have plants exceeding 30,000 kw in rating. Others of them do not reach 1000 kw. This state of affairs is largely attributable to the action of Parliament in granting powers to local authorities, which in many cases have run the electricity undertakings on a party basis, and also, in the case of companies, to the fact that tenure was limited by the insertion of clauses in the acts under which they operate giving the London County Council the right to purchase in the year 1931. Under these circumstances it is not surprising that such companies require to know where they stand before spending large sums of money on developments. Moreover, schemes which they have put forward for strengthening their position by amalgamation, or supply of power in bulk to areas operating with small generating stations, have generally been quashed on the score of a general scheme being developed before 1931 by the London County Council.

For example, a scheme for bettering the condition of affairs took the form of a bill before Parliament in 1905, the object being to centralize supply and amalgamate various undertakings under the name of the Administrated County of London & District Electric Power Company. In 1908 the London district electricity supply bill was brought forward, but neither of these bills matured, largely owing to the London County Council, which acts as the administrative authority over 121 sq. miles of the London area.

This body has already taken over and electrified the tramway service of London, for which purpose it has erected a generating station having a rating of 34,000 kw. It has now been in operation for nine years and is producing energy at a works cost, including fuel, oil, repairs and maintenance, of 0.66 cent per kw-hr.

It is not surprising that an administrative authority such as the London County Council, having already embarked on the tramway enterprise, should be carefully considering the best way to deal with the motor-service and lighting problem, and Londoners are to be congratulated on the fact that there are indications that a move will be made before 1931, when the Council can enforce its rights of purchase from the companies.

The London County Council in asking Messrs. Merz and McLellan to report on the position and advise it on future policy showed that it wished to deal with the problem on a large scale. This firm of consulting engineers is noted for the bold manner in which it has dealt with the supply of power in bulk in the northern counties and elsewhere. The Newcastle-upon-Tyne bulk supply undertaking, engineered by Messrs. Merz and McLellan, has already plant installed capable of developing 70,000 kw and is rapidly increasing its business.

Messrs. Merz and McLellan's report to the London County Council has now been published, and it must be admitted that it not only deals with the matter on broader lines than is usual in such documents, but also looks further into the future than is often considered necessary.

Investigations for the report lasted over eight months. The two areas under consideration were that of Greater London and 100 sq. miles covered by the county of London, the latter being practically in the heart of the former.

The continued use of the large number of comparatively small generating stations now in existence is not considered, but the cost of production in ten of the best existing stations, hypothetically developed into up-to-date stations of the necessary increased size, is compared with an equivalent single station situated down the river.

It is argued that the economy of concentration lies in the use of large generating sets, and that there is no advantage in having more than ten sets altogether, but as 30,000-kw to 40,000-kw machines are now available and it is likely that 50,000-kw sets are in sight, a generating station having an output of 500,000 kw and containing only ten sets is a probable solution.

As regards the position of such a generating station, it is not considered that, until further development of the Kent coal fields (about 70 miles from the center of London) has taken place, it would be wise to decide on a coal-field site. Moreover, it is estimated that any possible saving in the cost of carrying coal would be lost in the transmission lines. Thus the conclusion come to in the report is that the site or sites should be down the river.

Many of the existing generating stations are situated on the river, but as some of these are "above bridge," where the coal has to be barged, and others are limited in space for coal storage, it is stated that it will not pay to make use of such stations but that it would be wise to erect a new station where coal can be delivered without transshipment.

It is estimated that the initial capital outlay, allowing for growth of demand during the next four years, would be from £6,000,000 to £7,000,000, and that the saving effected in working costs would be £170,000 a year after allowing for all capital charges on new plant and trunk lines. It is pointed out that this saving, in conjunction with the present sinking fund collected, would enable the existing generating plants to be written off by 1931, the date at which the London County Council can take over the present concerns.

In order to form an opinion on the general scheme it is necessary to know the existing position of affairs, and also to estimate the likely conditions which will arise during the next few years.

In the area under consideration £26,000,000 has already been expended by the sixty-five existing undertakings. This includes £8,000,000 spent on seventy generating stations having a total rating of 307,000 kw, or approximately £26 per kilowatt of plant. The average working expenses of all these concerns is 2.2 cents per kw-hr., and the average price obtained 4.58 cents. The number of kilowatt-hours sold per head of population per annum is 48.5, the kilowatts connected per head being 0.07.

There are no less than thirty-one systems of generation, eight different frequencies, twenty-one different distributing voltages and fifty methods of charging.

The proposals laid down by Messrs. Merz and McLellan would eventually amount to a clean sweep of all these generating stations. This would result in a lower cost of generation, but as this gain would have to go in the repayment of loans the consumers would not benefit for some time to come unless the load was increased and the load-factor improved.

There is no doubt that a rapid growth in consumption is likely to occur in certain directions, such as cooking, heating and motor service. But to attain that growth it is essential to reduce the cost to the consumer, and thus the average price obtained per kilowatt-hour unit would be reduced. In New York and Boston the average price is much the same as in London, despite the fact that the consumption per head of the population is nearly double. If London, with its huge population, attains within the next few years the consumption per head which now rules in New York, Boston, Chicago and similar large cities, the success of the scheme proposed would be assured.

As regards the engineering features, there is nothing very novel, a high-voltage three-phase system (fifty cycles per second) being recommended. This would connect by means of transformers or rotary converters to the existing low-tension networks, which might cope with the heating and motor load for a time. Extensions would be carried out by means of a three-phase network so as ultimately to standardize this method of distribution.

The most novel feature, so far as English practice is concerned, is the suggested method of operating the proposal. After considering (a) the combination of the existing companies and local authorities, (b) a new company, and (c) a new public authority, it is recommended that an owning and controlling company be formed to finance the scheme and an operating body to take over the management. Reading between the lines, this is a suggestion of municipal control and ownership, the operation being done by existing private authorities. It is quite possible that such a proposal might be carried through with sound financial results. In any case it is to be hoped that some way will be found to interest the present companies, the properties of which are liable to compulsory purchase in 1931; otherwise a condition of inefficiency must exist up to that time. Not that the companies are themselves inefficient, but that there is no encouragement for them to be progressive. A means to insure that money spent on electrical undertakings in London now is a sound investment should be one of the first considerations in remodeling London's supply, which would then advance much more rapidly than has hitherto been possible under the restrictions of compulsory purchase.

Mr. Ferranti, who was the first man to provide London with a high-tension energy supply from the Deptford station, in his presidential address before the Institution of Electrical Engineers laid emphasis on the advisability not only of supply direct from the coal fields, but also of the use of internal-combustion engines with the object of collecting the by-products from the coal. In this connection it is interesting to note that by-product work is hinted at in the report. It is therefore quite possible that when a more detailed scheme is put forward it may contain suggestions which, if carried through, would provide London with a supply of electrical energy generated on lines which are only now beginning to be developed.

It must be borne in mind, however, that as the cost of generation is being reduced to a very low figure, the capital charges become relatively more important unless some means is found to improve the load-factor. London, compared with other towns in England, is not a large manufacturing city, but as a town it is so enormous that nearly every industry is carried out on a scale which would surprise the casual observer. Moreover, its various districts are populated by many different classes. For example, the City of London Electric Lighting Company, which deals with the City area only, is one of the largest and most flourishing concerns, yet the supply after business hours is comparatively small. The West End of London, on the other hand, being purely residential, with a class which does not in any way consider the cost of lighting, produces a heavy load in the evening. The East End of London is one mass of factories and workshops. All these represent a great diversity-factor which, from the point of view of a centralized supply, means a good load-factor. There is therefore no reason why the figures relating to cost of production mentioned in Mr. H. M. Hobart's paper read before the American Institute of Electrical Engineers in February, 1914, based on a 50 per cent load-factor, should not be improved upon under London conditions, and it is likely that, provided the many obstacles now existing be removed from the path of a properly organized publicity and selling organization, the consumption per head of the enormous population of London may reach, if not exceed, the high figure obtained in Chicago and other great American cities.

Electricity in Marine Service

As stated in the *Electrical World* of May 23, two papers on the use of electricity in marine work were presented at the May 19 meeting of the American Institute of Electrical Engineers in New York, as follows: "The Future of Heating and Cooking in Marine Service," by Mr. H. J. Mauger, and "Electricity the Future Power for Steering Vessels," by Mr. H. L. Hibbard. Abstracts of these papers are given below:

Electric Cooking in Marine Service

The recent trial trip of the U. S. S. *Texas* is of special interest because for the first time a large number of men (715) at sea were entirely dependent upon electric cooking for their daily meals. The results of the trial test on the cooking apparatus were discussed by Mr. Mauger. A general description of the electric-cooking equipment and a tabulation of a weekly menu, with the quantities of food prepared, were published in the *Electrical World* May 16.

Data secured during the trial trip demonstrated that the ship's equipment of fifteen ranges and two bake ovens was more than sufficient to care for a crew of 970 men, including seventy officers. The success of the trial is more apparent in view of the fact that none of the cooks had had any previous experience in using electrical apparatus and that they became acquainted so readily with its operation and had no difficulty in performing their prescribed duties.

Of the five ranges installed in the officers' galley four were in use daily. Six to eight of the ten ranges in the crew's galley as well as the two bake ovens were employed simultaneously. Food for 162 men was prepared in the officers' galley and that for 553 men in the crew's galley. The bake ovens proved to be sufficient to supply a crew twice as large as that aboard the ship during the trial trip. The officers' galley was in use from 6 a. m. to 9:30 p. m., except for one hour and a half from 2:30 p. m. to 4 p. m. A few hot-plates were kept in service at all times for heating coffee. The crew's galley was in use from 4:30 a. m. to 8:30 a. m., 10 a. m. to 1:30 p. m. and 4 p. m. to 8:30 p. m., depending somewhat on the daily menu.

Two of the accompanying diagrams indicate the average total daily energy consumption and the consumption over a period of four days subdivided under officers' and crew's galley and bakery. Other curves are shown indicating the variation in load during the preparation of a typical day's meals.

The total daily energy consumption averaged 1258.6 kw-hr.; the highest demand was 1695 kw-hr. and the lowest 806 kw-hr. The downward slope of the curve shows a radical increase in economy occasioned by the cooks becoming accustomed to the use of the electric ranges. It is probable that more extended experience would still further increase this economy. The energy consumed per person per day averaged 1.7 kw-hr. The average total consumption in the crew's galley (556 kw-hr.) was only slightly more than that in the officers' galley (519 kw-hr.). The average consumption per man per day in the crew's galley was 1 kw-hr., as compared with 3.2 kw-hr. in the officers'. The average daily consumption in the bakery was 182 kw-hr., or 0.25 kw-hr. per man.

In accounting for the difference of the energy consumption per man per day in the two galleys, it may be said that about 25 per cent to 30 per cent of the cooking in the crew's galley was performed in steam-heated caldrons, while electricity was used exclusively in the other galley. Another advantage obtaining in the crew's galley was that the ranges could be operated at a better load-factor because more food had to be prepared.

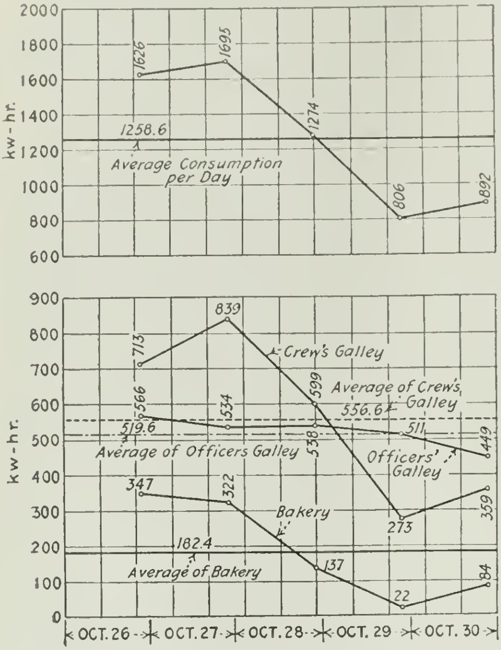


FIG. 1—TOTAL ENERGY CONSUMPTION OF ELECTRIC RANGES AND BAKE OVENS ON U. S. S. "TEXAS"

Analysis of one of the daily energy-consumption curves in the officers' galley shows that the average demand was 27.4 kw, while the maximum occurring during the preparation of dinner reached 54 kw. Four ranges were in actual use during the preparation of the particular meal referred to. The ratio of the maximum demand to the connected load was therefore about 54 to 120, and the load-factor about 50 per cent.

During the preparation of a typical day's meals in the crew's galley the average demand was 21.2 kw and the maximum 90 kw, making the load-factor about 24 per cent. Eight of the ten ranges were used, so the ratio of the connected load to the maximum load was 90 to 240. By properly concentrating the cooking in fewer ranges a ratio of 90 to 120 could have been obtained.

The kilowatt-hour curves were taken from wattmeter readings, and the other curves were plotted from ten-minute readings taken throughout the operating periods.

The ranges have a hot-plate area of 888 sq. in.; the broilers measure 18 in. by 24 in. and the ovens 18 in. by 28 in. by 16 in. Each hot-plate requires 1750 watts maximum, each broiler 4000 watts and each oven 4800 watts maximum, making the total connected load in each range 31.6 kw. One range will roast 75 lb. of meat at one time.

The bake ovens require 16 kw maximum and are capable of preparing 100 loaves of bread. The loaves do not have to be shifted in an electric oven to procure good results as has to be done in the coal-fired type, therefore the heat is not dissipated and wasted through open doors.

The ranges are capable of cooking larger quantities of food than coal-fired type of the same size, as the compartments usually devoted to fire and ash boxes are utilized as a roasting oven in the electric type.

Another advantage of the electric range is that it is equipped with a broiler, which the coal range lacks. The broilers can be used for toasting, warming dishes and browning the products from the oven.

Electric Steering of Ships

In the paper on steering ships by electricity, Mr. H. L. Hibbard called attention to the fact that electrical development in the marine field has been confined in a large measure to the navy, and the best experience with electric steering gear has been obtained in the same service. The problem of electric drive is largely one of control. The calculations for rudder and motor horsepower must be carefully made, with the proper assumptions for the conditions presented.

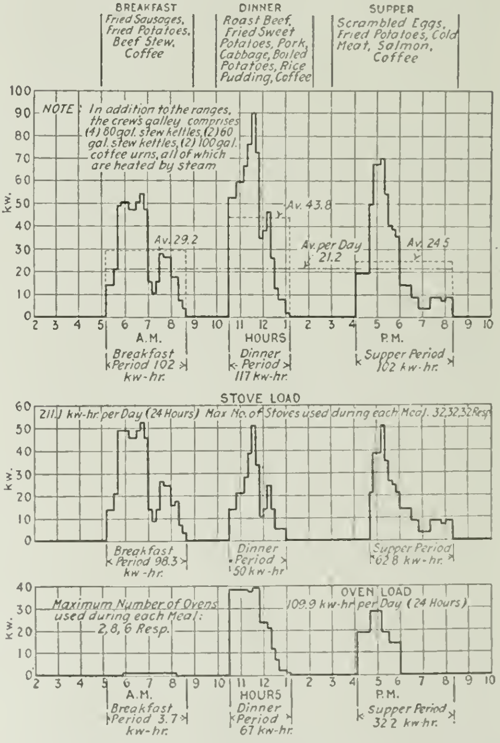


FIG. 2—ENERGY CONSUMPTION OF ELECTRIC RANGES IN CREW'S GALLEY

In commenting upon the disadvantages of steam steering apparatus the author brought out the following points: With the boilers amidship, as they are usually installed, considerable piping has to be employed which has to be arranged to prevent excessive condensation and large temperature rises in the vicinity of powder magazines. The piping may weigh as much as 3 tons, or about 45 per cent of the weight of the steering engine. Considerable steam is also wasted owing to the method of setting the engine valves. The engines are generally designed to take steam full stroke and are therefore uneconomical. The steam steering engine does not lend itself to overloads like an electric motor does. The reciprocating parts of a steam engine are subjected to excessive strains due to high speed when the rudder approaches its mid-position, while a motor is not. Moreover, the engine has to be operated frequently when the ship is in port to prevent rusting. In addition, the mechanical connections from the bridge to the engine valve are a source of considerable trouble as the wire rope frequently wears out, causing delay and inconvenience.

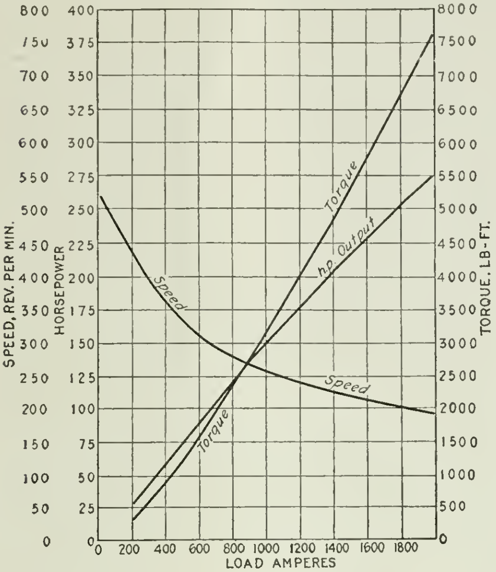


FIG. 3—CURVES FOR STEERING-GEAR MOTOR

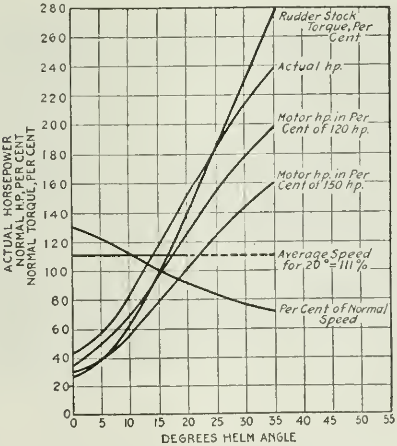


FIG. 4—CALCULATED RUDDER TORQUE AND POWER CURVES

By using electric steering gear it is possible to overcome most of these disadvantages and obtain more flexible operation. Among the advantages of electric steering are: Reduction in weight and space occupied by the steering mechanism; suppression of heat; elimination of accidents incident to bursting of steam pipes; reduction of vibration; obtaining of more efficient operation; simplification of control apparatus; increase in rapidity, and accuracy of response of the rudder to the control mechanism.

Several forms of electric steering apparatus which have been developed were described. The steering equipment on the U. S. S. *Texas* and *New York*, which is similar to that on the *Des Moines* and the *Mississippi*, was also described. The apparatus on these ships consists of a rudder motor, disk brake, main automatic controller, resistance, and master controller. The master controller is small and made of brass so it has no magnetic influence on a compass if installed near one. Starting, stopping, slow and fast speeds and reverse are controlled by moving the switch handle away from the vertical about 60 deg. No follow-up system is employed, so the motor will run as long as the switch handle is turned and will stop when the handle is released. The motor is rated at 150 hp, 250 r.p.m., and is 50 per cent series and 50 per cent shunt-wound, giving variable speed and torque characteristics. The rudder can be turned from 20 deg. right to 20 deg. left in twenty seconds.

ACTUAL POWER REQUIRED FOR STEERING ON U. S. S. "TEXAS"

Status of Ship	Speed of Rudder Motor	Kw Peak	Kw Steady
At anchor	Full speed Half speed	146.4 146.4	18.0 96.0
Full speed ahead	Full speed	146.4	13.2 with stream 48.0 against stream
	Half speed	146.4	96.0
Full speed astern	Full speed Half speed	156.0 156.0	18.0 near amidship 96.0 all conditious

The remainder of the paper was devoted to explaining the methods of calculating the engine horse-power required, describing results obtained in actual practice, etc. From data got on the trial trip of the *Texas*, the maximum torque required to move the rudder from hard-over to hard-over was found to be greater than that required for moving the rudder from mid-position to hard-over. This is accounted for by the change in the direction of the stream flow against the rudder. While full speed astern in general imposes the most severe conditions on steering, yet this was not the case on the *Texas*, probably because a balanced rudder was employed.

Growing Telegraph Poles Baffle East African Ants

On an East African telegraph line living trees are used to support the wires in order to escape the destructive ravages of the white ants, which attack the poles but not the trees. The latter are planted along the line with their branches cut off. They readily take root and need only to have their branches trimmed from time to time. The wires are affixed by means of tarred cords of hemp in place of insulators. Eventually the trees will be replaced with iron poles, which will be equally unattractive to the insects.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

"Four Million or More, July First or Before"

Taking the above phrase as its slogan, the Edison Electric Illuminating Company of Boston has been conducting a campaign to increase its connected load to or above the equivalent of 4,000,000 50-watt lamps by the end of the first six months of 1914. At the beginning of March, 3,786,011 50-watt lamps or their equivalent were connected to the system. During the last few weeks in May contracts for about 1000 kw were secured, and on May 31, 3,893,700 50-watt lamps or their equivalent were connected or contracts for service had been secured therefor.

Attractive Central-Station District Store in Montreal

The uptown branch office and store of the Montreal Light, Heat & Power Company, at 358 St. Catherine Street West, is in the heart of the retail shopping district and one of the most attractive establishments of its kind in eastern Canada. Customers find in this branch office as representative a display of electrical appliances as in the headquarters showroom on Craig Street. The accompanying halftone illustrates the diversity of equipment displayed without undue crowding in a comparatively small space, the store being only 25 ft. wide and about 20 ft. long in the section photographed. As a whole, the store is 73 ft. long and both gas and electric appliances are displayed, the arrangement being convenient for the merchandising of household equipment, the payment of bills and discussion of business by customers and employees.

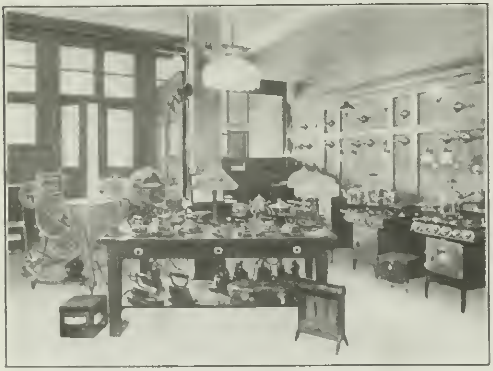


EXHIBIT OF ELECTRICAL APPLIANCES IN MONTREAL CENTRAL-STATION SHOWROOM

The store is lighted by eight 400-watt lamps mounted in pear-shaped translucent reflectors hung from the ceiling 11 ft. above the floor, the latter being 13 ft. high and painted white. Each of the windows is 7.5 ft. long by 5 ft. deep, lighted by three 150-watt lamps mounted in corrugated metal reflectors at the top of each bay. A sign bearing the company's initials is mounted above the door on the outside, there being fifty-six 60-watt lamps in the display. For the display of portable appliances the company utilizes a standard table, shown in the foreground and equipped with six outlets wired from below the top, the table being 8 ft. long, 3.5 ft. wide and 30 in. high, with a lower shelf for the display of flatirons, toasters, hot-plates, etc. Two outlets are provided on each of the interior columns, and a table can be energized by a flexible connection of any convenient position. At the right are six wall panels equipped with gas and electric-fixture outlets and an electric-range display which is in line with the route to the cashier's office. By placing the latter at the rear of the store each customer is led to see the display as a whole when paying bills in person. Other features are a glass case for the display of small appliances, a fireplace equipped with three 250-watt luminous radiator tubes, and an old portable Thomson watt-hour indicator shown at the left of the table, which is calibrated in terms of the cents per hour required to operate appliances at the company's motor-service rate.

Demonstrating Vacuum Cleaner on Mule's Hide

The Scranton (Pa.) Electric Company recently attracted and held a large crowd of people in front of its offices by demonstrating the effectiveness of a vacuum cleaner on the coal-begrimed hide of a mine mule. The animal, having probably never experienced a similar sensation before, expressed its surprise when the vacuum cleaner was put in operation by delivering a far-sounding "hee-haw." The noise soon attracted a crowd which watched the demonstration and probably carried the news to more quarters than any other form of advertising might have done.

LIGHT.HEAT.POWER.

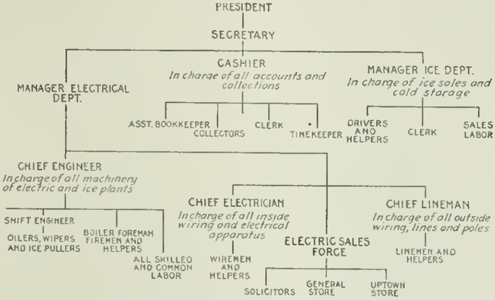
ELECTRICITY, THE VACUUM CLEANER AND THE MINE MULE AT SCRANTON, PA.

Staff Organization in an Ice-Electric Plant

The Brenham (Tex.) ice-electric company operates an 800-kva electric plant and a 40-ton ice plant. Mr. J. R. Kennedy is secretary of the company and manager of the ice and electric departments, and the responsibilities and duties of each sub-department head and employee are clearly shown by the accompanying "organization tree," a framed copy of which hangs in each sub-department. The arrangement illustrated has now been in force nearly six months and has been attended by very gratifying results, according to Mr. Kennedy. Harmony exists in all departments and still further improvement is expected in the future, when changes in accounting methods will contribute to the efficiency of the organization.

The cashier is directly subordinate to the secretary and is responsible for the accuracy, competency and efficiency of the office force. He has full and direct charge of all books and accounts, receives all collections, and makes all disbursements.

It is his duty to render the secretary a weekly report, showing the recapitulation of the weekly pay roll, and a monthly report, setting forth the gross income for the current month, the operating expenses and a comparison with the business done during the same month of the preceding year.


PRESIDENT
SECRETARY
CASHIER
In charge of all accounts and collections
MANAGER ICE DEPT.
In charge of ice sales and cold storage
MANAGER ELECTRICAL DEPT.
ASST. BOOKKEEPER
COLLECTORS
CLERK
TIMEKEEPER
DRIVERS AND HELPERS
CLERK
SALES LABOR
CHIEF ENGINEER
In charge of all machinery of electric and ice plants
CHIEF ELECTRICIAN
In charge of all inside wiring and electrical apparatus
CHIEF LINEMAN
In charge of all outside wiring, lines and poles
SHIFT ENGINEER
OILERS, WIPERS AND ICE PULLERS
BOILER FOREMAN FIREMEN AND HELPERS
ALL SKILLED AND COMMON LABOR
WIREMEN AND HELPERS
ELECTRIC SALES FORCE
LINEMEN AND HELPERS
SOLICITORS
GENERAL STORE
UPTOWN STORE

ORGANIZATION CHART OF ICE-ELECTRIC COMPANY

These reports are of much value to the president and manager, as they show fully the condition of the business at a time when defects can be easily corrected, instead of waiting until the end of the fiscal year.

The manager of the electrical department is directly subordinate to the president and is clothed with full executive power for the proper management of his department. He supervises all current purchases of apparatus and machinery, approves contracts for wiring, determines credit to be extended customers, handles the advertising, computes rates and holds his subordinates responsible for the proper performance of their duties.

The manager of the supply department issues no material to any sub-department of the company unless it is properly requisitioned on regular forms stating the purpose for which it is to be used and is signed by the sub-department chief. He receives all incoming and dispatches all outgoing material, checks the prices and freight, and turns the invoices in to the cashier, with the proper notation. The cashier rechecks them and submits them to the manager for final approval.

Material issued to sub-departments is entered under date and requisition number in a record provided with columns giving the correct distribution. This record is posted periodically to the proper controlling accounts in the general books.

No material is issued for house-wiring work until a signed contract has been obtained from the customer.

A sales book of special design is used in the stores for sales to customers. It is made in triplicate with the originals perforated, so that one can be torn out for each sale. There are eight of these small invoices to the page, each extending only one-half the width of the book. The duplicate and triplicate are ruled beyond the margin of the original, with columns for cost of article, its selling price, cost of labor and its selling price. The original goes to the customer, the duplicate is turned in to the cashier daily with the cash sales, and the triplicate is retained in the book for store reference and record. This book eliminates the necessity of a recapitulation at the end of the month.

All the employees and all of the equipment of the mechanical department are under the direct control and authority of the chief engineer. This department must be kept up to the highest point of economy and efficiency. Daily reports, showing a complete operating history of the plant for the preceding twenty-four hours, are made on regular forms and turned in to the manager every morning. The report shows the units operated, hours each runs, their condition, the output, the fuel consumed, lubricants used, and so forth. The daily reports are progressive; that is, the totals of output and fuel consumed are carried forward daily.

Any dispute arising is arbitrated by the manager, who takes special care to permit no wrangling or friction to exist in his force. All men in authority are required to respect others in like position, and no one must exercise authority over men who are not directly under him, except with permission from their superior.

When men belonging to one department are at work in another department, the chief of the latter department is not permitted to interfere with them unless they have been placed under his charge by their superior. Any failure of the one force fully to co-operate with the other must be reported to the manager.

Encouraging Display-Window Illumination in Lieu of "White-Way" Lighting

The value of merchants' illuminated window displays as a practical means of lighting the downtown thoroughfares of small cities in lieu of "white-way" installations obtains recognition in the annual report of recommendations on civic topics recently submitted by the Charlottesville (Va.) Chamber of Commerce. The solution proposed is one of direct interest to all those who have to do with the problems of lighting the business sections of small communities, and the recommendations made have been painstakingly worked out upon lines which, while reducing the general lighting burden on the taxpayer, yet give to the merchants the advantages of lower energy cost and increased show-window publicity.

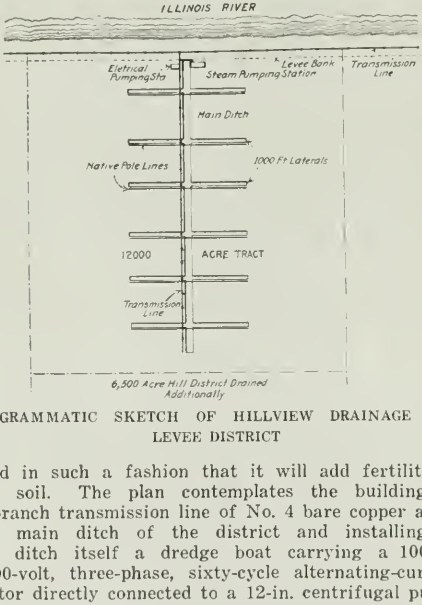
Four moving-picture shows keep the main streets of Charlottesville lively until about 10:30 p. m. By the proper lighting of the windows of all the local stores, and with these window installations kept in operation until, say, the closing time for the picture shows, a street illumination could be secured which, it is pointed out, would be even superior to that of so-called "white-way" lighting. Moreover, the advertising value of such window displays when inducements are offered to people to stroll through the business district before or after the picture shows gives the plan the aspect of a business proposition from the merchants' standpoint, rather than an expense and outlay on their part made solely for the benefit of the public. It is further recommended that this subject of lighting be presented formally to the local

Retail Merchants' Association, asking its support, while the co-operation of the local electric company is to be solicited to the extent of making a special rate for this long-hour window-lighting business, the company lighting and extinguishing the lamps at specified hours.

Transferring Ditch Silt with an Electric Dredge

When the Hillview Drainage and Levee District, a co-operative farmers' association, tilling reclaimed soil along the Illinois River, not far from Hillview, Ill., recently called for bids for cleaning out ditches and laterals on its property, the tenders made by the contractors were found to be twice as large as the amount of money available for the work. It therefore seemed out of the question to clean the silt from the ditches and to deposit it on the land as every farmer knew should be done.

At this juncture, however, the Central Illinois Public Service Company came forward with a plan which will not only save more than a third of the money already collected but has the further advantage of placing the silt taken from the bottom of the ditches upon the land in such a fashion that it will add fertility to the soil. The plan contemplates the building of a branch transmission line of No. 4 bare copper along the main ditch of the district and installing in the ditch itself a dredge boat carrying a 100-hp, 2300-volt, three-phase, sixty-cycle alternating-current motor directly connected to a 12-in. centrifugal pump. With this suction outfit connected to the transmission line paralleling the 12,000-ft. main ditch the soft mud will be pumped out onto the land, giving new life to the soil. Clips will be used to connect the motor leads to the transmission line, allowing the boat to travel the length of an entire span without changing the connections.



DIAGRAMMATIC SKETCH OF HILLVIEW DRAINAGE AND LEVEE DISTRICT

For cleaning the 1000-ft. laterals pole lines of native timber will be erected and temporary wires will be strung, the dredge boat proceeding up each lateral in turn. In this way ditches draining the entire 12,000-acre tract and its 6500-acre tributary will be freed from the soft mud accumulating in the bottoms.

After the farmers in the district had been shown how the ditches could be cleaned electrically, effecting so large a saving, they naturally began to look at their steam plant askance. The result has been a contract for a 250-hp electrical pumping plant, with the old steam station held in reserve, to be used only at times when the drainage cannot be handled by the motor-driven pump.

The commercial department of the Central Illinois Public Service Company, of which Mr. J. Paul Clayton is contract agent, is highly pleased with the contract, as it will afford the company a twenty-four-hour load, the suction dredge being operated day and night with the aid of searchlamps. In addition the electric-service company has been granted rights-of-way for transmission lines to any point in the district.

Requisites for Success in Selling Electrical Energy

Mr. Louis A. Ferguson, vice-president of the Commonwealth Edison Company of Chicago, gave an able address on "The Successful Salesman" at a recent meeting of the contract department of the company. This address made a deep impression on all those who heard it, and at the solicitation of friends Mr. Ferguson has had it copyrighted. The speaker said that he thought the salesman should be a technically trained man, but by this he did not mean necessarily one who has received technical training in college. The "rotating system" of training afforded by the Chicago Central Station Institute was referred to with approval.

In many cases the question of steam for manufacturing, heating and other purposes enters into the problem under discussion, and it is essential that the commercial representative of the electric-service company be familiar, in a general way at least, with the cost of operation of apparatus using steam, so that he may be able to demonstrate the economy of central-station service notwithstanding these costs. The electric-service salesman should also understand the fundamentals underlying cost of production and be familiar with the influence of load-factor in an isolated plant as well as in the central station. He should be familiar with all details of the cost of operating a private plant, from the coal bin to the lamp or motor, being able to point out, if necessary, defects in the calculated costs as made by architects or engineers.

"Since it is true," said Mr. Ferguson, "that the cost of making electricity depends largely upon the load-factor of the central station and the diversity of its business, the commercial man should know what effect a given piece of business would have on the general cost of producing electricity in the central-station plant, and whether making a contract for a large amount of power would have a tendency to reduce the cost of the whole power generated."

The salesman should have an accurate knowledge of how the rates of his company are determined. Again, the successful salesman must have certain personal characteristics—real qualities which come from the higher cultivation of the mind, from the strength of personal character and from a healthy development of the body. Initiative also is vital to success. A part of the salesman's leisure time should be spent in a study of the technique of the electric-service business, but a part also of his leisure time should be devoted to mingling with men in other lines of business.

In concluding, Mr. Ferguson dwelt on the necessity of courtesy and of presenting one's case clearly and concisely. A salesman should not only establish a reputation for fairness but should be enthusiastic in his work. Even the coldest man is fired by the spirit of an enthusiastic salesman. "Live in an atmosphere of optimism," said the speaker, "for it is the harbinger of prosperity. Determine for yourself a fixed purpose in life and work steadily toward it in a straight line."

Illumination and Wiring

Illumination Tests in New York Department Store

Data are given herewith on illumination tests recently made of the interior lighting of the new Lord & Taylor department store, New York City (described in the May 23 issue of the *Electrical World*). The ceilings on all floors of the building are divided into bays measuring 19 ft. 10 in. by 21 ft., making the area of each 417 sq. ft. Each bay is illuminated by one fixture suspended at its center. In every case the intensity in foot-candles was measured at a height of 39.5 in. above the floor or in approximately the same plane in which goods are usually displayed.

RESULTS OF TESTS OF ILLUMINATION IN NEW STORE OF LORD AND TAYLOR, NEW YORK CITY

	First Floor	Second Floor	Third Floor	Fifth Floor
Character of material of surrounding surface:				
Ceiling	Travertine marble	White plaster	White plaster	White plaster
Walls	Travertine marble	White plaster	White plaster	White plaster with wainscoting
Columns	Travertine marble	White plaster	White plaster	White plaster
Floor	Travertine marble	Green carpet	Green carpet	Light-colored wood
Woodwork	Mahogany	Walnut	Walnut	
Height above floor:				
Ceiling	18 ft. 5 in.	14 ft. 5 in.	14 ft. 5 in.	14 ft. 8 in.
Fixture bowls	11 ft. 11 in.	10 ft. 2 in.	10 ft. 2 in.	10 ft.
Equipment and rating:				
No. lamps	6	6	6	6
Rating lamps	Three 250 Three 150	150	100	60
Watts per sq. ft.	2.9	2.16	1.44	0.87
Illumination in foot-candles:				
Center bay	12.6	13.2	11.3	9.0
Corners	5.1	7.2	5.4	4.2
Third out on diagonal	11.4	12.1	9.5	8.6
Two-third's out on diagonal	8.7	9.0	5.8	6.3

Direct-indirect fixtures are employed on all floors, color correction being provided on the first two floors by polycase bowls. All of the glassware for the interior fixtures was furnished by the Gleason-Tiebout Glass Company, New York.

Sign Representing Ball Game

Installed in a conspicuous place facing the Fort Pitt Hotel, Pittsburgh, Pa., is a novel electric motion sign which represents the pitcher, batter and catcher going through the usual maneuvers of a ball game. The cycle of effects is as follows: First, the pitcher and catcher "warming up" before the batsman enters the box; second, the pitcher "winding up" and delivering the ball to the batsman, who knocks a foul ball; third, the pitcher throwing a ball which is missed by the batsman, and, fourth, the ball delivered and the batsman knocking a "pop fly" into the pitcher's hands. During the entire operation the figures go through the most lifelike movements, and the ball is represented flying through the air in passing from one position to another.

After the ball game is over the sign legend is illuminated in sections displaying respectively the words "Chew," "Smoke" and the name of the tobacco advertised. In addition to producing the spectacular effects described, the sign indicates the time of day by an electrically illuminated clock, as shown in the cuts. The

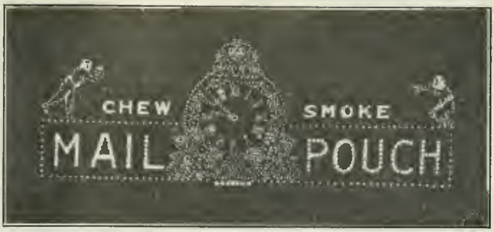


FIG. 1—WARMING UP

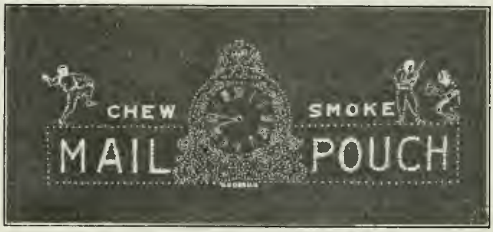


FIG. 2—BATTER UP

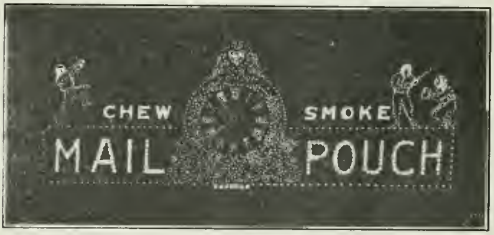


FIG. 3—PITCHER DELIVERING BALL

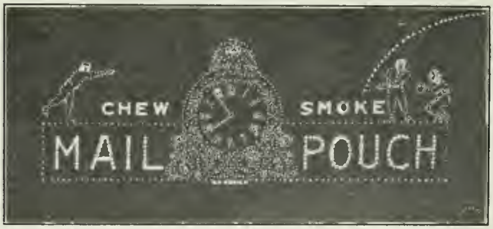


FIG. 4—A FOUL FLY

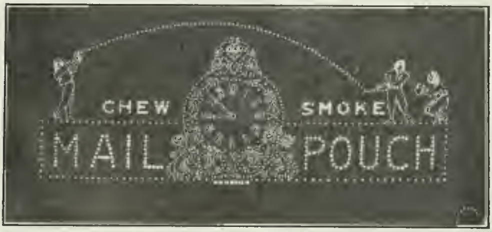


FIG. 5—BATTER OUT ON POP FLY

flasher which produces these effects is remarkably simple in its appearance, although it contains 185 contactors besides those used for control. The mechanism consists of three long contactor and control spindles arranged one above the other. By using control contactors several motion effects are produced without employing a complicated flasher mechanism.

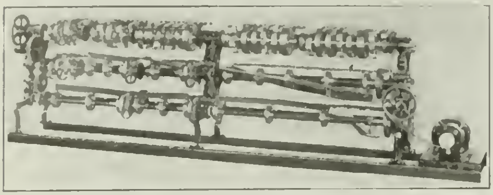


FIG. 6—FLASHER OPERATING SIGN ILLUSTRATING BALL GAME

G. G. O'Brien, Pittsburgh, manufactured the sign, and Betts & Betts, New York, furnished the flasher.

Lighting of an Outdoor Tennis Court with High-Efficiency Lamps

By A. L. Powell and A. B. Oday

The playing of tennis at night has become an established fact. A large number of tennis courts throughout the country are equipped with artificial lighting, thus making it possible for the business man to enjoy the game of tennis outside of his working hours. One may play the game in the evening without the annoyance of excessive heat often experienced during the day, and it is not necessary to stop playing as twilight approaches. One is not compelled to leave his office before work is completed, for he is now able to play after sundown.

There are several fundamental conditions which must be observed in order that the tennis court may be well lighted. The entire surface of the court must be brightly illuminated, and the light must be distributed over the entire surface likely to be traversed by the ball. Therefore illumination must be provided to make the ball visible at all points it is liable to reach. The surface of the court must be evenly illuminated so that the ball receives the same illumination at all times. The lighting units must be high enough and placed at such positions as to eliminate all danger of glare.

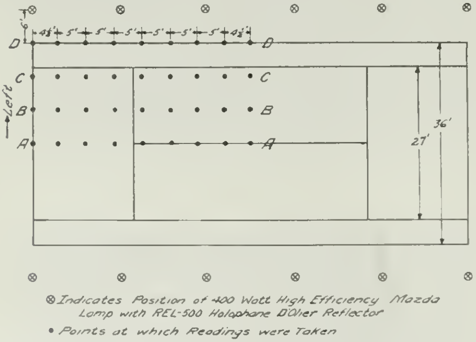

6'
4½'
5'
5'
5'
5'
5'
5'
4½'
D
D
C
C
B
B
A
A
Left
27'
36'
⊗ Indicates Position of 400 Watt High Efficiency Mazda Lamp with REL-500 Holophane D'Olier Reflector
• Points at which Readings were Taken

FIG. 1—PLAN OF COURT SHOWING LOCATION OF TEST STATIONS

During the last two years many tennis courts have been equipped for playing at night. The standard equipment has been twenty-two or twenty-four 250-watt multiple vacuum-type tungsten lamps with angle-type steel reflectors. These have been extremely satisfactory and have been the cause of much favorable comment from expert players. With the improvement in efficiency of the larger sizes (400, 500, 750 and 1000-watt) it seemed desirable to experiment with these as to their application to this particular class of service.

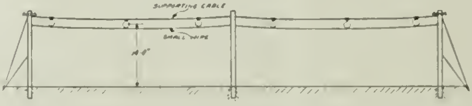


FIG. 2—DIAGRAM SHOWING IN ELEVATION ARRANGEMENT OF LAMPS AND SUPPORTS

A standard tennis court was, therefore, equipped as shown in Fig. 1, and various combinations of lamps and reflectors were applied. The most satisfactory arrangement was found to be twelve 400-watt (530-cp) high-efficiency tungsten lamps provided with bowl-shaped reflectors having the holders set at an angle, porcelain enamel and weatherproof, the large socket being part of the equipment.

The lighting units are so placed that their centers come 14 ft. above the court, 6 ft. back from the side lines. The end lamps are in line with the back lines of the court, and the others are equally spaced between these.

Figs. 2 and 3 show the arrangement of equipment in what might be termed "elevation and section." The particular court tested was surrounded by high wire netting, as shown in the day view (Fig. 4), the supporting posts of which serve to carry the pipe goosenecks for the lighting units. Courts not so equipped may have an arrangement as shown in Fig. 2, which is described later.

The night view (Fig. 5) cannot, of course, accurately picture the effect of the lighting. To use a homely expression, "the proof of the pudding is in the eating," and so the success of the lighting lies in the ease of playing the game at night.

The court under discussion has been utilized considerably for night playing, and all players have agreed that no difficulty due to the lighting is experienced. Several observers, most of whom, however, are not experts, have stated that they are able to play with ease almost equal to that of daylight playing. Trouble from glare is not noticeable.

It was with some doubt that the system was installed, as the writers believed that by reason of the greater intrinsic brilliancy of the high-efficiency lamp the glare would be more pronounced than with the earlier type of tungsten lamp. It was a pleasant surprise to note the effect, which might be described as follows: With the vacuum-type lamp in the porcelain-enamel reflector the filament appears brighter than the surface of the reflector; with the lamp of new construction the whole

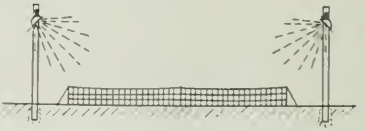


FIG. 3—DIAGRAM SHOWING SIDE VIEW OF LAMP ARRANGEMENT

mouth of the reflector appears equally bright and at a casual glance one cannot distinguish the location of the filament. It was originally planned to place a diffusing-glass plate across the front of the reflector, hiding the filament from view, but observation showed this to be unnecessary.

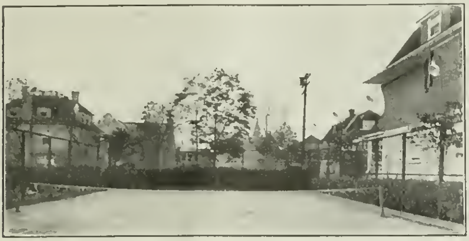


FIG. 4—DAY VIEW OF TENNIS COURT

The distribution of light is very satisfactory, as shown by the tests and observation. Sufficient light is sent upward to enable one to see the highest lobbed ball. Plenty of light is provided from all directions, giving good illumination on vertical surfaces. The most difficult ball to judge is, naturally, one sent swiftly diagonally across the court, parallel to the ground. In this event several light sources are in the field of vision, but the eye seems to be moving so rapidly that the difficulty of judgment is not extreme.

A summation of these comments enables one to arrive at the conclusion that this arrangement is as satisfactory as schemes previously used which have given very good service.

An illumination test was conducted with test stations as indicated in Fig. 1, using a calibrated Sharp-Millar portable photometer with the test plate 3 ft. above the ground. Readings were taken with the test plate in a horizontal plane and turned to the right and left respectively. The variation in illumination lengthwise through the court along four parallel lines is shown in the first four curves in Fig. 6. The fifth curve shows the variation in illumination across the court, each point on this curve being the average of the values along the lines *AA*, *BB*, *CC*, etc. The values plotted are corrected for voltage variation with lamps operated at rated efficiency, namely, 0.75 watt per candle. The letters *L* and *R* indicate the readings with the test plane vertical to the left and right respectively. *H* indicates the readings with the test plane horizontal. The values indicated represent an average of three readings at each position. The average illumination on the horizontal plane was 5.4 ft.-candles; the average illumination on the vertical planes to the right and left was 3.7 ft.-candles.

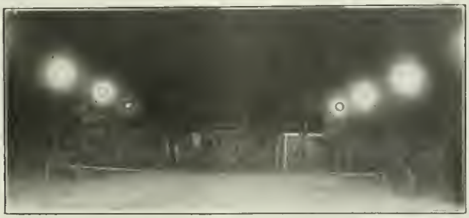


FIG. 5—NIGHT VIEW OF TENNIS COURT

For courts not equipped with netting the most economical method of supporting the lighting units will be along the idea suggested in Fig. 2. Here three posts are used at each side and lamps are suspended from a messenger cable. One method of suspension is shown in Fig. 7, where *A* is a screw clamp ear, *B* a ¾-in. by ⅜-in. reducing nipple, *C* a suspension box and *D* a ½-in. by ⅜-in. bushing. Of course, numerous schemes may be utilized for this purpose. Any ingenious electrician can devise a weatherproof hanger from standard pipe or conduit fittings, remembering that the sockets are tapped for ½-in. pipe.

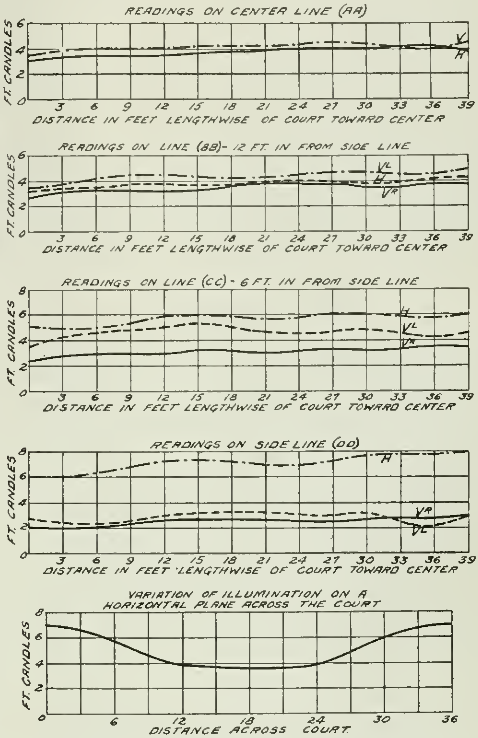


FIG. 6—CURVES SHOWING VARIATION OF ILLUMINATION OVER SURFACE OF COURT

Where the cable suspension is used a small second wire, parallel to the messenger, is advisable. The bottoms of the reflectors should be attached to this to prevent the reflectors from swinging and to assure alignment.

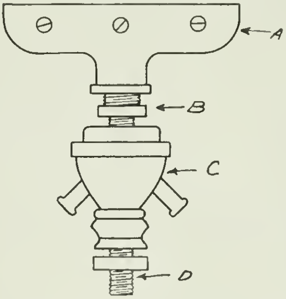


FIG. 7—SUGGESTED TYPE OF HANGER

The local conditions will determine the manner in which the current-carrying wires may be run to the lamps. The following is a summary of equipment required for installing the lamps for a standard tennis court, using the cable method of suspension: Twelve 400-watt multiple high-efficiency lamps, twelve angle-steel reflectors, porcelain enamel finish; twelve hangers for supporting reflectors, of some such type as shown in Fig. 7; six 20-ft. posts, 260 ft. of 3/8-in. galvanized-steel wire stranded for messenger cable, 190 ft. of 3/32-in. galvanized-steel wire stranded for lower wire, four guy anchors with turnbuckles and clamps, 600 ft. of No. 8 weatherproof copper wire, 75 ft. of No. 14 weatherproof copper wire (to connect lamps with main circuits), one double-pole 75-amp switch, one fuse block, one weatherproof service box, eight cross-arms with lag screws and braces, sixteen pins and insulators.

Recent Telephone Patents

A patent has been recently issued to Mr. J. Unterholzner, Germany, for an improved type of condenser telephone in which the condenser plates are placed close together with the alternate ones perforated to overcome air-compression effects. The first, fourth, seventh, etc., plates are connected together and to one side of the line; the third, sixth, ninth, etc., are joined to the other side of the line; while the second, fifth, eighth, etc., are connected to the induction coil and the ground. The varying static potentials on these plates cause them to vibrate and emit the transmitted message.

Mr. M. Setter has obtained a patent for a standard hand-type receiver, the magnetic apparatus being mounted in a cup which with the diaphragm is clamped between the ear piece and the receiver shell. The features lie in structural details.

Letters to the Editors

Charges for Electrical Energy

To the Editors of the Electrical World:

Sirs:—The great interest which has been taken in the past six months in the matter of charges for electrical energy must eventually crystallize the rate question into something universally useful. Let me add, therefore, to this discussion one other phase which I believe has hardly been touched upon.

Every engineer knows the complications which arise in any attempt to charge the customer according to the cost of reaching the individual, as likewise every thinking person knows the desirability of charging for the service according to such costs of distribution, but most of us also realize the folly of trying to satisfy the public with a system of charges which no one but a specialist can understand. Sooner or later the public simply will not submit to it. What kind of a mix-up would we have if the butcher or the grocer were to charge for his commodities according to the distance the delivery boy has to go, or according to the time required to put up the order, or according to whether the store man used an auto, a wagon or a bicycle for delivering goods? Is not the public better satisfied and is it not more convenient to pay 2 cents for all first-class, or letter, postage than to have the postal authorities arrange to pay according to distance, number of transfers, etc.? All savings brought about would be eaten up in handling so complicated a system. Let me repeat that sooner or later the public will demand a system which it can thoroughly understand, and that a system requiring a more or less extended knowledge of electrical engineering practice will not do.

The individual consumer will not make a complaint as long as all are charged on the same easily understandable basis, even if he has to pay a part of the cost of reaching his neighbor. It is therefore necessary to avoid unnecessarily complicated systems by restricting the charge for service to factors which depend only on conditions of consumption and taking care of investment charges in some other way. The suggestion of Mr. Tomlinson of basing all charges on only three factors—demand, quantity and time—seems to me to be timely.

In your issue of May 23, Mr. R. S. Hale takes exception to the above restricted method. He would make the consumers pay equally for generating-plant investment and not for underground construction. All are benefited equally by the continuity of service thus made possible; besides, underground construction is usually the result of public action, and every one who uses the service should pay his share. The matter of discriminating between congested territory and regions of scattered consumers can be taken care of by means of a transformer charge similar to the present meter charge, the only difference being that the transformer charge would vary with the size of transformer or number of connections. This charge would disappear when the transformer connections reached a certain number. It is not often that this charge would have to be resorted to, but it would meet with approval from the consumer where an unintelligible rate sheet would not. Mr. Hale intimates that at times a customer must be allowed to specify the payment he will make for service. This is exactly what has happened in many places where the state commissions have actually shown that certain twenty-four-hour consumers, such as traction companies, were getting the central-station energy for less than cost. This result was not intended by the central stations, to be sure, but it shows to what extent the practice of "giving the twenty-four-hour consumer the service at his own figure" can be carried. In quoting these companies a price to obtain their business the central stations had neglected the fact that a twenty-four-hour consumer does not get his energy from capital already invested but that he adds to the capital investment on generating equipment since he uses the energy at peak periods.

State College, Pa. W. M. Stempel.

Storage-Battery Load Regulation

To the Editors of the Electrical World:

Sirs:—On page 1032 of your May 9 issue, in the discussion of Mr. F. G. Gasche's paper entitled "Power Problems in Steel Mills," your record of my remarks may be misleading. This report contains the following sentence: "Mr. Milton said that the Electric Storage Battery Company stands ready to guarantee storage-battery installations to take up the fluctuating load and regulate the speed of the prime movers until within 6 per cent above and below normal." What I did say was: "The Electric Storage Battery Company stands ready to guarantee the load regulation on the generators within 6 per cent on either side of the average." If this were done, it would mean that the load fluctuations actually falling on the prime mover would be not greater than 6 per cent on either side of the average, and if the load on the prime movers were held constant within this range the speed variation of the prime movers would be practically nothing.

Chicago, Ill. Taliaferro Milton.

Field of the Operating Engineer

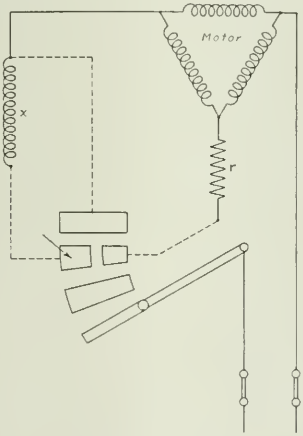
A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Economical Operation of Large Generating Units

In speaking of the results of operation as obtained by the Commonwealth Edison Company of Chicago, Mr. W. R. Wahl, of the Fisk Street station, recently presented some comparative data on the operation of the new 20,000-kw and 25,000-kw units installed in that station. Although these machines are very much larger than their 12,000-kw neighbors in the Fisk Street station, the increase in the number of operators attending the machines will not be in the same proportion. The number of operators does not increase in ratio with the kilowatt rating of the machines. As a matter of fact, the output, per man required for operating, increases from 40 per cent to 50 per cent.

Split-Phase Starter Troubles

It is the tendency of well-read but inexperienced electricians to look for serious causes of trouble when only a trivial cause may exist. In the absence of flashing or smoking or other demonstration to indicate a short-circuit or burn-out, generator or motor trouble, as a rule, is due to some slight cause easily found by any questioning eye. The accompanying diagram indicates the connections of a three-phase motor operated from a single-phase circuit by means of a reactor-resistor split-phase starting box, of which x represents the reactance and r the resistance, both being inclosed within the body of the starting box. The motor had refused to start on moving the handle to the starting position. Some one knew that such a box included a resistance and a reactance and that the motor could not start if there was an open-circuit in either, but did not stop to think that a break in an easily accessible conductor in series with either would cause the same failure. Accordingly, before the inspector arrived the starting box had been taken apart and nothing wrong had been found. The panel, which contained the fault, was lying face downward upon the floor. On reassembling the box and connecting it in the symptoms were the same as in the first place. Noticing a little blistering on the contact marked with an arrow, the inspector discovered that the contact spring on the starting handle was gone.



WIRING DIAGRAM

Conditions Affecting Electrodeposition of Nickel

A paper on the "Electrodeposition of Nickel," by Messrs. C. W. Bennett, H. C. Kenny and R. P. Dugliss, presented before the American Electrochemical Society's recent meeting in New York, pointed out that while stirring the electrolyte of a nickel-plating bath does not affect the efficiency of the deposition, rotating the cathode lowers it. In each case the iron deposit is increased, unless the cathode is placed in a porous cup containing an ammoniacal solution. The curves shown herewith indicate the effects on the efficiency of rotat-

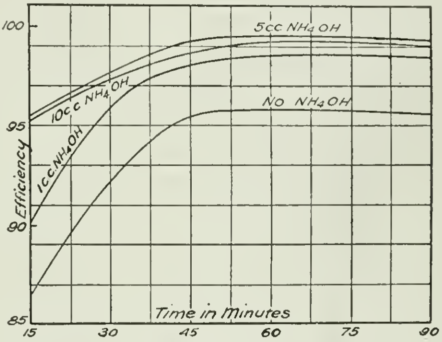


FIG. 1—EFFECT OF SURROUNDING CATHODE WITH ALKALI FOR NICKEL-PLATING

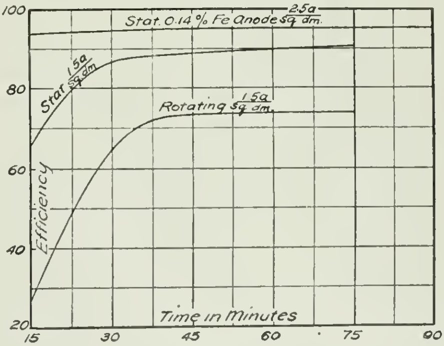


FIG. 2—EFFECT OF CATHODE ROTATION ON ELECTRODEPOSITION OF NICKEL

ing the cathodes, employing a porous cup and increasing the concentration of the ammoniacal solution in the porous cup.

The following conclusions were arrived at: A good deposit of nickel can be obtained from the double sulphate if the solution at the surface of the cathode is kept alkaline. Since the rate of deposition is dependent upon the degree of alkalinity of the cathode films an initially high efficiency can be obtained and maintained by adding a definite amount of ammonium hydroxide to the solution to begin with. The alkaline film can be disturbed and the efficiency of the deposition thereby decreased by stirring the solution vigorously; the iron deposited on a rotating cathode is greater than that formed on a stationary electrode, and the iron content of the anode does not materially affect the efficiency of deposition.

Losses by Leakage of Steam

By R. T. Strohm

The efficiency of a steam plant cannot be brought to its highest value without looking well to the matter of loss by leakage, particularly the leakage of steam. Every pound of water that is converted into steam and then allowed to escape carries with it more than a thousand heat units, a part of which at least should have been utilized in driving pistons or doing other useful work. A certain amount of leakage of steam is bound to occur in every plant, but it is likely to be unnecessarily large if the proper precautions are not taken to prevent it.

The amount of steam that will escape in a given time depends on the size of the leak and the pressure of the steam. Therefore, the higher the steam pressure carried in a plant, the greater is the loss when a leak does occur and the greater should be the precautions taken to prevent such loss.

One of the most prolific sources of loss by leakage is to be found in valves and pistons that have become worn or that are not properly fitted. A certain engineer and designer of steam engines, in speaking of the relative economies of various types of engines, gave it as his conviction that the performance of the steam engine could be made far more creditable by simply taking precautions to prevent leakage, instead of spending so much time, thought and experiment in making changes in the valve gear, the location of ports, and so on. In other words, his statement implied that poor engine performance was not due so much to the effect of the valve gear on the steam distribution as to the effect of preventable waste by leakage.

Leakage of steam from the steam chest past the valve into the cylinder may be detected in different ways. If the leak is of considerable size, enough steam will enter the cylinder after cut-off has taken place to increase the pressure appreciably, and this increase will be manifested on the indicator card by a high expansion line. If the leak is very small, the change in the height of the expansion line will be so small that it cannot be differentiated from the rise due to reevaporation. In such a case the indicator should be taken off, the piston moved near to one end of the cylinder and blocked in position. The indicator cock at that end should then be opened and the throttle valve slowly opened until full boiler pressure exists in the steam chest. If the steam valve leaks, steam will escape from the open indicator cock. The same test should be made with the piston at the other end of the cylinder.

A leak past the steam valve is of less consequence than a leak past the exhaust valve, because any steam that enters the cylinder past a poorly fitting valve will give up its energy by expansion in the same way as the steam entering during the admission period. But if the exhaust valve leaks steam escapes from the cylinder before its expansion is completed and thus wastes a part of its energy.

To test a slide valve for leakage on the exhaust side the exhaust pipe should be disconnected or a joint broken at some point in the pipe so as to open it to the atmosphere. Then the engine should be blocked with the piston in mid-position and the valve rod should be disconnected from the valve stem. Then, by moving the valve by hand, steam can be admitted to each end of the cylinder in turn and held there. If steam appears at the exhaust when the valve is not in a position to open either port to the exhaust, there is leakage through to the exhaust, either directly from the steam chest or past the exhaust edge of the valve.

If the engine is of the Corliss type, the piston should be set at the middle of its stroke and the engine should be blocked so that it cannot turn. The steam valves should be tripped and closed. The rod leading to one exhaust valve should be disconnected and the other exhaust valve should be set so as to close its port. Steam may now be allowed to enter the cylinder by moving the corresponding steam valve. Then the exhaust valve may be rotated slowly. If there is any leakage past the valve while it covers the port, steam will appear at the open end of the exhaust pipe. The same test should be applied to the other valve.

Piston rings may wear and break, and cylinders may be worn out of round, so that steam will escape from the working side of the piston to the exhaust side. If the leakage past the piston is large, it may be detected by the use of the indicator. The expansion line will fall too rapidly—that is, lie close to or below the theoretical expansion curve. Of course, if the steam valve should leak at the same time and at approximately the same rate, the indicator would fail to show the leak. But it is unlikely that this coincidence will exist.

The existence of a leak past the piston may be discovered without the use of an indicator, however. The cylinder head should be removed and the piston blocked in mid-position in the cylinder. The steam valve leading to the head end of the cylinder should be closed and the exhaust valve at the crank end closed. Steam is then admitted to the crank end by opening the steam valve at that end cautiously. If there is any leak past the piston, steam will escape from the open end of the cylinder. The same test should be made with the piston blocked in other positions in its stroke, as the leak may occur at some particular position of the piston.

Another way in which steam may leak from the engine is at the stuffing-box surrounding the piston rod, owing to a badly packed rod, poor packing material or a damaged rod. A leak at this point will be manifested by the hiss of escaping steam and by puffs of vapor.

Still another source of loss is leakage from the boiler and the steam pipes, due to bad joints. In the case of steam pipes the leak can be detected by the sound of the escaping steam or by the appearance of the vapor. If there is a leaky riveted joint in the boiler, the steam may escape inside the setting and be carried away unnoticed in the flue gases. It is possible to test for leakage at the stop valves, pipe joints and other outlets by shutting down all engines and pumps that use steam from the boiler, maintaining the normal pressure for a time, and noting whether there is any change in the water level. As no steam is being used, the water level should remain unchanged. If it falls, there must be some escape of steam. In making a test of this kind the pressure must be kept at the usual working point; for the water level always falls when a boiler is banked and the pressure is decreased, because of the natural contraction of the water due to the lowered temperature. When the pressure is maintained the only cause of a lowered water level is leakage. Moreover, the test must be sufficiently long. It will require considerable time for a small leak to affect the water level in a boiler; therefore the level should be noted very accurately at the beginning of the test, and the test should be continued until the existence or absence of leaks is assured.

A lowered water level in a test like the foregoing may be due to a leaky blow-off valve or cock. If the blow-off pipe is arranged in such a way that the discharge end can be seen, it is a simple matter to determine whether any water is escaping when the valve is closed. But the blow-off pipe is frequently arranged to discharge into a sewer or some other form of underground drain, and the end of the pipe is hidden. In such a case the cock may be tested for tightness by noting the temperature of the blow-off pipe a short distance beyond the cock. The piping from the boiler to the blow-off cock will be hot, because it contains heated water. The cock itself and the piping directly connected to it will be heated by conduction. But at a distance of a couple of feet from the cock the blow-off pipe should be comparatively cool when the cock is closed and not leaking. If there is a leak, the escaping water will make the whole pipe hot.

In many power plants the condensation resulting from loss of heat in the steam pipes is led to a steam trap and is discharged into a hot well or into a feed-water heater. The purpose of the trap is to open intermittently and discharge the collected condensation but to prevent the escape of steam, and this is accomplished in a variety of ways, as by floats, buckets, or expansion devices. If, through incorrect adjustment, wear of the valve or failure of any of the parts, the trap is kept open continuously, there will be a steady waste of steam. And if the discharge pipe of the trap cannot be observed readily, the leakage is apt to continue for a long time unnoticed. It is not likely that any one could determine by observing the temperature of the discharge pipe whether water or steam was passing. But it would be possible for an experienced ear to detect, by the sound of the discharge, whether water or steam was escaping.

Saving 1 Lb. of Coal per Kw-Hr.

Suspecting that one of the 250-hp boilers in the station of the Poplar Bluff (Mo.) Light & Power Company was not performing its full duty, Mr. F. M. Wilkes, manager for the company, determined to conduct an investigation. No flue-gas analyzing outfit being at hand, an ingenious device was resorted to for ascertaining the performance of each unit. Into a small hole drilled in the rear wall of the boiler setting just below the line of the lower tubes a small iron rod was inserted and allowed to extend a short distance under the boiler. With perfect combustion the rod melted away at the end and finally broke off at the wall, while with the combustion only fairly good the rod became white-hot and sparkling. When, however, there was a large percentage of the gas passing up the stack and air was coming through the grate in excessive quantities, the rod remained black or dull red.

Prior to these tests both boilers were operated at Poplar Bluff, but with the discovery that one unit was carrying practically all of the load, operation of one of the boilers was discontinued, with a consequent saving of approximately 1 lb. of coal per kw-hr.

Increasing Boiler-Room Efficiency

A plea for better wages and a better grade of men in the fire-room was presented by Mr. C. M. Rogers, Meridian, Miss., before the convention of the Mississippi Electric Association recently. A prosperous management can well afford, he asserted, to pay $125 to $150 a month to its fire-room foreman, who has the handling of thousands of dollars' worth of coal. In some progressive stations rates as high as 45 cents per hour are paid fire-room employees in order to attract good men.

The careless or ignorant fireman will often put on twice as much coal as is needed, usually piling it near the front of the grate while the sides and edges are relatively thin. By leaving holes in the fire-bed or allowing doors to remain open unnecessarily he also lets an excess of air go through the boiler, reducing the temperature of the flue gases. If holes are discovered in the setting, these should be patched and the brickwork treated with a special paint.

Each quality of fuel used requires its own special draft values. An average allowance for run-of-mine bituminous coals is 0.01 in. of water column for each pound of coal fired per hour. Thus two 500-hp boilers having 160 sq. ft. of grate area and burning 3200 lb. coal per hour would be consuming 20 lb. of fuel per sq. ft. per hour and would require a draft of $(20 \times 0.01 \text{ in.}) = 0.2$ in. In most cases one will find the draft actually used to be from two to five times that really required.

The effect of scale and soot in lowering efficiency must not be overlooked. For example, said Mr. Rogers, 3/8 in. of soot is equal in thermal insulating properties to 1.5 in. of asbestos covering, such as is used for lagging steam pipes. Scale is, of course, a better conductor of heat than soot, but the presence of even a thin coating will seriously affect boiler efficiency.

Induction Machine as Generator and Motor

On page 812 of your issue for April 11, 1914, you published an article entitled "Hydroelectric Plant with Induction Generator Operating Without an Attendant" which interested me greatly, as I have a development that could be carried out along similar lines, and I wish to obtain a little further information on the subject. What happens when the water gets low enough to allow the speed to drop below synchronism? Would the breaker open and drop off the line automatically or would the other generators become overloaded? The induction generator is brought up approximately to synchronous speed and then the switch is closed. Is this done by means of synchronizing lamps? When the speed is increased above synchronism the generator takes its share of the load, I presume. How much overspeed is necessary for full load? Is the load determined by ammeter readings on the induction generator panel? Could a 220-volt, three-phase machine be used through a transformer bank as well as a 2300-volt motor? C. D.

The induction machine operates at all times as motor with a load which is either positive or negative according to whether the speed of the rotor is below or above synchronism. When driven by the waterwheel the rotor accelerates to a speed somewhat above synchronism and the load takes on a negative value which is less than the power exerted by the waterwheel by reason of the losses in the induction machine. The machine can either be brought up to speed purely as an induction motor or it may be accelerated to approximately synchronous speed—either above or below—by the waterwheel and connected into circuit without using synchronous lamps. A polyphase wattmeter, or its equivalent in single-phase wattmeters, may be used to show the load—positive or negative—on the induction machine, but ammeters are useless for this purpose. When the voltage of the machine differs from that of the system, transformers or auto-transformers can be employed for connecting the one to the other.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

High-Tension Transformers with High Reactance.—A note on a recent British patent (No. 18,663, 1913) of the British Thomson-Houston Company and the General Electric Company of this country. In place of the laminated iron strips before used, a flat strip is wound in a spiral, directly over the secondary winding of the transformer. This device is found to give a straight-line reactance from no-load to full-load, while at the same time great mechanical rigidity is obtained.—London *Elec. Eng'ing*, May 14, 1914.

General Transformer.—J. SUMEC.—A brief mathematical article, illustrated by diagrams, on the transformation ratio and currents in the general transformer with reference to a former article by the same author on the design of single-phase commutation motors.—*Elek. u. Masch.* (Vienna), May 17, 1914.

Lamps and Lighting

Tungsten.—A note on a recent British patent (No. 6911, 1913) of O. Voigtländer. A mixture consisting of 60 per cent tungsten trioxide and 40 per cent aluminum is placed in a crucible and burned in a strongly heated furnace. A current of inert gas is passed through the crucible during the process. Pure, homogeneous tungsten is obtained.—London *Elec. Eng'ing*, May 21, 1914.

Generation, Transmission and Distribution

Electromagnetic Hammer. — L. SCHUELER. — While electric drive of all kinds of machine tools makes rapid progress, smaller hammers, like riveting hammers, are almost generally operated by compressed air. Operation by electricity is possible with the direct use of the tractive force of an electromagnet for the production of the hammer blow. But the difficulty has been that the excitation circuit must be interrupted after each blow, whereby destructive sparks are formed. The author uses the following method: Only the hammer blow is produced by electromagnetic means, and after the blow is over the armature of the electromagnet is carried back to its first position by the action of a spring. In order to make this possible twice as much time is allowed for the return movement of the armature as for the blow. At the beginning of a period when the rising emf wave passes the zero point the circuit of the hammer is closed by means of a slip-ring segment on the axle of the generator. The magnetic field is produced, the blow of the hammer follows, and the magnetic field is brought back to zero again. This will be the case approximately at the close of one cycle. The slip-ring segment then opens the circuit without a spark, and the circuit is kept open during the next two cycles, during which the armature is brought back by the spring to its initial position. The circuit is closed again at the beginning of the fourth cycle and the succession of operations repeats itself. For each hammer blow and return movement three cycles of the current are, therefore, used, so that if the hammer is operated by means of alternating current of fifty cycles per second the number of hammer blows is sixteen and two-thirds per second, which agrees well with the usual practice of compressed-air hammers. The design of the hammer is shown in Fig. 1 in two sections. It will be seen that the excitation coils are at the right and left of the moving armature. The central piece between the two excitation coils consists of two halves, of which the upper one represents the movable armature of the electromagnet, the spring which brings this armature back to its initial position being clearly shown in the illustration. The lower half of the central piece is stationary and hollow so that the hammer blow can be transmitted downward. The design of the electromagnet permits exact calculation. The calculation is given in some detail and two appendices are added on the effect of the stray field and of the iron losses.—*Elek. Zeit.*, May 14 and 21, 1914.

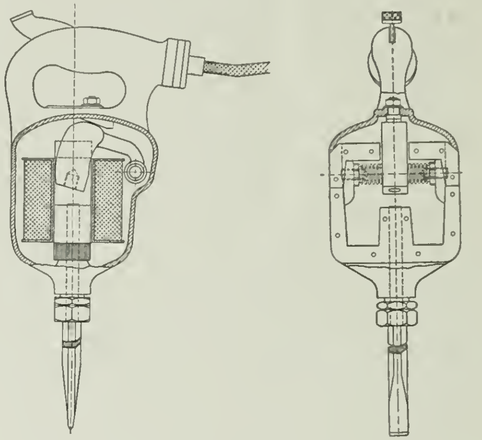


FIG. 1—DESIGN OF ELECTROMAGNETIC HAMMER

Electric Drive of Rolling Mills.—L. ROTHERA.—A paper on the application of electric drive to existing rolling mills, read before the (British) Institution of Mechanical Engineers. The author considers the conditions which render the application of the electric drive to rolling mills desirable and the methods in which the drive may be best applied. Questions of economy, improved output, space and greater use of existing plant are also dealt with.—London *Electrician*, May 22, 1914.

Rolling-Mill Machinery.—H. WINTERMEYER.—A summary of the principal types of modern German electric rolling-mill machinery.—*Elek. Kraftbet. u. Bahnen*; translated in abstract in London *Electrician*, May 2, 1914.

Condensers.—A. JOSSE.—The first part of a paper, illustrated by diagrams, read before the German Association of Electrical Engineers on the present status of condenser systems in connection with steam-turbine plants. Modern condensation systems must fulfil the requirements of a high vacuum and of a high specific capacity of the surface condensers—that is, small dimensions—and the auxiliary machines must have no reciprocating motion. The author discusses the principle of air suction by means of water or steam injectors and discusses the different systems based on these principles. The paper is to be concluded.—*Elek. Zeit.*, May 21, 1914.

Installations, Systems and Appliances

Feeder Protective Gear.—An illustrated article on the Ferranti-Waters feeder protective gear recently demonstrated in London. Should a fault occur on any one of the feeders working in parallel, that feeder is immediately cut out of circuit, leaving the unimpaired feeder or feeders to continue the supply. The operation of the system is independent of any pilot leads or split conductors, and certainty of action is irrespective of the position of the fault. Fig. 2 shows the arrangement adopted for demonstrating the capabilities of the apparatus. Energy was supplied from the St. Marylebone power house in Richmond Street at 6600 volts, three-phase, through the Manchester Square substation to the Rathbone Place substation. Artificial faults were put on the system in the way shown. The arrangement of the protective apparatus is shown diagrammatically in Fig. 3. At the central-station end are two series transformers, one in each of the feeders in parallel. These series transformers (which are shown in Figs. 3 and 4) each have two secondary windings. One pair of secondaries is coupled in opposition and in series with one coil of a relay. The other pair is coupled "in assistance" and in series with a second coil in the relay. This instrument is an ordinary reverse-power relay (Fig. 5) in which the voltage coil is replaced by a current coil. When this relay operates it completes the trip-coil circuit of an oil switch in one or other of the feeders in question, cutting out from the power-house end the faulty cable. The current transformers are of the simple-ring type, and slip over or are built around the complete cable, leaving the armoring, etc., untouched. Assuming now a three-phase system with the neutral point earthed, under all normal conditions, the vector sum of the currents in the cables being zero, the series transformers are unaffected. When a fault occurs the return of current via "earth" upsets this condition, thereby inducing emfs in the secondary windings. If the fault has occurred beyond the section in question, this condition of unbalance will be equally shared by all the cables in parallel, in which case no current will flow from the secondaries in opposition since the emfs will be equal and opposite. If, however, the fault occurs on feeder No. 1, a greater proportion of current will flow through it than through the others. This induces a higher emf in the corresponding series-transformer secondaries, which means that the secondary winding corresponding to No. 1 feeder will overcome that corresponding to No. 2, which is connected in opposition. This causes the current to flow through one coil of the relay. Current will also flow in the other secondaries since they assist each other; thus currents of certain definite phase relation flow through the two coils of the relay, causing it to operate in a certain direction. If now the fault be on No. 2 feeder, the current in the opposing secondaries will be reversed, but the current in the "assisting secondaries" will remain unchanged in sign. This, of course, causes the relay to operate in the other direction. If there is no alternative path (as in the case demonstrated at St. Marylebone) another arrangement is provided for the substation end. In this case the relay (Fig. 6) includes a voltage coil, this coil being connected across the remaining two phases of the system to the particular core of the feeder on which the current coil works. As long as the system is operating normally there is a balance between the two current coils and the relay does not tend to operate. When a fault occurs the current in the faulty feeder reverses. The emfs of the two relay transformer secondaries being now "in assistance," current flows through the current coils of the relay. Under this condition, these two coils repel each other and, being on a dead center, are in a state of unstable equilibrium. The effect of the voltage coil is to hold one current coil against its stop and to force the other away. This is the controlling force for an instant only, for as soon as one current coil has moved off the dead center the repelling action of the other current coil completes the movement with a certainty proportional to the severity of the fault, even though the voltage of the system fall to zero.—London *Electrician*, May 22, 1914.

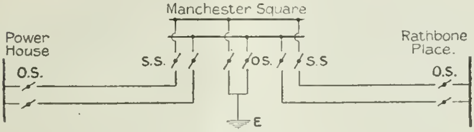


FIG. 2—WIRING ARRANGEMENT

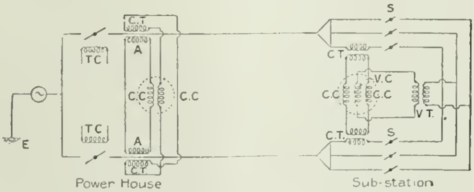


FIG. 3—ARRANGEMENT OF PROTECTIVE APPARATUS

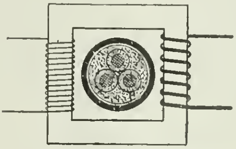


FIG. 4—FAULT CURRENT TRANSFORMER

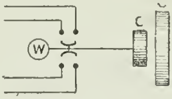


FIG. 5—RELAY FOR SUPPLY END

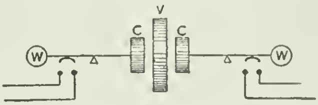


FIG. 6—RELAY FOR POT-END FEEDER

The Problem of Isolated Plants.—Walter Strauss.—In the last year German central stations have succeeded more and more in inducing larger consumers, especially factories, to buy electricity in bulk from central-station plants. The author discusses under which conditions it is of advantage for a factory to buy energy from a central station instead of erecting an isolated plant. Calculations of the cost of operation are given for three factories, one with a maximum power consumption of 15 kw, the second 110 kw, and the third 400 kw. The assumptions of the calculation are given and the yearly cost of operation is determined for isolated plants with different prime movers and for buying the energy from a central station. The results of the calculation are given in tables and are represented in diagrams and show that in very many cases it is best to buy the energy in bulk instead of erecting an isolated plant. The paper is to be concluded.—*Elek. Zeit.*, May 21, 1914.

First Cost of Central Stations.—Emil Schiff.—The author discusses sources of error in figuring the first cost of central stations per unit of rating. The rating of the storage batteries should be taken into consideration, but the amount of energy bought in bulk from other stations is not to be considered. The method of calculation of the first cost in different stations is not the same. If the first cost of all the machines installed in the course of time is summed up, it should be compared with the aggregate rating of all the machines installed, not with the rating of the equipment available at the present time. The author shows that there are uncertainties in calculating the first cost which may cause errors of from 50 to 100 per cent. By defining exactly what is meant such errors can be avoided.—*Elek. Zeit.*, April 23, 1914.

Storage-Battery Booster System.—An illustrated description of an installation of a battery with automatic booster in a direct-current three-wire system. The Cuneod regulator is used, which consists essentially of an electromagnetic balance with damped movement. The action of the regulator is described in detail, and wiring diagrams of regulator, battery and generator connections are given.—*La Revue Elec.*, May 1, 1914.

Rheostats.—L. Cachot.—The first part of an illustrated article giving a systematic review of different types of starting rheostats and speed-regulating rheostats for direct-current motors.—*La Revue Elec.*, May 1, 1914.

Electrical Accidents in Mines.—K. Schroeder.—A careful analysis of the accidents which occurred in mines in Prussia in 1912 and of the reasons which caused them. There were sixty-nine accidents, of which forty were fatal. Protective devices are recommended to prevent accidents from contact with the trolley wire. —*Elek. Kraftbet. u. Bahnen*, April 24, 1914.

Municipal Versus Private Ownership.—K. Pietzsch. —The author doubts whether the general public has a greater interest in seeing an increase of the number of private electric stations than in properly conducted municipal plants.—*Elek. Zeit.*, May 14, 1914.

Rates.—Some data on rates of eighteen German central stations with special low rates for lighting at late night hours for restaurants, hotels, etc.—*Elek. Zeit.*, May 14, 1914.

Wires, Wiring and Conduits

Manufacture of Impregnated Cables.—E. Masson.—The author speaks of a "crisis" in the manufacture of impregnated paper cables. This "crisis" is not a commercial one but rather of a technical nature. It is declared that some of the cables made by some manufacturers occasionally fail in a most unexpected way, and that in spite of long investigations the exact cause for these failures has not been determined. The author reaches the conclusion that it is the method of impregnation which is defective, not the insulating material. It appears that the papers commercially obtainable at present are more difficult to impregnate than were the papers some years ago. Whenever the maker succeeds in impregnating the paper the results are as good as ever. Even in cables which fail there are sections which are perfect and in which the paper is well impregnated. It is not only necessary to impregnate the paper with the insulating material, but it is also necessary to expel the humidity. Cable manufacturers seem to assume in principle that if they put their cables in a vacuum for twenty-four, forty-eight or seventy-two hours at a temperature of 160 deg. C. the humidity will surely be expelled. This the author considers to be an unproved assumption. Further, if the paper is heated too much it is dried but becomes unable to absorb the impregnating material. The question is whether it would be better to expel the humidity first or to fill the paper first with impregnating material. There is a vast field for systematic research here, and the author gives some hints as to how to proceed. As to tests of finished cables, he proposes that a 5000-volt cable should be tested for one-quarter of an hour with 20,000-volt alternating current and then for five minutes with 50,000-volt direct current. These tests, he is sure, would give the needed guarantee.—*La Revue Elec.*, May 15, 1914.

Electrophysics and Magnetism

Magnetic Properties of Ferro-Magnetic Mixtures.—C. Benedicks.—A brief note on a paper read before the (British) Iron and Steel Institute. Magnetic measurements were carried out on ferromagnetic, mechanical mixtures of magnetite (with quartz), iron (with copper) and nickel (with copper), the latter pressed together into solid bars. They proved, in agreement with older measurements, that the magnetic intensity shows a very distinct deviation from a rectilinear relation, depending on the concentration. This is an experimental verification of a previous theoretical curve of the author's, which serves, at least on broad lines, to explain how the assumption of one gradually occurring molecular change (the increased presence of gamma-iron with rising temperature in the alpha-iron) can agree with the falling of the magnetism within a certain interval.—London *Elec. Eng'ing*, May 21, 1914.

Units, Measurements and Instruments

Electrolytic Meter.—H. Stafford Hatfield.—In 1905 S. H. Holden proposed the use of an electrolytic hydrogen meter constructed as shown in Fig. 7. A hermetically sealed glass tube has two thin platinum plates, *A* and *C*, sealed into it with electrical connection through the glass to the outside. The tube contains a solution of dilute acid in water (say, sulphuric), and in the remaining space hydrogen gas at about atmospheric pressure. The electrodes *A* and *C* are coated with platinum black which is saturated with hydrogen and are, therefore, so-called "hydrogen electrodes." The cell is connected in parallel to a low-resistance shunt *S* and in series with a high resistance *R*. When a current is passed through the cell hydrogen disappears at the anode *A*, going into the electrolyte, and an exactly equal amount is liberated at *C*, and should, it was supposed, appear in bubbles and ascend into the measuring tube *B*, giving a measure of the ampere-hours passed. No chemical work is done. The condition of proportionality was, however, not fulfilled in practice. The trouble was not in the anode but in the cathode, and the present author has found that the trouble is due to the over-voltage required to deposit gas bubbles on the cathode. He has developed a new form of cathode which is shown in Fig. 8 and corresponds in a greatly enlarged scale to the part marked *C* in the preceding diagram. *A* is a small glass thimble, closed by a grating *B*, the holes in which are not more than 0.1 mm or so in diameter. The grating is of blackened platinum and connected as cathode. The space inside the thimble is filled with hydrogen, which remains thus held by the grating, since the difference in hydrostatic pressure between the top and bottom of the grating is not enough to overcome the capillary pressure at the top of the same.

The capillary pressure is, however, very small, being about 1 cm of mercury, and corresponds to a very small supersaturation of hydrogen ("about four-thirds of 1 per cent of 2 per cent = 0.026 per cent of the volume of the liquid"). When a current is passed, the gas deposited diffuses instantly into the gas space. Experiment shows that none is lost within the limits of load required in practice. The gas in the thimble increases in volume and finally pushes a bubble out through the largest hole in the grating. These bubbles ascend into the reading tube, each being only a fraction of a scale division, so that no discontinuity is observable. The apparatus is now working perfectly, but instead of platinum black the author now uses gold coated with rhodium black and phosphoric acid as electrolyte. One of these pieces of apparatus has been running for some months and subjected to heat tests, and has caused no trouble whatever. The readings are almost independent of the temperature, although they increase with rise of temperature to a very small extent and diminish to the same extent with fall of temperature. The instrument is useful as a voltameter or as a house-service meter.—London *Electrician*, May 22, 1914.

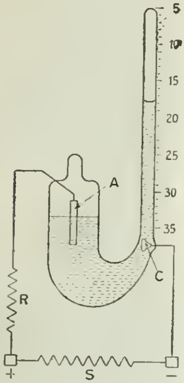


FIG. 7 — DIAGRAM OF METER

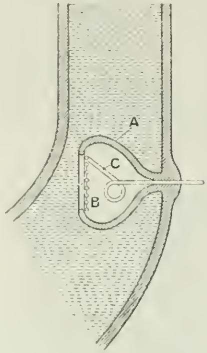


FIG. 8—SECTION C, ENLARGED

Single-Phase Meter.—An illustrated announcement of the Reichanstalt by which a single-phase induction meter of the A. E. G. is admitted for calibration. The construction is described and illustrated, together with the principle of operation and the methods of calibration. The principal element is an induction motor, the armature of which consists of a thin metallic disk and is acted upon by two fluxes, one being proportional to the voltage and the other to the current. In order to give correct readings with inductive loads the two magnetic fluxes are exactly in time quadrature when the voltage of operation and the current are in time phase. —*Elek. Zeit.*, April 30, 1914.

Measuring Power.—PESTARINI.—A brief illustrated paper read before the International Society of Electricians in Paris on a method of measuring the real power and the wattless power in an alternating-current circuit.—*La Revue Elec.*, May 1, 1914.

Telegraphy, Telephony and Signals

Wireless Telegraphy. — H. DIESSELHORST. — The author first gives a concise summary of the present status of wireless telegraphy and then discusses more in detail certain specific problems. He deals with the different systems of excitation, with frequency transformation, propagation of waves and the effect of the atmosphere, the method of operation, use of earth antennas, and finally discusses new receiving methods and atmospheric disturbances.—*Elek. Zeit.*, May 14 and 21, 1914.

Miscellaneous

German Association of Electrical Engineers.—The next annual meeting will be held in Magdeburg from May 24 to 28. The secretary's report, signed by G. Dettmar, states that the number of members has increased by 725 during the last year and is now 6011. The association includes within itself twenty-two local electrical societies, of which the Electrical Society of Berlin, with 1960 members, is the largest. A review is given of the work of the different committees during the past year.—*Elek. Zeit.*, May 21, 1914.

Book Reviews

MASCHINEN UND APPARATE DER STARKSTROMTECHNIK. IHRE WIRKUNGSWEISE UND KONSTRUKTION. By Gustav W. Meyer. Leipzig, Germany: Verlag von B. G. Teubner. 590 pages, 772 illus. Price, 15 Marks.

An excellent treatise on machinery for the electrical generation, transport and distribution of energy. The illustrations and diagrams are numerous and well selected. The treatment of the subject in the text is also clear and direct. The book is divided into six sections, dealing respectively with direct currents, direct-current generators, direct-current distribution systems, alternating currents, the transformer, and electric energy transmission by alternating currents. An excellent index with bibliographical list is appended. The matter is so treated that the book may be used either as a textbook in technical colleges or as a reference textbook for students in practical work. The book will be of interest to all who desire to familiarize themselves with German electrotechnical practice in energy generation and distribution.

FACTORY ORGANIZATION AND ADMINISTRATION. By Hugo Diemer. New York: McGraw-Hill Book Company, Inc. 378 pages, 174 illus. Price, $3.

This interesting book contains much suggestive matter. It is a sort of primer, to be placed in the hands of students who are entirely unfamiliar with industrial problems and with the questions arising from the building and organizing of industrial plants. Such student will obtain much useful information which he may later check up against practical experience. Book knowledge in matters of the sort with which this work deals is, perhaps, somewhat dangerous. It is true enough that the faults of children are much more apparent to the spinster, who also is apt to underestimate the difficulties and obstacles encountered by parents in improving the process and methods of bringing up their offspring. The practical men in the industries of today are continually being told by men engaged in teaching or law that their processes are uneconomic and wasteful, and that they could be and should be changed to advantage. Such advice is always worthy of careful attention, but it figures without consulting the host, namely, the inefficient workingmen and assistants with which modern industry abounds. The book before us is full of data covering such subjects as "organization and control," "factory accounts," "factory location," "the general office," "the order department," "the drafting department," "the pattern department," etc. The concluding chapters deal with "Rate Fixing and Time Studies" and "Principles Underlying Good Management."

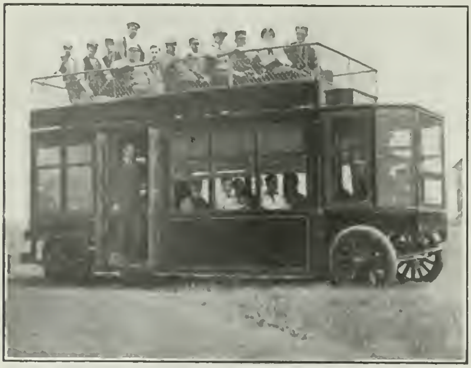
New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Stepless Electric Omnibus

A stepless, double-deck electric omnibus has been developed by the Field Omnibus Company, New York, with the co-operation of the New York Motor Bus Company. This bus has a seating capacity of thirty-eight passengers, eighteen on the lower deck and twenty on the upper deck. Its over-all length is 20 ft. 10 in., the height of the step from the ground into the car is 12.5 in., and the height of the roof from the ground is 7 ft. 8 in. Its height is 2 ft. 3 in. less than that of the motor buses now used in New York, Paris and London and the length is approximately 5 ft. less. No regular chassis is used, but the body, which is constructed of steel, is built up to fulfil the requirements of a chassis.

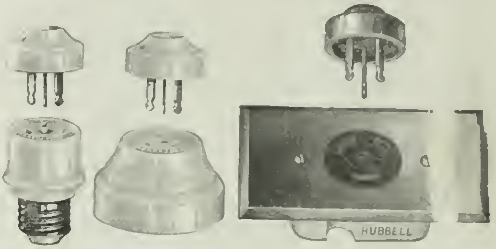
The rear wheels are mounted on an auxiliary truck which carries the driving machinery and which can be detached as a whole for examination and repair. An Edison storage-battery equipment of 100 cells furnishes energy to two 10-hp motors, driving by means of a universal-shaft internal gear and a spur pinion with a seven to one reduction. The front wheels are hung from the body by springs. The batteries are under the seats on the first deck and in a rear compartment under the stairway at the back of the door. The operator's cab is over the front axle and is equipped with a large railway-type controller with cut-outs for both motors, a safety switch, a charging plug, a circuit breaker, an ammeter and a voltmeter, and two sets of brakes. The energy for lighting is obtained from a separate battery.


STEPLESS DOUBLE-DECK ELECTRIC OMNIBUS

This bus is designed for heavy public-service transportation and will, it is claimed, give a daily average mileage of 125 miles or more. It has shown, it is said, a speed on the level of 18 to 20 miles per hour, and on a 6 per cent grade of 10 miles per hour. The builders of this omnibus have also designed a stepless bus which is a modification of the omnibus described above. The body is made after the old-English coach style with the entrance on the side at the front end. The bus seats thirty-six and can be operated by one man.

Attachment Plugs and Receptacles

Three-wire attachment plugs and receptacles are being made by Harvey Hubbell, Inc., Bridgeport, Conn. In Fig. 1 is shown a separable attachment plug which is rated at 660 watts for 250-volt circuits. The cap for this plug is made entirely of porcelain or of porcelain with a brass cover. The wall receptacle shown in Fig. 2 and the flush receptacle in Fig. 3 are rated at 10 amp for 250-volt circuits. These plugs and receptacles are of the polarized type, making it impossible, therefore, to reverse the polarity. They may be used with electric stoves, portable motors, etc.



FIGS. 1, 2 AND 3—ATTACHMENT PLUG, WALL RECEPTACLE, AND FLUSH RECEPTACLE

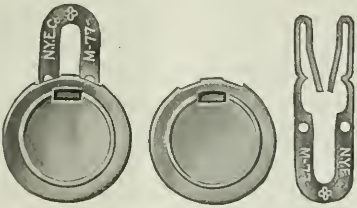
Bowl-Type Diffusive Reflectors

Steel reflectors of the bowl type designed to distribute uniform illumination over wide areas and to protect the eyes from glare have been placed on the market by Harvey Hubbell, Inc., Bridgeport, Conn. These reflectors are made in sizes ranging from 7 in. to 10 in. in diameter and are designed for lamps rated at from 40 watts to 250 watts. The reflectors are provided with either porcelain-enamel or baked-enamel-paint finish. A holder with a contractile collar made by the above manufacturer is used. This holder may be attached to any screw-base shell socket. The reflectors can also be fitted with a holder made by Harvey Hubbell, Inc., for porcelain sockets.

BOWL-TYPE STEEL REFLECTOR

Meter Seal

An all-metal seal consisting of a seal disk and a hasp is shown in the accompanying illustrations. When the hasp is pushed home into the disk it catches in the interior and cannot be pulled out again without breaking the seal. Holes are provided in the hasp where it enters the disk so that the seal can be broken easily at this place without any tool. A small trade-mark or number, for purposes of identification, can be stamped on the hasp as shown in the illustrations. While primarily designed to protect watt-hour meters and service cut-out boxes, it can also be used in sealing instruments, cash-boxes, fare-boxes, registers, freight cars, etc. The seal is being made by the Metropolitan Engineering Company, New York.

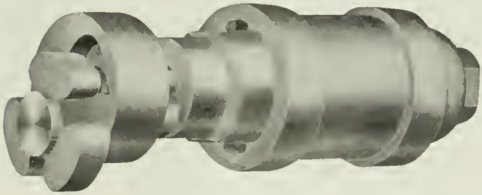


ALL-METAL SEAL

Turbine Cleaner for Fire-Tube Boilers

A "knocker-head" cleaner for dislodging scale from the outer surfaces of tubes in return-tubular boilers is shown herewith. It is driven by a turbine operating with steam or compressed air. This cleaner also removes the soot from the inner surfaces of the tubes. The soot is loosened by the vibrating knocker and is blown out of the tube ahead of the cleaner by the steam or air exhausting from the front of the turbine. The knocker-head is made in three parts—a cylindrical body somewhat smaller in diameter than the boiler tube, with an eccentrically pivoted lever carrying a clover-shaped knocker on a stud at its free end. The lever fits flush into a triangular recess in the forward face of the main body, the free end swinging in an arc through the center of the head. The three hammer faces of the knocker are shaped to fit the inner circumference of the boiler tube.

The head is driven at high rotative speeds. The eccentrically pivoted lever carrying the knocker is thrown from side to side and the knocker revolves on its axis at each contact with the tube. A gyratory motion is given to the knocker, causing it to hit all points of the interior circumference of the tube. The cleaner is fed into the tube by a flexible rubber hose which furnishes the supply of air or steam.

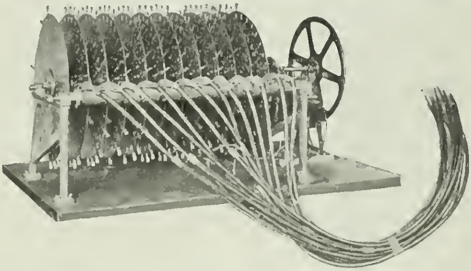


TURBINE CLEANER

The turbine for driving the head is of the rotary engine type. The air or steam strikes upon radial paddles, which are continually held out by the air or steam which is admitted into a chamber behind the paddles so that they always form a tight fit with the case. The turbine has four paddles, two of which are always under pressure, making it impossible for the motor to stall. This cleaner is manufactured by the Lagonda Manufacturing Company, Springfield, Ohio.

Flashing Window Signs with Unique Features

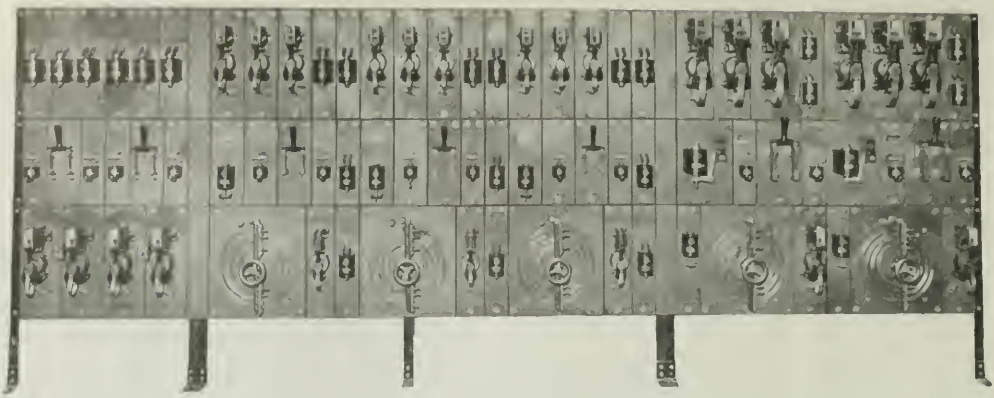
A window-display sign which automatically flashes several sentences or phrases successively has recently been placed upon the market by the E. B. Electric Sign Company, Inc., 209 North Jefferson Street, Chicago, Ill. On direct-current circuits the twelve 14-in. disks shown in the cut are driven by a 1/6-hp rotary converter which at the same time supplies alternating-current energy to a 250-watt transformer. The low-tension side of this transformer is connected to the small low-voltage lamps used in the sign. On alternating-current circuits a 1/32-hp motor is used to drive the disks, and energy for the lamps is furnished by a small transformer. Rotating on a common shaft, these disks are provided with thirty-two slots in which letter sticks may be inserted. As the disks revolve, these sticks make contact with an arm inserted between the disks, energizing the required number of lamps behind the sand-blasted glass cover to form the desired letter. There are 300 circuits leading from the flasher to the sign, and behind each letter plate, which is 3 in. high and 3 in. wide, are twenty-five small tungsten lamps. A portion of these are used to form each letter. The letter sticks are put into the disks of the flasher in much the same way that a printer sets up a line of type, and the manufacturer states that changes are easily made. With electricity at a 12-cent rate, a twelve-letter sign of this type can be operated for approximately 1.5 cents an hour.



ROTATING DISK WITH SLOTS FOR LETTER STICKS

Automatic Controllers for Steel Mill

A large automatic controller system is being installed by an Eastern steel company in its plant to increase the generator equipment without increasing the boiler equipment. Low-pressure steam turbines are to be used which will be operated from the exhaust steam of rolling-mill steam engines, etc., and to get the proper vacuum a large condensing plant is to be installed. The switchboard illustrated on page 1410 is for the control of the motors used in connection with this condensing plant.

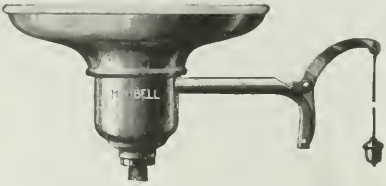


BOARD WITH AUTOMATIC CONTROLLERS

Beginning at the right-hand side of the switchboard, there are two automatic starters for two 125-hp motors with combined armature and field control for the motors driving the fans. In the center are three controllers of the same type for three 30-hp motors driving the pumps that circulate the cooling stream of water. The left-hand section contains two automatic motor starters for two 30-hp constant-speed motors driving the pumps which remove the water that has been condensed from the pipes. The entire operation is automatic and is said to be fool-proof. The running speed of the adjustable-speed motors is set by the hand wheels on the lower panels. When the starting push-buttons are depressed the motors accelerate to the speed determined by the setting of these regulators. If the supply of energy should fail and then come back on the line, the motors are automatically re-accelerated to their previous running speed. The equipment for this installation was made by the Electric Controller & Manufacturing Company, Cleveland, Ohio.

Ceiling Pull-Switch Rosette

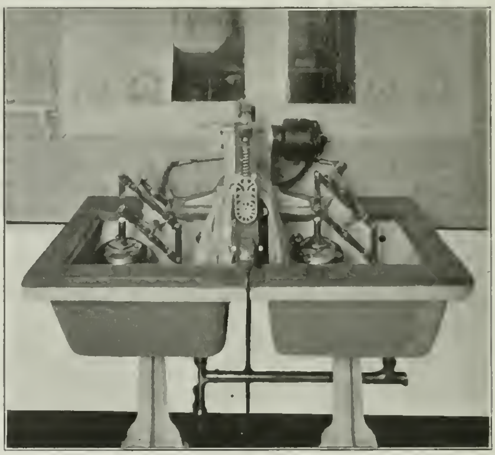
The ceiling pull-switch rosette shown in the accompanying illustration is being manufactured by Harvey Hubbell, Inc., Bridgeport, Conn. The device is equipped with a large metal-covered shallow ceiling base, and is designed for 3-in., 3.25-in. and 4-in. outlet boxes. The base of this rosette and of other rosettes similar in design is identical with the base of the standard wall sockets put out by the above manufacturer. The switch element is the same as that used in the pull sockets made by Harvey Hubbell, Inc. This rosette is furnished with an attachment called an "economy extender," the purpose of which is to extend the pull cord when used with a reflector.



PULL-SWITCH ROSETTE FOR CEILINGS

Electrically Operated Vacuum Washer

An electric washing machine which cleans the clothes by means of air compression and suction is shown herewith. This washer is designed to be attached to twin stationary tubs of any size or make. The machine can wash, wring or rinse simultaneously or separately as desired. All parts of this washer are accessible and are easily removable; they are also interchangeable. All the rapid-moving parts are incased in oil. The machine is operated by a small motor of the inclosed type. It is equipped with a ball-bearing wringer with inclosed gears, reversible water-board and quick-safety-release lever. This electric washer is being manufactured by the Arora Company, Inc., 501 Fifth Avenue, New York.



ELECTRIC VACUUM WASHERS

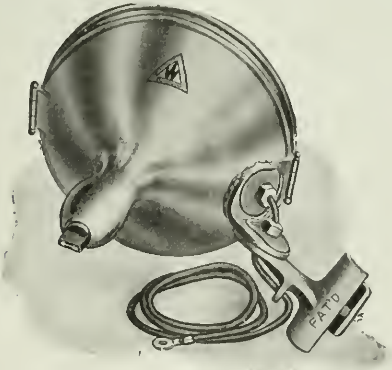
Carboy Rocker

A carboy rocker equipped with small truck casters is shown herewith. With this rocker one man can load and move a full carboy flask to any desired place and entirely empty it without spattering the contents on his hands, face, clothes or the floor. The caster wheels make it easy to move the heavy flasks around from place to place without lifting them on or off hand-trucks with the attendant danger of breaking. The rocker can be attached to a carboy flask or changed from one flask to another in a very short time. A vent tube used in connection with the rocker makes the flow of liquid uniform and free from bubbles and spattering. The rocker is made of wood and weighs 11 lb. It is manufactured by the Munning-Loeb Company, Matawan, N. J.

ATTACHING ROCKER TO CARBOY FLASK

Adjustable Electric Searchlamp

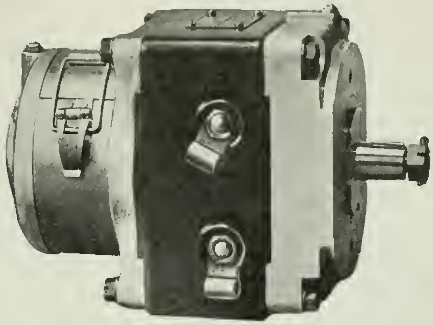
An electric searchlamp which can be fastened readily to an automobile windshield within easy reach of the driver is being placed on the market by the Wood Manufacturing Company, Fairfield, Conn. The lamp can be turned in any direction and will stay locked at whatever angle it is placed. The driver can read signs at the side of the road, light the step of the car and even illuminate the road at the rear when driving backwards while turning. The switch is made integral with the handle.



ELECTRIC SEARCHLAMP

Electric Equipment for Automobiles

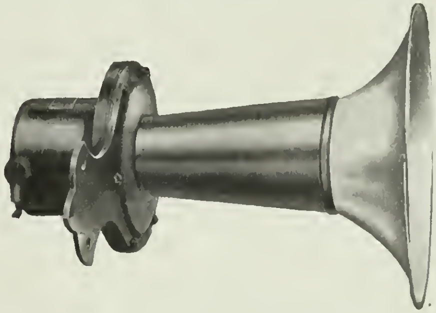
The 6-volt starting and lighting equipment, consisting of generator, starting motor and switch, voltmeter and junction boxes, made by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., has been adopted by the Locomobile Company of America for its 1915 model automobiles. In the accompanying illustration is shown the starting motor used in this equipment. The lighting generator is of the differentially wound, self-regulating type and is designed to operate at low speeds. The starting motor is of the series-wound type and is designed for high-starting torque. A flush-type voltmeter indicates the condition of the battery at all times. The lettering on the voltmeter scale is white on a black background. By using junction boxes all the wiring on the chassis and the body are centered at one point, thus facilitating the removal of the car body from the chassis. The connections for both the starting and the lighting systems are on single-wire circuits.



STARTING MOTOR FOR AUTOMOBILE

Electric Horn

An electric horn depending on magnetic vibrations for its sound-producing qualities is shown herewith. The device gives out a loud sound, which, the manufacturers claim, is not harsh or grating on the ears. It operates on 3 amp and is controlled by a push-button. The horn is made in two sizes, one with a 5-in. mouth and a length of 9 in. and the other with a 7.25-in. mouth and a length of 10 in. It is finished in brass, nickel or black enamel. This horn is being placed on the market by the Automobile Supply Manufacturing Company, 220 Taafe Place, Brooklyn, N. Y.



ELECTRIC AUTOMOBILE HORN

Jobber, Dealer and Contractor

Pacific Coast Jobbers' Association

The regular quarterly meeting of the Pacific Coast Jobbers' Association was held at Hotel Del Coronado, Coronado Beach, Cal., May 28 to 30, with a good attendance, particularly from points in the southern part of California. Following the business sessions of the jobbers, which were presided over by Mr. H. V. Carter, president, and Mr. A. H. Elliot, secretary of the association, a joint meeting of jobbers and manufacturers was held on the afternoon of May 30. Considerable discussion was given to the Stevens bill, the general opinion of the body being in favor of it. Mr. Carter, in commenting on the bill, referred to the fact that many metropolitan chambers of commerce have already expressed themselves in favor of the proposed act, and he said he believed that its passage would result in a stable market for standard articles of merchandise. The California eight-hour law was also discussed. This law is to go before the Legislature in the fall of 1914. The general feeling was that the wording of the law as proposed is too drastic, and that the act would, if passed, be detrimental to the manufacturing interests of the State and manifestly unfair to such industries. A resolution was unanimously concurred in that those present would use their influence as far as possible to defeat the passage of the act.

On Friday evening a rejuvenation of the Jovian Order was held under the joint direction of Statesmen J. N. Colkitt and Alfred May. Twenty-three candidates were admitted into the order. The permanent degree team of Los Angeles conducted the ceremonies.

On Saturday evening a banquet was held. Mr. T. E. Berger presided as toastmaster and presented the cups to the winning contestants in the golf tournaments. Short speeches were delivered by Messrs. Carter, H. T. Matthew, R. D. Holabird, A. H. Halloran, Ralph B. Clapp and A. H. Elliot. Following the banquet the party adjourned to the ballroom, where dancing was indulged in until a late hour. This is the first convention of the Pacific Coast Jobbers to be held at Coronado, and it appears likely from opinions expressed by those in attendance that a return visit will be paid to the resort meeting place. The next meeting will take place at Del Monte in about three months.

Louisville Electrical Clearing House

Means of increasing efficiency in electrical work are being considered with much attention by the members of the local Electrical Clearing House Association of Louisville, Ky., which has recently promulgated stringent rules, such as the loop system for the wiring of houses, etc. These rules tend to increase the expense to the owner, and the members of the organization are seeking to find ways of giving the better service without the increased cost. Mr. Frank A. Good, electrical engineer with F. A. Clegg & Company, addressed the association on this subject at the last meeting, and the members also saw demonstrations of the best ways to insulate fixtures.

The influence of the Electrical Clearing House in Louisville is shown by the issuance as of the first of May of three revised rules applying to electric wiring. These rules are as follows:

In bathrooms, fixtures and drop lamps not controlled by switches must be equipped with porcelain key sockets or insulated pull-chain sockets. All alternating-current motors of over 1 hp must be equipped with double-throw spring switches with running fuses when not equipped with approved starters which have the above-mentioned protection. All concealed work must be wired on the loop system, with boxes at each outlet, except in front-porch ceilings. The order, issued to electrical contractors, was over the signatures of Messrs. E. J. Theobold and Gus Ansbach, city electrical inspectors, and Mr. E. L. Kopf, electrical inspector for the Kentucky Actuarial Bureau.

Classified Results of House-Wiring Campaign

During an old-house wiring campaign conducted from Nov. 21 to Dec. 24, 1913, by the Iowa Railway & Light Company in Marshalltown, Ia., an analysis was made of the results. Several classes of advertising mediums were employed, and after the closure of each contract customers were closely questioned to determine which type of advertising had excited their interest. Of course, this system does not give an absolute check on the value of advertising, because in many cases it is a combination of all advertising that induces the prospective customer to make inquiry. However, the accompanying table of results does show conclusively that the advantages of window-display advertising should never be neglected.

Contractors co-operating agreed upon a fixed price for wiring, and the central station paid all advertising and soliciting expense. Small boys were employed to distribute handbills and inquiry cards throughout the city, and it was on the return of these cards and from information given by the company's employees that the "prospect" list was formed. Although the contractors agreed to allow customers to make partial payments on wiring accounts, extending over five months, more than 50 per cent of the business was settled on a cash basis or paid within thirty days.

Advertising during the campaign was confined exclusively to the bargain in wiring, the price being $22.50 for any four rooms, including wiring, two two-lamp fixtures, two drop cords and a lamp for each fixture. Mr. Charles Munson, local manager of the Iowa Railway & Light Company at Marshalltown, was in personal charge of the campaign and the collection of the accompanying

HOUSE-WIRING CAMPAIGN DATA

Total residence wattage since Nov. 21	34,285
Total contracts given to contractors	91
Total amount of contracts	$2,431.40

Division of contracts according to different means used in getting customers:

	Per Cent	Watts	Amount
Through window display	30	8829	$729.30
Through handbills	10	2943	243.10
Through newspapers	10	2943	243.10
Through office employees	10	2943	243.10
Through outside employees	10	2943	243.10
Through personal canvass	15	4420	364.65
Through neighborhood canvass	10	2943	243.10
Through street-car advertising	5	1471	121.55

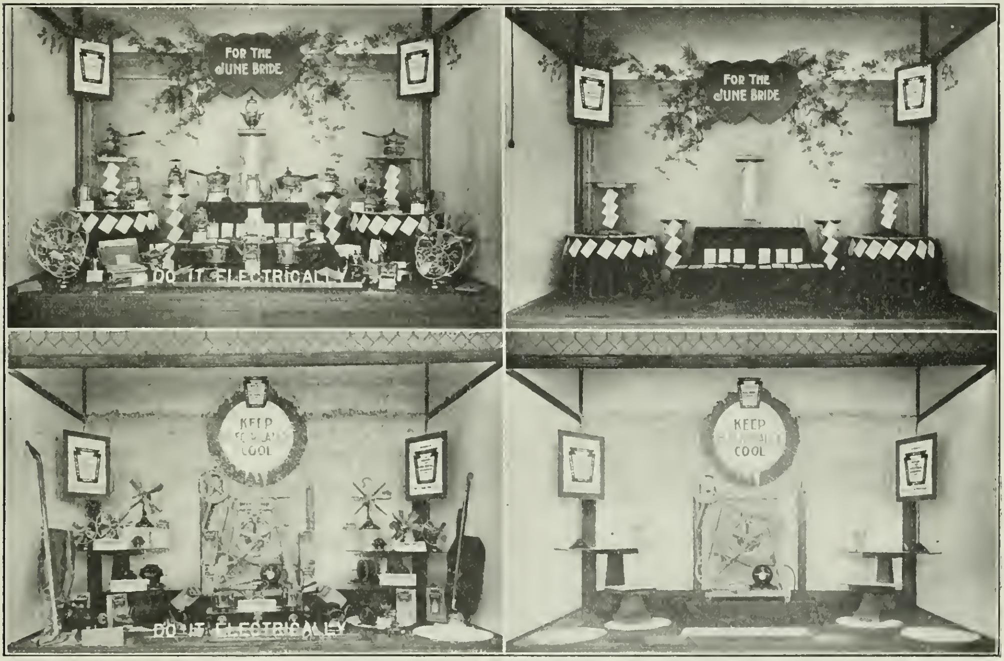
Total number of cards received in office	65
Number of "prospects" on cards secured as customers	35
Number of residences outside of limits of lines now erected or residences where new extensions would have to be built	13
Number of cards with wrong addresses or where parties were wanting information out of curiosity and were not really "prospects"	10
Number of houses estimated and parties yet undecided	1
Number of "prospects" estimated who could not be secured	6
Number of residences connected up during campaign that gave their contracts to non-co-operating companies (7199 watts)	21
Number of new services connected up since Nov. 21	101
Number of contracts yet to be completed	25

data concerning it. In speaking of the compaign results obtained before the recent convention of the Iowa State Section of the N.E.L.A., Mr. J. S. Forbes, Cedar Rapids, said that the "fixed-price" wiring scheme was without an equal as a means for securing new business from owners of already-built houses.

Montreal Contracting Situation

In a recent interview with a representative of the *Electrical World*, Mr. W. B. Shaw, of the Montreal Electric Company, stated that while general business in eastern Canada is quiet, the prospects are that better trade will follow the recent opening of navigation on the St. Lawrence River. Prudent management is called for in the electrical business field at present. The contractors are on good terms with the Montreal Light, Heat & Power Company and other energy-distributing organizations, and there appears to be a disposition in central-station circles to encourage the sale of electrical conveniences at a reasonable profit. Some difficulty has been encountered in electric-range campaigns through the unwillingness of prospective customers to pay the cost of wiring, which usually is about 10 per cent of the cost of the range, but the public is gradually being educated to appreciate electrical conveniences.

Montreal is thus far known principally as a great center of electric power service, nearly all the industrial plants of any magnitude in the city being consumers of hydroelectric energy, but the field is steadily broadening to include a more comprehensive utilization of appliances. The electrical repair business is at present in excellent condition in the city, and those engaged in this line feel optimistic.



SHOW WINDOWS ARRANGED BY THE SOCIETY FOR ELECTRICAL DEVELOPMENT

Electric Window Settings of Society for Electrical Development

The Society for Electrical Development, Inc., has inaugurated a window-dressing department which is intended to give its members direct service in the way of suggestions for seasonable displays. Mr. A. J. Edgell has been placed in charge of this department. Windows will be trimmed and photographed, two photographs of each window being sent to members, one showing the fixture setting and the other the finished window. The photographs will be accompanied by instructions as to how to trim the window to secure the results shown in the photographs. Four views of windows are shown herewith. As more weddings take place in June than in any other month, wedding gifts must be bought, and the married couple will want to furnish their house in the most comfortable way for the summer. One window display shows how a number of electrical appliances and devices can be featured to an excellent sale advantage at this time.

The central decorative figure consists of a double heart and arrow cut from red cardboard and lettered in white. Two membership posters are mounted on contrasting cardboard and placed in either end of the window. There is a pyramid arrangement in the center of the window with five pedestals used throughout to give a graduated height to the display. If fixtures as illustrated cannot be had, home-made stands or boxes may answer. A number of advertising pamphlets or circulars are scattered here and there throughout the trim to add color to the showing. On either side of the window are two circular display fixtures cut from compo board. Two large barrel heads will answer for this purpose. Of course it is necessary to cover all rough woodwork with suitable material. Velours is the best, but inexpensive cloth or crêpe paper will serve.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Electric Vehicles for Transfer Service.—The Baker Motor Vehicle Company has sold many electric trucks for transfer service in New York recently. It is claimed that its 1914 model brougham is also meeting with considerable favor in that city.

Central-Station Company Orders 6000 Irons.—The Union Electric Light & Power Company, St. Louis, Mo., recently ordered 4000 standard 6-lb. General Electric household irons to be disposed of during the summer months. Immediate delivery was asked on the entire shipment.

Planning for Increased Business.—Although business for both the Railway & Industrial Engineering Company and the Transmission Engineering Company is said to be dull at present, the feeling regarding the future is optimistic. Both companies have moved to larger quarters at Greensburg, Pa.

Ventilating Fans for Small Theaters.—The Typhoon Fan Company, 1544 Broadway, New York, has been making a number of installations of its large low-speed fans in theaters having capacities up to about 1500 people. This fan is also being used extensively in schools and other public buildings.

Waverley Trucks for Pittsburgh Lighting Company.—Five Waverley 2-ton electric trucks were shipped recently to the Duquesne Light Company, Pittsburgh, Pa. The slogan "You can do it better with electricity" is printed on the battery boxes of these trucks and effectively and forcibly calls the attention of the public to the advantages of electricity.

Number of Sales of Searchlamps Large.—The business of the Carlisle & Finch Company, Cincinnati, Ohio, in searchlamps for May was very good. Shipments were made to all parts of the United States and to Canada, China, the Philippine Islands and England. Following are the different types of units sold: seven 7-in. lamps, eleven 9-in. lamps, one 12-in. lamp, fifteen 14-in. lamps, nine 19-in. lamps, two 24-in. lamps, and two 30-in. lamps.

Endeavoring to Get More Foreign Trade.—At the First National Foreign Trade Convention held in Washington, May 27 and 28, it was arranged to organize the National Foreign Trade Council, consisting of thirty men representing industrial, commercial, transportation and financial interests. The object of this council is to make a systematic campaign to extend American foreign trade. The members of this trade council are to be appointed by the president of the convention, Alba B. Johnston, who is president of the Baldwin Locomotive Works.

Electric-Vehicle Route Book.—A touring book for users of electrical vehicles in the vicinity of New York City has been issued by the New York Electric Dealers' Association. The book indicates resorts and routes within the touring capacity of the electric vehicle, showing on the map distances, alternate routes and charging stations. The various routes are described in detail. The longest runs are to Poughkeepsie on the north, New Haven to the east, and Trenton and Atlantic City to the south. The book is distributed through manufacturers and agents of electric-vehicle manufacturers.

Mercury-Vapor Lamps for Motion-Picture Studios.—More than fifty motion-picture studios both in the United States and foreign countries are reported to have been recently equipped with Cooper Hewitt tubular lamps. Each of these installations represents from 100 to 1000 lamps. The Cooper Hewitt lamp is also used extensively in factories and workshops. The Cooper Hewitt company is putting out a reflector made of rhodamine, which gives the light a daylight value. A new so-called "targon" filament lamp is being placed on the market by the above company. It is made in sizes rated at 1650 watts, 2750 watts and 5500 watts.

Committee to Inspect Automobile Headlamps.—Many of the large cities in America are considering the danger of high-powered headlamps on automobiles. Chicago has appointed a committee called the Board of Motor-Vehicle Headlight Inspection to pass upon some forms of glare subduers in the construction of the lamps so that a proper driving light can be obtained by using headlamps. After a lamp has been inspected by this board, a certificate of inspection is awarded to the manufacturer. The Ward Leonard Electric Company, Bronxville, N. Y., is one of the concerns which have recently obtained such a certificate from the Chicago board.

Rush Season for Ice Equipment Closing.—Now that the summer months are here and the ice-making plants are generally working at full capacity there are not many orders for new equipment. The United Ice Improvement Company finds conditions thus and expects a lull until about September. Mr. W. Everett Parsons, vice-president of this company, has designed a "quick-freezing" system which is employed in installations made by this company. With this system perfect ice can be made, it is claimed, in twelve hours. This system is used in the refrigerating plant now being installed in the Hudson Terminal Building, 30 Church Street, New York, and it will also be used in the plant to be put in the new Equitable Building, New York.

Belt-Drive Mechanism Proving Popular.—The "Lenix" belt-drive mechanism, which is being made by F. L. Smidth & Company, cement engineers, Copenhagen, Denmark, is being installed in a number of electric plants in the United States, where economy of space is necessary. This drive was originally developed for use in cement plants. Just at this time there is a lull in the cement industry, and F. L. Smidth & Company are pushing the Lenix drive for other applications more than usual on that account. This drive consists of two counter-weighted arms attached to a roller. The roller bears down on the belt in such a way that the arc of contact with the pulley is increased, and it automatically takes up all slack. F. L. Smidth & Company have an office at 50 Church Street, New York.

Big Field for Manufacturers of Ball Bearings in United States.—Mr. C. F. Sultmeyer, formerly manager of the Globe Ball Bearing Company, asserts that well-made bearings are in great demand in the United States and that the larger portion of those used in this country are imported. Mr. Sultmeyer was for a number of years in the ball-bearing business in Germany and he has designed several automatic electric machines for making ball bearings. The entire equipment of the Globe Ball Bearing Company was recently sold to the Willis-Oberlin Company, Toledo, Ohio. This equipment was moved to the latter company's plant at Elmira, N. Y., where the bearings for all its cars will be made. The Globe Ball Bearing Company will be reorganized in the near future, and a new plant will probably be erected in Norwich, Conn.

Automatic Swinging-Disk and Electric-Lamp Signal.—The Bryant Zink Company, 600 Orleans Street, Chicago, Ill., has recently placed on the market a highway signal, consisting of a metallic disk in the center of which are placed two incandescent lamps between two 4-in. red lenses. Only one of these lamps is used at one time, and in case one burns out an automatic relay cuts in the other lamp. The disk is suspended from an arm extending from a post erected at the side of the road toward the center of the highway and when operating gives the effect of a red lantern swinging across the roadway. In conjunction with this "autoflag" an alarm bell can also be used. The business of this company is rather slack at present. This is due, it is claimed, to suspension of railroad work until the new rate increases are made.

Pushing Sales of Semi-Direct Units.—Mr. Edward O. Coles, general New York sales agent of the Luminous Unit Company, St. Louis, Mo., declares that he is carrying on a vigorous selling campaign and that the number of sales of "brascolite" fixtures, particularly to the retail trade, has been quite large. The brascolite unit is provided with what may be called its own ceiling. Various artistic designs have been made, and the fixture lends itself well to showroom and office illumination. It has been found that in banks, showrooms, offices, etc., where direct lighting of a more or less inferior kind is used those in charge are usually quite willing to consider a new method of illumination, and by installing one or two trial fixtures in these places, whereby the old lighting system can be compared with the new, many sales are often closed. A showroom has been established at 56 West Forty-fifth Street, and though it has been opened only since Feb. 1, Mr. Coles is contemplating renting enlarged quarters.

Ball-Shooting Target.—A. C. Smucker, ventilating engineer, 30 Church Street, New York, has designed a target which is operated by means of an electrically driven blower. The apparatus is simple, consisting of a tapered pipe provided with vertical outlets. This pipe is connected to a blower and is tapered to equalize the pressure throughout. The air passing from the outlets is made to play on small balls. These balls are held in mid-air in a manner similar to that used with decorative balls on fountains. Reducers are provided for the outlets so that the balls can be kept at any height desired. The advantage of using air for such a target instead of water is that there is no stream line for the marksman to follow as is the case with water, air of course being invisible and the balls seeming to dangle in mid-air with no visible means of support. Mr. Smucker has used this scheme for window advertising purposes also. Balls of quite large diameters, when made of the proper material, he has found, can be used, and advertising matter may be printed on the surfaces of these balls.

Interest Aroused in Lanz Locomobiles.—The Wiener Machinery Company, 391 Hudson Terminal, New York, was recently appointed sole representative in the United States and Canada for Heinrich Lanz, Mannheim, Germany. The Lanz locomobile is a combination of boiler, super-heater and engine in one unit, compactly assembled for eliminating radiation and pipe losses and economizing floor space. One of its features is the manner in which the engine is connected; the main parts are not inseparably riveted together, but are independent of each other. The crank-shaft bearings rest on lateral supports riveted to the boiler shell. The so-called Lanz valve gear used with this locomobile consists of a direct-acting distributing mechanism without any intermediate parts; the valve is lifted by means of one roller moving on a cam. A number of installations have been made in foreign countries. One of these consists of three Lanz engines for the electric central station of the harbor pumping plant of Lisbon, Portugal. These units act as prime movers for the direct-coupled sets. The Lanz locomobile is adapted for transport over difficult roads such as are often encountered in sparsely settled countries. A special truck has been designed for this purpose. This vehicle is arranged so that the boiler supports can be bolted to the axles.

Annapolis Public Utilities Company New Equipment.—President George T. Bishop of the Washington, Baltimore & Annapolis Electric Railroad Company, which owns the entire capital stock of the Annapolis Public Utilities Company, in his annual report to stockholders described the improvements in transmission. Under the contract with the Potomac Electric Power Company it was found that energy could be delivered at Annapolis with greater reliability and more satisfactorily than it could be generated at Annapolis. Accordingly the old plant at Annapolis was abandoned and a new transmission line paralleling the old one was authorized, together with a new substation in Annapolis. This substation, a brick and concrete structure, contains two 360-kw and one 120-kw motor-generator set, with the necessary transformers and switchboard apparatus to take care of the commercial city motor and lighting service, and three fifty-light arc rectifier sets to furnish energy for the arc and series incandescent street lamps in the city. The new substation also contains the two 300-kw rotaries used to furnish energy for the railroad. Since the railroad purchased the stock of the Annapolis Public Utilities Company new street-lighting equipment has been installed and the total service largely extended.

Growth of Electric Utilities.—The American Public Utilities Company has issued the following statement: "The commercial showing of the subsidiaries of the American Public Utilities Company in twelve different cities for the week of May 16, 1914, when compared with a similar period of 1913, is remarkably satisfactory. The output of gas and of electric energy shows increases ranging from 5 to 40 per cent. The increase in the amount of gas used is natural and was to be expected, owing to the growth of the communities in which the companies are situated and to the fact that the modern method of cooking is being almost universally adopted. The increase, however, in the amount of electric energy manufactured and marketed is more significant and important, for the reason that at all the plants more or less energy is used for power for manufacturing purposes. Taking into consideration the general conception of rather unsettled business conditions, the increase in the output of electric energy is very encouraging as showing a tendency toward the restoration of industrial activity and is an indication of healthy growth in industrial circles." This information confirms the views expressed in the *Electrical World* regarding central-station expansion in the current year. In last week's issue official data were presented from light and power utilities operating in the Central States, showing that their business for March, 1913, was increasing at a satisfactory rate, not much less than that established by the last census as the five-year average. Several of the electric properties of the American Public Utilities Company operate in the East North Central belt, in which the average rate of expansion seems to be about 13 per cent on a basis of income from the sale of energy, and about 14 per cent on a basis of kilowatt-hour output. While the rate of growth of the electric utilities throughout the country is not so great as it was a year ago, in view of the widespread business depression the proved rate of expansion is gratifying and even remarkable. There are many signs of confirmation of this condition, such as the evidence from the American Public Utilities Company.

Growth of the Central-Station Business on the Pacific Coast.—The central-station companies in the States of California, Oregon and Washington are not obtaining this year such increases as were experienced a couple of years ago and as are still being maintained by the electrical utilities in certain other sections of the country. The *Electrical World* has already presented some estimates of central-station growth in the Atlantic, New England and Central States, based upon authentic returns of kilowatt-hours output and revenue from the sale of energy, and while similar official data from the Coast companies are not very numerous, authentic figures for gross earnings of the properties are nevertheless available. The companies in San Francisco, Los Angeles and Seattle have not obtained a great increase in gross over 1913. It can be seen from the published statements of the Pacific Gas & Electric Company, the Southern California Edison Company and the Puget Sound Traction, Light & Power Company that gross earnings increased by only $62,315 from March, 1913, to March, 1914—$2,480,837, against $2,418,522, or 2.6 per cent. The unusually wet California season has had a radical effect on the character of this year's irrigation load of the companies in that State, particularly on the Southern California Edison Company. Little pumping has been necessary this spring, and the revenue from this source has fallen off very considerably. At the same time, and partly as an offset to this, it should be noted that one of the principal reasons for the ability of the Pacific Gas & Electric Company to decrease its operating expenses as it has done this year resides in the fact that the winter rains filled up the pondage to an unexampled extent and left the hydraulic plants in excellent shape for carrying the full load without the help of the steam auxiliaries. This circumstance will probably continue to have a beneficial influence for some time to come. So far as Seattle is concerned, gross earnings of the Puget Sound Traction, Light & Power Company are sure to be affected favorably by the recent action of the Railroad Commission in abrogating a decision of 1910 and virtually instructing the utility to file a new schedule of increased fares, with the admission that the theories upon which the reduction of 1910 was based are no longer operative. Official returns received from other Coast cities of 100,000 population show an increase in revenue from energy sales of some 6 per cent on a total of $500,000, corresponding to an increase in station output of 5.5 per cent. It is worth while noting again that, whereas in the Eastern States a kilowatt-hour of energy sold (considering all lighting, motor service and railway loads) represents a gross yield of some 3 cents, in many of the Pacific areas the gross return is little more than 1 cent; or, in other words, a company turning out say 250,000 kw-hr. in the month will receive only some $300,000 from the energy sold. These approximate indications of the 1914 rate of central-station expansion in the Western States may be converted into figures and tabulated with the results already given for the Eastern and Central States. Returns from the Mountain States, though not representative, seem to indicate a healthier rate of increase than in the cities of the Coast. For the present purpose it may be sufficiently accurate if a value of 5 per cent is selected as the 1914 expansion coefficient for gross earnings and 6 per cent for energy output for the states which are embraced in the combined mountain and Pacific Coast areas.

ESTIMATED EARNINGS AND OUTPUT FOR MARCH, 1914, FOR CONTINENTAL UNITED STATES BY GROUPS OF STATES*

	GROSS EARNINGS FROM THE SALE OF ENERGY, IN DOLLARS			TOTAL ENERGY OUTPUT IN KILOWATT-HOURS		
	March, 1914	March, 1913	Per Cent Increase	March, 1914	March, 1913	Per Cent Increase
Middle Atlantic.	10,300,000	9,717,000	6.1	314,500,000	292,500,000	7.5
South Atlantic.	1,798,000	1,615,000	11.3	104,500,000	85,170,000	22.8
Central. .	12,374,000	11,133,000	11.2	441,700,000	391,585,000	12.8
New England..	2,910,000	2,720,000	7.1	92,600,000	86,000,000	7.7
Mountain & Pacific..	4,531,000	4,315,000	5 0	303,950,000	286,745,000	6.0
Total for United States.......	31,913,000	29,500,000	8 2	1,257,250,000	1,142,000,000	10.0

*Rates of expansion based upon official figures collected by the *Electrical World* from approximately one-half the entire industry.

NEW YORK METAL MARKET PRICES

Copper	June 2 Bid	June 2 Asked	June 9 Bid	June 9 Asked
Standard spot*	13.50	14.00	13.40	13.00
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*....	62 6 3		61 17 6	
Prime Lake	14.12½	to 14.37½	14.12½	to 14.37½
Electrolytic	13.95	to 14.05	13.85	to 13.95
Casting	13.80	to 13.90	13.70	to 13.80
Copper wire base........	15.25	to	15.25	to .....
Lead	3.90		3.90	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter....	7.00		7.00	
Spelter, spot	5.10	to 5.20	5.10	to 5.20
Tin, spot	30.25	to 30.65	30.50	to 30.75
Aluminum:				
Prompt delivery	17.75	to 18.00	17.75	to 18.00
Future	17.75	to 18.00	17.75	to 18.00

*OLD METALS

	June 2	June 9
Heavy copper and wire	12.62½	12.87½
Brass, heavy	8.50	8.62½
Brass, light	7.37½	7.50
Lead, heavy	3.90	3.90
Zinc, scrap	4.00	4.15

*COPPER EXPORTS

Total tons to June 9............................ 11,808

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Easton Consolidated Electric Company Notes.—In his annual report President H. R. Fehr sums up the financial report for the year ended Dec. 31, 1913. The gross revenue from railway lines increased $40,972, or 9.58 per cent, while the operating expenses were 62.06 per cent of the revenue. The net earnings totaled $149,450, of which $126,437 came from the railways and $23,013 from the Edison Illuminating Company. A deduction for fixed charges of $71,076 left as surplus earnings $78,374, out of which was paid $30,000 in dividends. This left a surplus of $48,374, making the total surplus $190,338.

Blackstone Valley Gas & Electric Company Operating Arrangement.—The Blackstone Valley Gas & Electric Company has made an operating arrangement with the Rhode Island Power Transmission Company, a subsidiary of the New England Power Company. The Blackstone company will use electrical energy generated by the hydroelectric plants of the New England Power Company and the Connecticut River Power Company. The arrangement contemplates interchange of service so that the steam plants of the Blackstone company will help out the hydroelectric plants in dry seasons. The Rhode Island Power Transmission Company will furnish additional energy if needed.

Lehigh Valley Transit Company Operations.—The Lehigh Valley Transit Company, besides acquiring the controlling interest in the Easton Consolidated Electric Company, has organized new lighting companies and secured charters covering the borough of North Catasauqua and Allen Township in the county of Northampton, Pa.; the borough of Coplay and Upper Gancon township in the county of Lehigh, the townships of Doylestown, Hilltown, Richland, Springfield, East Rock Hill and New Britain in Bucks County, and Hatfield in Montgomery County. All franchises with one exception are without time limit. The lighting and motor-service business has increased substantially and very satisfactory results have been obtained.

Columbus Railway, Power & Light Company Plans.—The Columbus (Ohio) Railway, Power & Light Company has called a special meeting of stockholders for June 29 to authorize the issue of $3,145,000 of 4 per cent prior preference stock. This stock is to be issued for the purpose of retiring in whole or part $3,145,000 outstanding first consolidated mortgage 4 per cent bonds of the Columbus Railway Company. Stockholders will also be asked to approve an issue of $450,000 Series A 6 per cent preferred stock to retire the $450,000 6 per cent first mortgage bonds of the Columbus Electric Company. The stockholders will be asked to approve an authorized issue of $25,000,000 first and refunding sinking fund 5 per cent bonds.

Public Service Company of Northern Illinois.—The annual report of the Public Service Company of Northern Illinois for the year ended Dec. 31, 1914, shows gross earnings of $6,066,825, expenses including taxes of $3,590,100, and net earnings of $2,476,725. Against this was charged interest amounting to $1,307,399. There was deducted for depreciation reserve $121,120, leaving $1,048,206 available for dividends. The sum of $840,513 was paid in dividends. This left $207,693 to be carried to surplus. During the year obligations of subsidiary companies amounting to $110,900 were either retired or deposited with the trustee under the company's first and refunding mortgage. This brings the total of retired or deposited obligations up to $6,839,900. The company's outstanding bonds and notes have increased during the year $4,118,000. The increase in funded debt is due to the consolidation with the Northwestern Gas Light & Coke Company, to the acquisition of the plant of the Pontiac Light & Water Company, to the addition of a 7500-kw turbo-generator in the Blue Island electric station, to the addition of a 5000-kw turbo-generator in the Waukegan electric station, to the installation of a gas holder at Kankakee and to extensions of transmission lines. During the year the rate of dividends on the common stock was increased from 4 per cent to 5 per cent. The company's connected business in supplying electrical energy (exclusive of railway power business) amounted to the equivalent of 1,837,630 standard 16-cp lamps on Dec. 31, 1913, being an increase of 369,024 standard 16-cp lamps during the year.

Brazilian Traction, Light & Power Company, Ltd.—The board of directors of the Brazilian Traction Light & Power Company, Ltd., has issued its first complete report, covering the period from the incorporation in July, 1912, to Dec. 31, 1913. The company is a consolidation of the Rio de Janeiro Tramway, Light & Power Company, Ltd., the Sao Paulo Tramway, Light & Power Company, Ltd., and the Sao Paulo Electric Company, Ltd. For the eighteen months the gross revenue was $11,522,837. Deductions for interest and expenses made the surplus available for dividends $11,198,493. Dividends amounted to $8,185,495, leaving a surplus carried to profit and loss of $3,012,998. The Rio de Janeiro division showed a gross income of $4,520,507 for lighting and motor service. The Sao Paulo division showed $1,858,380 gross income from the same sources. The Sao Paulo Electric division showed a gross income of $1,731,219. This made a total for lighting and motor service of $8,110,106, or 34 per cent of the total gross income of the subsidiary companies.

Crocker-Wheeler Company Statement.—The statement of the Crocker-Wheeler Company as of Dec. 31, 1913, issued to stockholders by Dr. Schuyler Skaats Wheeler, the president, shows a net profit from operation for the year 1913 of $300,089. From this there was deducted as a reserve for replacement of plant $94,917, leaving a balance of $205,172. Common and preferred dividends amounting to $102,750 were paid. There was also deducted as a reserve for accrued preferred dividends $8,750. Interest amounted to $50,035. The total of these three items is $161,535. The balance was $43,637. There was added as profit on the sale of land $31,695, making a total surplus for the year of $75,332. The balance-sheet surplus at the close of the year was $461,061. Plant, including land, building, tools, patterns, equipment, etc., less the account reserve for depreciation, deducted, $783,313, amounted to $1,447,739. Patents at cost, less depreciation, deducted, $104,832, stood at $25,000. The value of merchandise on hand, at shop cost, was $1,041,258.

Annual Report of the Western Railways & Light Company.—For the year ended Dec. 31, 1913, the gross earnings from operation were $2,541,684. Deducting operating expenses and taxes of $1,585,536 gives net earnings from operation of $956,148. Other revenue amounted to $31,316, making the total net earnings $987,464. With interest at $620,561, the amount available for dividends $366,903 and dividends on preferred stock $190,140, the net surplus becomes $176,763, a slight increase over last year. During the year the company expended for the upkeep of properties $364,081, which is 14.32 per cent of the gross receipts. The following items make up the gross earnings: interurban lines, $548,745; city lines, $942,432; gas, $350,462; electric, $659,364; steam, $27,142; water, $13,539—a total of $2,541,684. The company expended for improvements $577,631 in developing its interurban lines and city motor-service and lighting equipment. During the year the company acquired the following companies: Jefferson City Bridge & Transit Company, Knoxville Electric Light & Power Company and People's Traction Company. The increased consumption of energy for lighting and industrial use was gratifying.

Minneapolis General Electric Company Notes.—An issue of $2,000,000 of three-year 6 per cent notes of the Minneapolis General Electric Company has been placed on the market by William P. Bonbright & Company, New York, and H. M. Byllesby & Company, at 99 and interest. The notes are part of an authorized issue of $3,000,000. The remaining $1,000,000 notes will not be issued until after Dec. 1, 1915. For the year ended April 30, 1914, the gross earnings were $1,952,790, compared with $1,785,309 in 1913 and $1,599,770 in 1912. The net earnings for the same periods were, respectively, $1,157,296, $1,027,125, and $915,652. The surplus for the year ending April 30, 1914, was $645,057. That the company is developing is indicated by the following connected-load statistics: Electric light customers in 1914, 24,422, or an increase of 24.6 per cent; electric power customers in 1914, 2245, or an increase of 16 per cent, making an increase in total customers of 23.8 per cent. Incandescent lamps increased from 581,903 in 1913 to 662,122 in 1914, or 13.7 per cent, and municipal arc lamps from 2335 to 2759, or 18.1 per cent. The total kilowatt lighting load increased 26.7 per cent, and 21.6 per cent more hp in stationary motors was served.

Annual Report of the York Railways Company.—In the annual report of the York Railways Company, President Gordon Campbell stated that in spite of general business depression the business showed wholesome gains for the year. Earnings from the light and power company were augmented by the addition of the business of a section of the country southeast of York, having its center about 8 miles from Center Square and including the borough of Red Lion, Dallastown, Yoe and Windsor. This territory was formerly served by the York & Windsor Electric Light Company, a local company which obtained its energy from the Edison Electric Light Company at wholesale rates. The company purchased the York & Windsor Electric Light Company and formed the Edison Light & Power Company by merger of the Edison Electric Light Company, the York & Windsor Electric Light Company, with franchises in Yoe, Dallastown and Red Lion, and fourteen suburban lighting companies. Because of this new acquisition a substation was built in Red Lion in combination with a freight station for the railway. The transmission line was reconstructed. The old electric-light poles in Dallastown and Red Lion were replaced by 50-ft. poles and in many cases combined with the railway poles.

Los Angeles Gas & Electric Corporation Statement.—During the year ended Dec. 31, 1913, the gross earnings were $4,527,164 as compared with $4,178,176 for 1912. Operating expenses and taxes were $2,589,594 as compared with $2,335,212. The net earnings were $1,937,570 in 1913 and $1,842,964 in 1912. Interest was $400,943 as compared with $396,405. The surplus for 1913 was $1,536,627, while that for 1912 was $1,446,559. Since May 1, 1904, $4,468,352 has been allowed for depreciation. The corporation is required to make annual sinking-fund payments, which began on July 1, 1910, equal to 2 per cent of the total amount of bonds outstanding. Up to the present time $747,500 underlying and corporation refunding mortgage 5 per cent bonds have been canceled or are held alive in sinking funds. The annual report issued to stockholders says that the physical property of the corporation alone is valued at over $20,275,000 without any allowance for franchise or good-will, or over two and one-half times the $7,902,500 of outstanding bonds. Although the gas business is the principal business of the company, the electric plant has a rated capacity of 25,650 hp. There are 2353 miles of electric overhead main wire and 21 miles of underground conduits; 36,086 electric meters are in use. The total electric connected load is 63,450 hp.

Atlantic Gas & Electric Company Operations.—By far the larger amount of the investment now under way by the subsidiary and affiliated companies of the Atlantic Gas & Electric Company, according to a statement issued by Arthur D. Lord, president of the company, is being used for improvements to the properties in the Easton (Pa.) district. This work is now nearing completion. The station building has been enlarged and the generating apparatus rearranged. In January a new 6333-hp turbo-generator was put into commission, while it was expected that a second one of the same size would be ready for operation about June 1. Other new apparatus includes a new switchboard, two new 1165-hp Stirling boilers, outdoor high-tension switches and transformers, and steel terminals for the high-tension transmission lines running out of Easton. One year ago the rating of the plant was 2000 hp; now, including the latest addition, it is 16,333 hp. The new station building at Boonton, N. J., has been completed and in addition to its present capacity of 500 hp two 1000-hp turbo-generators have been installed. Additional boilers are being added and plans are being made for the development of the hydroelectric equipment of the company to its full capacity. The Sayre Electric Company, which the company acquired in 1907, has authorized the purchase of an additional 1300-hp turbo-generator with necessary auxiliaries. Since 1907 the income of this plant has increased over 60 per cent, while the output so far this year is 15 per cent over that of last year. The company has closed a contract with the Morris County Traction Company for the operation of its lines in the Boonton-Dover-Wharton district for a term of ten years, covering 25 miles of electric road. A transmission line 15 miles in length is being built to furnish this service. In the Easton district extensive betterments are being made.

Business Notes

The Bruce-Macbeth Engine Company, of Cleveland, Ohio, has renewed its lease in the Oliver Building, Pittsburgh, Pa., for its branch office.

The General Insulate Company, Brooklyn, N. Y.—Fred. Steinberger has been appointed sales manager for this company in the Middle West, with headquarters at 9 South Clinton Street, Chicago, Ill.

Moloney Electric Company, St. Louis, Mo.—Arthur Purdon has been made assistant in the sales department of this company. Mr. Purdon was formerly connected with the Westinghouse Electric & Manufacturing Company.

The Electric Service Supplies Company has recently added the services of W. J. Bryan to its sales force. Mr. Bryan graduated in engineering at the University of Michigan in the year 1906, and was for five years connected with Wm. B. Scaife & Sons Company, Pittsburgh, Pa. He will represent the Electric Service Supplies Company in the New England States, with offices in Boston.

United States Light & Heating Company.—L. R. Pomeroy, consulting railway and electrical engineer, has been appointed manager of the New York sales office of the United States Light & Heating Company, the general offices of which are now at Niagara Falls, N. Y. Mr. Pomeroy has under his direction the sales of the U-S-L axle electric car-lighting equipment, U-S-L electric starter and light and U-S-L storage batteries.

Julius Andrae & Sons Company.—L. W. Orear has been placed in charge of the engineering department of the Juilus Andrae & Sons Company, Milwaukee, manufacturer and dealer in electrical supplies. Mr. Orear, who graduated from the electrical engineering department of the Missouri State University in 1900, was for many years connected with the United States Steel Corporation and later with the Jones & Laughlin Steel Works and the Lehigh Portland Cement Works, at New Castle, Pa.

New Industrial Companies

The Ward Electric Company, of Asheville, N. C., has been incorporated with a capital stock of $10,000 to carry on a general electrical engineering business. The incorporators are W. A. Ward, M. C. Ward and others.

The Majestic Appliance Company, of New York, N. Y., has been incorporated with a capital stock of $10,000 by J. P. Ryan, 158 East Thirty-sixth Street, New York; W. Burrows, of New York, and A. Rosenburg, of Jamaica, N. Y.

The American Electric Sign Company, of New York, N. Y., has been granted a charter with a capital stock of $5,000. The incorporators are H. Goldschmidt, J. Lieberman and P. Adelstein, 3151 Third Avenue, New York, N. Y.

The Acton Electric Company, of New York, N. Y., has been incorporated with a capital stock of $27,000 to manufacture and deal in electrical appliances, etc. The incorporators are G. K. Hamblin, Metuchen, N. J., O. A. Hirsch and E. B. Walsh, of New York, N. Y.

The Perkiomen Electric Transit Company has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $25,000, to manufacture electrical apparatus and machinery. The incorporators are J. L. Wolcott, M. L. Cole and J. H. Hughes, of Dover, Del.

The Marathon Electric Manufacturing Company, of Wausau, Wis., has been incorporated by Neal Brown, D. C. Everest and E. M. Bischoff. The company is capitalized at $25,000 and proposes to manufacture small electric motors, from 1/60 hp to 2 hp. The company will manufacture both alternating-current and direct-current motors of special design.

The Wells Construction Company, of New Richmond, Wis., has been organized with a capital stock of $10,000 for the purpose of manufacturing and installing individual electric-lighting plants and to deal in electrical equipment. The officers of the company are: P. F. Neverman, president; P. C. Harmon, vice-president, and A. S. Wells, secretary and manager.

Trade Publications

Pyrometers.—Catalog No. 9 of the Brown Instrument Company, Philadelphia, Pa., illustrates and describes the comprehensive line of indicating and recording pyrometers made by this company.

Substations.—The Delta-Star Electric Company, 617 West Jackson Boulevard, Chicago, Ill., has recently issued an illustrated thirty-six-page bulletin describing its new-type steel-tower outdoor high-tension substations.

Auto Starters.—Leaflet 3512-A issued by the Westinghouse Electric & Manufacturing Company refers to the auto-transformer starter for squirrel-cage motors. Its construction is fully described and illustrated, as is also the overload relay with which it is equipped.

Bell-Ringing Transformers.—Folder 4172 of the Westinghouse Electric & Manufacturing Company describes its bell-ringing transformer and shows how it should be installed. On the back page is given a comparison between the old method of using batteries and the new way.

Lighting Standards.—In an artistic catalog recently issued by the J. L. Mott Iron Works, Fifth Avenue and Seventeenth Street, New York, are shown some representative examples of posts for electric and gas lighting. Electroliers, lanterns and brackets are shown in many beautiful designs.

Generating Sets.—Alternating-current directly connected generating sets are illustrated and described in Bulletin No. 25, issued by Engberg's Electric & Mechanical Works, St. Joseph, Mich. These sets are made in ratings up to 70 kva for several different speeds. Bulletin No. 24 refers to direct-connected sets.

Anchors.—The "Never Creep" anchor, manufactured by the Chance Manufacturing Company, Centralia, Mo., is illustrated and described in Bulletin No. 3, recently issued by the company. It is claimed for this device that it will hold as great a strain per square inch of surface as any known method of anchoring.

Washing Machines.—The Victor Manufacturing Company, Leavenworth, Kan., in a sixteen-page illustrated booklet with the title "Clean Clothes," gives suggestions for eliminating washday troubles by the use of the "Wonder" washer. Various types are illustrated, among them a motor-driven washing machine, of which a complete description is given.

Water Sterilizers.—In Catalog 14-H of the Forbes Company, 1234 Callowhill Street, Philadelphia, Pa., are described the Forbes water sterilizers, operated by electricity, steam and gas. The principle of operation is discussed and diagrammatically shown. Illustrations are given of some of the prominent buildings of the country in which the Forbes system has been installed.

Transformers.—In Bulletin No. 1280, issued by the Pittsburgh Transformer Company, Pittsburgh, Pa., emphasis is laid on the latest improvement in its transformers, that of the new pressed-steel case. This is said to be a radical improvement over the heavy cast-iron cases heretofore used. The advantages of the lesser weight are fully set forth in this bulletin.

Railway Appliances.—An unusually comprehensive catalog is that of the Ohio Brass Company, Mansfield, Ohio, designated as No. 14-1914. Within its 608 pages are listed a remarkably complete line of appliances used in the construction, maintenance and operation of electric railways, mine haulage systems and transmission lines. The arrangement of the book is excellent, the illustrations are good, and the descriptive matter is well prepared. A number of useful tables and a good index add value to the book.

Headlamps.—The "Golden Glow" headlamps made by the Esterline Company, Indianapolis, Ind., are the subject of an attractive catalog—No. 310—recently issued. The text is printed in black, and the illustrations are appropriately printed in black and yellow, showing realistically the lighting effect obtained by the use of these headlamps. The questions of parabolic reflectors, glass parabolas and incandescent bulbs are fully discussed, and different types of headlamps made by the company are illustrated and described.

Personal Mention

Mr. B. A. Behrend, consulting engineer of Boston, sailed this week on the *Aquitania* for a vacation trip on the Continent.

Mr. J. P. H. de Windt has been appointed general manager of the Birmingham (Ala.) Railway, Light & Power Company.

Mr. F. W. Stearns, vice-president and legal representative of H. M. Byllesby & Company, Chicago, has resigned and is contemplating a trip abroad.

Mr. W. H. Clarke, formerly assistant manager of the bond department of H. M. Byllesby & Company, Chicago, has been appointed manager of that department.

Mr. K. Norton has been appointed superintendent of the municipal electric light and water-works plant at Coldwater, Mich., as successor to Mr. W. H. Friedrich.

Mr. R. E. Wilsey, vice-president and manager of the bond department for H. M. Byllesby & Company, Chicago, has resigned his position and announced his intention of making a trip abroad accompanied by Mrs. Wilsey.

Mr. Lewis Buckley Stillwell, consulting engineer of New York and past-president of the American Institute of Electrical Engineers, was the recipient of the degree of doctor of science from his alma mater, Lehigh University, on June 9.

Mr. Cyprien Odilon Mailloux, president of the American Institute of Electrical Engineers, pioneer professional electrial engineer in America, and the first editor of the *Electrical World*, was honored with the degree of doctor of science by Lehigh University on June 9.

Mr. Edward M. Graham, who has been assistant to President John H. Graham of the Bangor (Me.) Railway & Electric Company, has tendered his resignation, effective July 1. Mr. Graham has purchased an interest in the Frank Ridlon Company, of Boston, contractors and dealers in electrical supplies.

Mr. A. H. Ford, whose resignation as president of the Birmingham (Ala.) Railway, Light & Power Company to accept the post of general manager of the Cumberland County Power & Light Company of Portland, Me., was announced in these columns on May 30, was presented with a silver service by the employees of the company on May 28.

Mr. Frank H. Gale, well-known advertising manager of the General Electric Company, suffered a bereavement by the death of his wife on May 31. Telegrams of condolence were forwarded to Mr. Gale by the Commercial Section of the National Electric Light Association at the Philadelphia convention, and by the transportation and exhibition committees, of all of which he is an active member, and also by a host of friends.

Dr. Harold Pender, professor of electrical engineering and director of the research division of the department of electrical engineering at the Massachusetts Institute of Technology, will become professor in charge of the department of electrical engineering at the University of Pennsylvania in the fall. This department was formerly under the joint direction of the Whitney professor of dynamical engineering, but from January next the electrical engineering department will be on an independent footing. A biographical sketch of Dr. Pender appeared in the *Electrical World* of Aug. 8, 1913.

Mr. W. A. Thomas, who for several years past has been commercial engineer in charge of all sales of mining apparatus for the Westinghouse Electric & Manufacturing Company, with headquarters at East Pittsburgh, Pa., has resigned his position with this company and has taken up the practice of consulting engineering in mining work at Pittsburgh. Mr. Thomas is a graduate of Pennsylvania State College, and after completing the testing course of the General Electric Company he was for two years in charge of the power equipment of the Pennsylvania Coal & Coke Company at Cresson, Pa.

Mr. Charles L. Eshleman, who was recently appointed vice-president of the Union Metal Manufacturing Company, was graduated from the electrical engineering course at the Pennsylvania State College in 1905 and spent two years in the students' apprenticeship course at the Pittsfield works of the General Electric Company. He has held positions as assistant manager of the lamp and transformer sales department of the General Electric Company, secretary and treasurer of the Jandus Electric Company and sales manager of the Adams-Bagnall Electric Company. He has served as statesman of the Jovian Order and as member of the executive committee and chairman of the publicity committee of the Cleveland Electrical Exposition.

Mr. E. L. Callahan, chairman-elect of the Commercial Section of the National Electric Light Association, is in charge of the various new-business departments of the electric-light, gas and railway properties controlled by H. M. Byllesby & Company. He is thirty-nine years old and was graduated from the Case School of Applied Science in 1900. For three and a half years he was in charge of the sale of electric heating apparatus for the General Electric Company with headquarters in Chicago. Prior to that time he was assistant manager of the Simplex Electric Heating Company, manager of the Prometheus Electric Company, and with Westinghouse, Church, Kerr & Company. The experience he gained in assisting central-station companies in building up electric heating loads and his later experience with the Byllesby syndicate fit him admirably for the post of chairman of the Commercial Section.

E. L. CALLAHAN

Mr. Alfred C. Einstein, first vice-president and general manager of the Union Electric Light & Power Company, St. Louis, Mo., was recently elected president of the Missouri Public Utilities Association. He has had wide experience in construction, operation and management of public utilities. Mr. Einstein was born at Hoboken, N. J., and was educated in the St. Louis schools. After spending several years at Washington University he gave up his studies to accept the general managership of a mining property in Silver City, Mexico. In 1890 he was elected president of the Consolidated Engineering Company, St. Louis, and later held the same office with the Paducah (Ky.) Electric Light & Street Railway Company. The St. Louis County Gas Company was organized by him. Mr. Einstein is also president of the Electric Company of Missouri, which controls the American Light & Power Company, the Tibbe Electric Company, the Pacific Electric Company and the Mississippi River Power Distributing Company.

A. C. EINSTEIN

Obituary

Jacob Furth, president of the Puget Sound Traction, Light & Power Company of Seattle and one of the best known men in financial circles in the Northwest, died June 2. Mr. Furth was born in Bohemia, Nov. 13, 1840, and came to the United States when he was seventeen years old, going directly to California. In 1882 he went to Seattle, and the following year established the Puget Sound National Bank, of which he remained the head until 1910, when it was consolidated with the Seattle National Bank, forming one of the largest banking institutions in the Pacific Northwest. Mr. Furth was made chairman of the board of directors of the consolidated bank and held that position until the time of his death.

Construction

New England

LANCASTER, N. H.—The Lancaster & Jefferson El. Co. may install a new boiler this summer. Walter U. Colby is superintendent.

WEST STEWARTSTOWN, N. H.—Within the next six months the William F. Allen Co., of West Stewartstown, expects to purchase two waterwheels and about 1900 ft. of steel penstock, 6 ft. in diameter. W. F. Allen is manager.

BOSTON, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 25 for mechanical equipment (except elevators), for the United States immigration station at Boston, Mass. Drawings and specifications may be obtained from the above office or from the custodian of site at Boston. O. Wenderoth is supervising architect.

NORTON, MASS.—The property of the Norton El. Lt. & Pwr. Co. has been purchased by parties said to be interested in the Norton & Taunton St. Ry. Co., of Norton. The new company, it is understood, will erect a power plant near Meadowbrook.

PITTSFIELD, MASS.—The city committee on fuel and street lighting has asked the Pittsfield El. Co. to submit to the city solicitor a contract drawn up for a term of five years embracing the use of luminous direct-current arc lamps made by the General Electric Co. The plans provide for 54 arc lamps erected on pressed-steel posts with hexagonal bases maintained by underground wires. The cost of installing the new lighting system is estimated at $12,000, which will be borne by the company.

PAWTUCKET, R. I.—The Blackstone Valley Gas & El. Co., controlled by the Stone & Webster Corpn., of Boston, Mass., has made arrangements with the Rhode Island Pwr. Transmission Co., a subsidiary of the New England Pwr. Co., by which the Blackstone Valley company will distribute throughout the territory it now serves electrical energy generated by the hydroelectric power plants of the New England Pwr. Co. on the Deerfield River and the Connecticut River Pwr. Co. on the Connecticut River. The steam-power plants of the Blackstone Valley company will be held in reserve for emergency purposes and to use during low-water periods.

NEW HAVEN, CONN.—A permit has been granted the United Illg. Co., of New Haven, to erect a new power house 200 ft. by 144 ft., to cost $90,000, to be located at Grande Avenue and Haven Street.

Middle Atlantic

BATH, N. Y.—The Village Trustees have engaged Mr. Larue, electrical engineer, of Cohocton, to prepare plans and specifications for the municipal electric-light plant, for which bonds to the amount of $50,000 have been voted.

BINGHAMTON, N. Y.—At an election held recently the proposal to issue $148,000 in bonds for the installation of a municipal electric-light plant in Binghamton was carried.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until June 15 for installing electric equipment in new Public School 170, on Sixth Avenue, between Seventy-first and Seventy-second Streets, borough of Brooklyn.

BUFFALO, N. Y.—Plans are being considered for placing the wires on Connecticut Street in underground conduits.

CLAYVILLE, N. Y.—The Town Board has signed a contract with the Utica Gas & El. Co., of Utica, to light the streets of the village. The company will also furnish commercial and residential lighting.

FRANKLINVILLE, N. Y.—Preparations are being made by the Cattaraugus County Ltg. Co., of Franklinville, for extensions and improvements to its system, material for which has been purchased. The equipment will include one 600-kw General Electric motor-generator set (three-phase, 25 to 62½ cycles, 250 volts), switchboard, five General Electric 250-kva, 2200/22,000-volt transformers, two outdoor-type substations, 1000 35-ft. poles. Joseph B. Mayer is president of the company.

LIVINGSTON MANOR, N. Y.—Within the next three months the Livingston Manor El. Co. expects to purchase a generator, exciter and transformers. W. R. Woolsey is secretary and general manager.

MECHANICSVILLE, N. Y.—Within the next three months the Mechanicsville El. Lt. & Gas Co. expects to purchase a switchboard totalizing watt-hour meter. Edwin Farrow is president and treasurer.

MIDDLEVILLE, N. Y.—The Middleville Electric Lt. Co. expects to purchase within the next three months one 50-hp boiler and engine (not yet decided whether kerosene, gasoline or steam will be used).

MOHAWK, N. Y.—The Electric Light Commissioners are expected to purchase material for ordinary extensions to distribution system; also electrical appliances and supplies to meet regular demands. F. D. DuBois is superintendent of the municipal electric plant.

TOMPKINSVILLE, N. Y.—Bids will be received at the office of the lighthouse inspector, Tompkinsville, N. Y., until June 17 for furnishing the lighthouse depot, Tompkinsville, with two oil engines and air compressors. Blank proposals and particulars may be obtained at the above office.

UNADILLA FORKS, N. Y.—The contract for installing an electric-light plant in Unadilla Forks is reported to have been awarded to Lynn H. Baldwin, of Utica. The plant will be owned and operated by Charles A. Backus.

UTICA, N. Y.—The Utica Gas & El. Co., of Utica, has awarded the contract for the construction of a new substation in Rome to Griffiths & Pierce. The building will be 30 ft. by 50 ft. and will have an output of 4000 hp. The company is also erecting a substation in Holland Patent which will supply the villages of Holland Patent and Stittville with electricity.

BELLEFONTE, PA.—The power plant of the State Center El. Co., it is reported, will be removed from Bellefonte to Milesburg. At the new location the plant will be operated by water power instead of steam power.

BEN AVON, PA.—Bids will be received by the Board of school directors of Ben Avon until June 18 for the general contract for electrical work. Plans and specifications and necessary information may be obtained at the office of R. M. Trimble, architect, 705 Ferguson Building, Pittsburgh, Pa. Post office address, Ben Avon, R. F. D., Allegheny, Pittsburgh.

EMPORIUM, PA.—Improvements, it is reported, are contemplated to the municipal electric-light plant, including the installation of a 150-hp gas engine to be operated with natural gas, directly connected to a two-phase, 2200-volt generator, switchboard with necessary station equipment, also extension to distribution lines, including transformer, meters, etc. It is understood that material has not yet been purchased. For further information address Charles Crandall, secretary of borough council.

HAMBURG, PA.—Bids will be received by Dr. Samuel G. Dixon, Commissioner of Health, State Department of Health, Commonwealth of Pennsylvania, Philadelphia, until June 20 for construction of power plant and equipment for the State Sanatorium for Tuberculosis, near Hamburg, Berks County, Pa. Plans and specifications may be obtained at the office of the State Department of Health, in Harrisburg or Philadelphia, upon deposit of $25, to be refunded upon return of same.

HARRISBURG, PA.—Notice has been given that application will be filed by J. C. Dickey, W. O. Grueneisen and R. E. Vokacl with the Governor of Pennsylvania on June 17 for a charter to incorporate the West Deer Township El. Co., at West Deer, Allegheny County. The company proposes to generate and distribute electricity for lamps, heaters and motors in West Deer.

KITTANNING, PA.—The plans and specifications prepared by Arthur M. Morgan, of Chicago, Ill., engineer, for the proposed municipal electric-light plant and water-works system have been approved by the Council.

LANSDALE, PA.—Bids will be received by R. S. Landis, chairman of the Electric Light Department of the borough of Lansdale, until July 1 for the following supplies (separate bids to be submitted): Contract for Mazda lamps, 4000 ft. No. 2 6000 ft. No. 6, 3000 ft. No. 8, 3000 ft. No. 10, B. & S. gage, triple-braided copper wire, 2000 lineal ft. Washington fir cross-arms (3¼ in. by 4¼ in.), 500 cross-arm braces (1¼ in. by ¼ in. by 28 in. long), 1000 carriage bolts (¾ in. by 4 in. long), 600 steel pins (½ in. by 9½ in.), including 4½-in. locust-wood tops—all of the above to be galvanized by the heat process; 2500 ft. arc-lamp cord (¾ in. in diameter), two barrels Kempo wedge knobs to take No. 14 and No. 12 wire, porcelain tubes in barrel lots, six duplex mast arms, 12 ft. long, galvanized, miscellaneous pipe covering; also 25-ft., 30-ft. and 35-ft (8-in. top) chestnut poles. For details see proposal columns. Peter S. Dirks is superintendent of municipal electric-light plant.

LOYALSOCK, PA.—Property owners in Vallamont have petitioned the Supervisors of Loyalsock Township for the installation of a street-lighting system. The plans provide for the initial installation of 35 incandescent lamps and more later.

PHILADELPHIA, PA.—The contract for the construction of the building on the Parkway at the intersection of Seventeenth Street for the Bell Tel. Co. has been awarded to Cramp & Co. The building will be 157 ft. by 68 ft., 15 stories high, and will cost about $2,000,000 with equipment.

PITTSBURGH, PA.—Contract has been awarded by the Duquesne Lt. Co., of Pittsburgh, for the construction of a new substation on Warrington Avenue, near the south end of the Mount Washington tunnel, to cost about $15,000.

WASHINGTON, PA.—The Borough Council has granted the Relief El. Lt., Ht. & Pwr. Co. a franchise to furnish electricity in this borough. This is the second franchise granted the company. The former ordinance granting the company a franchise was vetoed by the Burgess and failed to pass the Council over the veto.

WILMERDING, PA.—Work has begun on the construction of a new power house on Fourth Street, Wilmerding, for the United El. Co.

WINBER, PA.—Plans have been completed by the Winber Tel. Co. for the installation of an entire new telephone system, including the erection of about 4 miles of new poles, installation of a new switchboard and new cables.

ATLANTIC CITY, N. J.—The Board of Public Utility Commissioners has granted the petition of the Atlantic City El. Co. to issue $103,000 in bonds, the proceeds to be used for fixed capital expenditures to plant and equipment.

FREEHOLD, N. J.—The Monmouth Ltg. Co., of Freehold, expects to erect within the next three months 10 miles of three-phase transmission line. The work will probably be given out by contract.

NEWARK, N. J.—The Shade Tree Commission has made an appropriation in its adopted budget of $3,000 for new lamps in Military Park.

NEWARK, N. J.—The contract for the tunnels and foundations in connection with the proposed eight-story terminal building which the Public Service Corpn. is to erect in Newark has been awarded to Holbrook, Cabot & Rollins Corpn., of New York. Proposals will soon be asked for construction of the building. The cost of the terminal complete, including track changes, is estimated at about $5,000,000.

ORANGE, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 10 for construction, including mechanical equipment and approaches, of the United States post office at Orange, N. J. Drawings and specifications may be obtained from the above office or from the custodian of site at Orange, or from York & Sawyer, architects, 50 East Forty-first Street, New York, N. Y. O. Wenderoth is supervising architect.

WASHINGTON, N. J.—Within the next three months the Washington El. Co. expects to build a new coal-handling system. The company has recently installed a 16-in. by 36-in. Hughes & Phillips Corliss engine, to replace two high-speed engines. Theodore Haldeman is superintendent.

BALTIMORE, MD.—The Pennsylvania Wtr. & Pwr. Co., of Holtwood, has awarded the contract for the construction of addition to substation on Philadelphia Road to the B. F. Bennett Building Co., 123 Howard Street, Baltimore. The building will be about 50 ft. by 54 ft., of brick and concrete construction.

BALTIMORE, MD.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 8 for repairs and additions to heating systems in the United States post office, court house, etc., in Baltimore. For details see proposal columns. O. Wenderoth is supervising architect.

CUMBERLAND, MD.—Preparations are being made by the N. & G. Taylor Co., of Cumberland, Md., for enlarging its plant, at a cost of $100,000, which will include a steel building 80 ft. by 100 ft., an additional 25-ton open-hearth furnace with a 40-ton overhead traveling crane and a 3-ton charging machine; also the installation of a 300-kw generator directly connected to a 500-hp engine in the power house.

EASTON, MD.—Bids will be received at the office of the Easton Electric Commission until July 8 for furnishing equipment and material for municipal electric-light plant as follows: engines, generators, switchboard, boilers, stack, feed-water heater, piping and pumps, changes to building, pole line and street-lighting equipment, in accordance with plans and specifications prepared by the Reliance Engineering Co., Fourth National Bank Building, Cincinnati, Ohio. For details see proposal columns. L. H. Chaffinch is president of commission.

THURMONT, MD.—The Burgess and Borough Council are considering the question of purchasing from the Hagerstown & Frederick Ry. Co., of Frederick, electrical energy for commercial and residential lighting and also for street-lighting, at least during the low-water periods.

WILLIAMSPORT, MD.—At a special election held recently the proposal to issue $40,000 in bonds for the installation of a municipal electric-light plant in Williamsport was defeated.

ABINGTON, VA.—The city of Abington, it is reported, has contracted with the Bristol Gas & El. Co., of Bristol, Tenn.-Va., for furnishing electricity for street-lighting and power purposes.

FREDERICKSBURG, VA.—The Spottsylvania Pwr. Co. has been organized to take over the Electric Generating Co., and Fredericksburg Pwr. Co., of Fredericksburg, and the Virginia Lt. & Pwr. Co., of Ashland, Va. The maximum capital stock is placed at $2,000,000. The officers are: William C. Whitner, of Rock Hill, S. C.; H. G. Northrop, of Fredericksburg, vice-president and treasurer, and G. B. Williams, of Richmond, secretary. The principal office of the company will be in Fredericksburg.

MENDOTA, VA.—The installation of an electric-lighting system is reported to be under consideration. J. C. Payne is Mayor.

WASHINGTON, D. C.—The Electrical Department of the District of Columbia is planning to install 1500-cp lamps on F and G Streets, between Seventh and G Streets, and on D Street between Seventh and Tenth Streets. Arc lamps are to be erected on Eighth, Ninth, Tenth, Eleventh, Twelfth, Thirteenth and Fourteenth Streets. Incandescent lamps of 100 cp are now being installed in the business district inclosed by G, I, Fifteenth and Seventh Streets.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until June 18, for furnishing 20,000 dry cells in accordance with Signal Corps specifications 221-F and drawings 99-7; batteries (two cells each) for calvary buzzers, in accordance with drawing 410 c-3; ¾-in. by 2½-in. miniature dry cells; No. 711, eveready, dry tungsten batteries (battery to have two cells instead of three) specifications 221-F. Captain Charles S. Wallace is chief signal officer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 23, for furnishing at the various navy yards and naval stations the following supplies: Puget Sound, Wash., Schedule 6843—three three-motor, 5-ton bridge cranes. Brooklyn, N. Y., Schedule 6856—four hot-wire ammeters, 4500 ft. armored, double-conductor wire, miscellaneous magnet wire; Schedule 6855—16,000 ft. rubber-covered wire; Schedule 6886—20,000 ft. armored and leaded, steel, twin-conductor wire. Philadelphia, Pa., Schedule 6866—400 lb. hard-bar copper, 2700 lb. sheet copper. Bids will also be received at the same place until June 30 as follows: Philadelphia, Pa., Schedule 6861—miscellaneous three-conductor potheads, miscellaneous panel and switches, 470 ft. three-conductor wire, 880 lb. bare copper wire; Schedule 6878—two 200-kw generating sets. Portsmouth, N. H., Boston, Mass., Brooklyn, N. Y., Philadelphia, Pa., and Norfolk, Va.—annual supply of boiler compound as per Schedule 6893. Bids will also be received until July 14 as follows: Mare Island, Cal., Schedule 6851—miscellaneous generating sets and spare parts. Brooklyn, N. Y., Schedule 6881—three fire-room hoist engines. T. J. Cowie is paymaster general of U. S. N.

North Central

DETROIT, MICH.—The contract for laying conduits for the Public Lighting Commission and the Detroit Fire Department on Cass, Second and Third Avenues under the new viaducts of the Michigan Central and Grand Trunk Railway crossings has been awarded to Frank H. Davis.

FLINT, MICH.—The City Council has instructed the city electrician to prepare plans, estimates of cost, etc., providing for the installation of underground conduits for electric wires on Saginaw Street.

GRAND RAPIDS, MICH.—Four electric elevators will be installed in the new building being erected by the Manufacturers' Realty Co. in Grand Rapids, to be occupied by the American Paper Box Board Co.

ISHPEMING, MICH.—The Northern Michigan Pwr. Co., incorporated in Maine, with headquarters in New York, N. Y., has filed articles of incorporation with the Secretary of State at Lansing. The headquarters in this State are in Ishpeming. The company is capitalized at $6,000,000. William P. Belden, of Ishpeming, is president.

OSSEO, MICH.—If sufficient patronage can be secured to warrant the expense, electricity will be furnished in Osseo from the municipal electric-light plant in Hillsdale, 6 miles distant.

BLUFFTON, OHIO.—The Western Ohio R. R. Co., of Lima, has submitted a proposal to the Town Council offering to furnish electricity for lamps and motors in Bluffton. Improvements to the municipal electric-light plant, it is understood, are contemplated.

CEDARVILLE, OHIO.—The Cedarville Lt. & Pwr. Co. is planning to erect a large steam-turbine plant in Cedarville. The company furnishes electricity in Clifton and Yellow Springs as well as Cedarville.

CINCINNATI OHIO.—Plans are being considered by the Main Street Merchants' Association for the installation of an ornamental street-lighting system on Main Street.

DAYTON, OHIO.—Plans are being considered by the Carrmonte Improvement Association, of Carrmonte, situated near Dayton, for the installation of an electric-lighting system.

MIDDLEPORT, OHIO.—F. C. Elliott, of Chicago, Ill., trustee, has purchased the property of the Mutual El. Lt. Co., of Middleport. It is understood that a connection will be made at once with the large plant owned by Martin Ebersbach in order to serve the local field until the high-tension transmission lines can be connected with the central power station in the Hocking Valley.

PAINESVILLE, OHIO.—As yet nothing definite has been decided in regard to the installation of an ornamental lighting system in Painesville. Reported in the issue of May 16 to be preparing plans for the installation of an electric-lighting system. Chester Hard is superintendent of the municipal electric-light plant.

RUSHSYLVANIA, OHIO.—The Village Council has granted William S. Lehrer a franchise to construct and operate an electric-light plant in Rushsylvania.

SEBRING, OHIO.—The McKee Lt. & Pwr. Co., of Sebring, has applied to the City Council for permission to erect 18 of the new type C lamps on Fifteenth Street between Pennsylvania Avenue and Maryland Avenue. In presenting this request the company asks for a new franchise.

SEVILLE, OHIO.—Bids will be received by S. D. Hall, village clerk, until June 22 for an electric distribution system in Seville.

SIDNEY, OHIO.—The property of the Sidney El. Co. is reported to have been purchased by the Albert Emanuel Co., of Dayton. E. D. Elwell will continue as manager.

ASHLAND, KY.—Rufus Vinsant, of Ashland, and others, it is reported, are interested in a project to install an electric-light plant and water-works system in Ashland.

BARBOURVILLE, KY.—The City Council has passed an ordinance providing for the installation of new street-lighting. The Barhourville El. Lt., Ht. & Pwr. Co. is rebuilding its plant and will furnish electricity for power purposes when completed.

CADIZ, KY.—George L. Smith and Stanley White have been granted a franchise to install and operate an electric-light plant in Cadiz. The proposed plant will be operated by water-power.

LOUISVILLE, KY.—William Schuff & Co., of Louisville, have decided to discard steam power and equip their tannery with electrically operated machinery. About 250 hp will be required, which will be obtained from the Louisville Gas & El. Co.

CHARLESTOWN, IND.—The Town Board has entered into a new contract with the Louisville & Northern El. Ry. & Ltg. Co. The contract provides for replacing the present arc lamps, of which there are 35, with 55 tungsten lamps of 80 cp.

EVANSVILLE, IND.—Bids will be received by the Board of Public Works, Evansville, until June 29 for lighting the streets and other public places with electricity and gas, and for furnishing electricity and gas for use in public buildings. For details see proposals columns. Edward N. Frisse is clerk.

FRANKFORT, IND.—Within the next 12 months the electric light committee expects to purchase an ash-handling system and one 75-lamp, 6.6-amp. mercury rectifier for series arc lamps. The committee has also under consideration the use of a synchronous motor to improve the power-factor. R. W. Hendrix is secretary.

INDIANAPOLIS, IND.—The Firestone Tire & Rubber Co., of Indianapolis, it is reported, will erect an addition to its plant. One extension will be 60 ft. by 120 ft., five stories, and the other 140 ft. A new 4000-kw generator with steam turbine will be installed and the present switchboard replaced by a new gallery board 70 ft. in length.

EVANSTON, ILL.—The Northwestern University, it is reported, is contemplating the installation of an electric-light plant.

JOLIET, ILL.—Improvements involving an expenditure of $60,500 are to be made to the municipal electric-light plant and will include the installation of one triplex plunger pump, one 40-hp motor, three Harris air lifts, one artesian well, replacing smokestacks at water plant, two motor-driven compressors, complete on foundations for water-works plant, and one 4,000,000-gal. concrete reservoir. C. D. O'Callahan is city clerk.

KEENSBURG, ILL.—The Mount Carmel Pub. Utility & Ser. Co., of Mount Carmel, is considering the question of extending its service to Keensburg.

BELDENVILLE, WIS.—The installation of an electric-lighting system in Beldenville is under consideration. H. O. Junkman is reported to be interested in the project.

FREDONIA, WIS.—L. H. Schmitz, it is reported, is contemplating installing an electric-light plant in Fredonia.

HIBBING, MINN.—The Water and Light Board has instructed E. B. Jackson, consulting engineer, of St. Paul, to prepare plans for the construction of a heating plant, to cost $10,000, to be operated in connection with the proposed new electric plant.

MURDOCK, MINN.—Plans are being considered for the installation of an electric-lighting system in Murdock.

RED CLOUD, MINN.—The electric light commissioners expect to purchase a small amount of wire and supplies for distribution system. Guy Zeigler is superintendent.

SPRINGFIELD, MINN.—A committee, consisting of Mayor Rieck, A. C. Ochs and Oscar Erickson, has been appointed to make investigation relative to the cost of the installation of a new municipal electric-light plant. The installation of an ornamental street-lighting system in the business section is under consideration. George P. Forster is chairman of the committee in charge of the proposed lighting system.

VILLARD, MINN.—Bonds to the amount of $5,000 have been voted for the installation of an electric-lighting system in Villard.

CEDAR RAPIDS, IA.—The contract for electric wiring for the Hayes grade school has been awarded to C. E. Fawcett, of Cedar Rapids, at $4,030; for generator set to the Ridgeway Dynamo & Engine Co., of Ridgeway, Pa., at $3,020.

CHARLES CITY, IA.—The Charles City Ltg. & Htg. Co., of Charles City, has changed its name to the Cedar Valley Pwr. Co. and has purchased plants or obtained franchises in the following towns: Nashua, Clarksville, Bristow, Allison, Dumont, Parkersburg, Hampton. Chapin, Sheffield and Rockwell, and will furnish electricity to these towns as soon as possible; the company also expects to extend its service to other towns. The capital stock of the company is placed at $1,000,000. The officers are: H. H. Caughlan, of Waterloo, president; M. A. Harrison, of Hampton, vice-president, and A. L. Dodd, of Charles City, secretary and general manager.

DUBUQUE, IA.—Steps have been taken by the Traveling Men's Greater Dubuque Club for extending the ornamental lighting system the entire length of Main Street.

LINN GROVE, IA.—At a special election held recently the proposal to grant the Peterson Pwr. & Lt. Co. a 25-year franchise to furnish electricity in Linn Grove was carried.

WAUCOMA, IA.—Contracts have been awarded by the Town Council for the construction of dam, flumes, equipment, etc., for the proposed municipal electric-light plant, as follows: For construction of concrete dam and concrete work to Chambers & Dobson, of New Hampton: waterwheels or turbines to James Leffel & Co., of Springfield, Ohio: switchboard and line material to Julius Andrae & Sons Co., of Milwaukee, Wis., and pole-line construction to C. E. Mackey, of Waverly.

WYOMING, IA.—At an election to be held June 20 the proposal to grant the local electric light company a renewal of its franchise will be submitted to the voters. The franchise does not expire for several years, but the company is contemplating extensive improvements to its system, provided the extension of franchise is granted.

HOPKINS, MO.—Within the next two months the Hopkins El. Lt. & Ice Co. expects to build an electric-light plant complete, including distribution lines and transformers; also to purchase one 65-hp oil engine, one 45-kw or 50-kw, three-phase, 2300-volt alternator, with exciter and switchboard, material for distribution line, including about 300 poles and 100 meters; one 4-kw, 6.6-amp transformer for street-lighting system with switchboard panel. When improvements are completed a 24-hour service will be established and the company is expecting to use a number of motors, irons, cooking apparatus and other household devices. G. D. Henderson is manager and engineer.

KANSAS CITY, MO.—The Dorn-Cloney Laundry Co., of Kansas City, will not build its power plant until next year. Reported in the issue of May 23 to be contemplating the installation of a power plant.

LA PLATA, MO.—The La Plata Lt. & Pwr. Co. expects to purchase within the next four months one car load of poles and 50 meters. J. M. Atkinson is manager.

SEDALIA, MO.—The City Lt. & Trac. Co., of Sedalia, is installing a La Blanc condenser and cooling tower. Harry D. Frueauff is treasurer and manager.

TOWER CITY, MO.—Plans, it is reported, are being prepared by Aiken & Barlett, of Fargo, for the installation of an electric-light plant in Tower City.

WIMBLEDON, N. D.—The Wimbledon El. Co., recently incorporated with a capital stock of $10,000, will soon begin work on the construction of an electric-light plant to be installed in the Wimbledon Motor Co.'s garage. F. H. Etter, Robert Clendening and others are interested in the company.

ARMOUR, S. D.—The new central power plant of the Interstate Pwr. Co., it is reported, will be situated in Armour. Material is now being ordered. The new plant will furnish electricity in Scotland, Platte and Wagner. A 24-hour service will be furnished to all towns on the circuit when the plant is completed. J. F. Cameron is manager of the Dakota plants.

ARTESIAN, S. D.—A. G. Schuler, president of the Schuler El. Co., of Woonsocket, has submitted a proposal to the Town Council offering to furnish electrical service in Artesian from its plant in Woonsocket. It is proposed to install a larger plant in Woonsocket.

ALLIANCE, NEB.—The city of Alliance is considering the purchase of a 12-kva constant-current transformer, 80 central support fixtures, wires and other material for series tungsten street-lighting system; also to purchase a pump with capacity of 1000-gal. per minute, and to build a 500,000-gal. reservoir. J. E. Hughes is superintendent.

FAIRBURY, NEB.—The Electric Light Commissioners expect to purchase within the next three months one 75-kw alternator (Red Fields, 720 r.p.m.) and switchboard. G. D. Myers is superintendent.

MEAD, NEB.—Bids will be received until June 26 for construction of an electric-light plant and water-works system, to cost about $13,000. Bruce & Standevin, 430 Bee Building, Omaha, are engineers.

PRAGUE, NEB.—Within the next five months the village of Prague expects to erect a new tower house (concrete-block building). Anton Kaspar is village clerk.

BARNES, KAN.—The installation of an electric-light plant in Barnes is reported to be under consideration. The cost of the system is estimated at $5,000.

VALLEY FALLS, KAN.—The Valley Falls El. Lt. Co. is installing an oil engine and adding another generator to its plant. Reported in the issue of May 30 that the City Council was planning to make improvements to plant. H. Swartz is proprietor of plant.

WELLSVILLE, KAN.—The contract for construction of the new electric-light plant in Wellsville has been awarded to the Bushong Electrical Works, of Ottawa, to cost about $7,000. C. A. Smith, of Wellsville, is proprietor.

Southern States

BAT CAVE, N. C.—J. T. Patrick, of Bat Cave, it is reported, contemplates the construction of a hydroelectric plant and will require equipment for same.

SCOTLAND NECK, N. C.—Plans are being prepared by L. R. Mills, superintendent of the municipal electric-light plant, for increasing the output of the plant.

ALLENDALE, S. C.—The City Council has engaged the H. S. Jaudon Engineering Co., of Savannah, to take charge of the construction of the proposed electric-light plant, water-works and sewer systems, for which $65,000 in bonds was recently voted. E. H. Oswald is chairman of Public Works Commission.

BATESBURG, S. C.—Plans, it is reported, are being prepared by the J. B. McCrary Co., of Atlanta, Ga., for electric-light plant, water-works and sewer systems, to cost about $25,000.

PORT ROYAL, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, S. C., until June 27 for furnishing and installing one boiler-feed water purification system with an open-type feed-water heater in the central power plant at the Naval Disciplinary Barracks, Port Royal, S. C. Plans and specifications may be obtained on application to the bureau. H. R. Stanford is chief of bureau.

PROSPERITY, S. C.—The city of Prosperity, it is reported, has engaged the J. B. McCrary Co., of Atlanta, Ga., to prepare plans for the construction of an electric-light plant, to cost about $10,000.

ATHENS, GA.—The Athens Mfg. Co. contemplates making improvements to its water-power plant. J. D. Moss is president.

BALL GROUND, GA.—The Amicola Marble Co., of Ball Ground, it is reported, has purchased a water-power sits on the Etowah River at Gober Station, about 3 miles from Ball Ground, where it will install a hydroelectric power plant, to develop about 500 hp. It is understood that the present dam and grist mill now on site will be used. Electricity generated at the plant will be used to operate the marble works of the company and other industries in Ball Ground, also for street-lighting and to operate the pumping station for the town.

CHATSWORTH, GA.—The city of Chatsworth has engaged the J. B. McCrary Co., of Atlanta, to prepare plans for electric-light plant and water-works system.

REYNOLDS, GA.—The City Council is considering the question of installing a municipal electric-light plant. The plans provide a gasoline engine and 100 lamps of 100 cp for street-lighting system. G. L. Cooper is secretary and treasurer.

PUNTA GORDA, FLA.—Bids will be received by J. F. Corbett, clerk of the Board of Bond Trustees, until June 30 for the installation of a 30-kva, 60-cycle, three-phase, 2300-volt, belted type generator, with pulley, rails and rheostat; a 2-kw, 115-volt direct-current exciter; Blue Vernon marble switchboard, with instruments; 20-ft. line shaft with hangers, collars and pulleys; vertical-type oil engine, complete with fuel tanks, pipe and fittings, exhaust pot, magneto battery and necessary tools, oilers, etc.; 7-in. x 10-in. duplex power pump, having a capacity of 330 gal. per minute, to be installed on foundations furnished by the town.

CHATTANOOGA, TENN.—Bids will be received by the city of Chattanooga until July 10 for lighting the streets and parks of the city for a period of five years. The contract with the Chattanooga Ry. & Lt. Co. expires in the fall.

FULTON, TENN.—Preparations are being made for the installation of an electric-lighting system, water-works and sewerage system in South Fulton, to cost about $45,000. R. C. Huston & Co., Exchange Building, Memphis, are engineers in charge.

OOLTEWAH, TENN.—The installation of an electric-light plant and waterworks system in Ooltewah is under consideration.

UNIONTOWN, ALA.—Within the next few months the Water and Light Department expects to purchase about 200 water meters. T. C. Collier is engineer.

BERWICK, LA.—At an election held recently the proposal to establish a municipal electric-light plant in Berwick was carried.

BROWNSVILLE, TEX.—It is reported that Albert A. Browne and associates, who have recently purchased the Rio Grande Railroad, which runs from Brownsville to Point Isabel, a distance of 22 miles, and the local street-railway system, contemplate the construction of an electric power plant to furnish electricity to operate the combined system. Gasoline motors are now used on the cars, but the new owners will equip the lines for electrical operation.

NEWSOME, TEX.—The installation of an electric-light plant in Newsome is under consideration. F. M. Streetman is reported interested in the project.

VICTORIA, TEX.—The property of the Victoria Mfg. Co., owned by John J. Welder, which furnishes electricity in Victoria, has been purchased by the South Texas El. Co., of Boston, Mass. The new owners, it is understood, contemplate a street railway system for Victoria.

Pacific States

BLAINE, WASH.—Improvements are contemplated by the Farmers' Mutual Tel. Co. to the local system, to cost about $10,000. The work will include a new switchboard and a cable system.

EVERETT, WASH.—The Florida Land Co., which owns a large tract of land at Beverly Park, has announced its intention of installing an electric-lighting system in that section of the city, electricity for which will be supplied by the Everett Ry., Lt. & Pwr. Co. The latter company has recently petitioned the County Commissioners for a franchise to erect a transmission line from the Interurban Road to Beverly Park, and if granted, the work will be completed this summer.

HUSUM, WASH.—The Northwestern El. Co., of Portland, Ore., it is reported, will build a new concrete dam on the White Salmon River this year for electrical development.

SEATTLE, WASH.—J. D. Ross, superintendent of lighting, recently notified the County Commissioners of King County that the city of Seattle would immediately make use for power transmission of its common-user rights over the poles of the Puget Sound Trac., Lt. & Pwr. Co. north of the city, bounded by Woodland Park Avenue and Evanston Avenue. This, it is understood, means that the transmission lines of the municipal electric-light system will be extended at once.

SEATTLE, WASH.—Bids will be received by the Board of County Commissioners of King County, Seattle, until June 29 for erection and completion of court house building, covering block 33 of C. D. Boren's addition to the city of Seattle. Plans and specifications may be obtained from A. Warren Gould, American Bank Building, upon deposit of $25.

SPOKANE, WASH.—The City Council is considering the installation of an ornamental electrolier lighting system on Main Avenue from Monroe Avenue to Division Street (the same system as recently installed on Riverside Drive).

BURNS, ORE.—The Harney El. Co., recently organized, proposes to take over the water rights filed by J. Edwin Johnson on the North Fork of the Malheur River, about 20 miles north of Drewsey. Energy developed will be used for irrigation purposes and for lamps, beaters and motors in Burns and Drewsey and surrounding territory. The company is capitalized at $250,000 and the headquarters will be in Burns.

DRAIN, ORE.—The city of Drain has voted bonds to the amount of $15,000 for the installation of a municipal hydro-electric light plant. The Council has not yet engaged an engineer or taken any action on the matter. George V. Sanders is city recorder.

PORTLAND, ORE.—Commissioner Daly will ask the City Council to recommend the appointment of an electrical engineer to make investigations of the feasibility and cost of establishing a municipal electric plant on one of two sites, both of which belong to the city, one capable of developing 10,000 hp and the other 30,000 hp, to furnish electricity for lighting the streets, public buildings, etc., of the city and also for commercial purposes. The present contract with the Portland Ry., Lt. & Pwr. Co. will expire in two and one-half years.

LOS ANGELES, CAL.—Bids will be received at the office of the United States Reclamation Service, Federal Building, Los Angeles, until July 14 for furnishing a variable-head turbine for the Salt River project. For particulars address the United States Reclamation Service at Los Angeles, Cal., or Washington, D. C. F. H. Newell is director.

LOS ANGELES, CAL.—Of the proceeds of the $6,500,000 power bonds voted May 8 for the completion of the aqueduct power project, approximately $1,250,000 will be used for completion of power plant, building a central receiving station in Los Angeles, and a transmission line from the plant to Los Angeles, for which equipment for material has been purchased; cable and insulators have also been purchased for the transmission line. Bids will be called at an early date for steel towers for transmission line. The $5,250,000 voted for the distributing system within the city is intended to be used for the purchase of existing lines already installed.

SANTA BARBARA, CAL.—Negotiations have practically been closed between J. T. Huntington, manager of the Santa Barbara Gas & El. Co., and the citizens of Carpinteria, whereby the former will furnish electricity for lamps and motors to the residents of the valley.

SAN FRANCISCO, CAL.—The electricity committee of the Board of Supervisors has decided to establish an additional district in which electric wires shall be placed underground.

ELK CITY, IDAHO.—Plans are being prepared for the erection of a hydroelectric power plant on the Red River, near Elk City. The proposed plant will develop from 700 hp to 1000 hp. Alfred Adams, Hunter B. Supplee, of Elk City, and others, are interested in the project.

IDAHO FALLS, IDAHO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 10 for construction, complete, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Idaho Falls, Idaho. Drawings and specifications may be obtained at the above office or from the custodian of site at Idaho Falls. O. Wenderoth is supervising architect.

MOSCOW, IDAHO.—The Washington Wtr. Pwr. Co., of Spokane, Wash., has applied to the Public Utilities Commission of Idaho for permission to extend its transmission lines connecting its power plants on the Spokane River with its distributing systems in Moscow, Genesee and Troy.

MANTUA, UTAH.—At an election held recently the proposal to install an electric-lighting system in Mantua was carried. Electricity for operating the system will be purchased from the electric plant in Brigham City. Mantua has not a post office.

MORGAN, UTAH.—The power plant of the Como Lt. & Pwr. Co., of Morgan, situated near the narrows in the Hard-Scrabble Canyon, has been purchased by the Utah Pwr. & Lt. Co.

NOGALES, ARIZ.—At an election held May 25 the proposal to grant S. S. Portor, of Nogales; and M. M. Mansfield, of Tucson, a franchise to supply electricity for lamps and motors in Nogales was carried.

SAFFORD, ARIZ.—The electric plant of the Gila Valley Lt., Pwr. & Wtr. Co., of Safford, was recently destroyed by fire. At present the town is without electrical service.

TUCSON, ARIZ.—Bids will be received at the office of L. O. Cowan, city clerk, until July 6 for 60 or more five-lamp and 26 or more single-lamp ornamental street-lamp standards, without globes or bulbs. The five-lamp standards to be equipped with a terminal block for four connections, the single-lamp standard to be equipped with a terminal block for two connections. Internal wiring arranged so that the lamps shall be connected in series and each pole equipped with a porcelain series socket.

LIVINGSTON, MONT.—The City Council is considering the installation of an ornamental street-lighting system and also a fire-alarm system. An election will be called in the near future to submit the proposal to the voters.

TRINIDAD, COL.—The officials of the St. Louis, Rocky Mountain & Pacific R. R. Co. in New Mexico have entered into a contract with the Trinidad El. Trans., Ry. & Gas Co., of Trinidad, to furnish electricity to the five mines owned by the railroad company at Brilliant, Gardiner, Sugarite, Van Houten and Koehler. The cost of erecting and equipping the transmission line to the mines is estimated at about $115,000. The city of Raton, N. M., will also purchase energy from the Trinidad company.

MAGDALENA, N. M.—The Magdalena Lt. & Pwr. Co. is building an electric-light and power, cold-storage and ice-manufacturing plant in Magdalena.

Canada

LACOMBE, ALTA.—A by-law will soon be submitted to the ratepayers asking for authority to purchase a boiler for the municipal electric-light plant.

PRINCE RUPERT, B. C.—The engineer engaged by the City Council to investigate the feasibility and cost of installing a municipal hydroelectric plant estimates the cost at $248,845, and that $22,320 would be required for electrical equipment. It is understood that preliminary steps toward construction will be taken at once.

WINNIPEG, MAN.—Tenders will be received by the Board of Control, Winnipeg, until June 18 for the supply of globes, electrodes, carbons, cut-outs, etc. Specifications may be seen at the office of J. C. Glassco, engineer, 54 King Street Winnipeg.

WINNIPEG, MAN.—J. G. Glassco, manager of the light and power department of the city of Winnipeg, writes that no addition to the ornamental lighting system is contemplated at this time. Reported in the issue of May 23 to be planning for extensions to the ornamental lighting system on Portage Avenue.

HALIFAX, N. S.—The Halifax El. Tramway Co., it is reported, contemplates the installation of a 2200-kw high-pressure turbo-generator set.

GANANOQUE, ONT.—The Gananoque El. Lt. & Wtr. Supply Co. has awarded a contract for an addition to its power house.

GRAVENHURST, ONT. — The Town Council has awarded the contract for the construction of a substation in Gravenhurst to Etler & Clift, of Gravenhurst.

RENFREW, ONT.—The Hydro-Electric Power Commission of Ontario has submitted an estimate of the cost of installing a street-lighting system in Renfrew, which is placed at about $16,000.

LACHINE, QUE.—A by-law for improvements, including a large sum for laying underground conduits, has been passed by the ratepayers.

MONTREAL, QUE.—Mr. Parent, superintendent of lighting for the city of Montreal, has submitted to the City Controllers a report of the cost of a municipal electric plant, to maintain 500 lamps for the central districts, in which the capital expenditure is placed at $172,667 and the annual operating expenses at $54,100, making the cost per lamp $108 per year. The report was compiled as the result of a disagreement with the Montreal Lt., Ht. & Pwr. Co. as to the cost of lighting the district by means of underground distribution, the controllers considering the price of $156 per lamp per annum asked by the company too high.

THREE RIVERS, QUE.—The City Council has engaged James Bennett, electrical engineer, Board of Trade, Montreal, to prepare plans for a new street-lighting system. It is proposed to replace the present arc lamps with new arc lamps erected on ornamental standards, to he maintained by underground wires. Electricity for operating the lamps will be supplied by the North Shore Pwr. Co. The Council is also considering the question of renewing the franchise for street and commercial lighting held by the North Shore Pwr. Co., of Three Rivers.

VAUDREUIL, QUE.—The Vaudreuil El. Co., a subsidiary of the Cedars Rapids Mfg. & Pwr. Co., is erecting a 12,000-volt, two-circuit pole transmission line from Cedars to Vaudreuil, a distance of 6 miles. The company is also erecting 2200-volt mains, street-series and 110-volt secondaries in Dorion and Vaudreuil villages, including a 12,000-volt cable crossing the Soulanges Canal with necessary substations. The company expects to furnish electrical service in Vaudreuil and Dorion by July 1, and will extend its lines to Cedars Village, Hudson, Como and Hudson Heights. The line will also be extended to Ottawa and other places on St. Lawrence River as required. Energy is at present being supplied by the Montreal Lt., Ht. & Pwr. Co. and will be until the Cedars plant is in operation.

VERDUN, QUE.—The Council has decided to place all wires in the central portion of the city underground, at a cost of about $500,000, to be completed in about five years.

CHAMBERLAIN, SASK. — Tenders are invited by F. R. Sanders, secretary of the Chamberlain Rural Tel. Co., of Chamberlain, for the installation of a telephone system.

STRASBURG, SASK.—Tenders will be received by V. G. Watkins, secretary of the East Mount Rural Tel. Co., of Strasburg, for the installation of a telephone system.

Miscellaneous

VALDEZ, ALASKA.—The capital stock of the Alaska Wtr., Lt. & Pwr. Co., of Valdez, has been increased from $100,000 to $250,000. The company contemplates extensive development work during the summer. S. A. Hemple is president of the company.

WELLINGTON, NEW ZEALAND.—Tenders are invited by the City Council of Wellington for furnishing and delivering an electric chassis for a 2000-lb. parcel delivery van and an electric motor car, required for the Electric Tramways Department. Copies of specifications, etc., may be obtained from the office of the Tramways Department and the electrical engineer, Harris Street, Wellington, N. Z., upon payment of $5.11 for each of the contracts, which will be refunded upon receipt of tender. Bids must be submitted by July 9, and local representation is necessary. Further Information may be obtained from the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and at branch office, 315 Custom House, New York, N. Y., by referring to No. 13,181.

New Incorporations

DOVER, DEL.—The Interstate Public Ser. Corpn. has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $2,000,000 and purposes to operate and control public utilities. The incorporators are W. J. Maloney, O. J. Reichard and H. E. Latter, of Wilmington, Del.

QUINCY, ILL.—The Adams County Mississippi River Pwr. Distributing Co. has been granted a charter with a capital stock of $60,000 to generate and distribute electricity for lamps, heaters and motors. The incorporators are John M. Schoeneman, Edward H. Hedrick and Randall B. Echols.

LITTLE ROCK, IA.—The Little Rock El. Lt. Co. has been chartered with a capital stock of $10,000 to construct and operate an electric-light plant in Little Rock. Frank Turk is one of the Incorporators.

ASHLAND, KY.—The Camden Pwr. Co. has been incorporated by John F Hager, J. W. M. Stewart and K. M. Fitzgerald. The company is capitalized at $100,000.

WIMBLEDON, N. D.—The Wimbledon El. Co. has been organized by F. H. Etter and others. The company is capitalized at $10,000 for the purpose of building a new plant.

HICO, TEX.—The Central Texas Pwr. & Transmission Co. has been granted a charter with a capital stock of $100,000. The incorporators are V. F. Wieser, H. Gleason and H. M. Weiser.

KINGSTON, WIS.—The Kingston El. Co. has been incorporated with a capital stock of $2,000 by L. A. Very, O. A. Oestreich and Leora Westlake.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 2, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,098,372. Telephone Apparatus; A. H. Dyson, Chicago, Ill. App. filed July 13, 1903. For selectively signaling any one of a number of operators at central station.

1,098,379. System of Selective Control; J. H. Hammond, Jr., Gloucester, Mass. App. filed Sept. 7, 1911. Ether disturbances of predetermined frequencies are received selectively by receiving station.

1,098,380. Automatic Ticker Receiver; J. H. Hammond, Jr., Gloucester, Mass. App. filed Aug. 24, 1912. Automatic ticker for an undamped electric wave receiver.

1,098,431. Magneto-Electric Generator; R. H. Cunningham, New York, N. Y. App. filed Oct. 8, 1912. For ignition purposes; has armature pole pieces arranged convergent on one side and divergent on the other side and asymmetrical.

1,098,436. Electric Heating System; W. S. Hadaway, Jr., New York, N. Y. App. filed Sept. 5, 1911. The steel and concrete elements of the building structure utilized for heating elements.

1,098,437. Electric Heating Device; W. S. Hadaway, Jr., New York, N. Y. App. filed Sept. 13, 1911. Soldering iron with heating unit inclosed and protected from fluxes.

1,098,447. Calling Device; W. Kaisling, Chicago, Ill. App. filed Nov. 6, 1911. For metallic-circuit telephone systems.

1,098,452. Inductor-Magneto Alternator; L. J. Le Pontois, New Rochelle, N. Y. App. filed July 11, 1908. Has an exciting winding on the permanently magnetized field element.

1,098,456. Trolley Harp; J. W. McKinney, Tyrone, Pa. App. filed May 24, 1913. Novel detachable connection between the harp and the trolley pole.

1,098,478. Attachment Plug for Electric Circuits; F. H. Chapman and O. E. Kenney, Toledo, Ohio. App. filed June 13, 1913. Lock for plug and socket couplings.

1,098,490. Thermostatically Operated Circuit-Breaker; T. R. Fagan, Huntington, W. Va. App. filed July 19, 1913. Particularly for dental furnaces and vulcanizing devices.

1,098,493. Electrical Attachment for Hay Presses; W. D. Gladney, Silex, Mo. App. filed Aug. 27, 1913. Bell automatically rung when each bale is completed.

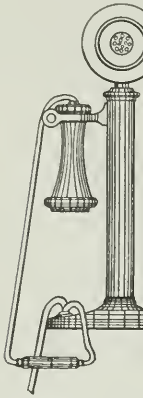
1,098,501. Electric Wire Connection; H. H. Holdaway and A. C. Candland, Salt Lake City, Utah. App. filed May 20, 1912. For preventing twisting of flexible telephone cord.

1,098,521. Automatic Recorder for Call Boxes and Fire Alarms; J. D. Nelson, Cincinnati, Ohio. App. filed June 25, 1910. Records time and box from which call is sent.

1,098,528. Telephony and Telegraphy for Mining Cages; J. H. Reineke, Bochum, Germany. App. filed Aug. 24, 1912. Uses the cage-hoisting cables as conductors.

1,098,529. Multiple-Brush Selector; J. N. Reynolds, Greenwich, Conn. App. filed Nov. 16, 1912. For automatic and semi-automatic telephone systems.

1,098,539. Internal-Combustion Engine; J. A. Williams, Cleveland, Ohio. App. filed Dec. 19, 1910. Two-cycle; at low speed causes charges to be ignited at each alternate compression stroke.



1,098,501—Electric-Wire Connection

1,098,549. Transformer; T. E. Barnum, Milwaukee, Wis. App. filed May 15, 1911. Adjustable, for arc lamps.

1,098,550. Electric Welding Machine; F. E. Beam, Toledo, Ohio. App. filed Nov. 27, 1911. For rings of rectangular or other shape.

1,098,557. Rotary Converter; S. M. Burk, Philadelphia, Pa. App. filed July 20, 1912. Commutator for transforming alternating current into direct current or vice versa.

1,098,573. Heater; M. Hauser, Jr., Kansas City, Mo. App. filed April 7, 1913. For heating water in a radiator.

1,098,592. Illuminating Device; E. O. Schweitzer, Chicago, Ill. App. filed March 4, 1912. Lamp base with spark-gap to form a bridge about the lamp.

1,098,602. Baling-Press Alarm; C. R. Warman, Newark, Ohio. App. filed Oct. 7, 1913. Alarm sounded when bale is tied and is being forced from baling chamber.

1,098,604. Lighter; R. E. Wing, Detroit, Mich. App. filed Jan. 16, 1914. Electric lighter for gas water heater.

1,098,606 Electric Battery; E. Achenbach, Hamburg, Germany. App. filed Feb. 6, 1913. Mercuric oxide is added to the manganese-graphite mass.

1,098,617. Electrical Apparatus for Transmitting and Receiving Signals; A. T. Dawson and G. T. Buckham, Westminster, London, Eng. App. filed Dec. 31, 1912. Step-by-step motors operating endless chains carrying a pointer or the like.

1,098,628. Pistol Flashlight; H. Hyman, Brooklyn, N. Y. App. filed Nov. 28, 1913. Casing in half-sections hinged together, and the trigger controls the circuit.

1,098,632. Electric Spot-Welding Machine; F. P. McBerty, Warren, Ohio. App. filed Sept. 30, 1912. Vertically disposed horn carried by a vertically displaceable arm supports an electrode cooperating with a fixed electrode.

1,098,649. Constant-Current Regulator; A. A. Tirrill, Schenectady, N. Y. App. filed Dec. 14, 1907. Controls both the direction and amount of magnetomotive force developed in the field of the booster.

1,098,656. Alternating-Current Motor Control; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Jan. 6, 1910. For operating motors on single-phase or multiphase currents.

1,098,661. Current Collector; F. E. Case, Schenectady, N. Y. App. filed Aug. 1, 1906. Automatic means for retracting and restoring the collector to operative position.

1,098,664. Instrument Transformer; M. D. Dobrowolsky, Wilmersdorf, Germany. App. filed Sept. 4, 1912. Each conductor is provided with a magnetic path.

1,098,666. Electric Brush; J. Graves, Milwaukee, Wis. App. filed Oct. 3, 1911. Battery in handle, and bristles always in circuit even when they yield.

1,098,698. Electric-Railway Trolley; J. A. Walsh, Rochester, N. Y. App. filed Oct. 20, 1913. Grooved roll in rear of trolley wheel engages wire when wheel leaves wire.

1,098,717. Overhead-Trolley Construction; G. Gibbs, New York, N. Y. App. filed July 11, 1908. Trolley wire for siding is lowered so as to be engaged only when car is to pass onto siding.

1,098,718. Rheostat; A. I. Grabham, Wellington, New Zealand. App. filed Nov. 8, 1912. Has resistance block of manganese oxide, zinc oxide, silicate of soda and brass filings, mixed together.

1,098,738. Lightning Rod; S. D. Kretzer, St. Louis, Mo. App. filed July 9, 1913. Supplemental ground circuit to which points are connected and provided with down leads extended into earth.

1,098,741. Electric Lamp Push Socket; L. F. Lindstrom, Bridgeport, Conn. App. filed Aug. 2, 1912. Operated by push-button extending out through guide in one side of the shell.

1,098,753. Electric Generator for Ignition Systems; E. Podlesak, Tiffin, Ohio. App. filed June 10, 1911. Special field aud pole structure, inclosed armature.

1,098,754. Inductor Alternator; E. Podlesak, Tiffin, Ohio. App. filed July 21, 1911. Especially for make-and-break ignition.

1,098,772. Signal or Alarm Device; W. M. Waite, Syracuse, N. Y., and J. H. Wheelock, Worcester, Mass. App. filed March 24, 1913. Has rotary conducting member with insulating plugs inserted in its surface and brushes bearing on same.

1,098,775. Bushing for Electric Tubular Insulation; C. M. Wheelock, Milwaukee, Wis. App. filed Nov. 16, 1912. For securing circular loom where it passes through the wall of a cut-out box or the like.

1,098,778. Circuit Controller; H. P. Ball, Pittsfield, Mass., and G. Wright, Schenectady, N. Y. App. filed Dec. 22, 1908. Non-closable on overload.

1,098,779. Concealed Wire-Supporting Chain; W. H. Blake, Boston, Mass. App. filed Oct. 18, 1912. Wires are passed only through the alternate links.

1,098,780. Motor-Starting Device; P. Caldwell, Pittsburgh, Pa. App. filed April 5, 1913. Embodies manually operated line switch and overload circuit-breaker.

1,098,794. Article with Protective Coating; S. H. Fleming, Cleveland, Ohio. App. filed Oct. 29, 1912. Electrode with coating of titanium nitride.

1,098,801. Spirit Level; W. J. Hughes, Chicago, Ill. App. filed Dec. 27, 1913. With flashlight mounted in pocket in the stock.

1,098,807. Rectifier; A. T. Kasley, Pittsburgh, Pa. App. filed May 7, 1910. Constant stream of mercury is periodically blown away from terminal by air currents.

1,098,809. Railway Switch Throwing Mechanism; H. C. Kinsel, Altoona, Pa. App. filed June 24, 1913. Embodying a rack and an electromagnetically operated toothed member.

1,098,834. Electric Bell; S. Oliver, Chicago, Ill. App. filed Oct. 9, 1913. Alternating-current bell with no permanent magnet and no contact points.

1,098,845. Elevator; M. C. Schwab, Chicago, Ill. App. filed Oct. 24, 1910. Counter-weight is locked so as to sustain positively the car and disable the motor upon occurrence of abnormal conditions.

1,098,852. Electric Permutation-Lock Switch; G. Stupar, Chicago, Ill. App. filed Dec. 6, 1912. Alarm is rung if false step occurs in operating lock.

1,098,859. Producing Isoprene; F. Webel, Mannheim, Germany. App. filed Feb. 27, 1913. Treats methyl-butenol ester at raised temperature when vaporized with alumina.

1,098,871. Galvanometer; J. L. Zander, Newark, N. J. App. filed April 30, 1912. One of the coils returns the shaft to normal position, thereby dispensing with returning spring.

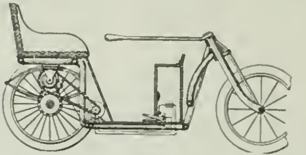
1,098,893. Electrically Operated Vibrator; J. L. Dinsmoor, New York, N. Y. App. filed Nov. 14, 1912. Sparking avoided by shunting from one coil to the other; no absolute breaks in circuit.

1,098,939. Controller for Motor Chairs; C. B. Chrysler, Chicago, Ill. App. filed Dec. 9, 1912. Interconnected motor and brake foot pedals.

1,098,983. Electric Musical Instrument; M. L. Severy, Arlington Heights, and G. B. Sinclair, Medford, Mass. App. filed Aug. 7, 1905. Electromagnets vibrate a tuned sonorous body, rotative pulsator for magnets and synchronizer for the motor which rotates the pulsator.

1,099,022. Trolley Wheel; T. Cavanaugh, Pittsburgh, Pa. App. filed May 17, 1912. Coiled springs encircling the wheel normally overhang the wire channel in the wheel.

1,099,062. Electric Scalp Appliance. P. P. Laposkey, Cherokee, Ia. App. filed Dec. 10, 1913. Rubber cap with insulated plates carrying metal scalp-engaging pins.



1,098,939—Controller for Motor Chairs

1,099,071. Rheostat; J. A. McCoy, Jr., Parkersburg, W. Va. App. filed July 23, 1913. Made from a plastic mass of graphite and an asbestos compound.

1,099,090. Terminal Device; W. G. Houskeeper, Philadelphia, Pa. App. filed March 31, 1909. Member with aperture in which a body of mercury is located, making contact with a conductor passing through the aperture.

1,099,091. Electrical Terminal Device. W. G. Houskeeper, Philadelphia, Pa. App. filed Nov. 3, 1909. Reservoir with mercury which is suspended across an aperture by capillary attraction.

1,099,093. Electric Contact Device. A. A. Kent, Philadelphia, Pa. App. filed Dec. 7, 1908. Ignition make-and-break in which both contacts are moved.

1,099,095. Process of Preparing Conducting Filaments; H. D. Madden, Bloomfield, N. J., and W. G. Houskeeper, Philadelphia, Pa. App. filed March 31, 1909. Applies different amounts of current to different portions of the filament.

1,099,113. Method of Producing Fire-proof Materials from Quartz and the Like; W. Boehm, Berlin, Germany. App. filed Oct. 30, 1913. Treats zirconia to render it electrically conductive and then heats to melting temperature by passing current therethrough.

1,099,125. Electric Heater; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed Feb. 20, 1913. For matrix-drying press; has liquid-containing tubes.

1,099,131. Refractory Lining for Furnaces; O. Serpek, Paris, France. App. filed Jan. 26, 1911. Consists essentially of aluminum nitride with carbon and aluminous material.

1,099,138. Solid Titanium-Carbide Stick Electrode; W. G. Abbott, Jr., Lynn, Mass. App. filed June 1, 1910. Titanium-carbide particles cemented together by titanium sub-oxide.

13,742 (reissue). Automatic Telephone Exchange System; J. W. Lattig, Glenside, Pa., and C. L. Goodrum, Urbana, Ohio. App. filed June 29, 1909. Original patent No. 920,350, May 4, 1909. Centralized battery, two differently wound selective relays and a neutral restoring relay.

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Psychology in Business

President Wilson is at least partly right when, in discussing psychology in business, he argues that the attitude of business men affects the state of business. Good times are more likely to come when we expect them and work to bring them about than when we expect bad times and work only half-heartedly to prevent them. A look toward good times does not always bring good times, but a look toward bad times is very likely to bring about events that accelerate the downward movement. While we agree, therefore, that there is an element of psychology in the business situation, we believe that it does not always control trade. The causes of our momentary unrest appear too clear to dispute. We think that the main cause of any psychological depression that exists now is the legislative situation at Washington. If business is actually good in a given industry, the facts will show it. If it is not good, the facts are the surest evidence of its real condition. If the facts show good business, the state of mind to which the President refers arises from influences not directly connected with the volume of trade. It is reasonably plain to candid observers that the principal influences of this kind are the measures pending in Congress for the regulation of business. Will these measures be harmful or helpful to business? When that question is answered speculation as to their effect will be in a fair way to be succeeded by fact. Then, no matter what is detrimental it will be the first duty of business men to readjust their practices where necessary, to conform to the law of the land, and to go ahead and do business with full confidence that if adverse legislation has to be borne the strength and common sense of the country will enable it to rise superior to this burden.

Labor Unions in Trust Laws

The legislation proposed for the exemption of labor unions from the anti-trust laws has been passed by the House of Representatives and is now before a comtee of the Senate. It provides "that nothing contained in the anti-trust laws shall be construed to forbid the existence and operation of fraternal, labor, consumers', agricultural or horticultural organizations, orders or associations instituted for the purpose of mutual help and not having capital stock or conducted for profit, or to forbid or restrain individual members of such organizations, orders or associations from carrying out the legitimate objects thereof." This is a perfectly plain statement that such organizations may be formed for legitimate objects. The natural inference is that these organizations may do what they want to so long as they do not do anything that is not legitimate; but before that inference is drawn the concluding words of the paragraph should be read: "Nor shall such organizations, orders or associations or the members thereof be held or construed to be illegal combinations or conspiracies in restraint of trade under the anti-trust laws." The bill says in effect that the organizations shall not be restrained from carrying out legitimate objects. Should it not read "lawful objects"? Do the lawmakers mean to say that if these organizations do things which are not lawful they shall not be construed to be illegal combinations or conspiracies in restraint of trade? If they do not mean that, what do they mean? Either this section means nothing in law or it means a great deal more than it ought to mean. If a thing is forbidden, it ought to be forbidden for all. Even if the wording of the section is so ambiguous that the interpretation which the courts will give it is doubtful, it is open to severe criticism as class legislation. The Senate should have the courage and independence to make any acts that it passes applicable alike to all classes.

Commutation Phenomena

The subject of commutation is very easy to understand and explain in its broadest and simplest aspects, but when it is discussed in full detail it becomes so complicated a matter that a complete analysis is hopeless. Nevertheless, it is understood by designers of direct-current machinery sufficiently well to enable them to produce satisfactory results. There are various ways of presenting the electrical phenomena of commutation from a quantitative point of view. One way is to symbolize the various quantities and then to deal with these symbols mathematically. Another way is to use as few symbols as possible, but to rely on graphical methods, as far as possible, for picturing the physical relations. The former method is essentially that of the mathematical physicist, and the latter that of the technician or of the experimentalist. An example of the latter method is presented in the article by Prof. Alfred Still the first part of which appears in this number. The illustrations indicate that certain assumptions are made in the discussion which greatly simplify the analysis and yet are reasonable from a practical standpoint. The result is that, with the aid of the diagrams, it becomes easily possible to compute the working mmf necessary to apply on the interpoles of a direct-current machine in order to predetermine sparkless commutation at the usual loads.

Definition of Photometric Units

An interesting paper has recently been presented by Mr. A. P. Trotter to the (British) Illuminating Engineering Society, commenting upon the report of a committee of the (American) Illuminating Engineering Society concerning photometric nomenclature and units. Mr. Trotter takes exception to some of the American definitions, because these are based essentially on the concept of "flux of light," instead of being based on the "candle" as a luminous point source. His contention is that the concept of a candle is simpler than that of a lumen, as well as much more firmly established in the photometric art, so that it would be better to base all photometric definitions as far as possible on the candle and keep the notion of luminous flux subsidiary. The American committee's report is manifestly addressed to technical readers, for the purpose of suggesting standard photometric definitions and conceptions in both national and international discussion. Incidentally, it was evidently framed with the object of eliciting just such critical discussion and debate as has recently been published in England. The ideas therein reflected are largely due to M. Blondel, who has contributed so largely to the nomenclature, logic, units and methods of measurement in photometry.

As regards the relative importance of the candle and the lumen, the state of affairs in photometry is very similar to that in the sciences of electricity, magnetism and radiation. In all of these cases the primitive idea, and the first to lend itself to quantitative development, was the point source. In electricity it was the point charge, in magnetism the point pole, in radiation the point radiant, in photometry the luminous point. The fundamental units of electricity and magnetism are derived from point sources. Thus, the unit electric quantity is that which repels its equal with unit force at unit distance, and the unit magnetic quantity is the same with respect to point poles instead of point charges. In early stages of applied electricity and magnetism, the point-source concepts and their descendants worked fairly well; but after a time they broke down from sheer inadequacy and had to be superseded by working conceptions based on fluxes.

In photometry, again, the primitive conception was based on the point source, but it is not too late to place international photometric science on a flux basis. An illumination of 1 ft.-candle is more fundamentally a candle-lumen per square foot than the illumination produced by a point source of one candle at a distance of one foot. Actual lamps are far from being point sources. They present, in fact, luminous surfaces of various sizes and shapes. What they necessarily and essentially produce are lumens. Ultimately, photometry hopes to become quantitatively dependent on the science of radiation, so that an assigned distribution and character of radiant flux shall determine a consequent attendant luminous flux. To such a conception the notion of a candle as a fundamental magnitude is purely empirical, whereas the notion of a luminous flux is a perpetual suggestion. As regards the fashioning of units in applied science to suit the supposed requirements of the man in the street, or the purely practical man, there is, we believe, no need of giving special consideration to him. He is abundantly well able to look after himself. What he wants is simplicity and accuracy in his working conceptions. But that is also just what the technical man needs. The best definitions, notions and nomenclature for the engineer are the best also for the untechnically trained worker.

Tests of the Gas-Filled Lamp

There has recently come from the hands of Dr. Lux, whose photometric researches are already known to our readers, a somewhat careful study of some of the characteristics of the so-called "half-watt" lamp as developed in Germany. Considering the fact that the gas-filled lamp in its present incarnation is an American invention, it is rather extraordinary that the most complete account of it, as well as some of the very earliest applications, have come to us from abroad. As is well understood, the gas-filled lamp differs radically in its conditions of efficiency from the ordinary vacuum lamp with metallic filament. In the latter the loss of energy from the filament, save by radiation, is very small, while in the former the convection losses are heavy. One endures this loss with equanimity, however, in view of the fact that by reason of the presence of the gas the working temperature can be pushed enormously higher than in the case of a vacuum lamp, and the blackening is carried to the top of the bulb by the convection currents. Dr. Lux investigated side by side with photometer and bolometer a gas-filled and an ordinary vacuum metallic-filament lamp, determining the specific consumption and absolute temperature of the filament at various impressed voltages.

The ordinary metallic-filament lamp increases in candle-power rather more rapidly with change of temperature of the filament than does the gas-filled lamp, as might be expected. The most distinctive difference between the two is in the distribution of losses in the lamp. The radiant energy from the two sources was separated roughly into the visible and invisible portions by means of a ray filter of copper chloride solution which cuts off substantially all the infra-red and a small portion of the red. In the case of the ordinary metallic-filament lamp the light radiation was 4.4 per cent of the total radiation and 3.7 per cent of the input; that is, in this particular type of vacuum lamp a little over 88 per cent of the energy supplied was delivered in the form of radiant energy. With the gas-filled lamp only 60 per cent of the supplied energy appeared as radiation, so that roughly almost a third of the energy supplied in this very efficient lamp is dissipated by radiation and conduction. Nevertheless, the efficiency of the lamp with respect to its luminous output in terms of the total input rises to almost 5 per cent, and the luminous radiation alone is somewhat over 8 per cent of the total radiation.

The facts just noted bring out the large improvement in efficiency gained by increasing the temperature, as can be done in the presence of the gas filling, while they also emphasize the large thermal losses which are the price paid for the gain. However paradoxical it may seem at first, the gas-filled lamp comes nearer to furnishing "cold light" than does the ordinary tungsten lamp, for the simple reason that the luminous efficiency of the former is so strikingly increased that, so to speak, the light outruns the heat. In point of fact, Dr. Lux found that the heat radiation from the gas-filled lamp per candle-power of light given was rather less than one-third that in the ordinary tungsten lamp. The gas-filled lamp, as everybody now knows, undeniably operates with a very high temperature at the globe, although the radiation per candle-power is kept low. The high bulb temperature of the new lamp is in the main chargeable to the carrying off, as an incident to its operation, of an exceptionally large amount of heat to the walls of a relatively small bulb.

Economy of Central-Station Service

In a very striking article published recently in the *Elektrotechnische Zeitschrift*, Dr. Walter Straus compared the economic results to be obtained from central-station service with those of various sorts of localized energy-producing systems. Such comparisons have been made frequently, but never before, so far as we are aware, in so thorough and up to date a manner. While the relative costs and prices would be somewhat different under American conditions, we think that, on the whole, the case would be slightly better for central-station service here than in Germany, where labor in an isolated plant is relatively cheap and the costs of the machinery somewhat less. The conditions assumed by Dr. Straus are first a 15-kw output required; second, 110-kw, and third, 400-kw. The first would represent a typical motor installation of small size, the latter two the larger and more important cases in which, on the whole, a local source of energy would be more seriously considered.

Dr. Straus brings to the front small prime movers of relatively very high efficiency, so that the comparison is not based on steam power or ordinary gas engines but on the very best that is available for the production of energy in small quantities. In every comparison the whole costs are taken into account, from the material consumed to the capital costs and the cost of the space occupied. The sources of energy taken for comparison with electric service at prevailing prices are the ordinary gas engine, the producer-gas engine, the gasoline engines, steam engines of the ordinary sort, the locomobile, and the Diesel oil engine. These certainly represent among them the best for the economical production of small amounts of energy. With the cost of energy obtained from these sources for periods up to 3000 hours per year in the small units and 6000 hours per year in the larger ones Dr. Straus compares the cost of electric service at 1.25, 2.5, 2.75, 5 and 6.25 cents per kw-hr. The results of this comparison are very striking.

With a 15-kw unit under full load for 3000 hours per year the electric motor would theoretically be less economical than the producer-gas equipment, the Diesel oil motor, the ordinary gas engine, the locomobile and the gasoline motor, in the order named. Every engineer realizes, however, that a condition calling for full load for 3000 hours per year is seldom or never encountered in practice. The hypothesis of ordinary use next introduced is that there will be full load for a third of the time and half load for two-thirds of the time. Under these conditions for 3000 hours' use per year only the Diesel oil engine and the producer plant are left as substantial competitors of electric service at 2.5 cents per kw-hr., and even these are out of the running if the hours of use fall to 2000. With electric energy at 5 cents, however, even the steam engine can hold its own under German conditions. The low cost of labor is evidently a large factor in keeping down the cost of attendance on local prime movers. Under ordinary American methods of charging for energy, a 20-hp motor, such as is considered at this point, under full load for 3000 hours per year would earn so good a rate as to leave very little chance for competition, and the figures would be relatively low even under the part-load hypothesis introduced by the author.

In the larger units examined by Dr. Straus the conditions are even more favorable for the electric drive, since while seriously considering only the two most efficient of the prime movers, the Diesel engine and the locomobile, the comparison is made with actual prices charged by various German central stations for energy furnished on a large scale. These prices are based on some form of demand system of charging terminating at figures even below 1 cent per kw-hr. for large and steady users. The result of the comparison is that while for use of from 3000 to 6000 hours per year the oil engine and the locomobile, especially the latter, make a very good showing, yet both are out of the running at the prices charged, not by one, but by half a dozen, German stations. On the whole, it is very evident that under ordinary conditions of loading the electric motor at commonly obtainable prices for energy is cheaper than any local prime mover, although the small prime mover is relatively more economical under German conditions than is possible here, owing to a combination of cheap and good machinery with low-priced labor.

In dealing with larger units the heavy discounts given to a customer with a first-class load-factor tell in favor of the electric motor in spite of the low costs shown for its competitors in the larger sizes. A well-balanced demand system would seem from the data presented to have considerable advantage in dealing even with relatively small consumers. We hope the data from Dr. Straus will prove of sufficient interest to encourage some one to make a similar comparison under American conditions.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Convention of Edison Illuminating Companies

Arrangements have been completed to hold the 1914 convention of the Association of Edison Illuminating Companies at the Greenbrier Hotel, White Sulphur Springs, W. Va. The usual reception will be held in the ballroom of the hotel on the evening of Sept. 14, and the first session will be held on the morning of Sept. 15. The business of the convention will be transacted on Sept. 15, 16 and 17, and plans are being prepared to conclude the convention with a general association dinner. The meetings will be held in the large ballroom of the White Hotel adjoining and connecting with the Greenbrier, leaving the latter entirely free for entertaining and the social life of the convention. If practicable, the active work of the convention will be confined to about twelve general papers and ten special committee reports. With one or two exceptions, the presentation of the papers and reports will be confined to a limit of twenty minutes, and those participating in the discussion will be limited as to time with the object of securing the widest participation in every feature of the convention. As is usual at all conventions of the Association of Edison Illuminating Companies, an elaborate entertainment program will be provided, but no important features of entertainment will conflict with the business sessions. Every Edison licensee in this country is now a member of the Association of Edison Illuminating Companies.

Railway Electrical Engineers at Atlantic City

The Association of Railway Electrical Engineers held its semi-annual meeting at Atlantic City, N. J., June 12. Vice-president H. C. Meloy acted as chairman and reports were read by the heads of a number of committees. Nearly 100 members were present. The report of Secretary Joseph A. Andreucetti showed a total enrolment of 514, with a treasury balance of $1,349.

The report of the committee on axle equipment, of which Mr. H. R. Bucks is chairman, related progress in collecting data in reply to inquiries sent to eighty railroads. The committee on axle belting, of which Mr. J. R. Sloan is chairman, presented a sample form of specifications for belting material, covering stitched-canvas, rubber and woven belting. Mr. L. S. Billau submitted the report of the committee on lamps, which recommends the adoption for train-lighting service of 25-34-volt lamps and 50-65-volt lamps, having nominal ratings of 15, 25 and 50 watts and 12, 20 and 40 cp, in globe bulbs. The committee also accepted (but withheld recommendation of) 15-watt and 25-watt lamps in S-17 and S-19 bulbs and 75-watt lamps in G-30 bulbs.

Mr. W. A. Del Mar, chairman of the committee on wire and cable specifications, reported that efforts will be made to adopt uniform standards corresponding with those of the American Electric Railway Engineering Association. The committee on standards, through its chairman, Mr. D. J. Cartwright, recommended the design of standard suspension lugs for generator mounting, improvement in methods of fastening battery-box doors, and more careful consideration of the requirements of car-lighting equipment in the design of trucks and brake-beams.

A paper by Mr. Edward Wray, editor of the *Railway Electrical Engineer*, Chicago, described the use of the ampere-hour meter in car-lighting service. Following an account of the elementary principles of the mercury-type meter, the author pointed out that for straight storage-battery operation the simple and differential shunt types and the resistor type of meter are best adapted, while for head-end lighting the register type of ampere-hour meter should be used. The variable-resistor meter is probably the best suited for axle-generator systems, more than 100 such equipments being already thus controlled.

Electrical Topics Before Automobile Engineers

At the annual convention of the Society of Automobile Engineers to be held at Cape May, N. J., next week (June 23 to 27), several of the papers presented will bear on electrical topics. Among these will be "Electric Transmission for Motor Cars," by Mr. Justus B. Entz, of the White company; "Ignition, Lighting and Starting Devices," by Mr. A. D. T. Libby, of the Splitdorf Electrical Company; "A General Summary of the Truck Tire Situation," by Mr. J. E. Hale, and others. Great importance is attached to the report of the electrical-equipment division, of which Mr. A. L. Riker is chairman, and to the report of the electric-vehicle division, of which Mr. A. T. Slade is chairman. The latter is formulating recommendations to be made with respect to practices concerning motors, controllers, wiring, charging appliances, tires, lamps, speed and "mileage" ratings. The membership of the society is now 1800.

Methods of Radio Transmission

At a meeting of the Institute of Radio Engineers held at the Engineering Societies Building, New York, June 3, Mr. Melville Eastham, of Boston, presented an interesting paper on the methods of radio transmission involving high group frequency and sending apparatus. He described a number of types of equipment using rotary, quenching spark-gaps, and operating on both direct and alternating current. In this method as ordinarily used a low-frequency alternating current or a direct current is employed to produce sparks recurring at a rate above the upper limit of audibility, and the very rapid groups of electromagnetic waves thus created are further subdivided into trains at audible frequencies. In this way it is said to be possible to secure higher over-all efficiency than by the common methods of conversion involving motor-generators.

Mr. Eastham also described methods of measurements involving high-frequency wattmeters operating on the dynamometer principle and gave a number of results secured by their use.

The paper was discussed at length by Messrs. Stone, Mayer, Pichon, Marriott, Simon, Hill and Hogan.

Officers of the Power Sales Club

For a number of years motor-service salesmen throughout the country have felt the need of some organization whereby the men engaged in this branch of electric-service business might be brought closer together to discuss their mutual problems and to exchange ideas. As noted in these columns June 6, the desire for such an organization culminated in the formation during the recent Philadelphia N. E. L. A. convention of the Power Sales Club. The following officers were elected to serve the club for the ensuing year: Chairman, Mr. Charles J. Russell, Philadelphia Electric Company; vice-chairman, Mr. George H. Jones, Commonwealth Edison Company, Chicago; secretary and treasurer, Mr. C. H. Stevens, Brooklyn Edison Company. Mr. Charles J. Russell, Philadelphia, was appointed chairman of the committee on organization, the other members of which are Messrs. Harvey G. Glass, H. J. Gille, J. J. Hurley, H. H. Holding, R. H. Knowlton and S. V. Walton. A committee on membership will also be named, consisting of the heads of the motor-service departments of the various central-station companies.

Chicago to Install 1000 More Street Lamps

On June 11 the board of the Sanitary District of Chicago voted to install and supply energy for 1000 more lighting units for the city. Under the terms of the original lighting contract the Sanitary District was to install and supply energy for 10,000 lamps, and this later order is an extension of the original contract, bringing the total number of lamps to 11,000. As yet it has not been definitely decided whether the new lighting units will be arc lamps or some other type of illuminant. In addition to the installation of new lamps the board has agreed to convert a system comprising approximately 1166 direct-current arc lamps and approximately 6328 old alternating-current arc lamps into an improved modern alternating-current lighting system consuming an amount of energy approximately equivalent to that used by the present system. Mr. Edward B. Ellicott is electrical engineer for the Sanitary District.

Program of Convention of Ohio Electric Light Association

The twentieth annual convention of the Ohio Electric Light Association will be held at the Breakers Hotel, Cedar Point, Ohio, July 21 to 24. President J. C. Martin will open the initial session of Tuesday afternoon with his annual address, which will be followed by reports of committees, including that on illumination, of which Mr. S. E. Doane, Cleveland, is chairman. On Wednesday morning there will be reports of the committees on meters, Mr. A. H. Bryant, Cleveland, chairman; electric transmission, Mr. M. H. Wagner, Dayton, chairman, and uniform accounting, Mr. L. K. Funkhouser, Dayton, chairman. At the afternoon meeting Dr. Thomas Darlington, secretary of the welfare committee of the Iron and Steel Institute, New York City, will lecture on "Welfare Work in Industry." On Thursday morning Mr. J. H. Mitchell, Columbus, will present a paper on motor service, and reports will be submitted by the committee on new-business co-operation, Mr. T. F. Kelly, Dayton, chairman, and by the committee on electric vehicles, Mr. M. E. Turner, Cleveland, chairman. At the afternoon session Mr. M. Luckiesh, Cleveland, will deliver his lecture on "Light, Shade, and Color in Illumination." Before the session of Friday morning the Hon. Halford Erickson, member of the Railroad Commission of Wisconsin, will speak on "Indeterminate Franchises." A number of entertainment features have also been arranged for the convention. The secretary of the Ohio Electric Light Association is Mr. D. L. Gaskill, Greenville, Ohio.

Progress of Trust Legislation

President Wilson practically assumed personal charge of the administration's proposed anti-trust legislation at Washington during the week. He declared emphatically that trust legislation shall not be sidetracked at this session of Congress. The President said that he thinks that the worst thing that can happen to business would be to keep it guessing as to what legislation is to be enacted. For this reason he said he is opposed to a plan which was formed in Washington for Congress to adjourn under a rule that would require an extra session before December at which anti-trust legislation might be passed.

Members of the House do not approve of the Newlands plan for the creation of a trade commission to which shall be granted the arbitrary right to stop any trade practices that are not fair. This was the very power which the House refused to grant in its own bill when it was under discussion. The House, to quote the words of Chairman Adamson of the interstate and foreign commerce committee, which had charge of the Covington bill, said, in effect: "This animal has no right to have any such teeth."

The Newlands amendment has gone on the calendar, where it may be called up at any time. Mr. Newlands announces that a majority of the Republican Senators supported the bill in committee, and he therefore calls it non-partisan. The important change in the amendment is an adaptation from the Stevens bill. This is the one that makes unfair practices and competition unlawful.

A protest against the inclusion of electric railways in the scope of any anti-trust legislation passed at this session of Congress was made before the Senate interstate commerce committee on June 16 by representatives of the American Electric Railway Association. At the same time a protest along similar lines for the smaller telephone companies was made by representatives of the National Independent Telephone Association.

Following his assumption of personal charge of proposed anti-trust legislation, President Wilson summoned to the White House what is known as the "steering committee" of the Senate, when the whole situation was discussed. Those present were Senator Kern, the democratic floor leader, and Senators Owen, Hoke Smith of Georgia, Thomas, O'Gorman, Martin, Newlands, Chamberlain, Clarke of Arkansas, and Culberson. As a result an announcement was made that every attempt will be made to expedite the proposed legislation, and that there is hope of finishing it by July 31. Those who are acquainted, however, with the views of some of the republican senators do not believe that adjournment will come before September.

Both the Senate judiciary committee and the Senate committee on interstate commerce are working on the bills from day to day. The judiciary committee is now attempting to perfect the Clayton interstate trade commission bill, and the commerce committee is holding hearings on the Rayburn bill.

Water-Power Legislation

For the committee on public lands, Representative James M. Graham, of Illinois, has filed a favorable report on the federal administration's water-power leasing bill. This measure is now on the calendar of the House of Representatives under a special rule for immediate disposition. Its passage seems assured before July 1, but there is little possibility that the Senate will consider it at the present session.

The bill authorizes the Secretary of the Interior to lease to citizens of the United States or properly qualified associations or corporations for a term of not more than fifty years water-power sites in the public lands of the United States, exclusive of the national parks. The Secretary is to have the power to prescribe the regulations for these leases, which are to be irrevocable except for a breach of their terms. The Secretary is to have the power of giving preference in these leases to political subdivisions, such as states, counties or municipalities. He is also authorized to grant temporary permits for one year, with extensions in certain contingencies, to enable intending applicants to investigate the possibilities of power development. The lease is to provide for speedy development and continuous operation, and a special provision is that not more than 50 per cent of the power developed is to be sold to any one purchaser without the consent of the Secretary of the Interior.

Whenever the power developed is sold outside the state of its development the regulation and control of the service, charges for service and the issuance of stocks and bonds are conferred upon the Secretary of the Interior or upon such body "as may be provided by federal statute." Similar control is given over intrastate business where there is no state public utilities commission. Combinations and agreements in restraint of trade or increase of prices are forbidden. Sale or delivery of power to distributing companies except for thirty-day periods in cases of necessity are also prohibited. Provision is made for keeping the property intact as a "going concern" at and after the time when the lease terminates. This is to be done by giving the United States the right to take over the property, upon not less than three years' notice prior to the expiration of the lease, upon payment of the actual costs of right of way, water rights, lands and interest, as well as of all structures and fixtures. This price is to be determined by mutual agreement between the Secretary of the Interior and the lessee if possible, otherwise through condemnation proceedings in the United States Circuit Court. Such "reasonable value shall not include or be affected by the value of the franchise or good will or profits to be earned on pending contracts or any other intangible element."

If the United States does not exercise this right or does not renew the lease, the Secretary of the Interior is authorized to lease the properties of the original lessee to a new lessee upon condition that the latter shall pay for the properties. Special consent of the Secretary of the Interior is necessary for contracts for power extending beyond the term of the lease. In that case the new lessees or the government will be bound by these contracts. The Secretary of the Interior is authorized to specify the rentals to be collected by the government on all power developed. These proceeds are to be paid in the United States reclamation funds, one-half of the amount is to be repaid to the treasury of the state in which the power is developed, when the reclamation fund is returned by the settlers. The states are to have these funds for educational uses or for public improvement. Municipal corporations developing power solely for municipal use may be permitted to do so without cost. Leases for the development of power not in excess of 25 hp may also be made without charges to individuals or associations for "domestic, mining or irrigation use."

The measure is to take the place of the act of Feb. 15, 1901. Concerning that act the Graham report says: "Under this provision it has been found impracticable to finance such enterprises, and the whole act was thus rendered nugatory."

The report contains the following statements: "The hearings before the committee conclusively show that over 90 per cent of the developed water-power in the public-land states is owned by twenty-eight private corporations and their subsidiaries, and that six of these control together over 56 per cent of the developed power. In addition, these same corporations own or practically control sites from which large amounts of additional power can be obtained, these sites being, as a rule, those which, because of convenience to market or cheapness of development, will be required by the economic necessities of the West for development in the near future. The Mountain Power Company owns 97 per cent of the developed power in Montana and controls nearly as much undeveloped power as it has now developed. The Utah Power & Light Company controls over 70 per cent of the power developed in Utah, and has in addition 30 per cent of the developed power of Colorado and 20 per cent of that of Idaho. And in addition it claims to have 60,000 undeveloped hp.

"While these twenty-eight companies are nominally distinct, seventeen of them are shown to be either subsidiaries of the General Electric Company or closely associated with that company through holding companies, interlocking directors and banking connections. These seventeen companies control about 60 per cent of the water-power developed by private corporations in the Western States, and this number includes four of the six companies having over 100,000 hp. Some of the remaining companies have certain affiliations with the General Electric Company and its subsidiaries, and operate in the same or adjacent territory harmoniously with them, but there is no direct evidence of General Electric control."

Strike Situation in Westinghouse Plants

Among the officials of the Westinghouse companies in the Pittsburgh district the feeling prevails that in a short time there will be a general movement on the part of a majority of the employees to return to work.

A number of the employees of the Union Switch & Signal Company left work at noon on June 12 without giving any reasons for their act. An announcement was made by the company promptly that the works would be closed until June 15, when employees would be expected to return. It is announced that practically the full number of men returned. An unsuccessful attempt was made by the strikers to induce the men at the Westinghouse foundries at Trafford City to go out on strike.

The management states that there has not been any change in its attitude with reference to importing "strike breakers," but so far it has devoted its energies toward safeguarding the valuable properties placed in its charge.

In answer to a question regarding the effect of the strike on the business of the companies, an official replied that owing to the policy adopted several months ago of manufacturing goods for stock in order to provide work for employees during the dull period, a large amount of goods, sufficient in many lines for several months' requirements, had been made and distributed to the warehouses of the company in various parts of the country, from which orders have been filled daily without delay.

A statement giving the attitude of the Westinghouse company on the questions at issue in the strike of the employees was published in the Pittsburgh daily newspapers on June 15. It was addressed to the employees and was signed by the Westinghouse Electric & Manufacturing Company, the Westinghouse Machine Company, the Union Switch & Signal Company and the Pittsburgh Meter Company. The statement set forth that a strike was called by the officers of the Allegheny Congenial Industrial Union of the employees of the Westinghouse Electric & Manufacturing Company, followed by a walk-out in the works of the other three companies, thereby interfering with their business and preventing employees from engaging in their work. The advertisement contained the published declaration of principles of the Allegheny Congenial Industrial Union. These principles are set forth as follows:

"We affirm the irreconcilable difference of interests between the employer who buys labor power in the labor market for the purpose of making a profit, on the one hand, and the wage earner who sells his ability to produce wealth to some employer in order to secure the necessities of life, on the other. We know from bitter experience that the buyer and seller in the labor market can never see things from a common viewpoint, as the employer always buys as cheaply as possible and we as wage earners wish to sell our labor power for the highest possible wages.

"We are therefore determined to band together in an industrial union which recognizes no distinction as to craft, sex, religious creed, political affiliations, age or nationality, for the purpose of compelling our common employers to give us every concession we can force from them by industrial solidarity.

"To such an object we pledge our united effort and call upon all workers in every industry of the Pittsburgh district to join with us immediately in the organization of a great democratic union which will include every man, woman and child that works for wages."

The principles for which the Westinghouse companies stand committed are expressed as follows:

"1. Westinghouse shops shall be open shops. We stand for the principle of an open shop in which union and non-union men may work without molestation or being forced to join any organization.

"2. Westinghouse employees may or may not be members of any organization. We do not require of our employees that they shall refrain from joining labor organizations any more than we attempt to restrain them from joining any other bodies, but we maintain for all our employees the right to refrain from joining any organization without prejudice to their positions, or their security, or their comfort in our employ.

"3. The pay of skilful and productive Westinghouse employees shall not be regulated by the pay of the inefficient and less productive. We pay wages and maintain shop conditions which compare favorably with other manufacturers in our industries. By this means, and by the added inducement of steady employment, we endeavor to attract the best workmen. In order to compete with other firms, both at home and abroad, we must introduce all of the agencies by which the best efficiency is obtained. We reserve the right to determine the compensation of our employees on the basis of the service they perform for us as well as by the day rate, which measures only the time spent in our works.

"4. Every Westinghouse employee has the right of conference with the management. We receive any one employee or any number of employees from any department, or any properly chosen committee whose selection shall be truly representative from any department or of the whole body of our employees.

"5. Every Westinghouse shop shall be safe, sanitary and comfortable, and all suggestions of employees for improvement in shop conditions are welcomed by the management. We seek to maintain the best standard of sanitary and working conditions in our factories as we believe that to provide as good surroundings as the character of our operations permits is the best guarantee we have of obtaining and holding the best class of employees.

"As opposed to the principles advocated by the Allegheny Congenial Industrial Union:

"We assert that the interests of the employee and the employer are identical and that there can be no success for either party unless each recognizes the necessities of the other.

"We deny that employers and employees can never see things from a common viewpoint, and assert that the success of any business undertaking is dependent upon each endeavoring to view their common interests from the same viewpoint.

"We assert that in seeking for concessions neither party should attempt to obtain them either by force or compulsion."

Convention of the Association of Corporation Schools

At the second annual convention of the National Association of Corporation Schools, held in the new auditorium of the Curtis Publishing Company at Philadelphia, Pa., from June 9 to 12, various electrical manufacturing and central-station companies were represented. About eighty corporations are now members of this association. Dr. C. P. Steinmetz, chief consulting engineer of the General Electric Company, was elected as the new president for the ensuing year.

At the opening session held on the morning of June 9 Mr. Arthur Williams, of the New York Edison Company, the president, presided. Dr. Steinmetz spoke briefly at this session. He said that corporations are absolute necessities under present conditions; free, open competition is out of the question because the means of production are ahead of the demand and the corporations alone can so regulate production that it will be profitable. Every corporation, he said, must solve the problems of proper financing, proper administration, technical efficiency of production, and the human factor. The last is composed of two elements, namely, welfare and education of employees. Dr. Steinmetz added that up to the present time the human element has been more or less neglected, but that now corporations are taking steps to meet adequately the necessity not only of giving men good conditions in which to work but also of training them in efficiency. He spoke of the great saving of labor to the corporations by union into an association to study the subject of education. He said that the present feeling against corporations is due in a large measure to the fact that they have failed to recognize the human factor.

At the afternoon session on June 9 the chairman was Mr. C. A. S. Howlett, of the General Electric Company. The subject under discussion was salesmanship, advertising and distribution. The discussion on this subject was continued during the evening session. Mr. C. R. Sturdevant, of the American Steel & Wire Company, Worcester, Mass., said that since so much of the value of advertising depended on imagination, which was a difficult quality to develop at the best, it was absolutely necessary to master first the known and public knowledge on the subject. Mr. F. C. Henderschott, manager of the Bureau of Education of the New York Edison Company, said that 80 per cent of the feeling favorable to public ownership is due to lack of good service rather than to high rates, and that service cannot be rendered through untrained men. A salesman who represents his company efficiently must be not only a salesman but also a business diplomat.

The session on the morning of June 10 was devoted to accounting, financing and purchasing. Among those who read papers were Mr. C. R. Sturdevant, American Steel & Wire Company, Worcester, Mass., who spoke on "Training Executives." Mr. Sturdevant said that the corporation should aid employees who were being fitted for positions of responsibility by placing at their disposal a good reference library and by having special classes for instruction.

Dr. Steinmetz, in discussing the papers read on this subject, said that executive success is to a considerable extent based not on training, education or instruction, but that there must be that inherent variation from type, individualistic temperament, which is the foundation of all such success. Mr. Louis L. Park, superintendent of apprentices of the American Locomotive Company, said that the training of draftsmen is one of the most difficult problems to meet, and that it is solved by the corporation schools. Mr. M. W. Alexander, of the General Electric Company, Lynn, Mass., read a paper on "Apprenticeship in the Mechanical Industries."

Training of Trades Apprentices

Mr. R. J. Watson, instructor in charge of trades apprentices of the Westinghouse Electric & Manufacturing Company, spoke on the training of trades apprentices. At the present time the company has 256 apprentices in the course. During the last five years there have been graduated 146 apprentices, of whom 42 per cent are still with the company. Of the total number, 15 per cent now hold executive positions, such as foremen, assistant foremen, rate men, limit setters and inspectors. Various reasons why all who were graduated did not stay with the company were assigned by Mr. Watson. Chief among these is the desire to broaden experience and become familiar with the work and conditions in other shops. Of those who leave after completion, the better will return much improved for their experience. Since the school has been in operation over 800 apprentices have been received. One-half of this number left the course or were requested to resign. Investigation shows that too much care cannot be used in the selection of the applicants. A great majority of boys do not know what a trade means except in a very superficial way. Many of those who left took up the course because some one told them that it was desirable or under compulsion of parent or guardian. At present no applicant is taken on the course until he is interviewed by the shop supervisor, the general foreman of apprentices and Mr. Watson.

Selection and Training of College Men

Mr. W. M. Skiff, manager of the engineering department of the National Lamp Works of the General Electric Company, discussed experiences in the selection and training of college men. The method which is in operation at present was inaugurated in 1906. The practice now is to take into the engineering department each year a few technical men who engage immediately in the productive work of the department and who, after having obtained a thorough foundation and understanding of the entire business as viewed from the home office departments, take up positions of responsibility in other departments and divisions of the organization. During the autumn a representative of the organization visits universities and technical schools and by prearranged program gives a talk to the classes from which it is expected men will be selected. At the time of this visit no attempt is made to obtain applications, the idea being to acquaint the men with the organization, methods, etc., with the thought that they will be stimulated to investigate the proposition as a business opening. Several of the universities in the country are using the publications of the company as textbooks on lighting. A second trip is made to the colleges shortly after the midyear examinations. This trip is made by a committee consisting of three men, one of whom is from the home office and one from the manufacturing and commercial end of the business. The home-office man continues permanently on the committee. The manufacturing and commercial members are rotated from year to year. In order that every student interested in the proposition may have the opportunity of conference for more detailed information, one or two days are spent at each university visited. When a student enters the employ of the organization, Mr. Skiff said, an effort is made to inculcate in his mind the idea that the age of dictatorial policies is passing and is being supplanted rapidly by the "part in business" policy, thus creating the feeling that he is a part of the organization and that the best interests of the organization are his best interests.

In his discussion on the "Application of Educational Methods to the Reduction of Accidents" Mr. Sydney W. Ashe, of the General Electric Company, Pittsfield, Mass., said that the practical application of the teachings of psychology to accident prevention is, after all, the surest and quickest way of curing this industrial evil, which in 1911 in this country exacted a total of 13,625 lives. Mr. Ashe gave a brief summary of a safety educational campaign which was instituted recently at the Pittsfield works of the General Electric Company with the results which have been obtained. Besides this work there is a safety committee, the chairman of which is a member of the central safety committee for the entire organization. All of the educational methods used have been for the purpose of obtaining the co-operation of the workingman himself, and it is gratifying to note that in this respect a splendid response has been secured.

In conclusion Mr. Ashe said that the experiences of the company showed that in a country like America an enormous amount can be done toward the reduction of accidents by the use of educational methods. As a final adjunct to this work he suggested a plan whereby some central association like the National Association of Corporation Schools, the American Museum of Safety or the American Red Cross would award a gold medal to every individual who performs an unusual first aid service such as resuscitating an unconscious comrade by the prone pressure method. If this extra stimulus could be given there is no question as to the increase in stability which it would bring to the whole safety movement.

The subjects of vocational guidance and welfare work, physical efficiency, hygiene and sanitation were considered at the session on the afternoon of June 12. Mr. T. H. Bailey-Whipple, of the educational department of the Westinghouse Electric & Manufacturing Company, acted as chairman, in place of Mr. C. R. Dooley, secretary of this department. Mr. J. C. Robinson, financial secretary of the Employees' Association of the New York Edison Company, read a paper on the relations of this company and its employees. Dr. William H. Tolman, director of the American Museum of Safety, presented an address on "How to Prevent 50 Per Cent of the Accidents." He said that the modern committee of safety, with the safety engineer and his specialized knowledge at its head, forms an important part of almost every large corporation. The policy of prevention instead of compensation is gradually allowing the old figure of the claim agent to evolve into the larger position of safety engineer and to embrace the wider field of claim prevention.

Importance of Good Health Campaign

Dr. C. A. Lauffer, medical director of the Westinghouse Electric & Manufacturing Company, presented a paper on "Standardized First Aid." The approved first-aid package is a glass container which is inclosed in a felt-lined metal box. Dr. Lauffer expressed the opinion that the good health campaign is more productive of results in the line of accident prevention than much additional safeguarding of machines. Extensive observation leads to the belief that fatigue is the underlying cause of most of the industrial accidents.

Exhibits showing the methods employed in education were made by the Westinghouse Electric & Manufacturing Company, the General Electric Company, the Western Electric Company, the New York Edison Company, the Chicago Central Station Institute, the National Commercial Gas Association and others.

The Design of Illuminated Signs

Before a joint meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers, June 10, Prof. A. H. Ford, of Iowa City, presented a paper entitled "The Design of Electric Signs," setting forth the laws governing the legibility of illuminated signs and the method of design which produces legibility at any predetermined distance. After a discussion of his investigations and research to determine visual acuity the speaker stated that the maximum possible acuity is about 2000 measured as the ratio of the distance from two parallel lines at which they appear as separate lines to the distance between them. Curves plotted from data obtained showed that there is a marked change of visual acuity as the intrinsic brilliancy of the filament varies. In explanation of this fact it was said that wherever two images of parallel lines are formed on the retina the lines appear as one unless the images are far enough apart to leave a row of retinal cones unstimulated between them. When stimulus is intense the effect is apparently not confined to cones upon which the image falls, but spreads to adjacent cones.

Design of Solid Letter Signs

In designing solid letter signs with dark backgrounds the most important rule to follow, said the speaker, is that the distance between the letters and the elements of the individual letters must be greater than the maximum distance at which the sign is to be read, divided by the visual acuity for the letter luminosity used. During tests a curious effect noted in solid letter signs was that as the luminosity increased the distance of legibility first increased and then decreased to a fairly definite minimum. Low luminosity, it was decided, is best as compared with current practice for signs of this type.

The Point-Letter Sign a Problem

A designer of point-letter signs must keep the distance between the separate letters and parts of the same letter greater than the distance to the observer, divided by the visual acuity for two bright lines when the observer is at the maximum distance at which the sign is to be read; at the same time the distance between lamps on each letter must be less than the distance to the observer divided by the visual acuity for two bright points when the observer is at the minimum distance at which the sign is to be read. Considering these limits the speaker concluded that point-letter signs made of illuminated bull's-eyes are ordinarily more legible than those made of exposed lamps.

Selecting the combination sign as the most desirable for ordinary use, the writer suggested solid letters for the legend, with a border of bright lamps where it is desirable to attract attention by means of the brilliancy of the sign. In such signs spaces between the letters or parts of the same letter should be greater than the distance to the observer divided by 1000 when the observer is at the maximum distance at which the sign is to be read. From the standpoint of legibility the speaker contended that the next best sign is one with trough-shaped letters equipped with bowl-frosted lamps.

Discussion

In the discussion of the paper, Mr. R. E. Cleveland, of the National Lamp Works, Cleveland, Ohio, reported that he had been conducting similar tests on signs, keeping in view the commercial problems of the sign manufacturers. Although it may be true that certain types of signs are most legible, their inability to attract attention might eliminate them from the category of successful advertising media.

Mr. L. G. Shepard, Federal Sign System (Electric), said that Professor Ford's data bore out a common rule in use among sign makers to the effect that a 6-ft. letter should be legible at a distance of 1 mile.

Dr. Harry Gradle, speaking of the distance between sign letters, said that an electric sign to be successful should be entirely readable without too great motion of the eyes.

Chicago Street Lighting

The second paper of the evening, "Chicago Street Lighting," by Mr. P. E. Haynes, of the City Bureau of Electricity and Gas, was read by Mr. W. R. Matheny. Data presented showed that there are now approximately 19,000 arc lamps in use in Chicago, and there are 4000 tungsten units illuminating railroad subways, in addition to the city's ornamental tungsten and gas-lighting units.

Those who spoke in the discussion were Messrs. A. J. Sweet of Milwaukee, and J. R. Cravath, F. H. Bernhard and H. Schaedlich of Chicago. The speakers brought out the point that the experimental high-efficiency gas-filled lamps now operating on arc-lamp circuits appear to be remarkably successful.

The letter ballot on officers for the Chicago Section of the A. I. E. E. resulted as follows: Chairman, Mr. E. W. Allen; secretary, Mr. W. J. Norton; member of executive committee for three years, Mr. D. W. Roper.

Annual Report of Pacific Gas & Electric Company

The eighth annual report of the Pacific Gas & Electric Company, containing forty-five pages, covers operations during the year 1913 and also gives much general information in regard to the property. It is signed for the directors by Mr. Frank G. Drum, the president.

The company does approximately 36 per cent of the gas and electric business of the entire State of California and ranks as one of the four or five largest corporations of its kind in the United States. During the year 1913 the gross earnings of $16,202,337 were divided as follows: Sales of electric energy, $8,230,782, or 51 per cent; gas, $6,547,594, or 40 per cent; Sacramento Street Railway system, $572,913, or 4 per cent; miscellaneous income and gross earnings from sales of water for irrigation and domestic purposes, $851,047, or 5 per cent. At the close of the year there were 2948 stockholders of record; the average ownership was a little less than 143 shares. Including bondholders the total number of investors in the securities of the company is estimated to be more than 17,000; the average holding of bonds is about $5,600.

At the close of 1913 there were 132,355 electric consumers, a gain of $76,651, or 138 per cent, in six years. The average gain per year was 12,775 consumers, or 23 per cent. The average gross revenue per electric consumer in 1913 was $62.19. The number of gas consumers at the close of 1913 was 208,269. The gain in six years was 85,965 consumers. The average gain per year in gas consumers was 14,328. The average gross revenue per gas consumer in 1913 was $31.42. The company operates in thirty counties of central California, which have an area of approximately 37,000 sq. miles and at the 1910 census had a population of 1,325,000, or about 55 per cent of that of the entire State. The population served by electric service is 1,221,123. The total number of cities and towns served by electric service is 214, of which 152 are served directly and 62 indirectly. Mr. Drum says that climatically California may be compared with Italy and that it has been estimated that with its area of 158,000 sq. miles and population of about 2,750,000 it is capable of comfortably supporting as large a population as that Old World state with its area of 110,000 sq. miles and population of 32,500,000.

A further detailed analysis of this report, including the classification of earnings, extent of the physical system, operating practices, attitude toward regulation, etc., will be given in a later issue.

F. P. Fish Argues Against United Shoe Machinery Dissolution

In a powerful argument made at Boston before the federal court Mr. Frederick P. Fish opposed the dissolution of the United Shoe Machinery Company by the United States government. He pointed out that the business is based entirely on patents, involving an enormous amount of costly experimental work and necessitating the marketing of machines on a royalty basis on account of their experimental character in the early stages of the business. The government proposes to destroy the leasing system, although every manufacturer in the shoe-machinery business regards his patents as protected by the courts. It is alleged by the government that the basic patents were about to expire in 1899, but thirty-nine patented machines have since been developed, the annual production of welt shoes rising from 17,000,000 to 80,000,000 pairs. There are now 150 operations in the making of a pair of shoes, and every machine is related to those that go before and to those that come after. The government appears to have ignored the advance in patents since 1899.

Regarding patents Mr. Fish said: "Under a patent the patentee has extraordinary powers. He may sell his invention in whole or in part, and he may choose his selling territory. No restriction on the purchase of patents is shown in the decisions under the Sherman act. If I have a patent and another man has a patent and we need to combine to give the public what it demands, the law says, 'Get together! Give the public the benefit of the combination of ideas' . . . All the companies acquired have been acquired normally and legally. The government scoffs because we have settled patent litigation out of court, but the wise patent owner leans over backward to make such settlement." Closing, Mr. Fish pointed out that if the patents are distributed the company cannot make its machines, and he urged the court not to wreck the business, which is a peculiarly efficient example of combination for developing the technical appliances of a great industry.

Fast Time in an Electric Roadster

A "Detroit Electric" roadster recently made the 167-mile run from Philadelphia to Washington, D. C., in eight hours and forty-seven minutes actual running time. On the preceding day the same car made the trip from Atlantic City to Philadelphia in two hours and eleven minutes. After an all-night charge at Philadelphia the start for Washington was made at 4:50 in the morning. The average speed maintained on the trip was about 19 miles an hour. It was necessary to make three stops on the road for charging the battery—at Wilmington and Belair, Del., and at Baltimore, Md. The motorists, after making many detours en route, arrived in the capital city that night at 9:12 o'clock.

DATA ON PHILADELPHIA-WASHINGTON RUN AND RETURN

Departed	Arrived	Miles	Amp-hours	Time	Miles per Hour	Amp-hours Boost
Phila., 4:13 A.M.	Wil'm., 5:48 A.M.	32	75	1 hr. 35 min.	20.6	75
Wilm'n., 7:54 A.M.	Belair, 11:42 A.M.	64	167	3 hr. 46 min.	17.0	58
Belair, 2:28 P.M.	Balto., 4:10 P.M.	25	71	1 hr. 42 min.	15.0	120
Balto., 6:42 A.M.	Wash'n., 9:12 P.M.	46	105	2 hr. 30 min.	18.0	
Wash'n., 11:00 A.M.	Balto., 12:58 P.M.	42	105	1 hr. 58 min.	21.0	102
Balto., 3:52 P.M.	Belair, 6:15 P.M.	32	86	2 hr. 23 min.	15.0	71
Belair, 9:15 A.M.	Wilm'n., 1:20 P.M.	74	190	3 hr. 45 min.	20.0	100
Wilm'n., 4:10 P.M.	Phila. 5:37 P.M.	32	79	1 hr. 27 min.	22.0	

Public Service Commission News

West Virginia Commission

The Manufacturers' Light & Heat Company, of Pittsburgh, Pa., has applied for an injunction restraining the West Virginia Public Service Commission from reducing its rates in the counties in which it operates. Besides attacking the recent order of the commission reducing its rates, on the ground that the reduction is confiscatory, the company is taking the position that the act creating the commission is unconstitutional. The company has already been issued a restraining order, and it is this that it is attempting to enlarge into an injunction.

New York Commissions

The Richmond Light & Railroad Company, which had a boiler explosion on Oct. 21, 1913, made an application recently to the New York Public Service Commission, First District, for the approval of expenditures for new equipment and generating apparatus. Up to April 1, 1914, $182,544 had been expended. The company had considered a plan for buying energy, but later found it would be cheaper to generate energy.

Prof. M. E. Cooley, dean of the engineering school of the University of Michigan, has been appointed a member of the committee which is to make an independent valuation of the property of the New York Telephone Company in the State of New York in connection with the pending valuation by the New York Public Service Commission, Second District. The names of the other members were given in the *Electrical World* of June 13, 1914, page 1383.

Ohio Commission

The Ohio Service Company has filed an application with the commission asking permission to purchase the light plant at Canal Dover, the light and steam-heating plant at New Philadelphia and the light plants at Uhrichsville and Dennison at an aggregate price of $964,000. This company also contemplates taking over the transmission line of the Lafayette Light & Power Company, now under construction between the central station at Coshocton and the above-named towns, at a cost of $45,807. Further acquisitions in contemplation are the properties of the Midland Power & Traction Company, operating the electric-light and ice plant and the street-railway property at Cambridge and the traction line between Cambridge and Pleasant City.

In reply to requests made by officials of Akron, Canton and Barberton, the Public Utilities Commission has promised to go to Akron and hold a hearing as soon as certain proposed complaints are filed against the Northern Ohio Traction & Light Company.

Illinois Commission

The Illinois Public Utilities Commission has under advisement a controversy affecting electric service at Barry, Ill.

At the expiration of the electric franchise of the Central Illinois Public Service Company the city of Barry refused to grant a new contract unless the company would materially reduce the charge for electricity. The company would not make the agreement demanded and the franchise was not granted. Local business men then decided to organize a company and have applied to the commission for approval of their plans.

It developed at the hearing on this petition, however, that the business men have no plant and do not intend to build one. They want the commission to force the Central Illinois Public Service Company to sell electricity to them in order that they in turn may sell it to the city.

Indiana Commission

A hearing has been held before the Public Service Commission of Indiana at which the Citizens' Gas Company of Indianapolis asked authority to issue extension bonds and the city of Indianapolis attempted to prevent the issue on the ground that the amount involved was not sufficient to take care of all the extensions ordered by the Board of Works.

During the argument Chairman Duncan of the commission said that the Board of Works was not empowered to infringe in any manner on the powers of the commission concerning contracts with or orders to a lighting utility which had surrendered its franchise and accepted an indeterminate permit, and that the ultimate power with reference to the duties of such a company to a city government lies with the commission.

Because of this situation it is possible that the Indianapolis City Council will fail to ratify the proposed contract with the Merchants' Heat & Light Company for city lighting, on the theory that the forthcoming decision from the commission regarding all lighting rates in Indianapolis will change the basis of lighting rates so materially that the proposed contract would have to come before the commission again for adjudication. Meanwhile holders of bonds of the Indianapolis Light & Heat Company are exerting influence to keep the City Council from ratifying the proposed contract because of the unnecessary duplication of capital invested in extensions which the change from the Indianapolis company to the Merchants' company will cause. Members of the commission say that the question of the lighting rates in Indianapolis may not be settled until late in the summer.

Current News Notes

LOUISVILLE JOVIANS TO MEET MONTHLY.—The Louisville Jovians have had to abandon the plans they had worked out for weekly noonday meetings. Instead, the organization has decided to hold monthly evening meetings. The second Tuesday has been selected as the time for these meetings, and the members will meet at a local hotel for dinner, remaining afterward for speeches and institutional work.

* * *

EXAMINATION FOR ASSISTANT RADIO INSPECTOR.—The United States Civil Service Commission will hold an examination for assistant radio inspector on July 8. The salary for this position is $1,200 per annum. The duties will be primarily the assisting of radio inspectors in the enforcement of the wireless communication laws. The inspection work requires a knowledge of the installation and operation of the several types of radio installations, including the adjustments and tuning of transmitters and receivers. Applicants should be graduates of electrical engineering schools of recognized standing or have had not less than two years' experience in special radio work or the manufacture, installation and adjustment of wireless apparatus. Applicants should apply for Form 1312 and state the title of the examination for which the form is desired.

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ELECTRICAL INDUSTRIES IN NEW YORK CITY.—The first of two articles on the subject of the electrical industries in New York City prepared by the industrial bureau of the Merchants' Association appeared in the current issue of *Greater New York*, the bulletin of the association. New York City, fourth in rank in the manufacture of electrical products, stands first in the use of electric energy and electrical supplies. It has ten electric light and power companies, supplying nearly 200,000 customers. In addition, there are about 1700 isolated generating plants having together a greater output than the central stations. Besides, there is the energy for electric railways and the Pennsylvania, New York Central and New York, New Haven & Hartford railroad trains. The New York Telephone Company operates 528,000 telephones in the city, a number far in excess of any other industrial center in the world.

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THE INTERNATIONAL ELECTRICAL CONGRESS AND A-B-C MEDIATION.—It is of present-day interest to note that the friendly assistance of the South American republics and their electrical engineers proved a helpful factor in securing the International Electrical Congress for San Francisco in connection with the Panama-Pacific Universal Exposition next year. At the Turin congress of 1911 Germany had made all plans to secure the next international conference for the Fatherland during the present year, 1914. In spite, however, of these Continental arrangements, vigorous representations were made for America's right to the meeting, and with the help of the South American delegates present Germany's plans were reversed and it was voted to bring the 1915 Congress to the Western Hemisphere to celebrate the opening of the Panama Canal. As already announced in these columns, the International Electrical Congress will be held at San Francisco Sept. 13 to 18, 1915.

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A PRIMARY-BATTERY-PROPELLED STREET CAR.—Propelled by energy from a battery of primary cells carried on a flat-car following it, one of the street cars of the Wichita Falls (Tex.) Traction Company was recently operated through the streets of the city without trolley connection or other source of supply. The battery used employs carbon and zinc with a secret solution which, like the zinc, must be renewed at intervals. Messrs. Julius J. Krohn and John McGivney are the inventors. On its trial trip the car carried thirty-five persons, but had to be helped over some of the grades by a trolley car.

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Examination for Steam Engineer.—The United States Civil Service Commission will hold an open competitive examination on July 8 for first-class steam engineer. The usual entrance salary of this position is $1,200 a year. Competitors will be examined in practical questions in mechanical and electrical engineering, comprising the construction and operation of the heating plant and electric lighting and elevator machinery in first-class public buildings, and will be required to write a letter on some mechanical or engineering subject. Training and experience will count twenty-five weights. Persons desiring to take this examination should write for Form 1312 of the United States Civil Service Commission, Washington, D. C., stating the title of the examination for which the form is desired.

* * *

Lighting Subways at Elevated Track Crossings.—Mr. Ray Palmer, commissioner of gas and electricity for the city of Chicago, has completed arrangements with the steam-railroad companies in Chicago by which the plan of standard lighting for the subways under the elevated tracks at street crossings, as worked out by the Department of Electricity, will be carried out. The contract involves the lighting of 830 subways, the railroads agreeing to pay for 410 of these and the city for 420. Incandescent electric lighting will be used, the units being 25-watt lamps. The number of lamps required for each subway will vary from two or three to possibly 100, depending on the size of the subway. The average number of lamps to a subway will be about sixteen. Electrical energy will be furnished by the Sanitary District of Chicago and the Commonwealth Edison Company.

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SOCIETY MEETINGS

American Electrochemical Society.—The fall meeting of the American Electrochemical Society will be held at Niagara Falls, N. Y., Oct. 1, 2 and 3. The secretary of the society is Dr. Joseph W. Richards, Lehigh University, South Bethlehem, Pa.

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Electrical Credit Men's Convention.—The fifteenth annual convention of the National Electrical Credit Association will be held at the Hotel Statler, Buffalo, N. Y., on June 27, beginning at 10 o'clock. Mr. F. P. Vose, Marquette Building, Chicago, is the secretary of the association.

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Jovian Activities at Louisville, Ky.—Mr. R. E. Brian was elected president of the Jovian League of Louisville at the recent June meeting held in the Tyler Hotel. Mr. Robert Montgomery was chosen vice-president and Mr. Carl A. Klemm was elected secretary. Messrs. James Clark, Jr., and W. O. Smith were added to the board of directors. The July meeting of the league will take the form of an outing at Senning's Park, Louisville.

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Jovian League of Southern California.—The luncheon of the Jovian Electrical League of Southern California, which was held on June 3 at Christopher's, brought forth an attendance of 100 members and guests. Mr. J. C. Rendler, chairman, introduced the speaker, Mr. Edward A. Regan, former Assistant United States District Attorney, who discussed "General Organization," referring in particular to the evident spirit of co-operation which exists throughout the electrical industries and interests of Southern California as plainly exemplified by the attendance at and interest shown in the meeting.

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Pittsburgh Section of E. V. A. Formed.—A Pittsburgh Section of the Electric Vehicle Association of America was organized on June 11 at a meeting held in Pittsburgh, Pa., under the auspices of the Pittsburgh Electrical Association. The new branch consists of about thirty members interested in electric automobiles and commercial vehicles. The organization was effected through the efforts of Messrs. Albert Jackson Marshall, executive secretary of the National Association, and Charles A. Ward, secretary of the Ward Motor Vehicle Company, New York. The executive committee of the Pittsburgh Section consists of Messrs. W. A. Donkin, chairman; M. V. Schoef, vice-chairman, and Joseph A. Jaques, secretary. Among those who spoke at the organization meeting were Messrs. Henry Harris, of the Duquesne Light Company, Pittsburgh, and Clarence Van Brandt, of the Exide Storage Battery Company, Philadelphia.

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Evening Meeting of Chicago Electric Vehicle Men.—The meeting of the Chicago Section of the Electric Vehicle Association of America on June 10, the first to be held under the direction of the new officers, Chairman W. J. McDowell and Secretary F. E. McCall, took the form of a dinner meeting instead of the usual luncheon. Mr. George H. Jones and Mr. Homer E. Niesz, Commonwealth Edison Company, and Mr. C. B. Frayer, manager of the Edison Storage Battery Company, made short talks concerning the interest shown in the electric vehicle at the recent Philadelphia convention. The speech of Dr. Steinmetz, as reported in the *Electrical World* of June 6, was read by Mr. Niesz, and was received with enthusiasm. In the routine business of the evening the following were appointed as committee chairmen: Programs and papers, Mr. L. E. Wagner; membership, Mr. C. B. Frayer; garage, Mr. Harry Salvat; orphans' day outing, Mr. Homer E. Niesz, and traffic regulation, Mr. D. C. Arlington.

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Canadian Electrical Association Convention Committees.—For the twenty-fourth annual convention of the Canadian Electrical Association, which will be held in Montreal, Canada, from June 24 to 27, at the Ritz-Carlton Hotel, the local committees are as follows: General committee, Major Hutcheson and Mr. J. S. Norris, joint chairmen, and Messrs. L. D. McFarlane, E. F. Sise, G. H. Olney, R. S. Kelch, R. J. Jones and J. M. Robertson and Dr. L. Herdt; ways and means committee, Mr. Julian C. Smith, chairman, and Messrs. K. B. Thornton, J. A. Shaw, R. H. Balfour, W. F. Graves and R. F. Morkill; entertainment committee, Mr. Lawford Grant, chairman, Alderman Boyd and Messrs. Paul Sise, R. G. Harris, W. C. Lancaster, W. H. Winter, H. C. Post, R. Roper, H. C. Powell and R. M. Wilson; publicity committee, Mr. S. W. Smith, chairman, and Messrs. W. J. Doherty and L. J. Belknap; finance committee, Mr. J. W. Pilcher, chairman, and Messrs. C. F. Medbury, F. W. Smith, R. M. Wilson and L. B. Belknap; honorary secretary, Mr. P. T. Davies. A special program has been arranged by the entertainment committee.

Plant of the Salmon River Power Company—II

General plan and features of design which are peculiar to the transmission end of this new and interesting hydroelectric installation

In last week's issue of the *Electrical World* the hydraulic and electrical generating equipment of the new power plant of the Salmon River Power Company, near Altmar, N. Y., was described, together with the history of the development of the project. The following paragraphs cover the transformers and control apparatus and the transmission line connecting the plant with the remainder of the system of the Niagara, Lockport & Ontario Power Company.

Transformers

The main transformers are water-cooled, and each set of three is star-connected on the high-tension and delta-connected on the low-tension side. Each has a weight of approximately 27 tons complete, made up as follows: Core and coils, 15.5 tons; oil, 5 tons, and case, 6.5 tons. Like the generators, the transformers are designed for high efficiency at light load, the full-load copper loss being 30.8 kw and the core loss 16.7 kw. The specified regulation is 1.55 per cent at full load and 100 per cent power-factor, and 4.15 per cent at 85 per cent power-factor.

The transformer cases are mounted on flanged wheels rolling on tracks, this mounting permitting the bringing of the transformers into the field of the crane. The usual provisions are made to drain the cases of oil and to clean and dry the oil. Three 100-kw self-cooled transformers are used for general service about the plant, stepping the voltage down from 6600 to 220. These are delta-connected on both sides.

Auxiliary Apparatus

The busbars, circuit-breakers, control switchboard, etc., are placed in galleries at one side of the turbine room and in the small bay already referred to. The high-tension busbars, which are in duplicate, are hung directly from the roof, and a row of disconnecting switches is mounted just below them, a switch as well as a circuit-breaker being in each line on the line side and on the transformer side. The line and transformer circuit-breakers are on the upper gallery, and all connecting wires are No. 0000 hard-drawn trolley wire, which is of sufficient stiffness to avoid the necessity of many supports. On the lower or main floor under the gallery are the generator circuit-breakers, the main and service transformers, the service circuit-breaker structure, the storage battery for switch operation, the oil storage, cleaning and drying equipment and auxiliaries.

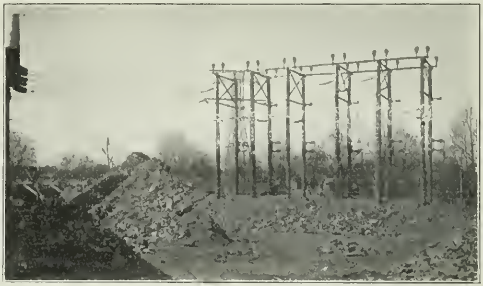


FIG. 11—LIGHTNING ARRESTERS AND TERMINAL STRUCTURE AT POWER HOUSE

The feeder bay, referred to before, has two floors, the lower of which contains the superintendent's office and the control switchboard. The switchboard is of the vertical panel type. It is, of course, quite remote from the turbine room. Above the switchboard room is the line entrance chamber with choke coils and line "disconnects."

Without going into detail of switchboard layout, it may be said that the general plan is as follows: For each generator there is one panel containing control apparatus for a generator, its exciter and its transformer bank, and an auxiliary recording meter and relay panel. The main panel contains a polyphase indicating wattmeter, a polyphase power-factor meter, a Tirrill regulator, ammeters, voltmeters, a drum-type,

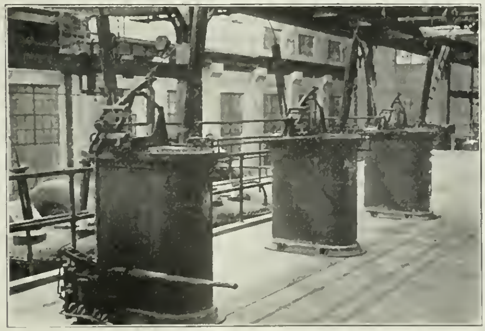


FIG. 10—60,000-VOLT TRANSFORMERS AND CIRCUIT-BREAKERS

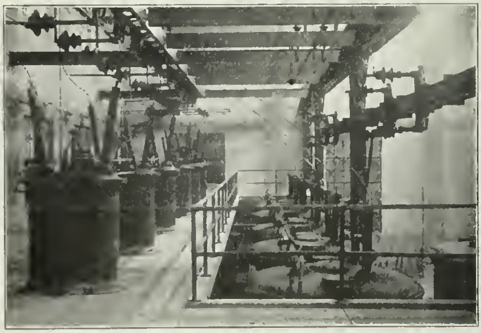


FIG. 12—60,000-VOLT TRANSFORMERS AND CIRCUIT-BREAKERS

oil-switch controller and the usual synchronizing plugs, indicating lamps and field-current controllers. On a swinging bracket are a frequency meter and a synchroscope. Each generator panel also contains a controller for the water-wheel governor and another for the 0.5-hp hydraulic valve control motor and indicating lamps to show the position of the hydraulic valve plunger. On each auxiliary panel is a polyphase watt-hour meter, a graphic polyphase wattmeter, reverse-power relays with selective relays, reverse-power relays without selective relays for overload and reverse power and connected to trip both the 60,000-volt and 6600-volt circuit-breakers, together with the necessary relay switches, and an instantaneous no-voltage relay.

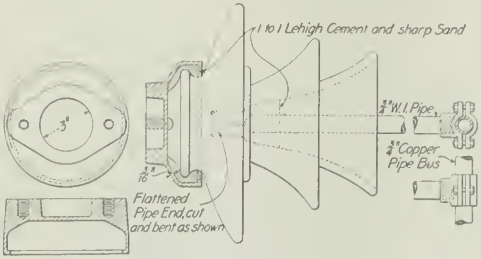

1 to 1 Lehigh Cement and sharp Sand
3'
3/4" W.I. Pipe
3/4" Copper Pipe Bus
1/16"
Flattened Pipe End, cut and bent as shown

FIG. 13—HIGH-TENSION BUSBAR INSULATOR

There is one 60,000-volt, three-phase feeder control panel with an auxiliary relay panel equipped for two 30,000-hp lines. An ammeter is provided for each line wire, and there are the necessary oil-switch controllers and indicating lamps. Finally there are two service panels, one for direct current and the other for alternating current. These have standard equipment.

The relation of all these switches, instruments, etc., will be evident from the accompanying diagram of electrical connections.

The high-tension line circuit-breakers are of the 110,000-volt, triple-pole, single-throw reactance type of 300-amp rating.

The Transmission Line

The line which connects the generating plant at Bennett Bridge with the substation of the Niagara, Lockport & Ontario Power Company at Solvay, near Syracuse, is approximately 42 miles long and comprises two circuits.

The line conductors are of No. 0000 seven-strand-cable, hard-drawn copper. The elastic limit of this is not less than 35,000 lb. per square inch and the ultimate strength 50,000 lb. Permissible elongation in 10 in. is not less than 1.5 per cent and as nearly 2 per cent as possible. Conductivity is at least 98 per cent of Matthiessen's standard. The lines are protected for a distance of a few miles at each end by three ground wires, and for the rest of the way by two ground wires. These ground wires are of galvanized Siemens-Martin steel strand. A telephone line of ¼-in. copper-clad steel is carried directly on the transmission towers.

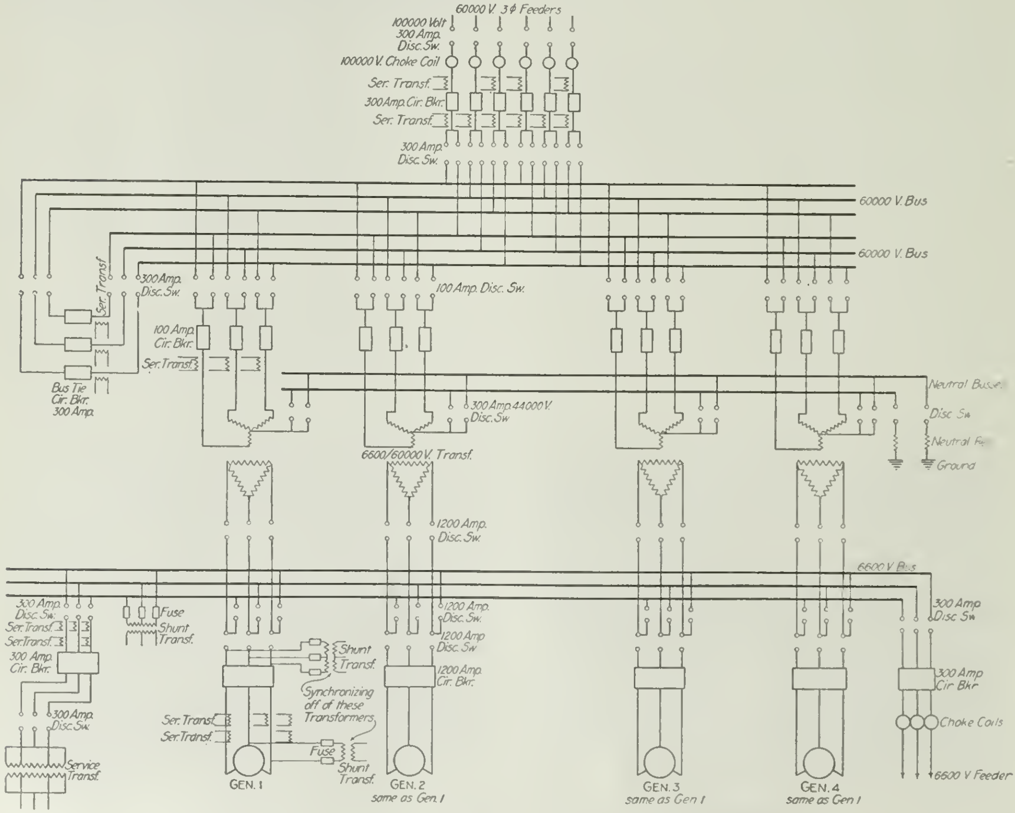


FIG. 14—DIAGRAM OF ELECTRICAL CONNECTIONS IN POWER HOUSE

Starting at the line circuit-breaker (see Fig. 14) each line wire first includes an oil-immersed choke coil, passing thence to a disconnecting switch mounted high in the terminal chamber. The wall entrance is through a 36-in. tile set in the wall at an angle and containing a concrete diaphragm supporting a multi-sleeve porcelain bushing.

Outside the power plant is a structure built up of 50-ft. wooden poles and cross-arms and serving several purposes. It acts as an angle and strain tower, taking up all line tension and starting the line off in the proper direction. The topography of the station site is such as to make this necessary. It carries the horn-gap arresters and fuses which furnish the lightning protection for the station, keeping this apparatus at a suitable distance from the latter. Each line wire is attached to the station wall by two strings of insulators set at an angle thereto, to prevent swinging of the entrance wire, and to the angle tower by a single string at each of two points.

Each lightning arrester consists simply of two electrically parallel, grounded horn-gaps, one longer than the other. The shorter gap is grounded through a fuse.

The Salmon River line is to be tied in with the Niagara Falls plant of the Ontario Power Company, acting in general as a source of energy but occasionally as a synchronous condenser plant. Towers of greater strength than is usual for such lines were installed. The specifications called for the following test load strength: For the standard towers, a load of 4000 lb. applied in a horizontal direction at any one of the conductor or ground-wire supports, or a horizontal load of 12,000 lb. applied at the center of the tower at the middle cross-arm, or a vertical load of 2000 lb. applied at any insulator or ground-wire support, should not produce failure or permanent distortion of any member. For the strain towers of standard type the corresponding figures are 4000 lb., 30,000 lb. and 2000 lb. The towers are heavy, not only on account of the great strength called for, but also because a very liberal allowance was provided for clearance to prevent the line wires from swinging together. The standard towers are designed for spacing ten to the mile.

The towers are of the square, rigid type, the arrangement being as shown in the accompanying diagrams. The height of the standard tower is 44 ft. to the point of support of the lowest insulator, and provision was made for extensions to be applied to the bases to raise some towers from 10 ft. to 20 ft. higher. While the insulators are placed in general one above the other, the middle one is offset. The vertical distance between cables is 8 ft., and the middle one on each side projects beyond the uppermost and lowest a distance of 6 ft.

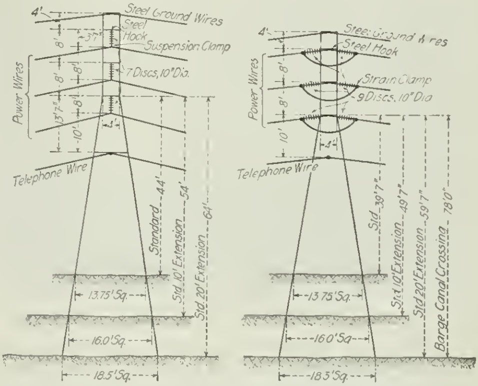


FIG. 16—STANDARD TOWER DIMENSIONS

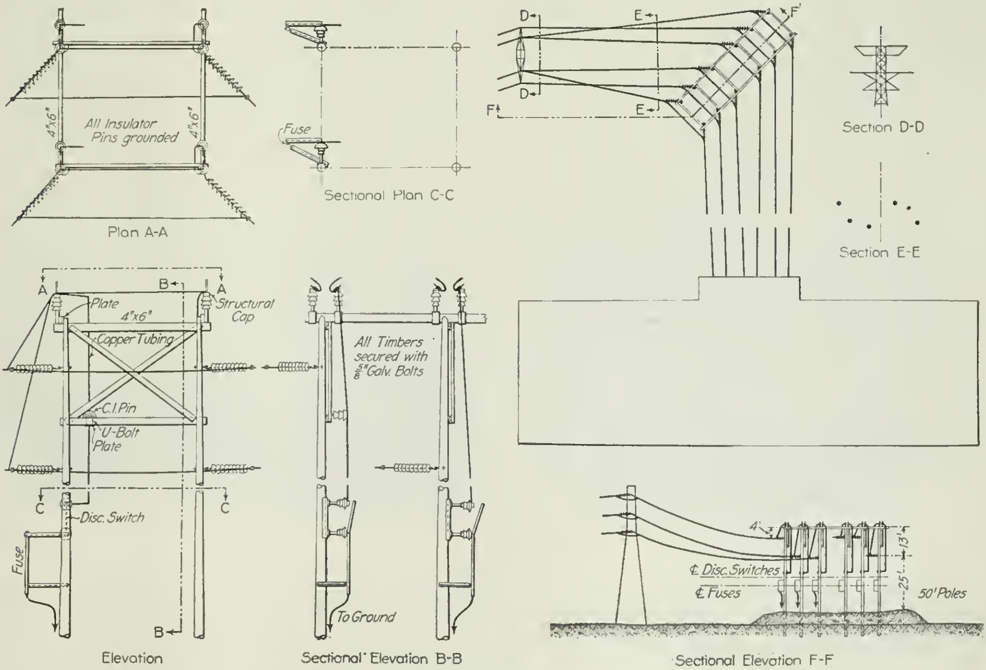


FIG. 15—DETAILS OF LIGHTNING ARRESTERS AND TERMINAL STRUCTURE

The towers carry four cross-arms. The top one is for the ground wires and below it are two short arms and one long one, all carrying strings of insulators at both ends. (See Figs. 16 to 21.) Approximately one-fourth of the towers are strain towers, and there are several special towers constructed to comply with the regulations of the steam railroads which have to be crossed. The parts of the tower are galvanized after manufacture and all bolts, nuts, washers, clamps and other small parts are sherardized.

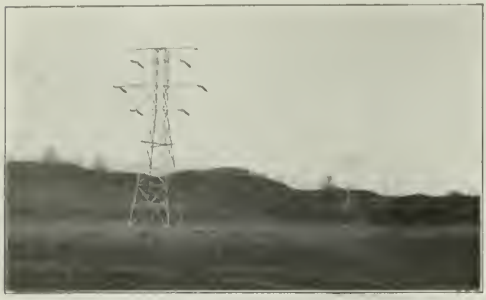


FIG. 17—STRAIN TOWER

All of the footings for the standard towers are of structural steel shapes, galvanized and provided with holes for the attachment of timber or other structures for adaptation to special conditions.

Special Design and Operating Features of the Plant

From the above description it is evident that the plant of the Salmon River Power Company is unusual in a number of particulars. It is designed to operate in parallel with a plant six times as large as itself, situated 200 miles away by transmission line. Its characteristics must be such that it will carry a proper portion of the load. The smaller plant must be protected from the effects of excessive loads on the line and of short-circuits within itself. For this reason, as will have been noted, the design of the generators is such that they will not be injured by any attempted draft of excessive current.

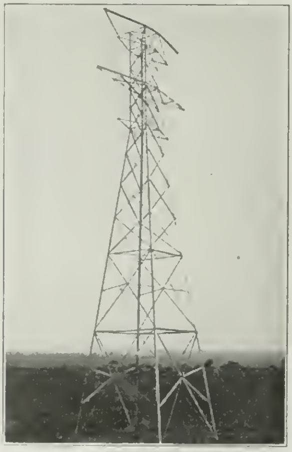


FIG. 18—TOWER NEAR ROCHESTER, SYRACUSE & EASTERN RAILROAD

From the operating standpoint the design of the plant involved studies of the following features: (1) The kilowatt rating of the plant in relation to the stream flow and the load characteristics, to the end that its output might be utilized to the best advantage. (2) The speed regulation of the plant, to the end that it should take its share of both slow and rapid load variations. (3) The regulation of the voltage of the plant, to the end that it should give a uniform voltage at any desired point on the transmission system. (4) Provision for utilizing the plant for power-factor regulation in the line and, when it is not carrying active load for one reason or another, for using it as a great synchronous condenser to draw leading current and thus improve the power-factor of the load on the Niagara Falls plant. Some of the interesting features adopted as a result of these studies are as follows:

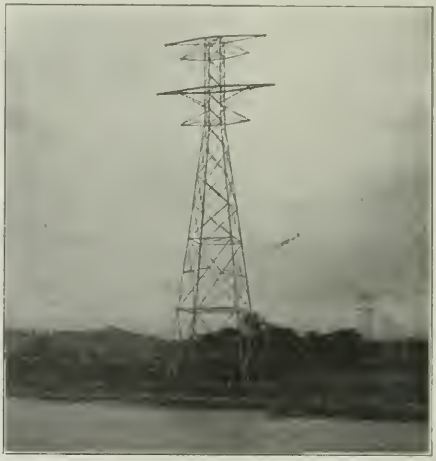


FIG. 19—ERIE CANAL CROSSING

The heavy flywheels were installed on the generating units for the purpose of increasing the flywheel effect of the rotating parts to a value equal to that of the units at Niagara Falls. The energy storage thus provided, by improving the speed regulation, will enable the plant to take its share of momentary overloads. For the present the load will be regulated by hand on telephone orders from a central point such as Syracuse. It is possible that automatic control of load

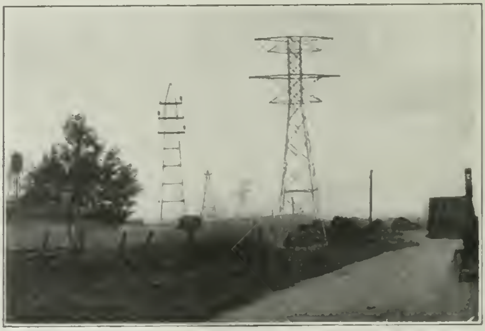


FIG. 20—TOWER LINE NEAR LINE OF N., L. & O. TRANSMISSION

will be provided later. For the purpose of improving the operation of the generators as synchronous condensers, amortizing windings were provided in the pole faces.

As the plant is to be operated at considerable distance from its load, the regulation of voltage has to be made with the requirements of the distant point in view. For this purpose the Tirrill regulators which are installed on each generating unit are operated in conjunction with a line compensator. A special scheme has been worked out by the company's engineers in which a series transformer with three windings is utilized for compensation. Two of the windings have variable numbers of turns, the adjustment being made by means of rheostat face plates. The remaining winding on the transformer is connected to the compensating coils, which form part of the Tirrill regulator.

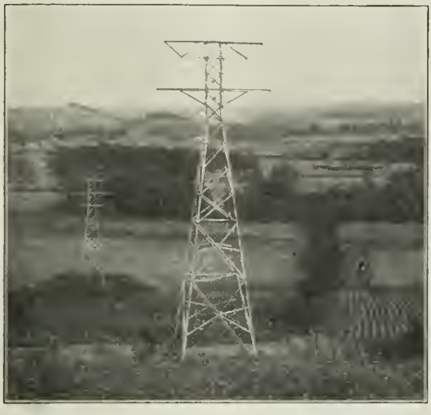


FIG. 21—VIEW OF CROSS-COUNTRY LINE OF TOWERS

With the regulator thus connected, when the two adjustable primary coils of the series transformer are connected respectively to the secondaries of current transformers in two of the three line wires, the compensating coils produce an effect in the regulator dependent upon the current in the two line wires and therefore proportional to the line drop. The numbers of turns in the primary coils are adjusted to give the desired degree of compensation. By manipulating the levers controlling the numbers of primary turns both relatively and absolutely, both the phase and the magnitude of current in the third winding can be controlled. Once set, the apparatus will regulate for any given compensating condition.

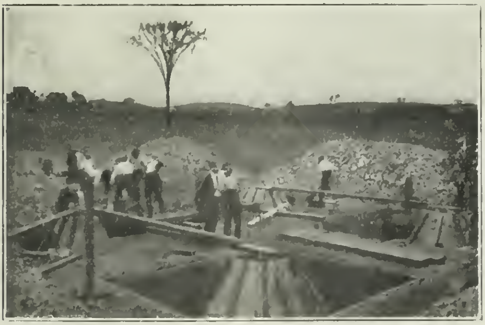


FIG. 22—CONCRETING FOOTINGS FOR SPECIAL NEW YORK CENTRAL CROSSING

FIG. 23—EXCAVATION FOR FLOATERS, CICERO SWAMP

The plant will contain four generators, which will be operated in parallel with separate Tirrill regulators. This desirable method of operation necessitates and is made possible by power-factor compensation to prevent interchange of current between generators. Such power-factor compensation is provided in accordance with the following simple plan: The alternating-current coil in the Tirrill regulator is provided with current from a circuit in which is the secondary of a shunt transformer with its primary winding connected across two terminals of the generator. In the regulator circuit is also a resistor connected across the secondary of a series transformer in the third leg of the generator winding. When the generator is supplying a unity power-factor load the two components of the electromotive force thus produced in the alternating-current regulator coil are in quadrature. When the power-factor varies from unity the electromotive force produced by the quadrature current has a rapidly increasing component in phase (or opposition) with the main electromotive force, thus causing the regulator immediately to restore the unity power-factor condition. The same system of connections works equally well when the load is at other than unity power-factor (within limits), except that a slight compounding effect due to load variation is magnified. By setting the apparatus to divide the wattless current properly among the generators at one load, the adjustment holds for other loads.

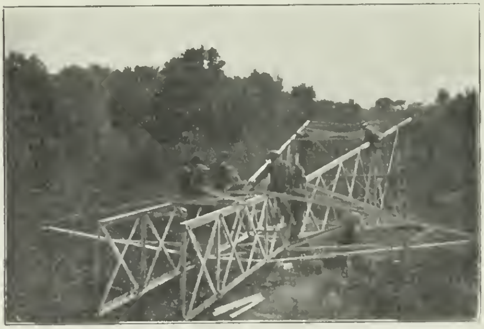


FIG. 24—WORKMEN EMPLOYED IN ASSEMBLING TRANSMISSION-LINE TOWER

Among other provisions for insuring satisfactory operation, we may mention the extra insulation of that portion of the station wiring directly exposed to line conditions from the line entrance to and including the line terminals of the choke coils. The insulation is designed for 110,000 volts so that failure is no more likely to occur here than on the line. The high-tension busbars are duplicate.

Provision has been made for grounding the neutrals of the generators in the station, but the desirability of doing so is still under discussion. The transformer neutrals have, however, been grounded through high resistance.

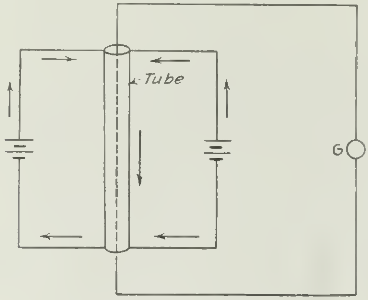
The generators in the new station are synchronized on the low-tension side by means of three shunt transformers. Two of these are connected to the circuits on one side of the oil circuit-breaker and are used for the instruments and relays. On the generator side of the circuit-breaker is a special shunt transformer for voltmeter, regulator and synchronizer. The arrangement of synchronizing apparatus is suggested in the accompanying electric circuit diagram. (See Fig. 14.)

Engineering Direction of the Plant

The engineering of the plant as described in the foregoing article has been under the direction of Mr. V. G. Converse, chief engineer of the Salmon River Power Company. Barclay, Parsons & Klapp had charge of the engineering and construction of the dam and acted as consulting engineers for the entire work. The plant was put into operation on April 10, 1914, and is now operating with entire satisfaction, carrying daily a maximum of 15,000 kw. Two units are now in operation and the third and fourth are in process of installation.

An Electromagnetic Puzzle

A conducting tube forms the return circuit as shown for two sources of emf, making a symmetrical arrangement of conductors with the tube as the central common path. The magnetic flux in such a tube is everywhere zero, and yet if the tube be threaded with a wire having its ends connected to a galvanometer and the flow of current be interrupted or restored in the tube, an induced emf will be indicated by the galvanometer, according to Prof. F. J. Rogers, of Princeton University, who submitted this phenomenon to the American Physical Society, at its Washington meeting, as "an electromagnetic puzzle." From his own experiments Professor Rogers reports that he found the induced emf to be proportional to the length of the conductor tube inclosing the galvanometer circuit.



MAGNETIC INDUCTION OCCURRING IN A FIELD OF ZERO FLUX

COMMUTATION—I

BY ALFRED STILL

MUCH valuable experimental work has been done in the investigation of commutation phenomena, and the amount of printed matter treating of the theory of commutation constitutes an important percentage of the formidable mass of literature devoted to electrical-engineering subjects. Notwithstanding this vast store of experience and knowledge, papers and articles dealing with various aspects of commutation still continue to be read and written. Clearly, the subject is not yet exhausted; yet the manufacturer of dynamo-electric machinery is ever ready to declare that during the last twenty years he has experienced no difficulty in producing machines to run absolutely without sparking, the impression produced on the buyer being that he, the manufacturer, prefers to sell a machine with a commutator rather than one which does not require this addition. This is an impression which may well be based on fact, seeing that the commutator quite appreciably enhances the price of the machine. The user, on the other hand, appears to be sceptical of the good qualities and behavior claimed for the commutator and brush gear; and, although as a general statement it may be said that his troubles—when they occur—are not infrequently due to his carelessness or fault rather than to defective design, yet, from the impartial point of view of those who are neither manufacturers nor operating engineers, it does seem that troubles due to commutation are not entirely imaginary or of merely historic interest.

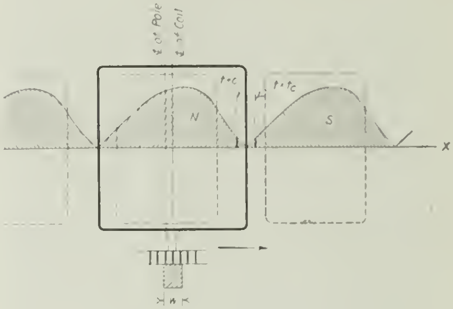


FIG. 1—COMMUTATED COIL IN NEUTRAL ZONE

The present writer might deem it necessary to apologize for presenting yet another article on the phenomena of commutation in continuous-current machines were it not that he believes it possible to put the fundamental principles involved into a somewhat simpler form than they usually assume when clothed in mathematical symbolism or when—as is not infrequently the case—the writer himself is embarrassed by his inability to obtain a clear mental conception of the physical phenomena he writes about.

Before the publication of Mr. Lamme's paper[1] the methods of Dr. Steinmetz[2] and Dr. E. Arnold[3] formed the nucleus around which the bulk of our commutation literature clung. Mr. Lamme's paper has the great merit of putting the more or less familiar problems of commutation in a new light. The end he attains is approximately the same as that attained by any other reasonably accurate method of analysis, provided all factors of importance are included, and the difficulties he encounters are of the same order and magnitude as those encountered by other investigators, but by getting nearer to the true physical conditions in the zone of commutation he saves us from drifting, sometimes aimlessly, on a sea of abstract speculation. Although the present article has undoubtedly been suggested by the reading of Mr. Lamme's paper, yet its aim is not so much to furnish additional material for the designer as to give the student a clear conception of the phenomena of commutation. The writer's end is simplicity or clearness, even if the less important factors are entirely ignored, while, in Mr. Lamme's own words, his method of analysis, including as it does more conditions than are usually included, "instead of making the problem appear simpler than formerly . . . makes the problem appear more complex."[4]

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[1] "A Theory of Commutation and Its Application to Interpole Machines," by B. G. Lamme. *Trans.* A. I. E. E., Vol. XXX, pp. 2359-2404.

[2] "Theoretical Elements of Electrical Engineering."

[3] "Die Gleichstrom-Maschine."

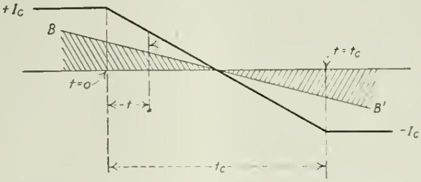

FIG. 2—RELATION BETWEEN SHORT-CIRCUIT CURRENT AND MAGNETIC FLUX IN COMMUTATION ZONE

In the first place, it may be stated that considerations of a mechanical nature, such as vibration, uneven or oily commutator surface, insufficient or excessive brush pressure, etc., cannot even be touched upon in the space of this article, and, in the second place, ideal or "straight-line" commutation will be assumed, and the conditions necessary to produce this—generally desirable—result investigated, in order that a multitude of more or less arbitrary assumptions may not obscure the problem in its early stages. By working from the simplest possible case to the more complex it is thought that the object in view—a physical conception of commutation phenomena leading to practical ends—will best be served, and influencing factors of relatively small practical importance will be either disregarded or but briefly referred to.

Consider a closed coil of wire of T turns moving in a magnetic field. At the instant of time $t = 0$ the total flux of induction passing through the coil is $+\Phi_o$ maxwells, and at the instant of time $t = t_c$ seconds, the total flux through the coil is $+\Phi_c$ maxwells. Then on the assumption that the flux links equally with every turn in the coil, the average value of the emf developed in the coil during the interval of time t_c is

$$e_m = \frac{(\Phi_c - \Phi_o)\,T}{t_c \times 10^8} \text{ volts.}$$

If r is the ohmic resistance of the coil and e is any instantaneous value of the emf produced by the cutting of the actual magnetic field in the neighborhood of the wire, the instantaneous value of the current in the coil is $i = \frac{e}{r}$, because e is the only emf in the circuit tending to produce flow of current. The usual conception of a distinct flux due to the current i producing a certain flux linkage known as the self-inductance of the circuit is avoided; but its equivalent has not been overlooked, seeing that the magnetomotive force due to the current in the coil is a factor in the production of the flux actually linked with this current at the instant of time considered. It is not suggested that the orthodox method of introducing self-induction and mutual induction as separate entities endowed with certain properties peculiarly their own is not without advantages in the solution of many problems, especially when mathematical analysis is resorted to, but it tends to obscure the issue when seeking a clear understanding of the physical aspects of commutation. The splitting up of the magnetic induction resulting from different causes into several components is frequently convenient and should not be condemned except in certain cases when iron is present in the magnetic circuit. It cannot, however, be denied that self-induction and mutual induction are frequently thought of as different from other kinds of induction. Indebtedness for this state of things is due to some writers whose familiarity with mathematical methods renders a clear physical conception of complicated phenomena unnecessary, but the practical engineer or designer who produces the best work, especially in departures from standard practice, is usually he who has the clearest vision of the physical facts involved in the problem under consideration. If the term self-induction calls up a mental picture of magnetic lines, being a certain component—expressed in maxwells—of the total or resultant flux of induction in a circuit, this does not prevent speaking of flux linkage per ampere of current as inductance—expressed in henrys—and using the formula $e = L\frac{di}{dt}$ to calculate that component of the total emf in a circuit which would have a real existence if the field due to the current i in the wire were alone to be considered.

Following the lead of Mr. Lamme, the wires in the coil undergoing commutation will be thought of as cutting through a total flux of induction, expressed in magnetic lines or maxwells, this flux being the result of the magnetizing forces of field coils and armature windings combined.

In Fig. 1 the thick line rectangle represents a full-pitch armature coil of T turns undergoing commutation. The dotted rectangles show the position of two consecutive field poles, and the shaded curves represent the ascertained or calculated flux distribution over the armature surface. The ordinates of this curve indicate at any point on the periphery the density of the flux entering the armature core. The direction of slope of the shading lines indicates whether the flow of flux is positive or negative. There are means of determining, within a reasonable degree of accuracy, the air-gap and interpolar flux distribution for all conditions of field magnet strength, armature load, and brush lead,[5] and the assumption is here made that such curves can readily be drawn to represent the actual peripheral flux distribution in the commutating zone. The coil is supposed to be moving from left to right, and measure-

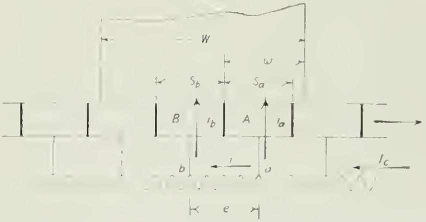

FIG. 3—CURRENTS IN COMMUTATED COILS AND CONNECTIONS

ments on the horizontal axis $X X$ may represent either distance traveled or lapse of time, since the armature is revolving at a uniform speed. The case considered is that of a dynamo without commutating poles, with brushes moved forward from the geometric neutral or no-load commutation position until a neutral commutating zone is again found. The flux curves as drawn are the result of the combined mmfs of field coils and armature windings. During the time of commutation, t_c, which, if we neglect the effect of mica thickness, is the time taken by a point on the commutator to pass under the brush of width W, the conductors on the right-hand side of the short-circuited coil have been moved through the neutral zone from a weak field of positive polarity into a weak field of negative polarity, while the conductors on the left-hand side of the coil have moved from a weak field of negative polarity into a weak field of positive polarity. Owing to the symmetry of the fields under the poles of opposite polarity (i.e., the similarity in shape and equality in magnitude of the shaded flux curves), and the fact that the small portions of the flux curves near the neutral point may be considered as straight lines, the resultant flux cut by the two coil sides—joined in series by the end connections—may be represented by the shaded area in Fig. 2, where positive values are measured above, and negative values below, the horizontal axis. Intervals of time are measured horizontally from left to right, and the straight line $B B'$ represents the flux distribution in the commutating zone. The direction of this flux is such as to develop in the short-circuited coil, at every instant of time during the period of commutation, an emf tending to produce a current in the required direction; that is to say, from the commencement of short-circuit, when $t = 0$, until the middle of the commutation period, when both flux and current are of zero value, the small amount of flux cut by the short-circuited conductors is of the same kind as that previously cut by the conductors, while from the time $t = t_{c/_2}$ until the end of commutation ($t = t_c/2$) the flux is of the opposite kind, being such as will cause the current to flow in the opposite direction. The amount of the flux required to bring about this condition is a small percentage of the flux cut by a coil under the main poles in the same interval of time, because the resistance of the armature windings is always low in comparison with the resistance of the external circuit, and, as a matter of fact, it is the *average* value of the flux entering the armature over the commutating zone with which the designer is usually concerned. If the brushes are so placed as to bring the short-circuited conductors in a neutral field, satisfactory commutation will result. At first sight it would seem that this general statement, being manifestly true, requires no further elucidation, but it has been known to have much the same effect as the proverbial red rag upon the normally inoffensive bull, as evidenced by the controversy which raged in the technical journals of not very distant date.[6] It is not the purpose of the present writer to take part in this controversy, because it seems to him that all, or nearly all, those who have written on this subject are agreed as to the desirable conditions for ideal commutation. Apart from the disinclination experienced by all but exceptional persons to admit the reasonableness of an opponent's point of view, the origin of controversies is usually a misunderstanding based on differences of language or the misuse of words. It is rarely that two men will regard a problem from exactly the same viewpoint, and, in the present writer's opinion, stereotyped methods of presenting the admittedly difficult problem of commutation are, therefore, to be avoided. The chief merit of Mr. Lamme's Institution paper, previously referred to, lies in the fact that it departs from conventional methods.

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[4] Reply to discussion, *Trans.* A. I. E. E., Vol. XXX, p. 2426 (1911).

[5] See, for instance, W. E. Goldsborough in *Trans.* A. I. E. E., Vol. XVII, p. 679.

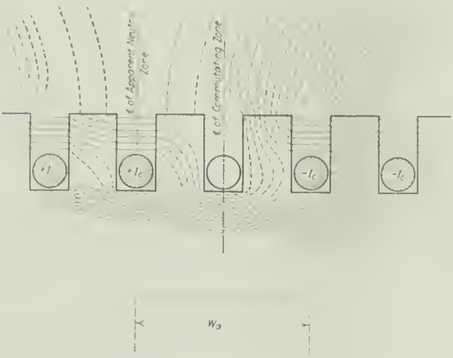

FIG. 4—FLUX DISTRIBUTION DUE TO MMF OF ARMATURE

Returning to a consideration of the case represented by Fig. 1, it must not be overlooked that the armature coil there shown is not of a practical shape, the end connections are shown parallel to the direction of travel of the coil, and the cutting of fluxes by these end portions of the coil has not been considered. When we consider the end fluxes, or the effect of commutating interpoles, especially when these are not equal in number to the main poles or do not extend the full length of the armature core, then the flux cut by the short-circuited conductors at any given part of their total length—such as the center of the "active" portion, whether on a smooth core or in slots—may have an appreciable value; but if we consider the *total* flux cut by *all* parts of the wire forming the commutated coil, at the instant of time when the current i in this coil is of zero value, it is most emphatically true that the coil as a whole is moving in a "neutral field," i.e., a resultant field which is either of zero value (when the sum of all its components is correctly taken) or of which the direction is parallel to the direction of travel of the conductors.

At the beginning and end of the commutation period the field in which the coil moves should be such as to produce an emf in the short-circuited coil of the value $e = I_c r$, where I_c is the value of the current per path of the armature circuit and r is the resistance of the short-circuited coil. On the assumption of a uniform current density over the surface of the brush, the brush

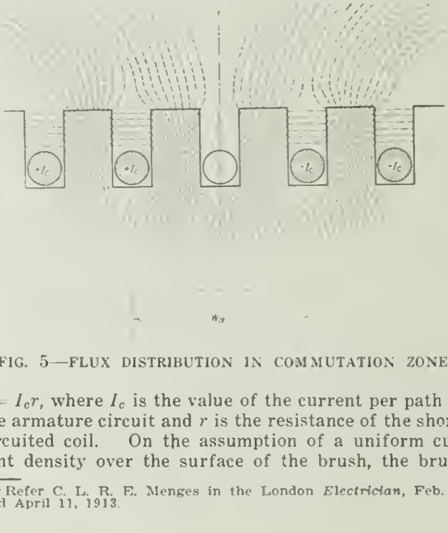

FIG. 5—FLUX DISTRIBUTION IN COMMUTATION ZONE

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[6] Refer C. L. R. E. Menges in the London *Electrician*, Feb. 28 and April 11, 1913.

contact resistance need not be taken into account, as will be clear from the following considerations. Fig. 3 shows a brush of width W covering several segments of the commutator. The total current entering the brush is $2I_c$, and since the density is constant over the surface of contact, the current entering the brush through any surface of width S is $2I_c \times \frac{S}{W}$. To calculate the volts e that must be developed in the coil of resistance r when the distance yet to be traveled before the end of commutation is w, consider the sum of the potential differences in the local circuit $AabB$ which is closed through the material of the brush. This leads to the equation

$$e = ir + i_b r_b - i_a r_a \qquad (1)$$

where r_a and r_b are contact resistances depending upon the areas of the surfaces through which the current enters the brush. Under the conditions shown in Fig. 3, the contact surfaces S_a and S_b are equal, and the currents i_a and i_b are therefore also equal. It follows that the voltage drops $i_a r_a$ and $i_b r_b$ are equal and cancel out from equation (1). The same is true in the later stages of commutation when S_a is no longer equal to S_b but to the portion w of the brush which remains in contact with the segment A. The relations between the currents and the surface resistances are then obtained by expressing these quantities in terms of the contact surface, thus:

$$i_a = w \times k_1$$
$$i_b = S_b \times k_1$$
$$r_a = \frac{1}{w} \times k_2$$
$$r_b = \frac{1}{S_b} \times k_2$$

where k_1 and k_2 are constants, and the voltage drop $i_a r_a$ is seen to be still equal to the drop $i_b r_b$. It follows that the only emf to be developed in the short-circuited coil when uniform current distribution is required will be $e = ir$.

The instantaneous value (i) of the current in the coil undergoing commutation can be expressed in terms of the brush width W and the distance (w) through which the coil still has to travel before completion of commutation, because,

$$i = I_c - 2\,I_c \times \frac{w}{W}$$
$$= I_c\left(\frac{W - 2\,w}{W}\right)$$

and

$$e = I_c r\left(\frac{W - 2\,w}{W}\right) \qquad (2)$$

At the beginning and end of commutation, when w is equal to W or to zero, the maximum value of the required voltage is $e = I_c r$.

In this study of the voltage to be developed in the coil undergoing commutation in order to produce a uniform current distribution over the brush surface, the resistance of the brush itself has been considered negligible; but with the assumption of a uniform current distribution over the cross-section of the brush the actual resistance of the brush material, even if it is relatively high, will not appear as a modifying factor in the general formula (2).

Referring again to Fig. 2, if the flux curve $B\,B'$ may be considered a straight line, the current $\left(i = \frac{e}{r}\right)$ will also obey a straight line law. It will fall from the value $+ I_c$ to zero in the time $\frac{t_c}{2}$ and rise again to the value $- I_c$ at the end of the period t_c according to the simple law expressed by the straight line in Fig. 2. If the change of current actually occurs in this manner, we have what is called "straight line" or ideal commutation. The commutation is then ideal or perfect, not only because it relieves the designer of much intricate and discouraging mathematical work, but because it is the only means by which the current density can be maintained constant over the brush surface of the usual rectangular form. It is generally the aim of the designer to maintain this current density as nearly constant as possible, because unequal current density leads to local variations of temperature and resistance in the carbon brush, and in those parts where the density attains very high values the excessive heating leads to pitting of the commutator surface even if visible sparking does not occur. Whatever method of studying commutation phenomena is followed, it is usual to assume some law connecting the variable current i with the time t and then investigate the causes which will bring about this condition. The straight line law will therefore be assumed, but the thing of immediate moment—being in fact the whole problem of commutation in its broader aspect—is the location, or the creation, of a neutral zone where the actual resultant flux cut by the coil undergoing commutation will be zero.

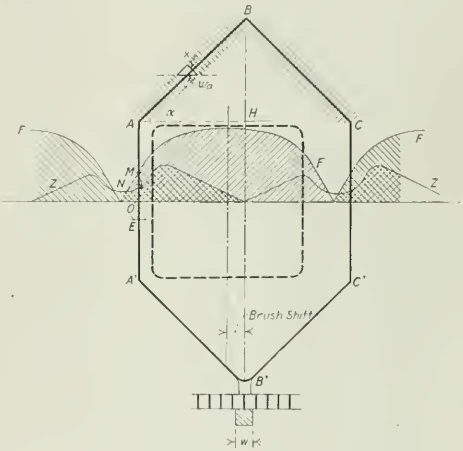

FIG. 6—CORRECTION FOR CUTTING OF END FLUX

Although the assumption of a smooth core armature very greatly simplifies the problem, especially when an effort is made, as in this paper, to picture the actual distribution of the magnetic flux, it seems preferable to consider a machine with toothed armature because this is the case which has generally to be dealt with by the practical designer, and moreover it is exactly this question of teeth, or what is known as the slot flux, which was one of the bones of contention in the recent "neutral zone" controversy. This suggests that the presence of the teeth introduces a factor which may not be disregarded in any modern theory of commutation.

In Fig. 4 an attempt has been made to represent, by the usual convention of magnetic lines, the flux due to the armature current alone, which enters or leaves the armature periphery in the interpolar space when the field magnets are unexcited. The position chosen for the brushes is the geometric neutral—i. e., the point midway between two (symmetrical) poles—and the magnetic lines leaving the teeth will cross the air spaces between armature surface and field poles and so close the magnetic circuit. The brush is supposed to cover an angle equal to twice the slot pitch; the current in the conductor just entering the left-hand end of the brush is $+I_c$, the current in the conductor under the center of brush is zero, and the current in the conductor just leaving the brush on the right-hand side is $-I_c$. The armature is supposed to be rotating, and it will be seen that the conductors in which the current is being commutated are cutting the flux set up by the armature as a whole. It is important to note that the flux cut by a conductor while traveling between the two extreme positions during which the short-circuit obtains is not only the flux passing into the air-gaps from the tops of the teeth included between these extreme positions of the conductor but includes also the flux due to the currents in the short-circuited conductors, which crosses the slot above the conductor[7] and leaves the armature surface by teeth which are not included in what at first sight may seem to be the commutating zone. In other words, the portion of the armature flux cut by a conductor undergoing commutation is that which passes up through the roots of the teeth included between the two extreme positions of the short-circuited coil. This picture of the conductor cutting the field set up by the armature currents is especially useful when calculations are made, as will frequently be found convenient, by considering the separate component fluxes due to distinct causes, all combining to produce the actual or resultant flux. It is not difficult to see that the flux shown in Fig. 4 is never such as to generate an emf tending to reverse the current in the short-circuited conductor.

Consider now Fig 5. The main poles have been excited and the brushes moved forward until a satisfactory commutating zone has been found where the fringe of flux from the leading pole tip is sufficient to neutralize the flux due to the armature windings.[8] With the main-pole excitation tending to send flux through the armature core from right to left, and the armature emf tending to produce a flux distribution generally as indicated in Fig 4, the resulting flux distribution in the commutating zone will be somewhat as shown in Fig. 5. Here the flux cut by the conductors during commutation is represented by eight lines only. the direction of this commutating flux being such as to maintain the current during the earlier stages of commutation and reverse it during the later stages. At a point midway between the two extreme positions the conductor is cutting no flux, and the current is therefore zero. It should be observed that the correct position for the brush is in advance of the "apparent" neutral zone; that is to say, the position of the neutral field on the surface of the armature does not correspond with the correct position for the center of the brush. That is because the slot flux must enter through the upper part of the teeth if it is not to be cut by the conductors during commutation. Thus the conductor, which at the instant of time $t = \frac{t_c}{2}$ must be in a neutral field, is actually below a point on the armature periphery where flux is entering or leaving the teeth, and this condition occurs even when, as in the present instance, the effect of the end connections is entirely negligible. This flux, which enters the teeth comprised between the two extreme positions of the commutated conductors, is neither more nor less than the slot flux (or equivalent slot flux, as the case may be). It is represented by twelve lines in the diagram Fig. 5, and it must be provided by the leading pole shoe if brush shift is resorted to, or by the commutating interpole when this method of canceling the armature flux is adopted. When the effect of the end connections of the armature coils cannot be neglected, the armature flux cut by this portion of the short-circuited coil must be canceled in the same way as the slot flux; that is to say, an equal amount of flux, but of opposite sign, must enter the armature from the leading pole tip or interpole, and this component of the compensating flux will actually be cut by the conductors in the slot, thus neutralizing the emf developed by the cutting of the end fluxes. This will be made clearer by reference to Fig. 6, which is generally similar to Fig. 1, except that, instead of the actual interpolar flux, two distinct curves have been drawn, the one, *F*, representing flux distribution over armature periphery due to the field coils acting alone, and the other, *Z*, representing the flux distribution due to the armature windings acting alone. The addition of these two fluxes at every point will not always reproduce the actual flux curve of Fig. 1, because of possible saturation of portions of the iron circuit such as the armature teeth and pole tips; but, in the commutating zone, the method of adding the several imaginary components of the actual flux is not objectionable, and the active conductor $A\ A'$ in Fig. 6 may be considered as moving in a field of which the density is represented by the length $M\ N$, since the portion of the field flux represented by the distance between the point N and the datum line is neutralized by the armature flux at this point. Let $A\ B\ C$ represent the position of the end connections of the coil undergoing commutation, then the portion $A\ B$ is cutting end flux due to the armature currents in all the end connections, and the direction of this flux will be the same as that represented by the curve Z, all as indicated by the direction of the shading lines. The portion BC of the short-circuited coil will be cutting flux of the same nature as that cut by the slot conductors CC', and the emf due to the cutting of the end fluxes will be of the same sign as that due to the cutting of the armature flux Z; that is to say, it will tend to oppose the reversal of current and must therefore be compensated for by a greater brush lead or a stronger commutating pole. Similar arguments apply to the end connections $A'B'C'$ at the other end of the armature. A means of calculating the probable value of the effective end flux will be considered later; but for the present it may be assumed that the average value of the density B_e of the field cut by the end connections is known. It may therefore be used for correcting the ordinate of the curve Z at the point O. Thus, the flux cut by the portion ABC of the end connections (see Fig. 6) in the time t_c is

$$\Phi_e = B_e \times x \times \text{length of } ABC$$

or

$$\Phi_e = B_e w_a \sin \alpha \times \text{length of } ABC$$

where α is the angle between the lay of the end connections and the direction of travel, and w_a is the arc covered by the brush, expressed in centimeters of armature periphery. The equivalent flux density B_a which has to be cut by the slot conductors AA' to develop the same average voltage is obtained from the relation

$$B_a w_a \times \text{length } AA' = B_e w_a \sin \alpha \times \text{length } ABC$$

which gives

$$B_a = B_e \sin \alpha \times \frac{\text{length } ABC}{\text{length } AA'} \qquad (3)$$

or, if preferred,

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[7] For the sake of simplicity, a single conductor is shown at the bottom of each slot and the whole of the slot flux is supposed to link with it. The calculation of the "equivalent" slot flux will be taken up later.

[8] Credit is given the reader for the ability to read in the expression "a flux neutralizing a flux" the more scientific but less convenient expression "the magnetic force due to one magnetizing source being of such magnitude and direction as to neutralize the magnetic force due to a second magnetizing source, thus causing the resultant flux of induction to be of zero value."

$$B_a = B_e \frac{2\,(BH)}{(AA')}$$

This may be plotted in Fig. 6 as the ordinate *OE*, making *NE* represent the armature flux, on the assumption that the whole of this flux component is cut by the "active" portion of the coil; and this suggests a graphical method of locating the correct brush position when commutating poles are not used, because what may be called the equivalent neutral zone is found when the conductor *AA'* occupies a position such that the length *NE* is exactly equal to *OM*. If this position cannot be found without passing under the tip of the pole shoe (represented by the heavy dotted rectangle), the machine will not commutate perfectly without the addition of a commutating interpole.

The question of relative magnitude of these end flux emfs deserves some attention, because it would be foolish to complicate the problem of commutation if the correction, when made, is of little practical moment. It is claimed by some writers that refinement of analysis and calculation is always commendable even when built upon a foundation that is admittedly a mere approximation. With this attitude of mind the present writer has no sympathy; it appears to lack the sense of proportion. Apart from any considerations of a mechanical nature, the practical problem of commutation, from whatever point of view it is approached, is, and always will be, the correct determination of the field in which the short-circuited coil is moving, whether this conception of the magnetic condition is buried in the symbols *L* and *M*, and referred to as inductance, expressed in henrys, or considered merely as any other magnetic field; and it would surely be a waste of time and mental effort to introduce refinements if the percentage correction, when made, is of a small order of magnitude. The question of end fluxes, however, is one of real practical importance; the end flux in actual machines is not of negligible amount, and although it cannot be calculated exactly, it is a factor which should not be left out of consideration. It is true that we do not concern ourselves with the end fluxes when calculating the useful voltage developed in the active coils; but, apart from the fact that in this connection the amount of the end flux is relatively small, it is not difficult to see that the emfs generated in the end connections as they cut through the end fluxes due to the armature currents balance or counteract each other and have no effect on the terminal voltage. The conception of the end connections cutting through the flux due to the armature as a whole, as indicated in Fig. 6, seems more natural, and is more helpful to the understanding of commutation phenomena, than what might be termed the academic method, in which more or less reasonable assumptions are made in respect to self and mutual inductances; but it is not suggested that the one method is necessarily superior to the other so far as practical results are concerned.[9] While moving from the position at the commencement of the commutation where the current is $+I_c$ to the position at the end of commutation where the current is $-I_c$, the short-circuited coil has cut through the flux of self and mutual induction—through the whole of it, not merely through certain components of the total flux in the particular region considered. This is well expressed by Mr. Menges when he says[10]: ". . . Self-induction is in no way distinguishable from other co-existent electromagnetic induction. Therefore, when the real magnetic flux resulting from all causes, and its changes relative to a given circuit, are taken into account, the self-induction is already included, and it would be erroneous to add an emf of self-induction."

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[9] As a matter of fact, a careful study of the problem will show that the total armature flux cut by one commutating coil during the period of short-circuit—being the difference between the number of lines threading the coil immediately before and immediately after commutation—is practically entirely due to the changes of current that have taken place in the coils under the brushes during the period of commutation.

[10] C. L. R. E. Menges in the London *Electrician*, Feb. 28, 1913.

Motor-Driven Prayer Wheels

According to the *Wide World*, the Buddhists in the far-distant Himalayas are utilizing electricity to drive their prayer wheels, which have heretofore been turned by hand, wind or water-power. This unique application of electricity has been brought about to conserve the flow of mountain streams which are being developed to furnish hydroelectric energy for lamp and motor service in Simla, the summer capital of India. Many of the small streams which formerly drove prayer wheels will now be robbed of their water during the dry seasons to increase the flow of the larger streams furnishing power to hydroelectric equipment. To avoid interfering with the long-established religious practices of the Buddhists, the government of India has therefore required the power company to equip with motors the prayer wheels affected and to furnish energy during the dry seasons without charge. The prayers (sometimes as many as several thousand) are usually inscribed on the shafts of the prayer wheels, one revolution of the wheel being considered equivalent to repeating verbally the same prayer.

Rutherford on the Atom

In a lecture before the National Academy of Sciences at Washington, D. C., recently Sir Ernest Rutherford discussed the structure of the atom and the bearing of recent researches on this subject. The speaker outlined a theory of nuclear atoms according to which a central nucleus of extremely high potential is surrounded by negative electrons whose motion it controls. The electrons are controlled by the nucleus very much as the planets are held to the solar system by gravitation, and, indeed, there appears strong reason to suppose that the force involved is really inversely proportional to the square of the distance as in the case of gravitation. From this point of view, the various elements are characterized by the number of electrons in the atom. Each electron carries a single negative charge, and the nucleus carries as many positive charges as there are electrons to be controlled. This theory of the atomic constitution explains the irregularity in the movement of alpha particles through a gas. When an alpha particle approaches a nucleus carrying a charge of millions of volts it is sharply deflected and may appear even to rebound in the direction from which it came.

It is possible to determine the number of positive charges contained in each one of the elements from hydrogen to uranium, and it seems also that if the elements are appropriately arranged the charges increase by unit steps, so that hydrogen contains a single positive charge and uranium ninety-two. This assumption corresponds to the actual elements with a small but very important exception. In the series of ninety-two possible charges there are just three gaps, corresponding, presumably, to three unknown elements. The relationship of these unknown elements to the known elements is made clear, so that the chemists have preliminary information to guide them in the search for the missing links. This is a wonderful advance on the periodic system, which has itself been fruitful in the discovery of elements.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

Results of Electric-Iron Sales at Muncie, Ind.

During a recent electric-iron sale the Muncie Electric Light Company offered a 6-lb. standard General Electric iron for $1.98 to anyone who brought in an old iron of any type. Although the majority of irons were of the exterior-heated style, it is of interest to note that some customers returned old electric irons worn out in service. In the month during which this sale continued the company disposed of 175 irons.

Since discontinuing this campaign the company has been offering solicitors a commission of 25 cents per iron for selling the irons at $2.25 each. Although this offer seems attractive at first glance, the solicitors have reported that from 80 per cent to 90 per cent of the company's customers are already users of electric irons.

One Way of Encouraging Evening Reading

As the spring season advances and the hours of electric lighting grow shorter, the Fort Worth (Tex.) Power & Light Company is encouraging reading in the home. To this end, there appears on one side of its monthly statement post cards the reminder shown herewith, pointing out the educational opportunities afforded by the Fort Worth city library and urging readers not only to register at the library themselves but to arrange so that all members of the family may draw books.

All the privileges of the City Public Library are Free; there are over 22,000 books at your command. Have you and the members of your family registered? If not, then do so at once.

FORT WORTH
POWER
AND
LIGHT
COMPANY

THE CENTRAL STATION AND THE PUBLIC LIBRARY

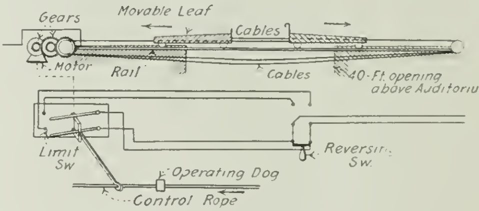
An Insect's Effect on Central-Station Revenue

As the results solely of the ravages of a tiny insect in its vicinity, one Southern central station has this year suffered a reduction of more than 20 per cent in its gross income. Fifteen months ago the boll weevil made its appearance in this district, and since that time cotton, the principal local crop, has been a failure. That the influence is only local is proved by the fact that the country's crop of cotton last year was a banner one.

The depression in income of the plant referred to, it is interesting to note, has not been confined strictly to receipts from its customers who depend directly upon the cotton industry. The plague of the boll weevil has made itself felt throughout every department of the company's business, even affecting the average lighting bills of the community. The most direct loss was, of course, caused by the shutting down of several cotton gins which formerly paid the central station $500 to $1,000 per month during the ginning season.

A Moving-Picture Theater with a Movable Roof

By means of motor-operated roof leaves, the Princess Theater, Meridian, Miss., can be quickly converted into an open-air auditorium, or at the approach of a sudden shower the covering can be almost instantly rolled back into place while the performance goes on uninterrupted. The 20-ft. by 40-ft. opening in the roof is arranged with movable leaves which travel on small rails and are operated by cables passing over a double drum gear-driven by a 3-hp motor. The two closed cable loops are wrapped on the drum in opposite directions and each operates one leaf. The control rope, which moves simultaneously with the main leaves, has dogs mounted at the limits of its travel. These dogs operate a reversing switch which stops the motor and connects it ready for starting in the opposite direction. About one minute is required to open or close the roof, moving both leaves through their entire travel. The construction of the joints about the opening is such that the roof is thoroughly weatherproof. Motor, gears and switches are housed in roof boxes. The proprietor of the show-house is well pleased with the innovation, which affords him all the advantages of an outdoor open-air theater with full protection during inclement weather.



MOVABLE-ROOF MECHANISM FOR MOVING-PICTURE THEATER

Electrical Presents for June Brides

Under the caption "The Open Season for Brides" the Glenwood Light & Water Company, of Glenwood Springs, Col., has mailed to its customers a timely announcement card which reads as follows:

"June is one of the best months in which to get married. The other good months are October, February, April, September, January, November, May, August, March, July and December. This brings up the question of wedding presents, and we rise to remark that there is nothing so acceptable to the bride as an electric coffee-pot, iron or other electric appliance. We have a considerable variety in stock at all times.

"Sometimes a bride gets duplicate presents. If any

Glenwood bride gets duplicate electric gifts purchased from us, we are always ready to exchange them for other appliances.

"Here's congratulations to the marital partnerships floated in Glenwood Springs this sunny June month!"

A Flat-Rate Schedule with an Active-Room Element

To discourage present metered customers from changing over to its controlled flat-rate schedule, the Jackson (Miss.) Light & Traction Company includes in the terms of the latter rate a minimum based on the number of "active rooms" in the house. Bathrooms, halls and galleries or porches are not counted, but for all other rooms the customer must contract for a minimum of at least 25 watts per room. Thus a four-room cottage has a minimum connected load of 100 watts, a six-room dwelling 150 watts, and so on. The rate is 1 cent per watt of connected demand per month, the customer buying his own lamps. About 200 flat-rate customers are now served from the lines of the Jackson company, and of this number about twenty-five changed over from metered service. It is thought that comparatively few will in future care to make the change.

Cotton-Carrying Electric Trucks on the Galveston Piers

For transporting bales of cotton between the Moody compress and the steamship piers at Galveston, Tex., distances varying from 0.5 mile to 4 miles, use is made of three special 6-ton electric trucks, equipped with "pack saddles" as shown in the accompanying illustration, which enable one truck to carry about thirty compressed bales of cotton. Although the trucks are rated at only 6 tons, they are commonly used to transport loads as high as 18,000 lb. In this way, at the present time, about 200 bales, varying from 550 lb. to 600 lb. in weight, are being transported daily between the cotton compress and the docks. The trucks are owned by the Galveston Motor Company, which now has three in service and will shortly add seven more similar vehicles to its cotton-carrying fleet.

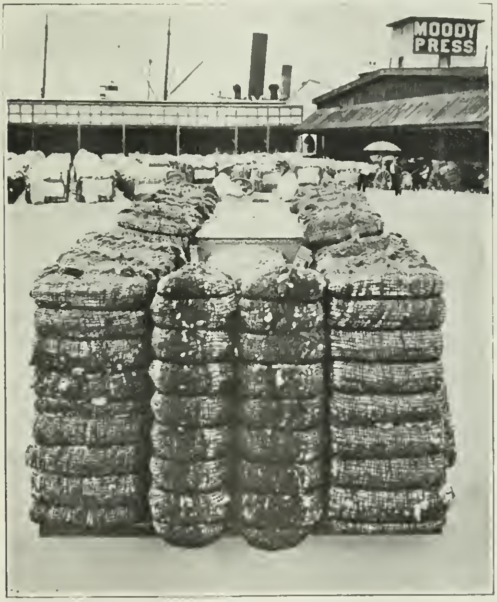


FIG. 1—COTTON AWAITING TRANSPORTATION

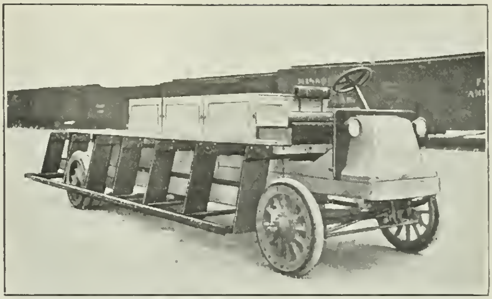


FIG. 2—ELECTRIC TRUCK FOR TRANSPORTING COTTON

The trucks are of the General Motors Company type, fitted with forty-four cells of twenty-one-plate "Ironclad" battery, and are equipped with the special "pack saddles" which were designed by Mr. John Mitchell, general superintendent of the Moody compress. Mr. Mitchell has applied for a patent on his device. Energy to operate the trucks is furnished by the Brush Electric Company, Galveston, Tex., of which Mr. Fred M. Lege, Jr., is general manager.

Co-operative Publicity Scheme in Conducting Electric House

Model "electric houses" maintained by central-station companies are no longer a novelty, but the one conducted by the Rockford (Ill.) Electric Company for five spring days is interesting because of the co-operative method of supporting it. Publicity, of course, has to be governed by the expense, so Mr. A. C. Martin, sales manager of the company, evolved the idea of interesting a real-estate firm and some household furnishers in the scheme of conducting an electric house and induced them to share in the expense of maintaining it.

Primarily it was necessary to awaken interest in the project even before the merchants were approached, and this was done by inserting a news story in one of the daily papers. In this way the interest of the mer-

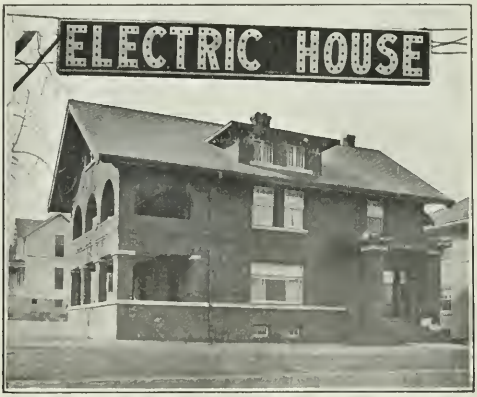


FIG. 1—"THE HOUSE ELECTRIC," ROCKFORD, ILL.

chants was aroused and the rest was easy. A local real-estate firm loaned one of its newest houses in a residential district, while furniture, rugs, draperies, art decoration, linen, china and kitchen utensils were furnished by other dealers in the city. The electric-service company, assisted by electrical manufacturers and contractors, equipped the house electrically.

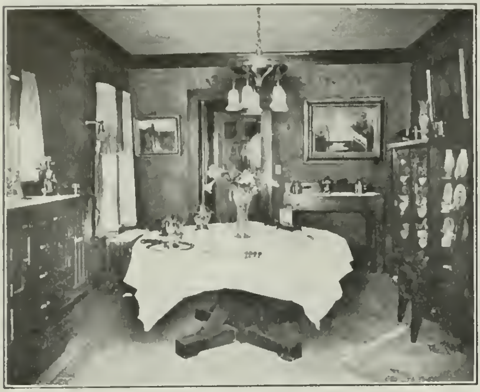


FIG. 2—THE DINING-ROOM

One energetic advertising manager of an afternoon newspaper, who conceived the idea of publishing an electrical page every day during the exhibit, secured advertisements from every merchant exhibiting in the "electric house." The center column of this page was devoted by the newspaper company, without charge, to articles relating to the house. Other local newspapers followed the example and gave the project considerable publicity. During the first ten days of the exhibit fifteen full-page advertisements were run concerning the "electric house," one-fifth of the expense being borne by the central-station company.

The house was opened on a Saturday, and people arrived in crowds. Transportation to and from the house was furnished by the local railway company, which also displayed advertising cards on the front of its cars.

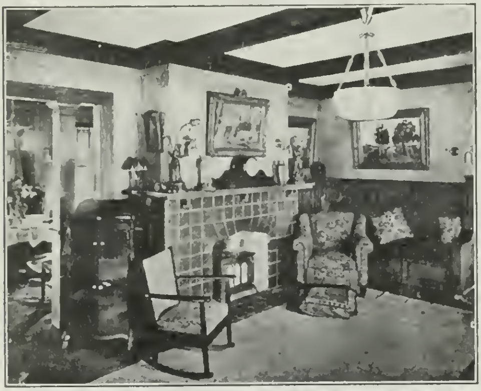


FIG. 3—COSY CORNER OF THE LIVING-ROOM

During the first week more than 9000 persons visited the house. Oftentimes, especially during the evening, the crowds were so large that it was impossible to accommodate them all at one time. Two representatives of the company, one of each sex, were stationed in the reception hall to receive guests on behalf of the electric-service company. Each guest was requested to register. Other representatives of the company were in attendance in other parts of house to answer questions and explain details. An electric piano and a victrola furnished the latest popular airs and grand-opera productions.

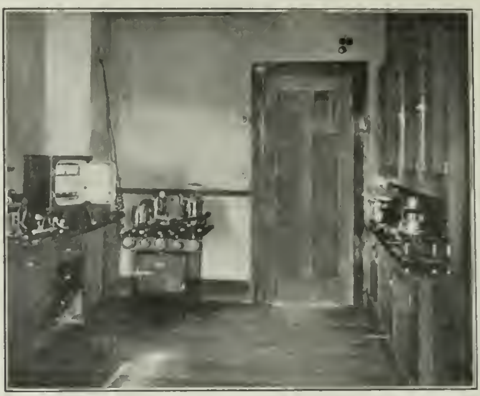


FIG. 4—THE "ELECTRIC KITCHEN"

All rooms were equipped with the latest electrical devices making for home comfort. The kitchen contained an electric range and oven, electric grills, percolators, etc. The laundry was equipped with various laundry appliances, including a large stationary vacuum cleaner. The bedrooms were fitted with bed lamps, telephones, fans and electric heating pads. Displayed conspicuously in the bathroom were vibrators, hair-driers, bottle warmers, etc. Every room was artistically and effectively illuminated. Luminous heaters were installed in the fireplace in the living room.

In planning the "house electric" the company intended to keep it open for one week, but the number of visitors did not diminish during that time, so the exhibit was prolonged over two weeks. During the second week special sales were conducted. The real-estate company sold its house; the house furnishers closed several contracts, and the electric-service company sold twenty-five toasters and 140 flatirons, besides securing a number of "prospects" for other energy-consuming devices.

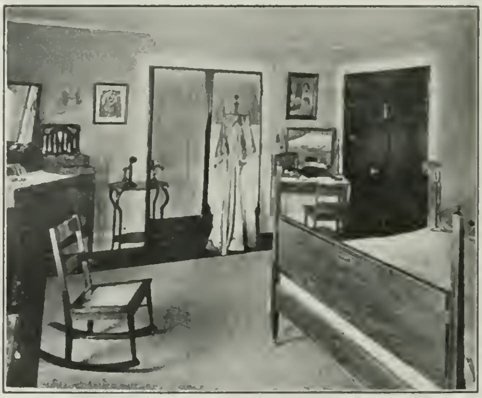


FIG. 5—THE CIRCASSIAN-WALNUT BEDROOM

Illumination and Wiring

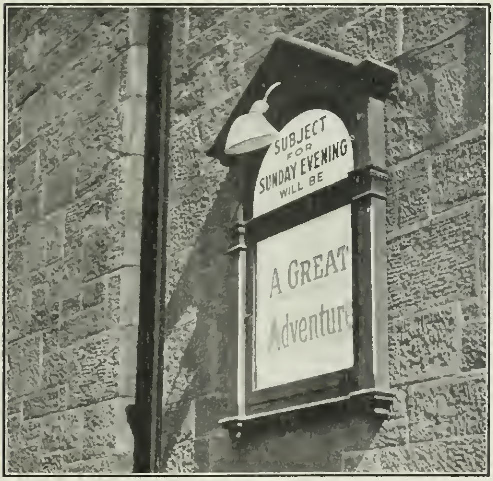
An Illuminated Barber Post

A barber-shop advertisement which is somewhat out of the ordinary has been erected in front of the Neil Hotel, Columbus, Ohio. As shown herewith, the post consists of a square vertical column surmounted by a cross-bar bearing two ornamental suspended lamp inclosures. The entire upper part of the post is made up of colored glass illuminated from within by tungsten lamps. Two lamps are mounted in the body of the post, while a single lamp furnishes illumination for each division at the top.

ILLUMINATED ART-GLASS BARBER POLE

Electric Lighting of a Church Bulletin

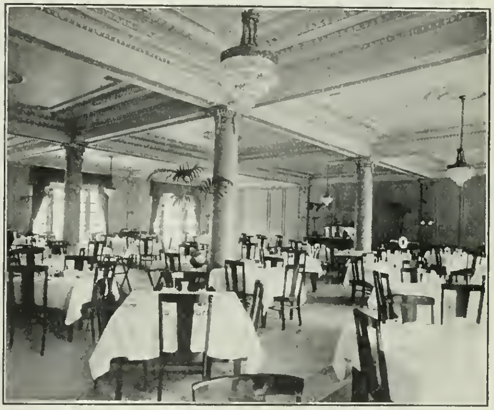
A simple but well-designed bulletin of services is in use by the First Baptist Church, Hartford, Conn., as illustrated herewith. The display board is 6 ft. high and 3 ft. wide and is lighted by a 60-watt lamp housed in a parabolic reflector hung about 12 in. away from the reading surface. The lamp is placed so that the greater part of its light is thrown upon the sermon subject, which is displayed about 6 ft. above the sidewalk close to the church entrance.



ILLUMINATED CHURCH BULLETIN

Hotel Vermont Dining-Room Lighting

One of the most effectively lighted dining-rooms in New England hostelry service is that of the Hotel Vermont, Burlington, Vt., which was the headquarters of the last convention of the New England Section of the N. E. L. A. The service is furnished by the Burlington Light & Power Company, and the room, which is about 60 ft. square, is composed of nine bays 19.5 ft. square, and is finished in cream with mahogany tables and chairs. The ceiling height is about 13.5 ft. Each bay is equipped with a central outlet from which depends a chandelier about 6 ft. long provided with six outlets, only four of which are used, 15-watt lamps being employed. The reflectors consist of four circular sets of glass prisms about 12 in. high over all and 18 in. in maximum diameter. Exclusive of the wall lighting, which is done by twelve sets of brackets carrying two 15-watt lamps each in prismatic reflectors harmonizing with the pendent fixtures, there is an expenditure of only 540 watts for a floor area of 3600 sq. ft. The wall bracket fixtures each consist of sixteen glass prisms 6 in. long with ½-in. sides, hung in a circle of 3-in. diameter 6 ft. above the floor, the pairs of prism groups in each bracket being 11 in. apart on centers. The wall units aggregate 360 watts, making a total expenditure of 900 watts for the room, or 1 watt for 4 sq. ft. of floor area. The illumination is ample for reading the smallest type used on menu cards.



WELL-LIGHTED HOTEL DINING-ROOM AT BURLINGTON, VT.

Latest Developments in Gas-Filled Tungsten Lamps

A meeting of the Pittsburgh Section of the Illuminating Engineering Society, which embraces Cleveland, was held at Nela Park, East Cleveland, on a recent evening. About twenty members from Pittsburgh attended the Cleveland meeting. With some other out-of-town guests they were entertained at dinner by the National Lamp Works of the General Electric Company. The gentlemen present inspected the lamp laboratories at Nela Park, the meeting being held in one of the buildings. Mr. S. E. Doane, chief engineer of the works, opened the evening's program by explaining how Nela Park had been located on suburban heights in compliance with a desire to get healthful and pleasant surroundings. Prof. H. S. Hower, of Pittsburgh, presided at the meeting. Mr. C. L. Dows, of the lamp laboratories, gave an illustrated address on the latest developments in tungsten lamps. His talk related to the recent gas-filled lamp. He pointed out that the true standard of lamp efficiency is the number of lumens per watt. In the case of the gas-filled lamp this number is twenty-one or twenty-two. Owing to convection, the heat loss in the gas-filled lamp is greater than with the vacuum lamp. Heat loss with small filaments is relatively larger than with larger filaments. Experiments were shown to demonstrate this. But the filament in the gas-filled lamp can be operated at a higher temperature—that is, nearer the melting point—than in a vacuum lamp. This accounts for the higher efficiency.

Mr. Dows explained the practical advantages of coiling the filament in the form of a helix. Interesting pictures were thrown on the screen to show the filaments, greatly enlarged, first dark and then brought to red heat and white incandescence by the passage of a current of electricity. The speaker said that the currents most commonly used in the new lamps range from 5 amp to 20 amp. The 750-watt lamp is the lowest-wattage multiple gas-lamp now available. Experiments are in progress to adapt this lamp for use with motion pictures. For use with stereopticons it is now employed satisfactorily.

Lighting of Building Exteriors

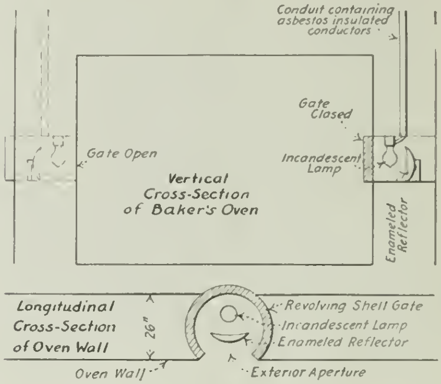
Mr. Ward Harrison, of the National Lamp Works, gave a talk on "The Lighting of Building Exteriors." This lighting is accomplished by the use of the new gas-filled lamp, with specially designed reflectors, which Mr. Harrison described. Previous to his talk, however, he gave a demonstration of portrait photography, using the gas-filled lamps to supply the light. The light reached the sitter through a diffusing screen made of tracing cloth. A screen on the other side of the sitter softened the shadow on the side of the face opposite to the diffusing screen. The exposure was of three seconds' duration and a satisfactory negative was made.

Mr. Harrison described the type of reflector used for the flood lighting of building exteriors. This reflector is designed so that a solid beam of light is projected. It is believed that many building fronts can be illuminated in this way. The lamps and reflectors are placed at some distance from the façade. In this manner the architectural beauties can be brought out at night. Furthermore, this flood lighting of building exteriors will place at the disposal of commercial houses a very dignified means of publicity or advertising. Mr. Harrison also described the new two-piece refractor for high-efficiency incandescent lamps. The refractor is of glass, the prisms being on the inside when the two pieces are put together, so that both the exterior and the interior of the completed refractor present smooth surfaces.

Messrs. G. H. Stickney, of Harrison, N. J.; Thomas F. Kelly, of Dayton, Ohio; M. Luckiesh, of Cleveland; M. E. Turpin, of Pittsburgh, and others took part in the discussion. Mr. Luckiesh said that the half-watt lamp gives light possessing greater actinic value than the light of the older tungsten lamps. He told about using colored screens to reduce the luminosity of light from high-efficiency gas-filled lamps without affecting its photographic value. He also spoke of using true-tint glassware with the high-efficiency lamps to give the equivalent of daylight. A Pittsburgh delegate described the spectacular method of illuminating, with colored screens, steam escaping from a stack, giving an excellent imitation of blast-furnace glare. In conclusion, Mr. Dows said that it was hoped to concentrate 1000 watts in gas-filled lamps to a greater degree than is done in the present 750-watt lamp.

Illumination of Interior of Baker's Oven

Incandescent lamps are being employed by a baking company in Vinita, Okla., to illuminate the interior of the ovens when it is desired to observe the progress of a "bake." Each lamp is supported in a cylindrical-shaped recess in the oven wall, the axis of the bulb and recess being vertical. Diagonally opposite apertures connect the recess with the interior and exterior of the oven. As a temperature of about 500 deg. Fahr. is maintained for baking and as the light is desired only for short intervals, a revolving cylindrical-shell cast-iron gate is provided to cover the interior aperture except when light is desired. An enameled reflector placed back of the bulb spreads the light over the interior of the oven when the aperture is opened by revolving the gate.

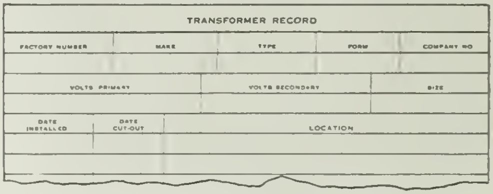


LIGTHING DIAGRAM FOR BAKER'S OVEN

To give a neat outward appearance to the installation the electric-service wires are run to the lamp through conduit concealed in the oven wall. Although the wall is 26 in. thick, it was considered advisable, because of the existence of the very high temperature, to insulate the wires with slow-burning asbestos insulation. The Vinita Electric Light, Ice & Power Company furnishes electricity to this bakery.

A Map and Card System of Installation Records

The system of installation records employed by the Southwestern Gas & Electric Company, Shreveport, La., is one that has proved very useful for this community of 30,000 population. The key to the scheme is a large blue-print wall-map of the city, in which tacks have been placed representing all the distribution transformers in service. Each tack is numbered to correspond with its transformer, those marked with red indicating three-phase units and those with black single-phase installations. In a standard filing cabinet



TRANSFORMER RECORD

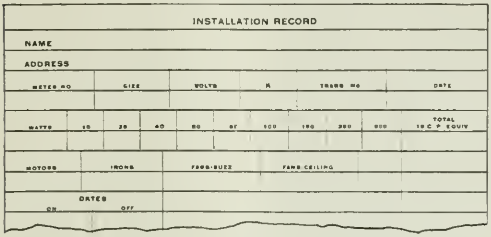
FACTORY NUMBER	MAKE	TYPE	FORM	COMPANY NO

VOLTS PRIMARY	VOLTS SECONDARY	SIZE

DATE INSTALLED	DATE CUT-OUT	LOCATION

FIG. 1—TRANSFORMER RECORD CARD

are filed numbered cards corresponding to each transformer in use, and behind each such transformer card there are inserted the installation record cards of all customers who receive service from that transformer. Where two or more transformers are banked, their record cards are pinned together with clips, and directly behind these cards, in the way already described, are filed the customers' installation records. At a glance, by this method, the line superintendent can determine the characteristics of any transformer on the system as well as the character of the customers' loads it supplies.


INSTALLATION RECORD

NAME

ADDRESS

METER NO	SIZE	VOLTS	K	TRANS NO	DATE

WATTS	10	25	40	60	75	100	150	250	500	TOTAL 16 C P EQUIV

MOTORS	IRONS	FANS-BUZZ	FANS CEILING		

DATES ON OFF

FIG. 2—CUSTOMER'S INSTALLATION RECORD CARD

Electrical Dental Sign

Realizing the effectiveness of advertising a business through the medium of an electric sign, a dentist on Forty-second Street, New York, has had installed in front of his office a large electrically illuminated set of false teeth which are made to open and close in a most realistic manner. The upper jaw is supported by a steel frame projecting from the face of the building and guyed by chains and wires. The lower jaw is hinged to the upper one and is counterweighted so that very little power is required to move it on its hinges. Concealed by the upper jaw is a $1/8$-hp motor connected through reduction gears to an eccentric which causes the jaws to open and close. Thirty sockets containing 10-watt lamps are staggered around each jaw. The jaws are made of molded zinc, the spread of them being about 3 ft. The Federal Sign System (Electric) manufactured the mechanism.

ELECTRICALLY ILLUMINATED AND OPPERATED DENTAL SIGN

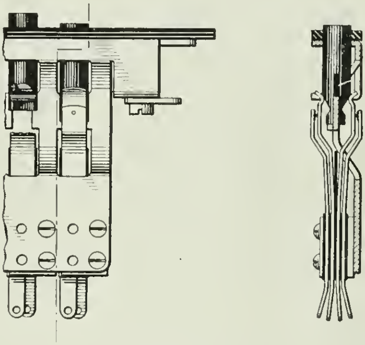
Recent Telephone Patents

A relay patented by Mr. John Erikson, Chicago, exhibits a novel method of adjustment. The movable part which presses the contact springs together consists of an angle piece, one leg of which holds an insulated block in contact with the springs, while the other leg is flexibly attached to the armature. An adjusting screw permits of tilting the armature with relation to the angle piece, thereby varying the air-gap and the throw of the movable parts. This patent is assigned to the Automatic Electric Company, Chicago.

To the Century Telephone Construction Company, Buffalo, N. Y., has been assigned a patent for a desk-stand telephone set which is the joint invention of Messrs. H. L. Knight and B. W. Sweet, of Cleveland, Ohio. The transmitter mounting, hook-switch lever and springs are all permanently mounted upon the main stempiece. In the final assembly of the apparatus a tubular shell is slipped over this stem from below and a sheet-metal base piece secured in position by a lock ring screwed onto the end of the stem piece where it protrudes through the base.

Improved Apparatus

Herewith is shown a simple form of calling-circuit key designed to be manufactured in strips. It will be noted that a single punching serves for the foundation of the strip, including support for the cup piece, for the mounting lugs and for guides for the button. Furthermore, the set of springs may be assembled individually and then mounted. This key has been patented by Mr. J. N. Williams, of La Crosse, Wis., and assigned to the Western Electric Company.


CALLING-CIRCUIT KEY

Mr. J. J. Comer, of Chicago, has invented a double-acting granular transmitter. The middle part of the carbon diaphragm is confronted on both faces with a circular granule chamber. These are lined with a fibrous material the edge of which extends beyond the walls of the chamber. The contact with the diaphragm for retaining the granules is made by the fiber. The diaphragm is therefore free to vibrate. The front granule chamber is concentric with the bore of the mouthpiece, but it is surmounted by a cone, and a row of holes outside the button admits sound waves to the diaphragm. This patent is assigned to the Automatic Enunciator Company.

A party-line attachment has been invented jointly by Messrs. F. M. Wolf and R. M. Austin, Monroe, Wis., which taps off the number of any station when the hook switch is raised, thus informing those using the line of any interlopers.

Letter to the Editors

Systems of Charges for Energy

To the Editors of the Electrical World:

Sirs:—In the first portion of Mr. Tomlinson's letter in your issue of April 11, he deals with unmeasured service and generally condemns the system, because it is "based upon the clearly unjustifiable principle which is only known as expediency."

I am fully aware that in the United States, in the early days of electricity supply, practically all energy was supplied on the unmeasured system, whereas in this country, from the beginning, practically all supplies were metered.

Now, the occupiers of middle-class and upper-class premises, both residential and business, are users of electric light where a supply is available and funds will permit of the necessary installation, but there are hundreds of thousands of small cottages and one, two and three-room tenements in blocks which have puzzled central-station engineers, and are puzzling them still, to devise a system of charge which will rake in this enormous and valuable long-hour lighting business.

A measured rate is out of the question. Such consumers could not be relied upon to pay monthly bills; they would not pay a deposit to cover such monthly bill, and the consumption in kilowatt-hours is so small per consumer that a meter rent must be charged, or a high rate per kilowatt-hour made to cover the investment and depreciation cost of the meter and the accountancy, clerical and meter-reading proportion of the undertaking's expenses attributable to such small consumer.

Another method of measuring service is by means of a "coin-in-the-slot" prepayment meter. This has all the disadvantages of the straight meter rate in that it restricts the use of energy, piles up the big peak, and in addition the investment costs, depreciation and repairs are greater than with the ordinary watt-hour meter.

A third method of measured rate is to make a weekly primary charge per installation and a secondary rate (prepaid) of, say 1d., or 2 cents, per kw-hr. This still brings in investment and depreciation costs on the meter, which the consumption of this class of property will not stand, according to my experience. There is no question that in order to handle this business efficiently and with a view to obtaining the greatest income at the smallest cost and insuring the highest load-factor an unmeasured rate is the only method to adopt.

A system which is on trial in many districts at the moment, and which from my own experience here will probably be considerably extended in the near future, is an unmeasured rate based on the following foundations:

(a) The supply authority wires the property (either by its own staff or by contractors) by agreement with the owners. This is only done where the owners are substantial people enabling a ten-year agreement to be entered into, resulting in the amortization of the investment within that period.

(b) The supply authority furnishes the lamps and maintains the installation.

(c) The charge for energy is based on the supply authority's cost, plus profit, assuming twenty-four hours' use per day of the supply. In many cases this could be profitably undertaken at 1 cent per kw-hr. at 100 per cent load-factor.

(d) A weekly sum is charged the consumer, payable in advance, which can be collected by the owner's agent at the same time that he collects the weekly rent, the supply authority allowing, by arrangement with the owner, a collecting commission to the agent.

(e) In some cases this weekly sum is included in the rent, as far as the tenant is concerned no distinction being made between the cost of light and rent charge. The owner's agent in these cases hands over the electric-light proportion of the rent to the supply authority.

(f) The weekly charge referred to consists of: (1) A sum calculated to pay back to the supply authority the cost of the installation in ten years and the interest combined; (2) a sum calculated to repay the supply authority for the supply of lamps (which are, of course, always tungsten) and repairs and maintenance of the installation; (3) a sum for energy used, based on, say, twenty-four hours' use per day at 1 cent per kw-hr. This provides for waste in the use of energy.

In some cases, after experience, it has been found that the hours per day of calculated use per lamp can be cut down to ten or eight, at the same time raising the calculated basis cost per kilowatt-hour. This is especially the case in blocks of tenements, where the owner's agent can check waste and exercise a considerable amount of supervision over the occupiers.

In Marylebone we have had a block on this system for some years, and the average receipts per kilowatt-hour are a fraction under the revenue we should have received had the supply been on our "telephone" or "measured differential" system of charge. The cost of replacements of lamps, repairs of installation and amortization of capital come out better than estimated.

Under these conditions we avoid all meter costs and also clerical costs incurred in respect to billing and collection, the whole system being on a cash basis. We are now making offers to owners of other property on the same lines. The installation costs of the experimental block were much greater than would be the cost of work carried out to-day, as we have obtained greater experience.

I object to Mr. Tomlinson's terms "monadic," "diadic" and "triadic." These simply add confusion to the rate terminology which already exists. I think it is preferable to stick to the definitions of the rate research committee of the National Electric Light Association, which surely cover all requirements.

There are really only three measured systems—the flat rate per kilowatt installed or per kilowatt of maximum demand, the straight meter rate, and the differential system. The latter I consider to be the only correct system where a measured system can be used, and I agree that it should be used except in the case of the small property I have already referred to.

I am afraid the investment charges on what Mr. Tomlinson calls the "triadic" system will be considerable, which will not matter in the case of large consumers, but will be very important in the case of consumers whose revenue amounts to not more than a few dollars per month. It necessitates the installation of a maximum-demand indicator, a watt-hour meter and a time meter, or a combination of all three.

Finally, I believe the ideal basis of rates to be the time-honored Hopkinson system. Where the size of the consumer is too small to warrant the installation of a watt-hour meter and maximum-demand indicator, the maximum demand can be assessed and only the kilowatt-hours need be measured. A classification of consumers will deal with the time element, which is obviously of great importance from the diversity-factor point of view, but with all large consumers there is no difficulty in applying Mr. Tomlinson's "triadic" system, as the revenue per consumer is sufficiently great to warrant the installation of apparatus to take into consideration the kilowatt-hours, maximum demand and time.

A. Hugh Seabrook,

General Manager Borough of St Marylebone Electric Supply.

St. Marylebone, England.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Electric Hoisting Equipment for Erecting New Quebec Bridge

The new Quebec bridge which is being constructed across the St. Lawrence River at Neilsonville, Canada, 9 miles above Quebec, will be erected with the help of two huge electrically operated hoisting towers. The bridge is to be of the cantilever and suspended center-span type, the distance between the centers of piers being 1800 ft. The length of the suspended span is 640 ft. and the length of the anchor arms is 515 ft., the total length of the bridge being 3239 ft.

For the erection of each cantilever there is provided an erecting tower, which is supported on a cantilever itself and is moved out toward midstream as the bridge structure is extended from the shore line. The towers are constructed of steel, are 200 ft. high and weigh about 840 tons each.

Motor Installation

Twenty-six motors, aggregating 752 hp, are employed on each tower for hoisting. On each of the four corners of the tower is a 90-ft., 15-ton motor-driven derrick hoist. On top of the tower, about 350 ft. above the river, are two traveling cranes carrying 55-ton main hoists and auxiliary gantry cranes. Each gantry crane is equipped with two 5-ton hoists. All movements are performed by electric drive except the bridge travel of the gantry cranes. The main erecting towers are moved along the cantilevers by utilizing two of the 50-hp motors normally driving the 15-ton derrick hoists.

About 1600 hp is required to operate the electrical equipment used in erecting the bridge. High-potential energy is delivered to substations on each side of the river from different hydroelectric systems. A submarine cable ties together the two substations, each of which is capable of operating the entire electrical equipment used in constructing the bridge. The energy is converted to 250 volts, direct-current form, before being utilized. Direct-current apparatus is used exclusively on the erection towers because it affords better control and permits of dynamic braking. As an illustration of the amount of energy obtainable from one of the main hoists lowering its maximum load through the maximum distance, sufficient heat would be generated in any type of friction brake to melt 100 lb. of iron. Instead of using friction brakes, therefore, the motors are operated as generators when braking, and the energy which is pumped back is dissipated in cast-iron grids installed at the base of the tower. For regulating the various motors employed about 5376 grids are required.

MOTOR EQUIPMENT OF ONE ERECTION TOWER

Kind of Crane	Service of Motor	Number of Motors	Hp of Motor
15-ton derrick hoist	Hoist Swing	4 4	50 5
55-ton main traveler	Hoist Bridge Trolley	4 2 4	80 16 5
5-ton auxiliary gantry	Hoist	8	20
Total		26	752

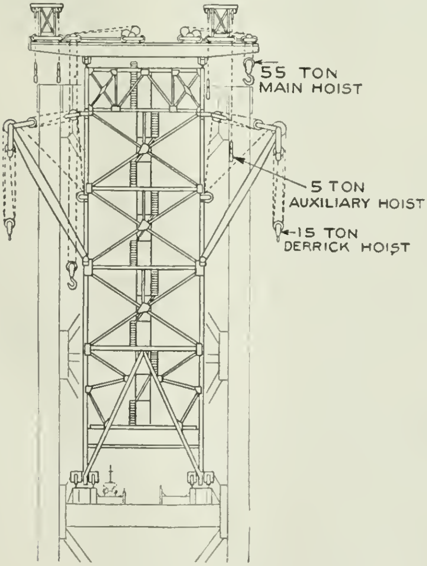


FIG. 1—END VIEW OF ERECTING TOWER

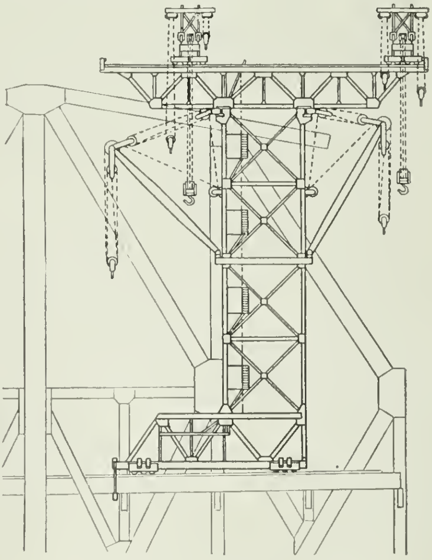


FIG. 2—SIDE VIEW OF ERECTING TOWER

which if placed end to end would extend over a distance of 242 ft.

For holding loads stationary magnetic brakes are employed. Some of the hoists are provided with travel-limit mechanisms. Switchboards 16 ft. long are erected in each hoisting tower. Six men will be stationed on the operating platform and two on each main crane where they can control the electrical equipment by master switches. A complete telephone system is installed on each tower with permanent connections on shore so that communication can be held between widely separated workmen. An electrically operated passenger elevator serves the various floor levels of each tower.

The contract for erecting the bridge is held by the St. Lawrence Bridge Company. The electric control apparatus employed in the erecting towers was furnished by the Electric Controller & Manufacturing Company, Cleveland, Ohio.

The Frank Confession of a Small-Plant Manager

In his paper entitled "A Trip Through a Small Plant," read before the recent convention of the Missouri Public Utilities Association, Mr. F. M. Wilkes, Poplar Bluff, Mo., outlined some of the conditions existing in his engine room prior to a trip through the station in company with the president of the organization. The same difficulties prevail in many other plants, and a study of the following extract from the paper may lead to betterment:

"At first view the engine room looked all right to me," said Mr. Wilkes, "but in a few minutes I found that I was using too much oil, that the dust should be blown out of the fields of the alternator, that the commutator of one of my exciters had a high piece of mica in it and should be grooved to prevent sparking, and that my belts were too tight and could be run more loosely, thus reducing the strain on the bearings of both the prime mover and the generator. Any slipping which might occur when the belt was slack could be avoided, I learned, by using a little fuller's earth to remove the oil and then applying a dressing of one part mutton tallow to one part neatsfoot oil, thus increasing the adhesion and pliability of the belt. I also found that we were using too many wiping rags and that we had two steam leaks starting on the steam line. The time to stop these leaks is, of course, when they are first starting and not after they have commenced cutting fittings to such an extent that it is difficult to make new gaskets hold. Aside from these defects the plant looked to be in fairly good condition.

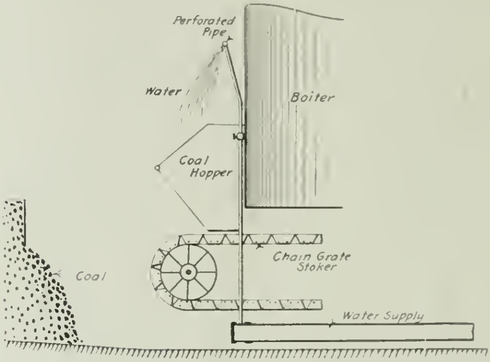
A Look Behind the Switchboard

"However, when we went over to the switchboard we found that all the other dirt and rubbish not already discovered—including three old rectifier tubes, two or three old belts, some burnt-out fuses, a can of paint, two bags of cement, four or five lengths of pipe, some very oily wiping rags, etc.—were piled away behind the switchboard, which stood about 24 in. from the wall. Here this material was out of the way of everything except an arc from the arresters or fuses. This was probably the most criminal of all the things done, or left undone, around the plant, for an arc on the back of the average board in a small plant is only too apt to take all the wiring on the board with it, and there was the additional danger of setting fire to the very inflammable material conveniently stored by the engineer in this out-of-the-way nook.

"This ended the inspection of the plant, leaving me with a clearer insight into the condition in my station, which, if remedied, would go further toward increasing its efficiency than many thousands of dollars spent in automatic stokers, smoke-consuming apparatus, voltage regulators, etc."

Wetting Coal in Stoker Hoppers

A central-station company in central Illinois, finding that it was almost impossible to get too much water on the grade of coal used under its boilers, has equipped each unit with a mechanical sprinkler. Water is led to the face of the bank of boilers along the floor of the boiler room in a supply pipe. From this source a riser is conducted to the horizontal perforated pipe running along the face of the boilers above the hoppers.



PIPING FOR COAL SPRAYER

While the coal is on the boiler-room floor it is sprinkled with water from a hose, and after the firemen have shoveled the hopper full the valve on the riser is opened, permitting more water to be sprinkled on the fuel. The coal itself is of a fair grade but rather fine, and the water has been found to reduce the number of holes forming in the fire.

Feed-Water Purification

To what extent can preheating feed water purify the water for boiler use? H. L. B.

When the boiler-feed water contains foreign substances which can be precipitated at temperatures produced during the preheating process, it may not be necessary to employ other means of purification. On the other hand, water sometimes contains in solution chemical compounds which cannot be precipitated or removed even at the boiling point or at any temperature to which water can be subjected in the feed-water heater. In such cases if the feed water foams, pits the boiler or deposits scale therein, it is necessary to neutralize the injurious substances by adding some chemical which should be selected only after careful quantitative and qualitative analysis of the water. Boiler compounds should not be added unless it is definitely known that (1) the injurious substances will be rendered unharmful thereby, and (2) that no new deleterious chemicals are formed. Among substances commonly used for purifying boiler feed water are sodium hydroxide, calcium hydroxide, soda ash, trisodium phosphate, compounds of tannin and starchy materials.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Oil-Cooled Transformers.—A note on a recent British patent (No. 24,162, 1913) of H. Weiss. To prevent the deleterious effects which are due to the presence of air above the surface of the oil, this specification describes a means by which the transformer case can be completely filled with oil. An outlet pipe communicates with a vertical cylinder in which a weighted piston works. When the oil expands the piston rises. The weight of the piston serves to maintain a pressure in the transformer casing, which effectively prevents the cooling liquid from leaking into it through the material of the cooling coils.—London *Elec. Eng'ing*, May 28, 1914.

Lamps and Lighting

Half-Watt Nitrogen-Filled Tungsten Lamp.—H. LUX.—An illustrated account of an extended investigation of a 1000-cp nitrogen-filled tungsten lamp. In spite of the high light output of the half-watt lamp as compared with the ordinary tungsten lamp, the transformation of electric energy into light does not show any particular advance. Out of the total radiated energy 8 per cent is light, but only 4.8 per cent of the total consumed energy is changed into light. This is due to the fact that considerable energy losses are resulting from heat conduction. These are relatively much greater than in evacuated lamps. Further, within the closely wound filament coil there are also light losses. The principal results of the investigation are given in the accompanying table. The author finally discusses what would be the limit to which the efficiency of the tungsten lamp can be driven. This is evidently at the melting point of tungsten, about 3200 deg. absolute temperature. The author finds that this would be reached with a specific consumption of about 0.3 watt per mean spherical hefner candle.—*Elek. Zeit.*, May 28, 1914

DATA ON NITROGEN-FILLED TUNGSTEN LAMP

Power Demand, Watts	Total Radiation, Watts	Total Radiation in Per Cent of Power Consumption	Light Radiation		Light Radiation in Per Cent of Total Radiation	Light Radiation in Per Cent of Power Consumption	Heat Radiation per 100 Cp in Watts
			Watts	Spherical, Cp			
236.6	155.1	65.6	3.12	133.0	2.010	1.32	133
264.6	171.1	64.8	5.46	178.0	3.019	2.06	93
326.4	208.4	63.9	7.42	296.3	3.560	2.27	68
391.5	242.1	61.9	12.16	468.5	5.020	3.11	49
457.0	280.0	61.3	18.67	686.2	6.680	4.09	38
524.7	315.8	60.2	25.30	926.2	8.040	4.82	32

DATA ON ORDINARY OSRAM LAMP

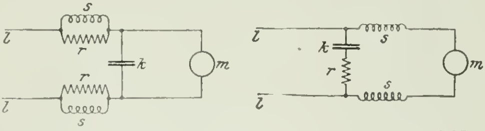
94.6	85.4	88.2	3.14	64.2	3.76	3.32	125
102.4	90.4	88.3	3.79	79.0	4.41	3.70	103

Photometric Units.—A. P. TROTTER.—A paper read before the (British) Illuminating Engineering Society. The author discusses critically certain proposals made by a sub-committee of the American Illuminating Engineering Society regarding the definition of certain photometric magnitudes. The question of the best symbols to use for these magnitudes is also dealt with. The author refers especially to the definitions of luminous intensity, illumination, brightness and coefficient of reflection. An account of the discussion which followed is also given.—London *Electrician*, May 29, 1914.

Light Signals.—C. O. HARRINGTON, JR.—A long illustrated discussion of the optics of light signals and of the most efficient distribution of light for railway signals giving day and night indications. After discussing the elements of railway signaling, the author takes up the light signal, the use of the incandescent lamp and its influence on light signal design, the use of lenses and reflectors and phantom indications, the relation of candle-power to the range of light signals, the distribution of light, the reduction in candle-power at night and the color of signals.—*Journal Frank. Inst.*, April and May, 1914.

Generation, Transmission and Distribution

Protection Against Traveling Waves.—REINHOLD RUEDENBERG.—Neither condensers alone nor induction coils alone furnish reliable protection against traveling waves. In order to get perfect protection it is necessary to combine a self-inductance with a capacity and an ohmic resistance. The ohmic resistance is necessary because in it the energy of the traveling wave must be annihilated. The ohmic resistance of the protecting device should be about equal to the characteristic of the line loop to be protected. That self-inductance and capacity are to be used together follows from the consideration that a self-inductance coil reflects a traveling wave with unchanged sign while the capacity reflects the wave with reversed sign. The capacity and the inductance must be so proportioned that the two waves reflected with opposite signs counterbalance each other. An effective protective method based on these principles is shown in Fig. 1, in which the machine m is to be protected by means of the condenser k and the inductance coils s which are in parallel with the resistances r. During normal operation the current passes through the inductance coils s and is little affected by the resistances r and the condenser k. But when a rapid traveling wave arrives it cannot pass through the self-inductances s, but passes through the resistances r and is reflected by means of the condenser k so that it has to pass again through the resistances r. If the self-inductance and the capacity were infinitely large, the energy of the traveling wave would be completely an-



FIGS. 1 AND 2—DIAGRAMS OF PROTECTIVE WIRING SCHEMES

nihilated in the resistance. In reality only a very small amount of the wave is permitted to pass or to be reflected. Another arrangement based on the same principle is shown in Fig. 2. The condenser *k* is here in series with the resistance *r*, while *s* represents inductance coils. A protective arrangement for use at the point where cables are connected with an overhead line is shown in Fig. 3. This is essentially a double arrangement by which both the overhead line and the cable are protected against each other.—*Elek. Zeit.*, May 28, 1914.

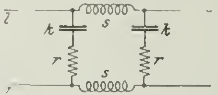


FIG. 3—DOUBLE PROTECTIVE ARRRANGEMENT

Installations, Systems and Appliances

Buying Energy in Bulk Versus Isolated Plant.—Walter Straus.—The conclusion of his long paper in which the author gives detailed calculations as to the conditions under which it is more economical for a factory to buy energy in bulk from a central station than to have its own isolated plant. The calculations are based on the rate schedules of various German central stations. It is shown that in very many, although not in all, cases connection to a central station is more advantageous. The author finally criticises the rates made by many central stations. The rate of a central station for a large consumer should be arranged in such a way that the cost to the consumer is less than the cost of energy generation in an isolated plant. On the other hand, the charge must be sufficiently higher than the cost to the central station in order to yield a proper profit. The author thinks that most German rates are much too low for short periods of operation and low load-factors. Consumers could pay much higher rates and would still be better off than with their own isolated plants. For long hours of operation various tariffs like that of the Rhenish-Westphalian Electricity Works are quite good, while others are much too high; for instance, the tariff of the Berlin Electricity Works. The result is that in Berlin many isolated plants are in existence. Other weaknesses of rates of German central stations are discussed. If a rate is to be devised according to the cost of energy generation in an isolated plant, it should be based on the following considerations: The consumer should pay a fundamental rate per maximum kilowatts (this corresponds with interest and amortization of an isolated plant). To this is to be added a charge depending on the maximum kilowatts and the time of operation (this corresponds to wages and lubrication in isolated plants). Finally, a charge is to be made per kilowatt-hour, depending also on the kilowatts and on the average load (this corresponds with the expense for fuel in isolated plants). A rate based on such calculations should then be adapted to the cost of power generation in the central station itself, and this could easily be done. Every central station should try to eliminate isolated plants altogether from the districts to which it supplies service.—*Elek. Zeit.*, May 28, 1914.

Electrophysics and Magnetism

Magnetic Properties of Manganese Steel.—Sir Robert Hadfield and B. Hopkinson.—An abstract of a paper read before the (British) Iron and Steel Institute. Manganese steel containing about 12 per cent of manganese and 1.25 per cent of carbon, when prepared in the ordinary way, is practically non-magnetic, but if heated to a high temperature and slowly cooled it can be rendered magnetic. Samples heated for long periods at temperatures in the neighborhood of 500 deg. C. were tested magnetically at intervals (by a differential method, which compared their permeability with that of a standard piece of nearly pure iron) and were found to exhibit a gradual rise in permeability, according to a curve asymptotic to a constant value varying with the temperature. Quenching the specimen did not destroy the magnetic quality thus created, but further heating at temperatures exceeding 640 deg. C. resulted in a diminution of the magnetic quality at a rate more rapid the higher the temperature, until at 750 deg. C. the magnetic properties were practically removed in a few minutes. At intermediate temperatures the magnetic quality does not entirely disappear, but ultimately settles down to constant reduced value. The material in the ordinary non-magnetic condition, or in the magnetic condition induced by prolonged heating at 520 deg. C., is unchanged by immersion in liquid air, but in an intermediate condition, after short heating at 500 deg. C., it is rendered more magnetic by immersion in liquid air. Cold working makes the water-toughened material slightly magnetic. Heating and cooling curves showed a change point at about 650 deg. The explanation of these effects appears to be that the stable form of the alloy at temperatures below about 750 deg. C. is more or less magnetic, the proportion of magnetic substance present in the equilibrium state diminishing rapidly when the temperature approaches that figure. Above 750 deg. C. the magnetism disappears. From about 650 deg. C. to 750 deg. C. there is a critical range similar to that corresponding to the loss of magnetism in ordinary carbon steel. If the alloy be cooled from above this critical range, the tendency, as it passes through any lower temperature, is toward the attainment of the amount of magnetism proper to that temperature. But the rate of approach to equilibrium is so slow that even when the cooling takes several minutes only very little of the magnetism is restored, and the effect produced is similar in kind to that produced by quenching a carbon steel. The important effect of the manganese is, apparently, this retardation of the attainment of the equilibrium, rather than any very marked shift of the position of the critical range.—London *Elec. Eng'ing*, May 21, 1914. A longer illustrated abstract in London *Electrician*, May 29, 1914.

Electrochemistry and Batteries

Electrometallurgy of Iron and Steel.—S. Guggenheim.—The author first gives a review of the different electric-steel furnaces and the development of electric-steel processes and shows the difficulties which are in the way of rapid development. He then discusses briefly the reduction of pig-iron from ores in the electric furnace.—*Elek. Zeit.*, May 14, 1914.

Electric Steel from Ore.—E. Humbert and A. Hethey.—An abstract of a paper read before the (British) Iron and Steel Institute. The authors describe the production of steel direct from ore by means of an electric furnace and give details of tests on steel made direct from different ores. They discuss fully the advantages of the process.—London *Electrician*, May 22, 1914.

Forces Between Atoms and Chemical Affinity.—Sir J. J. Thomson.—A highly theoretical paper in which the author shows that chemical compounds may be divided into two principal classes. In one class the atoms are electrically neutral; in the other they are charged, some positively, others negatively. The properties of compounds are strikingly different according to whether they belong to one class or to the other. The author discusses the chemical effects produced by the electric fields arising from intra-molecular ionization, the number of active molecules which a molecule of a different kind can hold in combination, and the conditions required for the existence of a chemical compound. He also develops a new theory of valency. He regards the negatively electrified corpuscles in an atom as arranged in a series of consecutive layers. Those in the inner layers are supposed to be so firmly fixed that they do not adjust themselves so as to cause the atom to attract other atoms in its neighborhood. There may, however, be a ring of corpuscles near the surface of the atom which are mobile and which have to be fixed if the atom is to be saturated. The number of corpuscles of this kind may be anything from 0 to 8, but when the number reaches 8 the ring is so stable that the corpuscles are no longer mobile and the atom is, so to speak, self-saturated. The number of these mobile corpuscles in an atom of an element is equal to the number of the group in which the element is placed according to the Mendeleef classification. Thus helium and neon have no free corpuscles; hydrogen, lithium, sodium, potassium, each 1; beryllium, magnesium, calcium and strontium, 2; boron and aluminum, 3; carbon and silicon, 4; nitrogen, phosphorus and arsenic, 5; oxygen, sulphur and selenium, 6; fluorine, chlorine, bromine and iodine, 7. The bonds in the usual structural formulas of valency compounds are considered as tubes of forces.—*Philos. Mag.*, May, 1914.

Units, Measurements and Instruments

Vibration Electrometer.—H. Greinacher.—If a string galvanometer, such as has been used extensively in recent years for radioactive purposes and ionization measurements, is connected to a source of alternating current of moderate frequency, the string begins to vibrate in synchronism with the alternating current. The author shows how the Wulf double-string galvanometer can be used as an electrometer. He also discusses its employment in the Wheatstone bridge and its application to measurements of capacities and dielectric constants and to the observation of alternating magnetic fields and alternating electric fields. Some notes are added on the construction of a vibration electrometer. —*Elek. u. Masch.* (Vienna), May 17, 1914.

Telegraphy, Telephony and Signals

Magnifying Relay.—An English translation in abstract, with illustrations, of E. Reisz's German paper on the Lieben magnifying telephone relay.—London *Elec. Review,* May 1, 1914.

Automatic Telephony.—An illustrated description of the new semi-automatic telephone exchange of the city of Dresden in Germany.—London *Elec. Rev.*, May 29, 1914.

Miscellaneous

Export Trade of the United States.—Ludwig W. Schmidt.—A statistical article in which it is pointed out that the electric export trade of the United States has increased from 1908 to 1913 by about $5,000,000. These advances have been made chiefly in North America and South America, while the export trade to Europe and Asia has decreased. The electric export trade of the United States has undergone considerable fluctuations during this period. The author thinks that the electrical export trade of the United States will concentrate itself chiefly on the American, and perhaps on the Australian, market, and will gradually give up the European market, while nothing can yet be said concerning Asia and Africa.—*Elek. Zeit.*, April 30 and May 7, 1914.

Air Condensers.—G. Seibt.—An illustrated article in which the author describes some new designs of variable-capacity air condensers.—*Elek. Zeit.*, May 7, 1914.

Integrating the Amount of Light.—H. S. Hatfield. —The author describes a method of integrating the amount of light received from a variable source—for example, the sun—for a long period. For this purpose the photoelectric alkali cell is used in combination with the hydrogen voltameter described in the Digest last week.—London *Electrician,* May 22, 1014.

Electricity Meters.—The regulations of the German Association of Electrical Engineers as to the requirements which electricity meters and measuring transformers must fulfil in order to be officially certified.—*Elek. Zeit.*, May 21, 1914.

The Telephone as Oscillograph.—Mannie Siegbahn. —An account of experiments made to determine whether the telephone with a normally working current intensity can be used to register variable currents. An instrument is described by which it is possible to reproduce the variation of the membrane of the telephone with the required accuracy, and the sources of error are discussed. Diagrams are shown giving a reproduction of the currents through the telephone in some simple cases, and the general conclusion is reached that the telephone cannot be utilized for oscillographic purposes. *Philos. Mag.*, May, 1914.

Book Reviews

Electrical Engineering Problems. Part I, Direct-Current Circuits and Apparatus. Part II, Alternating-Current Circuits and Apparatus. By Prof. F. C. Caldwell. New York: McGraw-Hill Book Company, Inc. 106 pages. Price, $1.

A book of arithmetical and algebraic problems in electrical engineering subjects, suitable for use in technical colleges. The work is divided into two parts, each comprising fifteen different sections. There are altogether about 800 problems offered for solution. Appended to each problem is an estimate of the time needed for its solution. The problems are of a practical engineering character. The book will be of value to instructors in electrical engineering courses and also to students who desire to develop their own powers of analysis.

Photo-Electricity. By Arthur L. Hughes. New York: G. P. Putnam's Sons. 144 pages, 40 illus. Price, $2.

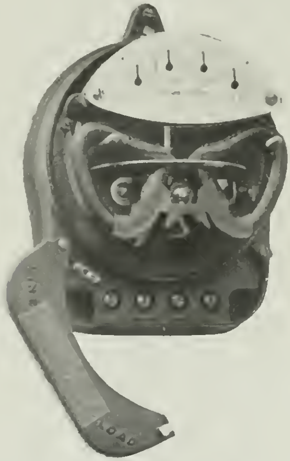
An interesting and full résumé of researches made during the last few years into the nature of the photoelectric effect. The effect itself has become known only during a very few years, so that the accumulation of so much experimental and theoretical material in so short a time is remarkable. The book relates to the following topics: Ionization of gases and vapors by ultraviolet light; the velocities of emission of photo-electrons; the total photo-electric effect; the photo-electric effect as a function of the frequency and state of polarization of the light; photo-electric properties of thin metallic films; photo-electric effects of non-metallic elements and inorganic compounds; photo-electric effects of dyes, fluorescent and phosphorescent substances; positive rays produced by light; sources of light used in photo-electric experiments. The book will be of interest to students of optical physics and of photometry. It is clearly written and shows the mark of careful study.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Single-Phase Watt-Hour Meter

A single-phase induction-type watt-hour meter with all the working parts rigidly attached to a single integral casting is being placed on the market by the General Electric Company, Schenectady, N. Y. The base or central iron casting of this instrument supports the complete motor element on the inside and the damping magnets, bearings and registering mechanism on the outer or front side. An extension at the bottom forms the terminal box. The leads enter the bottom of the box, the brass terminals being permanently molded into place in a non-combustible insulating compound.



INDUCTION WATT-HOUR METER

The rotating element consists of an aluminum disk mounted on a vertical shaft with a worm cut in the upper end, which transmits motion to the worm wheel at the back of the register. The lower shaft bearing is a sapphire mounted in a brass screw, which is readily accessible. A brass cap is screwed on over the end of the jewel screw and acts as a guide, preventing the pivot from jumping out of the cup in the event of some disturbance in the circuit.

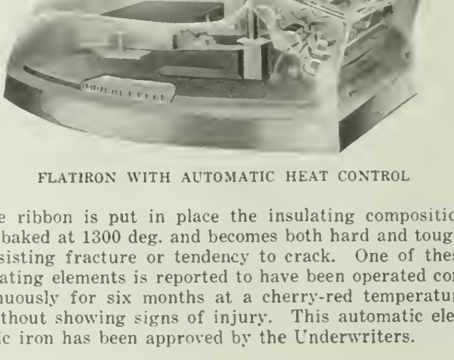
The magnetic circuit is in two sections rigidly fastened together by two punched-iron reinforcing plates. There are two current poles and one potential pole. Three screws hold the entire element in position inside the base. The permanent magnet, by means of which the speed of the disk is regulated, is made up of two individual magnets astatically arranged and mounted in a brass shoe. The system is supported by a shelf on the main casting and provided with micrometer adjustment. Turning the screw clockwise draws the magnet out and decreases the speed of the disk.

Two holes punched diametrically opposite in the disk prevent creeping or turning on potential alone. A lagging device, consisting of a rectangular copper punching in the form of a short-circuited loop and attached to the light-load plate, compensates the instrument for inductive loads. The meter is tested and adjusted at a power-factor of 50 per cent. It is built in ratings from 5 amp to 300 amp for two-wire circuits and from 5 amp to 150 amp for three-wire circuits.

Electric Iron with Automatic Temperature Control

A novel feature of automatic uniform heat control is incorporated in the electric iron illustrated herewith. By means of the thumb-nut at the rear this iron can be set to maintain itself at any temperature between 300 deg. Fahr. and 600 deg. Fahr. A platinum point on the thermostat bar makes contact with a similar contact point the position of which is adjustable by turning the black insulated thumb-piece. As the temperature of the iron rises the expansion of the bar causes the contact to be broken. A mica-and-foil condenser, mounted near the front of the iron, is bridged electrically across the contact points and practically eliminates altogether the arc of breaking the 600-watt circuit. Ordinary ironing temperatures, according to the Dover Manufacturing Company, Canal Dover, Ohio, maker of the electric iron described, range about 450 deg. Fahr. The automatic control adjustment thus affords a wide range of operating temperature which can be set according to the character of the work.

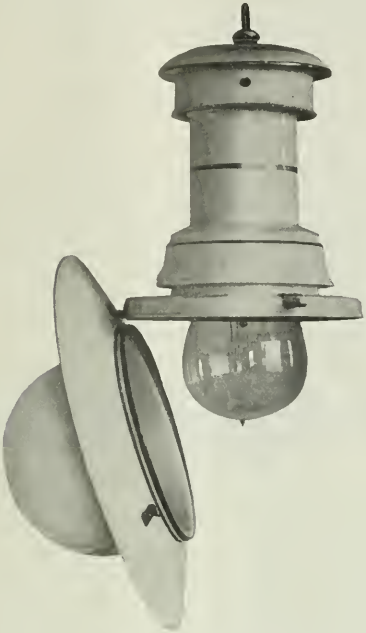
The resistor element employed in this "A-best-o" automatic iron is a nickel-chromium ribbon embedded in a special insulating composition which has the desirable property of combining high thermal conductivity with its value as an electrical insulator. After the ribbon is put in place the insulating composition is baked at 1300 deg. and becomes both hard and tough, resisting fracture or tendency to crack. One of these heating elements is reported to have been operated continuously for six months at a cherry-red temperature without showing signs of injury. This automatic electric iron has been approved by the Underwriters.



FLATIRON WITH AUTOMATIC HEAT CONTROL

Ventilated Holder for High-Efficiency Tungsten Lamps

A ventilated holder for outdoor use with gas-filled tungsten lamps is shown herewith. It is an adaptation made from the five-mantle gas lamp. The ventilation is sufficient, the manufacturers claim, for any nitrogen-filled lamp now on the market. The accompanying table gives a comparison of the heat generated by five-mantle gas lamps and high-efficiency tungsten lamps.



VENTILATED HOLDER FOR NITROGEN-FILLED LAMPS

The globe is made of clear white glass which is said to show no spots or filament lines. A 0.25-in. hole is drilled in the bottom of the globe. This globe rests on an asbestos ring placed inside the shade holder, which consists of an annular ring supported at three points by means of a hinge and two set-screws. No set-screws touch the glass itself. The shade holder can be swung down on a hinge to renew the lamp or clean the glassware. Use is made of a special socket so designed that it is unnecessary to bring the wires in through a cap at the top of the binding posts. The holder is finished in black or white enamel. The bottom of the annular ring which supports the glass is always white-enameled. This holder is being manufactured by the Multi-Lux Illuminating Company, Cleveland, Ohio.

RELATIVE HEAT GENERATED BY GAS AND INCANDESCENT ELECTRIC LAMPS

Light Source	Illuminant	Cubic Feet or Kw-hr. per Hour	Lb.-Fahr Heat Units per Hour	Relative Heat Liberated
Five-mantle gas lamp	Natural gas	11-15	12,100-16,500	0.85-1.15
Five-mantle gas lamp	Artificial gas, pressure 2.6 in.	22	14,300	1
750-watt nitrogen-filled lamp	Electric	0.750	2,560	0.18
1000-watt nitrogen-filled lamp	Electric	1.000	3,420	0.24

Porcelain Rosette and Sign Receptacle

The porcelain rosette shown in Fig. 1 is for use with outlet boxes only. Pass & Seymour, Inc., Solvay, N. Y., makers of the device, manufacture it in two sizes, one for use with a 3.25-in. box and the other with a 4-in. box. The hole in the cap is arranged to take the so-called fixture loops, permitting the rosette to be used with a chain. The line terminal screws are easy to get at and are long and "upset." Fig. 2 shows an exploded view of a sign receptacle which is designed so that it will not turn after being placed in position. Five notches are provided as shown in the illustration. One projection only is used, and this projection can be bent down into any of the five notches for practically any position of the receptacle desired, thus insuring against turning.

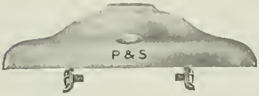


FIG. 1—PORCELAIN ROSETTE

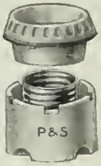
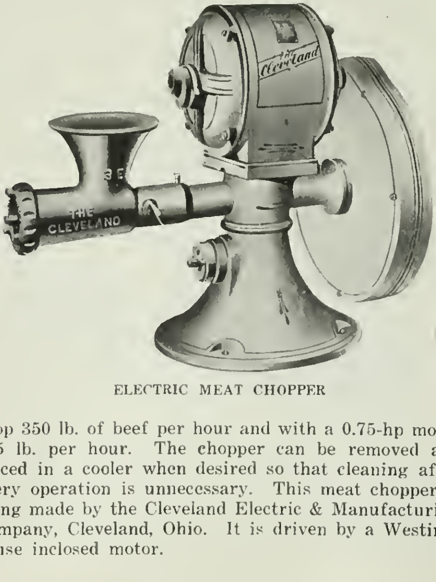


FIG. 2—SIGN RECEPTACLE

Motor-Driven Meat Chopper

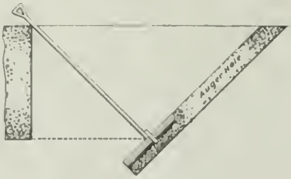
A compact electrically operated meat chopper is shown in the accompanying illustration. All working parts are inclosed. The height of the machine is 23 in., the width 16 in. and the length 28 in. It weighs 240 lb. With a 0.5-hp motor this machine is designed to chop 350 lb. of beef per hour and with a 0.75-hp motor 375 lb. per hour. The chopper can be removed and placed in a cooler when desired so that cleaning after every operation is unnecessary. This meat chopper is being made by the Cleveland Electric & Manufacturing Company, Cleveland, Ohio. It is driven by a Westinghouse inclosed motor.



ELECTRIC MEAT CHOPPER

Anchor That Bears Against Undisturbed Earth

Guy anchors as a rule have been designed to be set with the pull rod in the strain position. An anchor recently placed on the market by the Chance Manufacturing Company, Centralia, Mo., involves a new principle whereby the anchor plate is made to bear on undisturbed earth. This anchor, which is known as the "Never Creep," is made in two pieces, a pull rod and an anchor plate.



ANCHOR DESIGNED TO PREVENT CREEPING

As shown in the illustration, the hole in the earth is bored with an ordinary 8-in. auger and as nearly at right angles to the line of strain as conditions will allow. The depth of the hole varies with the length of the rod used. After the hole is dug the pull rod is driven through the undisturbed earth to the center. The anchor-plate is then lowered into the hole and set on the end of the pull rod by means of a special hook casting fastened to the end of a tamping bar. The slot in the anchor plate is tapered so that it will slip over the end of the pull rod without difficulty. The released plate assumes a position in which the anchor-head socket engages the head of the pull rod, thereby holding both securely in place. It is claimed that this anchor has a greater holding power than a "deadman" of the same area, and at the same time is much more quickly and easily installed. The manner of attaching the pull rod to the anchor plate is also considered advantageous because there are no threads; consequently the entire pull-rod section is available for anchor strains.

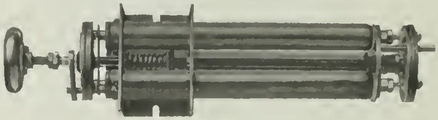
Apparatus for Portable Incandescent Lamp

A socket with a combined reflector and guard mounted on a clamp for use with portable work lamps is being placed on the market by Mr. R. S. Mueller, 423 High Avenue, S. E., Cleveland, Ohio. The jaws of the clamp have a spread of 2⅓ in. and can be applied to a bench or table as shown in the illustration, or to a pipe, rod, spoke, fender, wire or rope. A hook is provided at the end of the clamp for use where nothing is available to apply the jaws. When the lamp is used as a hand-lamp the clamp serves conveniently as a handle. The reflector is of nickel-plated steel. The socket, which is insulated from the clamp, contains a switch operated by a short hard-fiber knob. The socket turns so that the reflector may be rotated to throw light on the work and shade the eyes. Twenty feet of rubber-reinforced, waterproof cord is provided with this outfit, and use is made of a two-piece separable attachment plug. A 15-watt tungsten lamp is generally employed with this apparatus.

PORTABLE LAMP EQUIPPED WITH CLAMP

Speed Regulators for Slip-Ring Induction Motors

A compact speed regulator for slip-ring induction motors has been developed and is being placed on the market by the Allen-Bradley Company, Milwaukee, Wis. This regulator is of the carbon-compression type, the carbon disks being contained in steel tubes from which they are completely insulated. One of these tubes is provided for each phase. The resistance can be changed by varying the compressive force exerted on each pile of disks. This is accomplished by means of the hand wheel shown in the illustration. The regulator is so designed that the pressure is equalized in each tube.

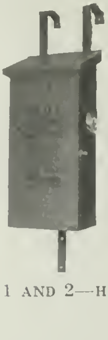


SPEED REGULATOR FOR SLIP-RING MOTORS

With a regulator of this type any slight turn of the handle effects a change in the speed of the motor. Being inclosed in steel tubes, the resistors are not easily affected by moisture or acid fumes. For 50 per cent speed reduction this regulator is made for motors for far service, etc., with ratings up to 10 hp and for motors for machine operation up to 5 hp.

Lightning-Arrester Hangers

The hangers shown herewith are being manufactured by the Electric Service Supplies Company, Philadelphia, Pa., and are designed for supporting the Garton-Daniels lightning arresters made by this company. The style C hanger, shown in Fig. 1, is for installations between two cross-arms, the upper part of the supports being bent to fit over the upper arm. The style B hanger, shown in Fig. 2. is for single-arm installations; it differs from the style C hanger in that the lower support of the latter is not used.



FIGS. 1 AND 2—HANGERS FOR TWO CROSS-ARMS AND FOR ONE CROSS-ARM

Jobber, Dealer and Contractor

Examination Board for Electricians in Kansas City, Kan.

A board of electrical examiners has been appointed in Kansas City, Kan., to examine all applicants for licenses. The board is made up of Messrs. H. C. Marshal, city electrician; E. A. Brown, an electrical contractor, and Edward Henschel, a former electrician. The applicants for licenses will bear the cost of examinations.

Westchester County Contractors Organize

Leading electrical contractors of Westchester County (N. Y.) have recently organized under the name of the Electrical Contractors' Association of Westchester County. Its membership covers contractors in Yonkers, Mount Vernon, Port Chester, New Rochelle, White Plains, Ossining, Tarrytown and other Westchester County towns. The officers of the association are: President, Mr. W. N. Barlow, Yonkers; first vice-president, Mr. F. E. Schmidt, Mount Vernon; second vice-president, Mr. I. W. Austin, White Plains; secretary, Mr. C. E. Youmans, Yonkers, and treasurer, Mr. Charles A. Sillery, Yonkers.

Threefold Co-operation Inaugurated in Indianapolis

An electrical appliance-selling campaign recently inaugurated at Indianapolis, Ind., seems to have produced that threefold co-operative spirit toward which jobbers, dealers and central-station men are striving in many other cities. Mr. N. A. Perry, manager of the Indianapolis Light & Heat Company, originated the idea, and in its operation the Varney Electrical Supply Company, the Indianapolis Electric Supply Company and the Western Electric Company are included as jobbers, and the following dealers are participating: Sanborn Electric Company, Skillman Electric Company, Porter Electric Company and Hatfield Electric Company. All sharing in the plan have expressed themselves as highly gratified at the results obtained.

CO-OPERATIVE FAN DISPLAY AT INDIANAPOLIS

As the campaign is now being conducted the dealers purchase their stock of appliances from the three jobbers and consign a portion of it to the appliance sales department of the Indianapolis Light & Heat Company. The central-station company then employs several methods in disposing of the goods. Irons, as a rule, are sold by eight salesmen working for the lighting company, the selling price being $3.50. With the city divided into four districts these men canvass electric-service customers along the meterman's route and receive a commission of 50 cents for each sale. Each agent carries two samples of the same manufacture, it being the plan of the company to sell a different make of iron in each of the four districts. If a prospective customer desires a type of iron not being sold in her district, the agent takes the order and it is filled from the store by a motorcycle man who delivers irons as rapidly as the orders come in. When a customer takes advantage of the part-payment offer which has been made and elects to pay $1 down and $1 a month, the salesman collects the first $1 with the order and the remaining collections are made by the dealer. Turning in the $1 to the company, the solicitor receives his 50 cents and the remainder goes to the dealer supplying the iron. Some irons, of course, are sold in the store and some by the company's regular solicitors. The commissions in these cases revert to a fund to be expended for advertising at the discretion of Mr. N. A. Perry. During the summer months the company expects to dispose of about 200 irons.

Fan and other appliance sales are handled almost exclusively from the lighting company's appliance store. This business is generally dispatched on a cash basis, and 10 per cent of the gross revenue is retained by the lighting company for its advertising fund. The jobbers have agreed to do no retail appliance business, and with the dealers fixing the retail price charged by the lighting company the chain of co-operation is complete. Lamps and industrial motors are not included in this appliance sales campaign.

Building Managers Want Lead-Covered Wires

The Building Managers' Association of Chicago is endeavoring to induce the city government to modify the rules and regulations of the Department of Gas and Electricity to permit the use of lead-covered wires in downtown office buildings instead of the steel-conduit construction specified. The elemental objection to the conduit is not the expense but the fact that it is sometimes difficult to install it without breaking the fireproofing. The matter is pending in the City Council committee on gas, oil and electric light. Mr. Ray Palmer, city commissioner of gas and electricity, is opposing the proposed change.

Louisville Electrical Contractors Adopt Open Shop System

Following the lead of other employers of labor, the leading electrical contractors of Louisville, Ky., have announced that they will operate hereafter on the open-shop system. Heretofore the electricians' union has had the bulk of the work there, and the announcement of the employers amounts practically to a lockout, for the reason that the rules of the unions will not permit their members to work in any other than closed shops. The Moore-Young Electric Company, Frazer & Bush and the Builders' Supply Company are the contractors who took the lead. Other trades in which a similar condtiion exists are the carpenters, the barbers, the plasterers, the painters and the plumbers.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Business in Ball Bearings Good.—From present indications it is declared that the business of the Hess-Bright Manufacturing Company, Philadelphia, Pa., this year will be the best the company has ever enjoyed.

Electrical Equipment for Government Service.—Orders have recently been received from the United States government for nineteen directly connected generating sets and eleven switchboards by Engberg's Electric & Mechanical Works, St. Joseph, Mich.

Storage Batteries for Headlamp Service.—An order has been received by the Electric Storage Battery Company, Philadelphia, Pa., from the Southern Pacific Railroad Company for 650 sets of "Ironclad Exide" batteries for locomotive headlamp service. With the previous order received several months ago, this makes a total of 946 sets, or 2838 cells, for this class of service.

Poster Stamps for Advertising Purposes.—Poster stamps are a German advertising novelty. They have recently been introduced into this country, and among the firms to make use of them is the Westinghouse Lamp Company. The stamps measure 2 in. by 1.5 in. in size, and they are used on the backs of envelopes, packages, etc. Various attractive color designs are printed on these stamps.

Extension from Grinnell, Ia.—The Grinnell (Ia.) Electric & Heating Company, which is controlled by the Federal Light & Power Company of Boston, and of which Mr. H. C. Utter is the local manager, has obtained a franchise for supplying electrical energy in Brooklyn, Ia., a village of 1000 population, which has hitherto had gas for lighting and heating but no electricity. Energy will be transmitted from Grinnell over a line about 18 miles long.

Summer Central-Station Service to Private Plants.—Contracts have just been signed by Mr. Robert Montgomery, commercial manager for the Louisville Gas & Electric Company, to furnish the Galt House and the department store of the Herman Straus & Sons Company with electricity for lamps and fans this summer. Both these concerns maintain their own plants and run these in the winter in connection with their heating systems.

Tool Manufacturer Moves to Larger Factory.—Moving into its new factory at Belmont and Kedzie Avenues, Chicago, the firm of Mathias Klein & Sons now occupies a modern and much larger plant. The new building is situated on a 6-acre tract, and the factory, including the company's power house, has approximately 65,000 sq. ft. of floor surface. With recent additions to its force, the company now employs 133 men making tools for linemen.

Mica Business Fair.—The business of Eugene Munsell & Company, 68 Church Street, New York, is reported to be fair, and a spirit of optimism regarding the future is manifest. The calendar year 1913 is said to be the best this concern has ever had. The mica marketed by this company is obtained chiefly from India and Canada, although a certain amount is also taken from the United States. The Canadian amber mica is declared to be the best for commutator insulation.

Orders for Gas Engines.—Orders have recently been received by the Bruce-Macbeth Engine Company for the following equipment: One 60-hp twin-cylinder natural-gas engine for the Mirroscope Company, Cleveland, Ohio; one 40-hp two-cylinder engine for the West Virginia Central Gas Company, Weston, W. Va.; one 60-hp twin-cylinder natural-gas engine for the Delaware Blue Limestone Company, Delaware, Ohio; one 40-hp natural-gas engine for the A. H. Jackson Company, Sandusky, Ohio; two 150-hp four-cylinder natural-gas engines for the Hardwicke-Etter Company, Sherman, Tex., and one 60-hp two-cylinder gas-engine for C. W. Downey's garage, Cleveland, Ohio.

Violet-Ray Sterilization for Niagara Falls' Water Supply.—The first municipal ultra-violet-ray sterilizing plant to be installed in this country is now being constructed at Niagara Falls, N. Y., and will be completed about Sept. 15. Thirty-five "pistol" lamps will be employed, seven being used in each of five concrete canals. Of this number, however, only about twenty-five will be actually required to handle the 16,000,000 gal. pumped by the plant daily. The canal and sterilizing-lamp installation will cost about $20,000, and it is estimated that during operation the energy cost will be about 7 cents per 1,000,000 gal. The equipment is being constructed by the R. U. V. Company, Inc., New York.

Reducing Number of Pending Patent Applications.—Considerable progress has been made in reducing the number of applications pending for the issuance of patents, according to Hon. Thomas Ewing, Commissioner of Patents, in a recent report to Secretary Lane on the output of the work of his office since he assumed charge last August. Commissioner Ewing states that since Jan. 1 the number of applications passed for the issuance of patents exceeded by 6987 the number granted for the corresponding period last year. Since last August the number of new applications awaiting action has been reduced by 539 and the number of old cases by 5152, a total reduction in pending cases of 5691. Receipts of the Patent Office for the first five months of this year were $968,376, compared with $910,531 for the same period last year. Receipts last year were $157,000 in excess of expenses, and the commissioner says this year's surplus will be more than $200,000. Since its establishment the receipts of the Patent Office have been more than $10,000,000 in excess of expenses.

Annual Report of Federal Sign System (Electric).—As chairman of the board of directors Mr. Samuel Insull reported to the stockholders of the Federal Sign System (Electric) for the fiscal year ended March 31, 1914, the report being issued on June 10 last. The chairman of the board reports gross income from operation for the year ended March 31, 1914, as $1,988,260. The expenses were $1,815,488, leaving $172,781 as net income. From this $141,059 was deducted as the 7 per cent dividend on the preferred stock, leaving $31,722 as the balance carried to surplus. In his report Mr. Insull makes the following interesting comment on the business of the company: "Generally the company has continued its policy of developing its merchandising business, but without diminishing the line of its own manufactures, to which it has added several new articles. Light and power companies continue to be its principal customers. The company's gross sales have increased substantially, but it has found that its customers have this year confined their purchases largely to staple apparatus and supplies essential to their regular business, on the sale of which your company makes but a medium profit. Customers have been inclined to defer until a period of more plentiful money the purchase of electricity-consuming devices, in the sale of which your company makes its best profit. During the year the company has opened one new office, at Toronto, Canada, making a total of twenty-four offices." The total surplus of March 31, 1914, was $217,646. The company's outstanding capital stock consists of $2,045,400 in preferred and $3,110,150 in common. The general office is in Chicago, but there are branch offices in New York, Philadelphia, St. Louis, Pittsburgh, Baltimore, San Francisco, Minneapolis, Toronto and fifteen other cities. The officers of the company, beside Mr. Insull, are as follows: President, Mr. John H. Goehst; treasurer, Mr. John F. Gilchrist; secretary, Mr. James M. Gilchrist; general manager, Mr. Herbert I. Markham; general auditor, Mr. J. S. Macpherson.

Electricity for Coal Companies.—A recent electric-service contract of interest is that by which the Wallings Creek Coal Company, the Clover Fork Coal Company and the Harlan Coal Mining Company have agreed to get their energy supply from the Kentucky Utilities Company, whose headquarters are at Lexington, Ky. To give this service, the company before the end of the present summer will run a transmission line into the Hazard section, while the mining companies which heretofore have generated their own energy will discontinue their isolated plants. At least one of them, it is said, will use the machinery in the operation of an ice factory.

Central-Station Business in the Atlantic States.—Official returns for the month of April from central stations operating in the Middle Atlantic States indicate a rather better rate of increase over 1913 than was shown by the figures for the previous month. From the comparative data for this territory for March and April shown in Tables I, II and III, it will be seen that throughout the three states of New York, New Jersey and Pennsylvania the expansion characteristic on both earnings and output is higher for April than for March. Although the figures in the accompanying tables have been derived from the official returns of the operating companies, they should not be taken to mean that there has been any marked improvement in the industrial situation in the East, as the expansion for March seemed unduly low. The returns for April will at least have the effect of leveling up the 1914 monthly average, so that the first six months of the year should show an increase over 1912 of from 8 to 9 per cent on the gross earnings. Even the higher figure would be appreciably below normal, but before the industry can enter upon any fresh boom period and again register annual increases in the neighborhood of 13 or 14 per cent a very marked change must take place in the industrial situation generally. At the present time the electric utilities are busy but business is not booming. From the first three tables it will be noted that operating companies sometimes report a rising revenue with a falling output. Last month the reverse was the case. Too rigid a comparison of the two quantities should never be attempted, since the station output is totaled for a calendar month, while the revenue is based on meter readings, and the monthly totals for such readings never correspond strictly to the calendar month. It should be stated that the gross earnings from the sale of energy for the entire industry in the Middle Atlantic States for April were probably a little in excess of $10,000,000. Data gathered by the *Electrical World* show that the gross earnings of thirty-one companies in this belt increased from $5,257,092 in April, 1913, to $5,769,418 in April, 1914, or at a rate slightly less than 10 per cent; while the energy output increased from 189,904.240 kw-hr. to 209,156,581 kw-hr., or at a rate of just over 10 per cent. For the South Atlantic States (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia and Florida) it is again found that a higher rate of increase over last year was shown by April than by March. Comparative returns for the two months are given in Table IV, from which it will be noted that the total gross earnings from the sale of electricity by ten central-station companies was 12.7 greater in April of this year than in April, 1913, energy output having increased in the same time by 26.1 per cent. Comparable figures for March showed 10.7 and 25.0 per cent. If an addition is further made of the companies reporting April figures but from which data were not received for March, it is found that in the South Atlantic belt the gross earnings of seventeen companies increased from $928,664 in April, 1913, to $1,058,320 in April, 1914, or at a rate of 14 per cent; while the energy output increased from 41,176,414 kw-hr. to 50,532,426 kw-hr., or at a rate of 22.8 per cent. It should be borne in mind that the entire industry in this group of states showed an output for April, 1914, of a little over 100,000,000 kw-hr., for which it received probably around $1,750,000.

TABLE I—EARNINGS AND OUTPUT FOR MARCH AND APRIL, 1914 AND 1913, FOR SEVENTEEN LARGE CENTRAL STATIONS IN NEW YORK STATE

	Gross Earnings from the Sale of Energy			Total Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
March	$3,708,765	$3,489,552	6.3	112,580,788	107,844,478	4.5
April	3,577,519	3,313,347	8.0	107,131,606	101,381,741	5.7

TABLE II—EARNINGS AND OUTPUT FOR MARCH AND APRIL, 1914 AND 1913, FOR EIGHT LARGE CENTRAL STATIONS IN THE STATES OF PENNSYLVANIA AND NEW JERSEY

	Gross Earnings from the Sale of Energy			Total Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
March	$1,894,955	$1,792,602	5.7	98,262,459	88,499,066	11.1
April	1,943,913	1,733,836	12.2	95,211,713	82,740,110	15.1

TABLE III—MIDDLE ATLANTIC STATES—EARNINGS AND OUTPUT FOR MARCH AND APRIL, 1914 AND 1913, OF CENTRAL STATIONS REPRESENTING OVER ONE-HALF OF ENTIRE INDUSTRY OF NEW YORK, NEW JERSEY AND PENNSYLVANIA

	Gross Earnings from the Sale of Energy			Total Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
25 companies (March)	$5,603,720	$5,282,154	6.1	210,843,247	196,343,544	7.5
31 companies (April)	5,769,418	5,257,092	9.8	209,156,581	189,904,240	10.1

TABLE IV—SOUTH ATLANTIC STATES—EARNINGS AND OUTPUT FOR MARCH AND APRIL, 1914 AND 1913, OF TEN CENTRAL-STATION COMPANIES

	Gross Earnings from the Sale of Energy			Total Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
March	$938,939	$848,951	10.7	43,086,047	34,451,793	25.0
April	901,639	799,672	12.7	41,665,255	32,978,594	26.1

NEW YORK METAL MARKET PRICES

	June 9		June 16	
Copper	Bid	Asked	Bid	Asked
Standard spot*	13.00	13.40	13.25	13.75
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	61 17 6		61 10 0	
Prime Lake	14.12½	to 14.37½	14.12½	to 14.25
Electrolytic	13.85	to 13.95	13.80	to 13.90
Casting	13.70	to 13.80	13.65	to 13.75
Copper wire base	15.25	to	15.00	
Lead	3.90		3.90	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.10	to 5.20	5.10	to 5.20
Tin, spot*	30.50	to 30.75	30.00	to 30.25
Aluminum:				
Prompt delivery	17.75	to 18.00	17.75	to 18.00
Future	17.75	to 18.00	17.75	to 18.00

*OLD METALS

Heavy copper and wire	12.62½	12.87½
Brass, heavy	8.50	8.62½
Brass, light	7.37½	7.50
Lead, heavy	3.70	3.75
Zinc, scrap	4.00	4.15

*COPPER EXPORTS

Total tons to June 16 17,708

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Midland Counties Public Service Corporation.—This corporation, which was organized under the laws of California on Oct. 11, 1913, has acquired the properties of the Coalinga Water & Electric Company, the Midland Counties Gas & Electric Company, the Paso Robles Light & Water Company and the Russell Robinson Light & Water Company.

Westinghouse Electric & Manufacturing Company.—At the annual meeting of stockholders of the Westinghouse Electric & Manufacturing Company, held at the general offices of the company in Pittsburgh, Messrs. A. G. Baker, William McConway, George M. Verity and Paul M. Warburg were re-elected directors, while Messrs. John R. McCune, H. H. Westinghouse, Paul D. Cravath and James N. Wallace were elected to fill vacancies in the board.

American Gas & Electric Company's Extra Dividend.—At the recent meeting of directors of the American Gas & Electric Company, besides the regular quarterly cash dividend of 2 per cent, an extra dividend of 2 per cent payable on July 1, 1914, in common stock was declared. It will be the policy of the company to distribute such portion of its earnings as may be available for that purpose above the requirement of the regular cash dividends in the form of common stock dividends. The company, however, does not commit itself as to the date of declaration or rate of future stock dividends.

Columbus Electric Company Notes.—Eastabrook & Company, of Boston, Mass., have purchased a new issue of $1,750,000 three-year 6 per cent notes of the Columbus (Ga.) Electric Company, operated by Stone & Webster. These notes are being offered at 99 and interest yielding 6⅜ per cent. The proceeds of these notes will provide funds for retiring $1,000,000 of 5 per cent coupon notes dated July 1, 1914, and the floating debt incurred for new construction. The Columbus Electric Company owns the securities of companies which do the entire electric-railway, electric-lighting, gas and power business in the city of Columbus, Ga., and vicinity, and in the adjoining towns of Phoenix and Girard.

Texas Southern Electric Company Merger.—The Texas Southern Electric Company has been organized under the laws of Massachusetts and has purchased electric properties at Cuero; the electric and ice properties at Victoria; the electric, ice and water properties at Bishop, Kingsville and other south Texas cities. The transaction, with contemplated improvements, represents $1,000,000. Warner, Tucker & Company, of Boston, financed the transaction, and Mr. W. A. Leland, president of the Tennessee Eastern Electric Company, is president. Messrs. W. B. Tuttle and B. G. Slining, of the Southwestern Engineering Company, of San Antonio, Tex., were prominent in the engineering, financing and organization of the merger.

Ohio Service Company.—The Ohio Public Utilities Commission has authorized the Ohio Service Company to issue securities aggregating $1,489,807, and to acquire the property of the electric companies in Dennison, Uhrichsville, Canal Dover, New Philadelphia, Coshocton, Cambridge and Pleasant City. The commission, however, does not approve the prices which are to be paid for the plants. The companies to be acquired with prices to be paid are as follows: County Electric Company, having plants at Canal Dover, Dennison, Uhrichsville and New Philadelphia, $694,000; Lafayette Light & Power Company, transmission lines between these towns, $45,807; New Midland Power & Traction Company, having electric plant at Cambridge and an interurban line between Cambridge and Pleasant City, $750,000.

Annual Report of Associated Gas & Electric Company.—The fourth annual report of the Associated Gas & Electric Company has been published. The company is under the management of the J. G. White Management Corporation. For the year ended Dec. 31, 1913, the gross earnings from operation were $774,818. Deducting $549,410 for operating expenses and taxes leaves $225,408 as net revenue from operation. To this is added $53,913 as income from other sources, making the gross income $279,321. Subsidiary companies' deductions amounted to $97,827, giving $181,494 as the balance available for the company. After deduction of $112,807 for interest and $39,627 for dividends, $29,060 was left for surplus. Adding $25,100 for profits on sale of securities of Bethlehem Consolidated Gas Company and subtracting $17,600 for amortization of debt, discount and expense leaves as surplus for the year $36,560. During the year $95,823 was expended for improvements and $41,000 was expended for maintenance.

Virginia Power Company Bonds.—A. B. Leach & Company, of New York, are now placing on the market the $3,300,000 issue of first and collateral trust mortgage 5 per cent gold bonds of the Virginia Power Company which they bought. Many of these bonds have been sold, and the remainder are being offered at the rate of one thousand-dollar bond and three shares of common stock for $900. These bonds are thirty-year bonds dated Dec. 1, 1912. Since that time they have been held as collateral for notes. These notes are to be called in at an early date. The issue is secured by an absolute first mortgage on a modern steam-power plant at Cabin Creek Junction, W. Va., having a capacity of 26,666 hp and an ultimate capacity of 53,332 hp. The bonds are further secured by 129 miles of transmission and distribution lines, by water rights and lands between Bluestone and the Virginia state line, and by the outstanding capital stock of the New River Power Company and the Dominion Power Company of Virginia. The three power sites which the company controls on the New River are at Bluestone, Richmond Falls and Hawk's Nest, W. Va. The estimated available power from Bluestone is 125,000 kw, from Richmond Falls 15,000 kw and from Hawk's Nest 30,000 kw—a total of 170,000 kw.

Southwestern Cities Electric Company's Plans.—Mr. John C. Keys, of Lawton, Okla., president of the Southwestern Cities Electric Company, states that the company is contemplating the purchase of a number of plants in that district. So far it has nearly completed the transmission line in Texas which is to tie all of the Texas properties together, supplying them from one plant, thereby eliminating the local plants in smaller communities. Mr. Keys further stated that it is hoped eventually to connect the Texas properties and most of the Oklahoma properties on one transmission line. At present changes are being begun at the Lawton property; Diesel engines and Westinghouse generators have been ordered to replace the present steam plant. The lines are being rebuilt and the entire plant and transmission system will be rehabilitated. At present the company controls the Chillicothe Light & Power Company, Chillicothe, Tex.; the Comanche Light & Power Company, Lawton, Okla.; the Duncan Electric & Ice Company, Duncan, Okla.; the Mangum Electric Company, Mangum, Okla.; the Pecos Valley Gas & Electric Company of New Mexico, and the Quanah Light & Ice Company of Quanah, Tex. The officers are John C. Keys, of Lawton, Okla., president; A. D. Converse, New York, vice-president; F. L. Search, Rochester, N. Y., treasurer, and A. H. Mosle, New York, secretary.

Pacific Gas & Electric Company Permanent Financing Plan.—A letter has been sent to stockholders of the Pacific Gas & Electric Company in which is set forth a plan for the permanent financing of the company. The stockholders are asked to approve of a charter amendment for reclassification of the stock into $100,000,000 common, $50,000,000 first preferred 6 per cent cumulative, and $10,000,000 first preferred. They are also asked to subscribe to $12,500,000 new preferred, which will be issued immediately at $82.50 per share, payable in instalments. To holders of the old $10,000,000 preferred is extended the right to exchange for new preferred, after July 1, 1916, at the rate of 10¼ shares of new preferred for every 10 shares of old. This is equivalent to an additional exchange value of $20.60 on ten shares. Upon consummation of the plan dividends on the common stock will be resumed at the beginning of 1915 at the rate of 4 per cent per annum. The present plan of capitalization for raising new capital has meant the issuing of short-term bonds, which have made it necessary to reinvest in the property an undue proportion of the earnings. This, coupled with the fact that the Railroad Commission of the State of California has indicated to public utilities that it views with disfavor the practice of raising new capital entirely from the sale of bonds, caused the board of directors to propose the new plan.

Business Notes

The Formica Insulation Company, of Cincinnati, Ohio, is now the name of the firm formerly known as the Electric Service Company.

Dodge Brothers, of Detroit, Mich., have appointed A. E. Barker, who was the founder and for many years the active head of the Dean Electric Company, Elyria, Ohio, their district representative, with headquarters at Cleveland. He will have charge of sales in sections of Ohio, New York, Pennsylvania, West Virginia and Maryland.

The Westinghouse Electric & Manufacturing Company.—On account of the increased activities of the railway and lighting department of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., two new positions have been created, and E. P. Dillon and M. B. Lambert have been appointed to fill these positions with titles of assistant managers. Mr. Dillon will have charge of the commercial activities of the company in connection with the generation and distribution of power, involving power houses, substations, transformer stations and similar apparatus. Mr. Lambert will have charge of all sales work pertaining to electric traction, including steam, interurban and city installations. Both Mr. Dillon and Mr. Lambert have been connected with the railway and lighting department of the above company for a number of years.

New Industrial Companies

The Mason Bouck Electric Company, of Binghamton, N. Y., has been incorporated with a capital stock of $5,000 by E. Mason, F. J. Mason and W. C. Bouck, all of Binghamton.

The United States Lightning Conductor Company, of Chicago, Ill., has been incorporated with a capital stock of $1,000 to manufacture and deal in lightning conductors. The incorporators are Mark L. Smith, William H. Bell and W. W. Huse.

The M. & F. Electrical Company, of Rock Island, Ill., has been incorporated with a capital stock of $2,500 to manufacture and deal in all kinds of electrical apparatus, machinery, etc. The incorporators are Martin McNealy, William McNealy and William Fox.

The American Electrical Display Company, of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 to do a general electrical advertising business. The incorporators are Mrs. E. R. Blitz, Henry Baker, Max P. Goodman, M. E. Tettlebach and A. L. Dietz.

The Aladdin Electric Company, of Chicago, Ill., has been incorporated by Samuel P. Marmley, Jr., Norman C. Crosshaw and Joseph Bonomo. The company is capitalized at $10,000 and proposes to manufacture and deal in electrical and automobile merchandise, supplies, etc.

The Jeffries-Young Antenna Company, of Atlantic City, N. J., has been incorporated with a capital stock of $50,000 by J. L. Young, P. E. Lane, E. H. Cuthbert and J. W. Gallaway, of Atlantic City. The company proposes to manufacture equipment for wireless telegraphy, electrical apparatus, etc.

The Empire Electric Vehicle Company has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $200,000 and proposes to manufacture bicycles, wheeled chairs, etc. The incorporators are I. T. Conway, L. A. Brownhill and M. E. Dorsey, of Wilmington, Del.

The Anasco Asbestos & Asphalt Company, of Chicago, Ill., has been chartered with a capital stock of $50,000 to manufacture and deal in waterproofing, roofing, paving, paint and insulating materials, asbestos products, etc. The incorporators are Richard N. Simpson, W. Barrett Fitzgerald and E. R. Beifuss.

The Braun-Hoff Electric Company, of Canal Dover, Ohio, has been incorporated by W. A. Braun, Jesse D. Baker, S. L. Holmes, C. E. Kreiter, O. A. Keyser and E. B. Hoff. The company is capitalized at $50,000 and proposes to take over the property of the Dover Electric Company and will manufacture electric motors, generators, electric appliances and devices.

The Porter-Phonet-Scope Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,500,000. The company proposes to manufacture and sell phonetic apparatus for talking, singing and moving pictures. The incorporators are F. R. Hansell, of Philadelphia, Pa.; G. H. B. Martin and S. C. Seymour, of Camden, N. J.

The South Electric Manufacturing Company, of New York, N. Y., has been incorporated with a capital stock of $25,000 by William S. Lison, 165 Broadway; Charles R. Pedle, 165 Broadway, and Lewis C. Randolph, 206 Broadway, all of New York, N. Y. The company proposes to manufacture and deal in machinery and devices, and to do a general contracting, electrical and mechanical engineering business.

Trade Publications

Pull Sockets.—A leaflet describing in detail a new pull socket has been issued by W. R. Ostrander & Company, 22 Dey Street, New York.

Fans.—A neat, attractive booklet of forty-eight pages has been issued by the Western Electric Company to show the many types of fans made by this company.

Keyless Sockets.—W. R. Ostrander & Company, 22 Dey Street, New York, have issued a leaflet entitled "Socket Talks No. 3." It describes a new keyless socket put out by the above company.

Batteries.—The Willard Storage Battery Company, Cleveland, Ohio, has issued Bulletin No. 45, referring to various types of its LBA battery. Descriptions, illustrations and price-lists are given.

Axle-Lighting System.—In Bulletin No. 144 the Electric Storage Battery Company, Philadelphia, Pa., describes the fundamental principles of an axle-lighting system. It contains several photographs and a diagram of connections.

Rectifier.—The Wotton rectifiers, made by the Electric Products Company, Cleveland, Ohio, are illustrated and described in an eight-page pamphlet issued recently. Ignition, starting and lighting battery-charging equipments are fully discussed.

Pumps.—Bulletin No. 118 of the Goulds Manufacturing Company, Seneca Falls, N. Y., relates to centrifugal fire pumps. A comprehensive, illustrated description of this apparatus is given, together with instructions for installing and various useful tables.

Pole-Line Hardware.—W. N. Matthews & Brother, St. Louis, Mo., in a pamphlet of twelve pages illustrate and describe their new line of pole hardware called "Prisections." These devices, the invention of John L. Fay, have many practical features of interest to central-station men.

Cables.—The Belden Manufacturing Company, Twenty-third Street and Western Avenue, Chicago, Ill., in its Bulletin No. 1006 gives data on its line of standardized bare-copper cables and braids. A complete range of sizes is shown, including a new line of cables designated as the "Hawserlay" woven-rope effect.

Electric Vehicles.—In a pamphlet bearing the title "Good Store Service," the General Vehicle Company, Inc., Long Island City, N. Y., makes practical suggestions for laying out the delivery system of a department store and refers specifically to the value of the G. V. electric vehicles in solving department-store vehicle problems.

Copper Wire.—A recent issue of *Copper Gossip* contains a résumé of the copper-market situation, New York and London copper prices, the exports and imports of copper from January to April, 1914, and other copper news. This sheet is published periodically by the National Conduit & Cable Company, 41 Park Row, New York.

Storage Batteries for Locomotives.—A catalog describing the so-called "Ironclad-Exide" storage battery for locomotives has been issued by the Electric Storage Battery Company, Philadelphia, Pa. The book is illustrated with various types of locomotives using this type of battery. It also contains characteristic curves and tables giving dimensions and weights of different kinds of batteries used in this service.

Personal Mention

Mr. C. M. Means, of Pittsburgh, Pa., has been retained as consulting electrical engineer by the United States Bureau of Mines.

Mr. Edgar S. Nethercut, consulting engineer, of Chicago, will assist Mr. Harold Almert in making valuations of traction properties in the city of Washington and the District of Columbia.

Mr. H. H. Rice, vice-president and general manager of the Waverley Company, Indianapolis, Ind., was elected vice-president of the National Automobile Chamber of Commerce at its recent New York meeting.

Mr. C. B. Rhodes, formerly head of the motor-application department of the Kansas City Electric Light Company, is now industrial commissioner for the Mississippi River Power Company at Keokuk, Ia.

Mr. Tadahiko Ayai, manager of the Tokyo Electric Company, Ltd., of Japan, is spending two months in the United States studying American methods of incandescent-lamp manufacture. He attended the Philadelphia convention of the National Electric Light Association and will return to New York City for a stay of several weeks before sailing for Europe. Mr. Ayai expects to spend a month in England and three weeks in Germany and Switzerland before returning to Japan.

Mr. E. W. Lloyd, general contract agent of the Commonwealth Edison Company, Chicago, and newly elected first vice-president of the National Electric Light Association, sailed for Europe on the steamship *Imperator* June 6, in company with Mrs. Lloyd. During his trip to England and the Continent Mr. Lloyd expects to visit London, Paris, Berlin, Milan, Munich, Frankfort and other cities in France, Italy and Germany. Making the trip one of combined business and pleasure, Mr. Lloyd plans to inspect several electrochemical factories and steel mills where electric furnaces are being used extensively. He will return to this country by way of Liverpool about Aug. 1.

GEORGE B. MULDAUR

Mr. George Barton Muldaur, of the staff of Barclay Parsons & Klapp, has taken the position of "field representative" with the Society for Electrical Development, Inc. Mr. Muldaur was graduated from the Stevens Institute of Technology in 1889, and his first electrical experience was gained with the Edison Electric Illuminating Company of New York. He was associate editor of the *Electrical Engineer* for several years and World's Fair editor at the Columbian Exposition at Chicago in 1893. Of late years he has specialized as a development engineer in connection with new railway, light and power propositions, chiefly in the South and Southwest. This has included a great deal of publicity work both through newspapers and by personal contact with commercial bodies, city officials, financial organizations, etc. In his position as head of the field co-operative section of the Society for Electrical Development Mr. Muldaur will travel through the country, forming local co-operative leagues, establishing electrical pages in the newspapers with a view to intensive cultivation of the field by co-operative advertising, and organizing regular "get-together" meetings. These leagues will be posted on their local ordinances, particularly as regards wiring, inspection, rates, etc. Mr. Muldaur will also co-operate closely with architects and builders, with a view to having specifications written to provide for full electric service instead of merely for lighting. In addition, he will attempt to bring school textbooks and lecture courses up to date and will speak before chambers of commerce, boards of trade, etc., to urge local co-operation which will benefit the development of the electrical industry in general.

Mr. F. A. Gaby, chief engineer of the Hydroelectric Power Commission of Ontario, was married on May 20 to Miss Catherine Florence Macbeth, of Toronto, Ont.

Mr. A. H. Jones, who was elected president of the Mississippi Electric Association at its recent meeting at Meridian, Miss., resigned June 1 as manager of the McComb (Miss.) City Electric Light & Power Company. For the present Mr. Jones plans to take a much-needed rest.

Mr. R. E. Richardson, recently general manager of the Commonwealth Power Company, Kalamazoo, Mich., sailed for France, June 9, on board the steamship *New Amsterdam*. Mr. Richardson was formerly general manager of the Kansas City Electric Light Company, Kansas City, Mo.

Mr. Harold Almert, consulting engineer, Chicago, Ill., has been retained as technical counsel by the Washington Railway & Electric Company and the Potomac Electric Power Company, of Washington, D. C., to make a detailed inventory and valuation of the property of the companies in the District of Columbia.

Mr. Frederick A. Scheffler, the newly elected president of the New York Electrical Society, is one of the well-known pioneers of the electrical industry. He became associated with Mr. Thomas A. Edison in 1881 and as engineer designed for him the second electric locomotive built for experimental purposes at Menlo Park, N. J. Later Mr. Scheffler held such important positions as those of general superintendent of the Westinghouse Electric & Manufacturing Company's works, Pittsburgh, Pa.; general superintendent of the Brush Electric Company, Cleveland, Ohio, and manager of the Sprague Electric Company's factory, Watsessing, N. J. Mr. Scheffler was also connected with the introduction of the Stirling type of boiler manufactured by the Babcock & Wilcox Company, with which he is now associated. Mr. Scheffler has the rank of fellow in the American Institute of Electrical Engineers and is a member of the American Society of Mechanical Engineers and the Engineers' Club, New York.

L. R. POMEROY

Mr. L. R. Pomeroy, consulting engineer, who was recently appointed manager of the New York office of the United States Light & Heat Company, has long been engaged in work in the railway and electrical fields. He was born at Port Byron, N. Y., in 1857, and attended high school at Milwaukee, Wis., and the Irving Institute at Tarrytown, N. Y. From 1874 to 1880 he was engaged in commercial business, bookkeeping, special auditing, drafting and designing of cars and locomotives. From 1880 to 1886 he was secretary and treasurer of the Suburban Rapid Transit Company of New York. For four years following this he was a special representative of the Carnegie Steel Company, introducing basic boiler steel for locomotives and special forgings for railways. For nine years he was engaged in the same work with the Cambria Steel Company and the Latrobe Steel Company jointly. This assignment involved metallurgical engineering and experimental research to adapt special steels for railway axles, crank pins and piston rods. From 1829 to 1902 he was assistant general manager of the Schenectady Locomotive Works. For six years following this he was a special representative in the railway field for the General Electric Company, this work covering the electrification of steam roads and railway shops and the general application of electricity for all railway purposes. Subsequently he was for two years assistant to the president of the Safety Car Heating & Lighting Company, during which period he devoted a portion of his time to consulting work in the special field or railway shops and machine tool operation. From the Safety company he went with J. G. White & Company, New York, as chief engineer of the railway and industrial division. Before becoming associated with the United States Light & Heating Company he conducted a consulting engineering office in New York City.

Construction

New England

HAMPTON, N. H.—The Hampton Water Works Co., of Hampton, has engaged Charles N. Taylor, of Wellesley, Mass., to prepare plans and take charge of constructing a water-works system, consisting of about 12 miles of 6-in., 8-in. and 10-in. cast-iron pipe, standpipe, 25-in. in diameter and 85 ft. high, concrete pumping station, two pumps, each having a capacity of 300 gal. per minute, one to be driven by a 20-hp electric motor and the other to be driven by a 22-hp fuel-oil engine. William H. Jaques, Little Boar's Head, N. H., is president of the company.

WARREN, N. H.—Within the next four months the Warren Wtr. & Lt. Co. expects to purchase a 100-hp waterwheel and governor and material for 4 miles of 6600-volt transmission line and 1 mile of distribution line, 2300/110/220 volts. Edgar S. Carbee is treasurer.

BOSTON, MASS.—Bids will be received by the schoolhouse commissioners of the city of Boston, 120 Boylston Street, Boston, until June 23 for installing electric systems in the Andrews School, Genesee Street, Boston.

BROCKTON, MASS.—The Edison Electric Illg. Co. of Brockton has petitioned the Board of Gas and Electric Light Commissioners for permission to issue $316,200 in capital stock, the proceeds to be used to take up floating indebtedness and for further extensions to its plant.

FRANKLIN, MASS.—The Union Lt. & Pwr. Co., of Franklin, has applied to the State Board of Gas and Electric Light Commissioners for permission to issue $130,000 in capital stock, the proceeds to be used for extensions to its property.

GREAT BARRINGTON, MASS.—The Great Barrington El. Lt. Co. has been granted pole locations for a new transmission line as far south as Ashley Falls, through the village of Sheffield. The company proposes to furnish electricity in that section.

MANSFIELD, MASS.—The Municipal Electric Light Commissioners have entered into a contract with the Union Lt. & Pwr. Co., of Franklin, for the installation of a breakdown service at the Mansfield plant. A 13,000-volt line will be erected over a private right-of-way.

NORTH PROVIDENCE, R. I.—The electric light committee has decided to recommend to the Town Council the installation of electric lamps along Mineral Spring Avenue from Centredale to Marieville.

SMITHFIELD, R. I.—At a recent town meeting the taxpayers made appropriations for the installation of electric lamps on the main highways of the town of Smithfield as follows: For lamps in Esmond and Georgiaville, $1,000; for Greenville, $1,000, and $500 for Stillwater.

HARTFORD, CONN.—The municipal building commission has recommended the award of the contract for electric-lighting fixtures in the municipal building to the Tiffany Art Studios, of New York, at $21,600.

MANCHESTER, CONN.—Plans are being considered by Cheney Brothers for the construction of an electric power plant to furnish electricity to operate part of their silk mills and to furnish electricity to the Manchester Lt., Pwr. & Tramway Co.

MERIDEN, CONN.—The contract for installing underground conduit for the Meriden El. Lt. Co. has been awarded to the Lundin El. & Machine Co., of Boston, Mass. The contract calls for 6000 linear ft., equivalent to 60,000 duct ft., with about 30 manholes and 40 sub-manholes.

SEYMOUR, CONN.—The contract for erection of substation for transformers for the high-tension transmission line to be extended from Waterbury to Seymour has been awarded to William Harris. The building will be 50 ft. by 15 ft. and will furnish electricity for distribution in Seymour and Naugatuck.

WATERBURY, CONN.—The contract for mechanical equipment, consisting of light, heat and power plant, for the new municipal building has been awarded by the city hall commission to the George A. Fuller Co., of New York, N. Y., at $104,145.

Middle Atlantic

ARGYLE, N. Y.—Plans have been completed for the installation of a hydroelectric plant to furnish electricity for lighting the almshouse in Argyle, to cost about $3,500.

AUBURN, N. Y.—Preparations are being made by the Empire Gas & El. Co., of Auburn, for the erection of a 2300-volt transmission line between Seneca Falls and Auburn, a distance of 15 miles. The company will purchase line material of all kinds for the proposed line. L. C. Reynolds, general superintendent, will have charge of the installation.

BROOKLYN, N. Y.—The contract for installing electric equipment in new Public School 170 has been awarded to the Commercial Construction Co., 8 Bridge Street, New York, at $8,752.

BROOKLYN, N. Y.—The contract for installing electric equipment in new Public School 48 has been awarded by C. B. J. Snyder, superintendent of school buildings, to Eugene Frank, 22 East Twenty-first Street, New York, at $8,585.

BUFFALO, N. Y.—The City Council has adopted resolutions providing for replacing the cluster lamps on Genesee Street, between Main and Jefferson Streets, with 85 luminous-arc lamps.

NEW YORK, N. Y.—Contract for construction of Section 1-A of the Seventh Avenue subway has been awarded to the Rapid Transit Subway Construction Co. at $474,244 by the Public Service Commission.

NEW YORK, N. Y.—Plans and specifications have been completed for additional boiler plant, two 225-kw direct-current engine-driven generators, steam fitting and wiring, switchboard and sprinkler equipment for the addition to the Bonwit-Teller Building now being erected at 415 Fifth Avenue, 3-7 East Thirty-seventh Street and 8 East Thirty-eighth Street, New York. Howells & Stokes, 100 William Street, are architects, and Percival Robert Moses, 336 Fifth Avenue, New York, is consulting engineer.

NEW YORK, N. Y.—Percival Robert Moses, electrical engineer, and Frederick Pope, mechanical engineer, associate engineers, have awarded the general contract to the Turbine Equipment Co., 30 Church Street, New York, for remodeling the main factory and adjacent buildings of the Rock Plaster Mfg. Co. at 150th Street and East River, New York. This contract includes overhauling and retubing present boilers, grates, smokestack, steamfitting, turbine, generators, condenser, wiring, motors, induced-draft fan and engine and switchboard.

OGDENSBURG, N. Y.—The City Council has entered into a new contract with the Ogdensburg Pwr. & Lt. Co. for a period of five years, under the terms of which the company agrees to install cluster lamps in the business section of Ford Street. The contract provides for 136 arc lamps and 37 tungsten lamps.

PLATTSBURGH, N. Y.—The Plattsburgh Gas & El. Co. is extending its transmission line to the village of Morrisville, a distance of about 4 miles. The company has also secured franchises for extending its lines 8 miles further west to the village of Cadyville, and over all roads adjacent thereto. All line material and substation equipment has been purchased. George M. Cole is manager.

SPENCERPORT, N. Y.—At an election held June 3 the proposal to appropriate $16,000 for the installation of a municipal electric-light plant was carried.

JOHNSTOWN, PA.—The Citizens' Lt., Ht. & Pwr. Co., of Johnstown, it is reported, contemplates the construction of a large central power plant in Seward, 10 miles from Johnstown. The company is also planning to extend its service into Mineral Point, Echo and East Taylor townships.

PHILADELPHIA, PA.—Bids will be received by the building committee of the Marple-Newtown Joint High School until June 22 for the construction of a school building on the Marple-Newtown Township Line Road, Newtown Township; also for plumbing, heating and electrical work in above building. Plans and specifications may be obtained at the office of Lachman & Murphy, 933 Witherspoon Building, Philadelphia. John F. T. Lewis, 115 South Thirtieth Street, Philadelphia, or Broomall, is secretary.

SPRING CITY, PA.—Improvements are to be made to the County Home in Spring City, including the installation of a motor-generator set to supply electricity to operate the laundry machinery and other machines used about the county home. Energy for the system will be supplied by the municipal electric plant in Chambersburg.

WEST CHESTER, PA.—The installation of a municipal electric-light plant is under consideration. T. Lawrence Eyre, it is reported, has offered to give a perpetual lease of the water-power at his Deborah's Rock Farm, together with a waterwheel, capable of developing 100 hp.

ASBURY PARK, N. J.—The Ocean Township committee is planning to replace the present arc lamps with tungsten lamps throughout the township. There will be 65 lamps installed.

CLINTON, N. J.—The property of the Clinton El. Lt. Co. has been purchased by Charles S. Johann, consulting engineer, 50 Broad Street, New York, N. Y. The present plant will be dismantled and replaced by a modern power house. Mr. Johann also proposes to extend the present system to several nearby towns.

MORRISTOWN, N. J.—The Morris & Somerset El. Co. contemplates the installation of a 1500-kw turbo-generator set and new boiler equipment. The company is also considering the construction of a garage. J. H. Drake is treasurer and manager.

NEWARK, N. J.—The Board of Public Works, it is reported, has decided to enter into a contract with the Public Ser. El. Co. for a period of five years, under which a portion of the city will be lighted with nitrogen lamps. The company has offered to install 200 lamps at once and 500 during the year.

TRENTON, N. J.—Application has been made by C. S. Johann, consulting engineer, 30 Broad Street, New York, N. Y., and Frederick C. Simons, of New York, N. Y., to the Governor, for a charter for a company to conduct an electric-light and power business in the State of New Jersey. The company will be known as the Western New Jersey El. Lt. & Pwr. Co., and will operate an extensive electric transmission system covering several towns in the western part of New Jersey. The headquarters of the company will be at 50 Broad Street, New York, N. Y.

WOODBRIDGE, N. J.—Bids will be received by the Town Commissioners for lighting the streets of the town for a period of one year.

BUCKHANNON, W. VA. — Ernest Phillips, of Buckhannon, it is stated, would like to receive estimates on a generator with storage battery, with sufficient output to maintain 100 to 150 lamps, and gasoline engine.

SCOTFORD, W. VA.—The Coal Bell Coal Co., of Scotford, it is reported, contemplates the purchase of electric equipment, including electric mine fan, mining machines and electric locomotives.

WARWOOD, W. VA.—The contract for construction of a power house at dam No. 12, located near Warwood, has been awarded to Earl N. Everson, of Brilliant, Ohio.

ABINGDON, VA.—The City Council has granted the Abingdon Lt. & Wtr. Co. a franchise for a period of 30 years to furnish electricity for lighting the streets of the city and for commercial purposes. The company is planning to build a large dam and power plant at the middle fork of the Holston River, near Abingdon.

WASHINGTON, D. C.—Bids will be received at the office of the purchasing agent of District of Columbia, District Building, Washington, D. C., until June 23 for furnishing and installing a complete electric time and program system in the Normal School No. 2. For further information address the purchasing agent.

North Central

BATTLE CREEK, MICH.—The Commonwealth Pwr. Co. is planning to extend its transmission line from Battle Creek to Urbandale.

BOYNE CITY, MICH.—The Boyne City El. Co. is planning to install a new lighting system to replace the arc lamps now in use. The plans provide for the erection of 50 4-amp luminous lamps, at a cost of $3,500.

DETROIT, MICH.—Bids will be received at the office of Charles A. Gadd, secretary, Board of Education, 50 Broadway, Detroit, until June 23, for furnishing and installing four new boilers and stokers in the power plant at the Central High School building, situated at Cass, Warren and Hancock Avenues. Plans and specifications may be seen at the office of the supervisor of school buildings, 50 Broadway, Detroit.

GRAND RAPIDS, MICH.—The city engineer has submitted an estimate of the cost of installing an ornamental lighting system on West Leonard Street from the bridge to Fremont Avenue to the Sixth Ward Improvement Association, in which he estimates the cost at about $8,000. A committee will be appointed by the association to solicit funds for installing the system.

KALAMAZOO, MICH.—The City Council will consider bids on June 22 for the sale of the old municipal electric-light plant and equipment. The best offer previously made was $5,300, but it is thought that the plant should bring more.

LANSING, MICH.—The Reo Motor Car Co., of Lansing, is erecting a large addition to its plant. The company, it is reported, expects to purchase electric generating equipment.

WHITEHALL, MICH.—The Council is reported to be negotiating with the Grand Rapids-Muskegon Pwr. Co., of Grand Rapids, for energy to operate the municipal electric system.

WYANDOTTE, MICH.—At a special election to be held June 30 the proposal to issue $40,000 in bonds for improvements to the municipal electric light and water plants will be submitted to the voters. Of the proceeds $29,000 will be used for the electrical department. A. S. McClenehan is superintendent.

ATHENS, OHIO.—The City Council has decided to call an election July 18 to submit the proposal to issue $45,000 in bonds for a new electric light plant and $65,000 for water-works system.

CINCINNATI, OHIO.—The Andrew Jergens Co. is planning to build an addition to its factory, 99 ft. by 120 ft., four stories high, to cost $45,000. Considerable electrical equipment and supplies, it is understood, will be required.

CINCINNATI, OHIO.—Bids will be received by the director of public safety, City Hall, Cincinnati, until June 26 for furnishing material and labor necessary for the completion of the buildings on the Cincinnati Refuge Farm for Boys, located near Glendale, separate bids to be submitted as follows: (1) Lathing and plastering; (2) marble work; (3) electrical work. Plans and specifications and blank proposals can be obtained at the office of Tietig & Lee, architects, Lyric Building, Cincinnati. Edward P. Durr is secretary.

CINCINNATI, OHIO.—Contracts will soon be awarded by Henry Price for the construction of a four-story factory building, 83 ft. by 100 ft., for the N. Manichewitz Co., as an addition to its plant. Motors and other electrical equipment will be required.

CONNEAUT, OHIO.—The City Council is considering rebuilding the municipal electric-light plant, at a cost of $35,000. It is understood that an engineer will soon be engaged to take charge of the work. S. W. Mehaffey is director of public service.

GREENVILLE, OHIO.—The Greenville El. Lt. & Pwr. Co. has applied to the State Public Utilities Commission for authority to issue $28,000 in capital stock, the proceeds to be used for installing a new turbine engine and other improvements.

LANCASTER, OHIO.—The Lancaster Trac. & Pwr. Co. has been granted a franchise to construct and operate a street railway upon a number of streets in the city; also a renewal of its franchise upon the streets already occupied by the company for a period of 25 years.

MARION, OHIO.—Five petitions have been presented to the City Council asking for the installation of cluster lamps on Center and Main Streets.

MARTIN'S FERRY, OHIO.—Propositions have been submitted to the City Council by the Wheeling Trac. Co., of Wheeling, W. Va., and the Sunnyside El. Co. for furnishing electricity to operate the municipal electric-light system.

MASON, OHIO.—Improvements are contemplated to the municipal electric-light plant involving an expenditure of about $14,000.

URBANA, OHIO.—The City Council has voted to grant the Urbana Lt. Co. a new franchise for a period of 10 years. The recommendation adopted by the Council provides that the company will furnish not less than 100 4-amp metallic-flame arc lamps and such incandescent lamps as the city may require; also ornamental lamp standards carrying two 50-cp and one 80-cp lamp, or four 50-cp and one 80-cp lamp.

FULTON, KY.—The Pub. Ser. Co. of Western Kentucky has been incorporated to take over the Fulton El. Lt., Ht. & Pwr. Co., of Fulton, and the Hickman El., Ice & Wtr. Co., of Hickman. The incorporators are J. H. Boughton, W. C. Morehead and H. L. Lowe.

LEXINGTON, KY.—Arrangements have been made whereby the Wallings Creek Coal Mining Co., the Clover Fork Coal Co. and the Harlan Coal Mining Co. will secure electrical energy from the Kentucky Utilities Co., of Lexington. To furnish the service before the end of the summer the Kentucky company will extend its transmission line into the Hazard section.

LOUISVILLE, KY.—The Louisville Gas & El. Co., it is reported, is contemplating an annex to its power house on Washington Street, which will double the output of the plant, at a cost of $478,361. Overhead bunkers extending east and west along the Water Street front will be constructed to connect with the elevated steam railway tracks on the water front.

ANDERSON, IND.—The contract for the installation of the ornamental street-lighting system in the business district has been awarded to the Richmond El. Co., of Richmond, at $25,000. Specifications call for 315 standards carrying five-lamp clusters.

CENTERVILLE, IND.—Bids will be received by the Board of Commissioners of Wayne County at the office of the county auditor, Richmond, until June 27 for the erection of a transmission line from the town of Centerville to the poor farm, electric wiring, battery, transformers, fixtures, etc., for the poor farm buildings. L. S. Bowman is auditor

HUNTINGTON, IND.—The Board of Public Works has rejected the proposal submitted by the Huntington Lt. & Fuel Co. for lighting the city, on the ground that the city can supply the service cheaper. Plans and specifications for rebuilding the municipal electric-light plant have been prepared by Engineer Brossman, of Indianapolis. The cost of rebuilding the plant on the present site is estimated at $44,527; the cost of a new plant in the downtown section is estimated at $63,077. F. H. Bowers is president of the Board of Public Works.

ANNA, ILL.—The City Council has renewed the contract for street-lighting with the Central Illinois Pub. Ser. Co. The new contract provides for replacing the present arc lamps, of which there are 53, with 100 tungsten lamps.

AURORA, ILL.—Contracts for the electric wiring, plumbing and heating for the new Aurora City Hospital will soon be let. Worst & Shepardson are the architects.

CHICAGO, ILL.—Bids will be received by John McGillen, clerk of the Sanitary District of Chicago, Room 700, 910 South Michigan Avenue, Chicago, until June 25 for electrical apparatus and supplies as follows: (A) Chicago pole lamp brackets; (B) internal lamp hoist; (C) single conductor lead-covered cable; (D) multiple conductor, 12,000-volt, varnished-cloth, insulated, lead-covered cable; (E) lamp globes. For details, see proposal columns. Thomas A. Smyth is president board of trustees.

CLINTON, ILL.—The citizens on June 10 rejected the proposal of the Clinton Gas & El. Co. to furnish electricity to operate the pumping station of the municipal water-works system. The city may decide to install a municipal electric-light plant.

HAVANA, ILL.—Plans are being considered by the Commercial Club for the installation of an ornamental street-lighting system.

MOLINE, ILL.—Contracts will soon be awarded for electric wiring, heating and plumbing for the new fire station to be built by the city of Moline. E. L. Eastman, commissioner of public health and safety, has charge of the work.

PETERSBURG, ILL.—The Illinois Public Utilities Commission has granted the Abbott Lt. & Pwr. Co., of Petersburg, permission to erect a transmission line from its plant at Petersburg to Ashland and to purchase the municipal electric plant in Ashland for use as a substation.

SPRING VALLEY, ILL.—The Spring Valley Utilities Co. has been granted permission by the Illinois Public Utilities Commission to erect an electric plant in Annawan and extend a transmission line to Mineral, Ill.

MILWAUKEE, WIS.—Plans are being prepared for the installation of a power plant, heating and lighting system and sewerage system at the Milwaukee County Tubercular Sanatarium, to cost about $100,000. R. Messmer & Brothers are architects.

OAKFIELD, WIS.—The Oakfield Lt. & Pwr. Co. has been granted permission by the State Railroad Commission to issue $10,000 in bonds, the proceeds to be used for taking up outstanding indebtedness to provide funds for the erection of a transmission line from the company's distribution system to the terminus of the lines of the Eastern Wisconsin Ry., Lt. & Pwr. Co., of Fond du Lac, with the necessary substation equipment. The Oakfield company proposes to purchase energy from the Wisconsin company.

TOMAHAWK, WIS.—The State Railroad Commission has authorized the Tomahawk Lt. Tel. & Improvement Co. to issue $6,000 in bonds, the proceeds to be used for extensions and improvements to plant.

TREMPEALEAU, WIS.—Bonds to the amount of $8,000 have been voted for the installation of a municipal electric-light plant in Trempealeau.

BUFFALO LAKE, MINN.—The Central Minnesota Lt. & Pwr. Co., of Bird Island, has submitted a proposal to the Village Council asking for a franchise to furnish electricity in Buffalo Lake.

CORRELL, MINN.—Bids will be received by the Board of Education of Correll until June 30 for the erection of a school building. Separate bids to be submitted for the following work: General construction, heating, plumbing and electrical work. Plans and specifications may be obtained from Alban & Lockhart, architects, 407 Chamber of Commerce Building, St. Paul, upon deposit of $10, which will be refunded upon return of same. H. H. De Wall is secretary consolidated school district.

HILLS, MINN.—The town of Hills has engaged Earl D. Jackson, Capitol Bank Building, St. Paul, consulting engineer, to take charge of the construction of the proposed municipal electric-light plant, for which bids, it is understood, will soon be asked.

MINNEAPOLIS, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until July 6, for erection and completion of the School of Mines at the University of Minnesota, Minneapolis, including the general contract work, heating and ventilating, plumbing and electrical work, in accordance with plans and specifications furnished by C. H Johnston, architect, 715 Capital Bank Building, St. Paul. Bids will be received collectively and separately. Copies of plans and specifications may be seen at St. Paul and Minneapolis Builders' Exchange, at the office of George H. Hayes, comptroller, University of Minnesota, and at the office of the State Board of Control, Capitol Building, St. Paul.

PINE RIVER, MINN.—The Pine River El. Co., it is reported, contemplates extending its transmission line to Backus.

FARMERSBURG, IA.—The Standard El. Construction Co., of Waterloo, has been awarded the contract for the installation of a 20-kw oil engine plant; also a 200-amp-hour battery and pole line.

GRINNELL, IA.—The Grinnell El. Lt. & Htg. Co. is erecting a transmision line to Brooklyn. The town of Malcolm will submit the proposal to secure electricity from this line to the voters immediately.

HOLSTEIN, IA.—Extensions and improvements are contemplated by the Holstein Ser. Co., including the installation of a 100-hp engine and a 75-kw generator.

LE MARS, IA.—A movement has been started by Dr. W. M. Richey to extend the ornamental street-lighting system in Le Mars, at a cost of $2,000.

MALCOLM, IA.—The Grinnell El. Lt. & Htg. Co., of Grinnell, has applied to the Town Council for a franchise to supply electricity in Malcolm.

MINDEN, IA.—The contract for the installation of a complete electric-lighting system in Minden has been awarded to the Standard El. Construction Co., of Waterloo. The equipment includes one 35-hp and one 15-hp oil engine.

PRIMGHAR, IA.—A committee has been appointed to make investigations for the installation of an electric-lighting system in Primghar.

SANBORN, IA.—The electric plant of the Sanborn El. Co., it is reported, was badly damaged by a windstorm recently.

SILVER CITY, IA.—Harold Boehner, manager of the Malvern Lt. & Pwr. Co., of Malvern, has petitioned the City Council for a franchise to erect transmission lines for the distribution of electricity in Silver City.

WATERLOO, IA.—The contract for the installation of a 10-kw oil engine plant and an 80-amp-hour battery for the new Black Hawk County Home Building has been awarded to the Standard El. Construction Co., of Waterloo.

WAUCOMA, IA.—The city of Waucoma has engaged A. H. Latimer, engineer, to take charge of construction of the proposed municipal electric-light plant, to cost about $12,000. Bids for material have been received. N. A. Hurd is clerk.

WELLMAN, IA.—The Council has granted a private company a franchise to install and operate an electric-light plant in Wellman.

KANSAS CITY, MO.—The City Council has passed an ordinance providing for the installation of ornamental brackets and lamps on Main Street.

ST. LOUIS, MO.—The Light & Devel. Co., of St. Louis, is constructing a power house and water-works reservoir in Cape Girardeau, and also installing three 500-hp boilers; contracts for material have been closed. The company is also installing a 200-hp boiler at its power plant in Monmouth, Ill.

DE SMET, S. D.—The Lake Preston Milling Co., it is reported, contemplates the installation of an electric-light plant to furnish electricity for lighting the town.

NORTH BEND, NEB.—An election will soon be held to submit the proposal to issue bonds for the installation of a municipal electric-light plant to the voters. Plans and specifications for the proposed plant have been prepared by the Fairbanks, Morse Co., of Omaha. Frank Howe is city clerk.

TECUMSEH, NEB.—The Electric Light Commission is contemplating making a special rate for electricity for cooking purposes and expects to purchase ranges and cooking devices of all kinds. W. R. Tasker is superintendent of the municipal electric plant.

HOISINGTON, KAN.—Negotiations are under way between the City Council and the Hoisington El. & Ice Co. for a franchise and also for the installation of an ornamental street-lighting system on Main Street.

POWHATTAN, KAN.—The city of Powhattan is contemplating erecting an electric transmission line and distributing system, bids for which will soon be asked for. L. C. Christensen is city clerk.

Southern States

GREENSBORO, N. C.—The Citizens' Association has practically secured funds for the installation of ornamental lamps in the business section.

APOPKA, FLA.—The City Council will call an election at an early date to submit the proposal to issue $15,000 in bonds, the proceeds of $9,000 to be used for the installation of an electric-lighting system.

TALLAHASSEE, FLA.—The City Council has decided to call an election to submit to the voters the proposal to issue $47,000 in bonds, the proceeds to be used for paving, improvements to electric-light plant and water and gas mains.

CHATTANOOGA, TENN.—The Tennessee Valley Lt. & Pwr. Co., of Chattanooga, is planning to distribute electricity in South Pittsburg, Bridgeport, Tracy City, Monteagle, Sewanee and other cities. The company, it is reported, has contracted with the Chattanooga & Tennessee River Pwr. Co. for electricity from the Hales Bar hydroelectric plant.

DUCKTOWN, TENN.—The machinery of the McPherson mine of the Tennessee Copper Co. will be equipped with electrically operated machinery. The company is installing an electric plant to furnish electricity to operate same.

BAY MINETTE, ALA.—The town of Bay Minette has engaged an engineer to prepare plans and estimates of cost of the installation of a municipal electric-light plant. When plans are completed an election will be held to vote on the proposal to issue bonds for same. J. M. Franklin is clerk.

MERIDIAN, MISS.—The power house of the Meridian Lt. & Ry. Co. was badly damaged recently by an explosion of a 250-hp boiler.

MENA, ARK.—The City Council is reported to have granted the Century Engineering & Construction Co. permission to install an electric system in Mena.

PATTERSON, LA.—The Patterson Lt. & Pwr. Co., it is reported, would like to receive prices on a second-hand 60-kva or 75-kva, three-phase, 60-cycle, 2300-volt generator directly connected to a simple, single-valve engine of sufficient rating to drive same; also second-hand switchboard panel with equipment for control of generator.

LAWTON, OKLA.—The Comanche Lt. & Pwr. Co., of Lawton, it is reported, contemplates the reconstruction of its plant and power house. John C. Keys is general manager, and Albert H. Keys local manager.

POND CREEK, OKLA.—Bonds to the amount of $5,000, it is reported, have been voted for improvements and extensions to the municipal electric-light plant and waterworks system.

CUERO, TEX.—The Texas Southern Electrical Co., of Boston, Mass., has purchased the electric light and power plants at Cuero, Beeville, Victoria, Bishop and Kingsville, and is also negotiating for several other electric plants in Southern Texas. The company has also taken over the rights and franchises of the Cuero Lt. & Pwr. Co., which were recently granted by the State Legislature for the construction of a series of dams across the Guadalupe River and the installation of hydro-electric plants. It is reported that the company proposes to construct an extensive system of interurban electric railways to connect the different towns where it has holdings.

NIXON, TEX.—Preparations are being made by C. D. Puckett for the installation of an electric-light plant. The equipment will include a 50-hp engine, a 30-kw or 37½-kw alternating-current generator, three 2-kva, two 3-kva and two 5-kva transformers, 1¼ miles of No. 10 wire and 100 25-ft. cedar poles and 750 incandescent lamps. The site for the proposed plant has not yet been decided upon. A. L. McKean, of Nixon, is engineer in charge.

Pacific States

ANACORTES, WASH.—Plans are being prepared by the Independent Tel. Co. for the construction of a telephone cable between Anacortes and Lopez, on the San Juan Islands, during the summer.

CHEHALIS, WASH.—The installation of a cluster-lamp lighting system in the business district is under consideration by the City Commisioners.

GOLDENDALE, WASH.—The Board of County Commissioners has granted the Pacific Pwr. & Lt. Co., of Portland, Ore., a franchise to erect and maintain electric transmission lines along certain county roads and highways in Klickitat County.

MONROE, WASH.—Negotiations are under way between the Monroe Wtr. & Lt. Co. and Seattle capitalists for the sale of the local plant. If the deal is carried through, it is understood that extensive improvements will be made.

TILLAMOOK, ORE.—The City Council has granted the Tillamook Lt. & Fuel Co. a franchise for a period of 25 years. The company, it is understood, contemplates extensive improvements.

BANNING, CAL.—The Board of City Trustees has sold to Ghreist & Son, of Newport Beach, a blanket franchise. They propose to install an electric light and power system in Banning. The company also proposes to operate electric plants in Victorville and neighboring towns with headquarters in Banning. Energy for operating the system will be supplied by the Southern Sierras Pwr. Co.

FALL RIVER MILLS, CAL.—Work has begun on the construction of the hydroelectric power plant of the California Pwr. & Mfg. Co. in Fall River Mills to furnish electricity in northeast Shasta County. The equipment will include a 300-hp Leffel turbine, operated under 56-ft. head, Lombard governor (type F), three-phase, 60-cycle, 440-volt Westinghouse generator, General Electric switchboard, General Electric transformers, 440/6600 volts (6600/440 volts and 220/110 volts); Locke insulators (No. 289), wooden poles, 35 ft. (8-in. top, 25 to mile), No. 4 aluminum wire for main line, No. 6 and No. 8 copper wire for branches, and General Electric lightning arresters. Work will be done by the company. E. B. Bunstead, Insurance Exchange Building, San Francisco, is engineer in charge and consulting manager. General offices of the company are located in the Insurance Exchange Building, San Francisco.

LINDSAY, CAL.—The Tulare County Pwr. Co., of Lindsay, has decided to issue $1,000,000 in bonds, the proceeds to be used for erecting main transmission lines and extensions, increasing the output of its steam power plant and to purchase machinery for a hydroelectric power plant to be erected on the Tule River, east of Porterville.

LOS ANGELES, CAL.—The City Council has approved the assessment, plans and specifications for the proposed ornamental lighting system of the Hollywood Boulevard, between Cahuenga Avenue and Wilcox Avenue.

NORDHOFF, CAL.—The Ojai Pwr. Co. has petitioned the State Railroad Commission for permission to issue $19,200, the proceeds to be used for the installation of an additional generating unit to supply electricity for lamps and motors in this vicinity.

SAN FRANCISCO, CAL.—The Supervisors have authorized the Board of Public Works to enter into contracts for electrical wiring, metal lathing and plastering of the academic building of the Polytechnic High School.

SAN FRANCISCO, CAL.—The Board of Supervisors has adopted resolutions directing the removal of all poles and overhead wires in the so-called underground districts. This order affects the following companies: City El. Co., Western Union Tel. Co., California Special Messenger Service, San Francisco Special Messenger Co., American District Tel. Co., Pacific Telephone & Telegraph Co., Pacific Gas & El. Co., Postal Telegraph Co. and Ocean Shore Ry. Co.

HEYBURN, IDAHO.—The Farmers' El. Co., of Heyburn, recently organized, purposes to furnish electricity to farmers in this locality. Electricity for operating the system will be secured from the government power plant located at the Minidoka dam on Snake River. About 3 miles of material for overhead line (35 poles to the mile) will be required; also about 100 incandescent lamps, five meters and 11 transformers. J. M. Butler is secretary and treasurer.

OGDEN, UTAH.—The Ogden Rapid Transit Co. has awarded contracts for material for construction of extensions in Cache Valley, both north and south from Logan, including wire, electrical machinery, etc. It is expected that contracts will soon be placed for wire and other material for the Hermitage-Idlewild extension. P. D. Kline is manager.

PRESCOTT, ARIZ.—The Arizona Pwr. Co., of Prescott, is contemplating installing an additional generating unit in its plant on Fossil Creek. R. S. Masson, Security Building, Los Angeles, Cal., is vice-president.

TUCSON, ARIZ.—Bids will be received at the office of the city clerk, Tucson, until July 6 for 60 or more five-lamp and 26 or more one-lamp ornamental street-lamp standards, without globes or bulbs. For details see proposal columns.

BAKER, MONT.—A special election will be held June 23 to submit the proposal to grant E. G. Heinrich a 20-year franchise to construct and operate an electric-light plant in Baker.

GREAT FALLS, MONT.—The City Council has authorized the installation of ornamental lamp standards on First Avenue North, to cost $126.50 each installed.

LIVINGSTON, MONT.—The Northern Pacific Ry. Co. will soon begin work on the installation of an automatic block signal system, between Livingston and Toston, a distance of 195 miles. The company is also planning to reconstruct the telegraph and telephone system between this city and Missoula.

LOVELAND, COL.—At a mass meeting held recently the citizens voted to establish a municipal electric-light plant, to cost about $12,000. Power for operating the proposed plant will be secured from the waterfalls in Big Thompson River, about 12 miles from Loveland. Filings have already been made on power site.

FALLON, NEV.—Bids will be received at the office of the United Reclamation Service, Fallon, Nev., until June 25 for the lease from the United States of the electric power plant at Lahontan, Truckee-Carson project, Nevada. For particulars address the United States Reclamation Service at Washington, D. C., Fallon, Nev., or 605 Federal Building, Los Angeles, Cal. A. P. Davis is chief engineer.

Canada

EDMONTON, ALTA.—The City Council has rejected the proposal submitted by the United Colliery, Ltd., of Winnipeg, for furnishing electricity in Edmonton, generated at one of its mines, a few miles from Edmonton.

ESTEVAN, SASK.—Tenders will be received by P. J. Stephens, secretary and treasurer, until July 1 for furnishing and installing two 250-kw, three-phase, 60-cycle, 2300-volt generators for direct connection to engine, two exciters for direct connection to above generators, one 500-kw, three-phase, 60-cycle, 2300-volt alternating-current generator for direct connection to engine, one exciter for direct connection to above generator, three gas engines using producer gas, complete with all gas generators, tar and dust extractors, and all the necessary gas and water piping, one switchboard complete for the above units. For further particulars address S. G. Detheridge, town electrical engineer, of Estevan.

MOOSE JAW, SASK.—The Electrical Department is contemplating improvements to the municipal electric-light plant, including the installation of 1000-hp boilers, water-softening plant, 15-kw motor-driven exciter set, eight 100-lb. dump automatic coal scales, complete new piping for 3500-hp steam plant, line extensions, meters and transformers. J. D. Peters, superintendent of electrical department, will have charge of the work.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until June 25 for steel cable, pipe fittings, valves, curb boxes, copper gaskets, shavings exhaust system for planing mill, steel plates and angles, etc. Blanks and general information relating to this circular (No. 857) may be obtained at the above office or from the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

New Incorporations

MUNFORDVILLE, KY.—The New Munfordville El. Lt. & Pwr. Co. has been incorporated with a capital stock of $2,800 by F. W. Wheeler, J. W. Payton, J. M. Craddock and Richard Lobb.

SAULT STE. MARIE, MICH.—The Chippewa Edison Co. has filed articles of incorporation for the purpose of furnishing electricity in this county. The company proposes to erect transmission lines connecting Brimley, Rudyard and Pickford with Sault Ste. Marie as soon as possible. It is also planning to extend its lines to Dafter, Cedarville and vicinity. The officers are: F. R. Warner, president; William Chandler, vice-president; W. W. Edwards, secretary; Edward Horry, treasurer; Thomas Chandler, general manager, and Allen Scherzer, superintendent.

KANSAS CITY, MO.—The Western Utilities Co. has been organized to promote and operate electric light and power plants. The office of the company is located in the Orear-Leslie Building, Kansas City. F. J. Buckley is manager

NEW YORK, N. Y.—The Equitable Lt. & Pwr. Co. has filed articles of incorporation with a capital stock of $250,000 under the laws of the State of Delaware. The incorporators are Randall W. Borough, J. Stanley, of Lyon, and W. I. N. Lofland, of Dover, Del. The company proposes to construct and operate electric and gas plants.

SOUTHOLD, N. Y.—The Cutchogue El. Co. has been incorporated with a capital stock of $10,000 to furnish light, heat and power. The incorporators are W. A. Fleet, J. B. Roach and S. H. Moore.

HOT SPRINGS, N. C.—The Industrial Pwr. Co. has been incorporated by Archibald Nichols, S. M. Hanes, and James E. Rector, of Asheville, N. C. The company is capitalized at $100,000 and proposes to build a hydroelectric power plant and erect long-distance transmission lines to supply electricity for commercial purposes.

SPARTANBURG, S. C.—The Shores-Osborne El. Co., of Spartanburg, has been chartered with a capital stock of $15,000 to build and operate an electric-light plant and to do a general construction business. The incorporators are R. A. Shores, Wallace Osborne and C. E. Rogers.

JASPER, TENN.—The Bays Mountain El. Co. has been chartered with a capital stock of $25,000. The incorporators are Joseph Burger, J. L. Clark, Ernest Koella and others.

McALLEN, TEX.—The Rio Grande Pub. Ser. Corpn. has been incorporated with a capital stock of $80,000 by R. L. Lewis, T. J. Powell and D. W. Glasscock.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 9, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,099,164. Party-Line Ringing Key; A. J. Carter, Chicago, Ill. App. filed Aug. 27, 1913. Indicating type.

1,099,211. Process of and Apparatus for Producing Zinc and Other Similar Metals; H. Specketer, Griesham-on-the-Main, Germany. App. filed May 6, 1912. Revolving furnace.

1,099,241. Rectifier; T. A. Edison, Llewellyn Park, West Orange, N. J. App. filed Oct. 7, 1910. Sparkless commutator.

1,099,259. Electric Traffic Controlling System for Railroads; W. H. Lane, Westfield, N. J., and A. V. T. Day, New Rochelle, N. Y. App. filed July 9, 1908. Continuously conductive track rails and heavy cross bonds.

1,099,268. Panelboard Cabinet; C. D. Platt, Bridgeport, Conn. App. filed Feb. 6, 1913. Employing snap switches.

1,099,283. Railway Signaling System; A. V. T. Day, New Rochelle, N. Y. App. filed Aug. 28, 1908. Employs relays responsive to different frequencies.

1,099,313. Electric Switch; J. G. Peterson, Hartford, Conn. App. filed Oct. 2, 1911. Rocker construction for push-button switch.

1,099,320. Wire-Securing Device; J. F. Southgate, Worcester, Mass. App. filed July 2, 1913. Staple carrying wire-encircling insulating strip.

1,099,332. Circuit-Breaker; C. Aalborg, Wilkinsburg, Pa. App. filed July 3, 1905. Prevented from remaining in its closed position under overload conditions.

1,099,338. Combined Signaling and Telephone System; M. J. Carney, Chicago, Ill. App. filed Dec. 27, 1904. Transmits signal alarms, fire, etc., at same time with telephonic messages.

1,099,343. Automatic Exchange Selector; E. B. Craft, Hackensack, N. J. App. filed March 1, 1911. Embodies a rotating shaft carrying a contact sleeve axially movable thereon.

1,099,365. Combined Spark Plug and Vaporizer for Internal-Combustion Engines; J. C. Henderson, Washington, D. C. App. filed Jan. 21, 1914. Spark plug carries an electric heating element which can be switched in at starting.

1,099,374. Insulator; I. Hunter, Carlisle, Ky. App. filed Aug. 18, 1913. Wire-receiving cylindrical insulator sections seated in bore in the cross-arm.

1,099,375. Electrode Material for Vapor Electric Apparatus; R. P. Jackson, Edgewood Park, Pa. App. filed July 17, 1912. Mercury and a fractional percentage of lead.

1,099,381. Electric Pocket Lamp; W. Krafft, Berlin, Germany. App. filed Jan. 24, 1914. Series resistance mounted on one of the contact springs of the battery cell.

1,099,384. Trolley Pole; J. Ledwinka, Philadelphia, Pa. App. filed Sept. 27, 1909. For "trackless trolleys."

1,099,386. Station Indicator; C. S. Mackearnin, Boston, Mass. App. filed April 21, 1909. Indicating band under push-button control.

1,099,390. Wire Splicer; J. O. Mulligan, Eccles, W. Va. App. filed Nov. 19, 1913. Ends of trolley wire held in clamps which are relatively adjustable.

1,099,397. Alarm System; G. A. Sabine, Robinson, Md. App. filed April 26, 1913. Plurality of related circuits with periodic circuit closer in main circuit.

1,099,406. Relay for Telephones; C. Stille, Berlin, Germany. App. filed Jan. 11, 1910. Two coils having a contact resistance between them are caused to move against one another in a strong magnetic field.

1,099,421. High-Voltage Switch; A. W. Burke, Pittsburgh, Pa. App. filed June 14, 1911. For opening circuit under load; has diverging arc horns which engage before and disengage after the switch members engage.

1,099,440. Electrical Induction Furnace; K. A. F. Hiorth, Christiania, Norway. App. filed Oct. 8, 1913. Disk transformer type.

1,099,469. Railway Traffic Controling Apparatus; W. H. Reichard, Troy, N. Y. App. filed Dec. 14, 1910. Alternating-current motor and direct-current indication magnet.

1,099,480. Signal Alarm; F. Winter, New York, N. Y. App. filed March 16, 1912. Wire embedded in plate glass so as to be broken by fracturing of the glass.

1,099,512. Safety Stop; L. R. Palmer, Pittsburgh, Pa. App. filed Jan. 30, 1911. For electric cranes; to prevent lifting the load too high.

1,099,550. Telephone Set; P. L. Jensen and E. S. Pridham, Napa, Cal. App. filed Sept. 3, 1913. Has a sound box and a hollow stationary arm carrying an earpiece.

1,099,558. Electrode; F. J. Machalske, Plattsburg, N. Y. App. filed June 27, 1913. Refractory magnesium and graphite.

1,099,559. Electric Furnace; F. J. Machalske, Plattsburg, N. Y. App. filed June 27, 1913. Bottom and lower side walls lined with artificial graphitic carbon and adjacent wall portions covered with magnesite.

1,099,562. Electrical Current Limiting Device; M. Mertens, Berlin, Germany. App. filed Nov. 14, 1911. A slight overload causes circuit to be intermittently interrupted and heavy overload causes permanent break.

1,099,589. Fuse; F. B. Cook, Chicago, Ill. App. filed May 10, 1911. Embodies a fuse wire wrapped about a notched mica strip.

1,099,590. Protective Device; E. E. F. Creighton, Schenectady, N. Y. App. filed July 13, 1907. Ground connection with spark-gap electrodes and plurality of circuits of different inductance.

1,099,595. Process of and Apparatus for Heating; F. Fischer, Charlottenburg, Germany. App. filed Oct. 6, 1913. Heats by a metallic resistor in a chamber full of hydrogen.

1,099,618. Trolley; W. Rohkohl, Potsdam, Germany. App. filed Feb. 3, 1914. Pantograph carrying plurality of contacts.

1,099,625. Motor-Operated Switch; H. M. Stevens, Schenectady, N. Y. App. filed May 28, 1906. Remote control type.

1,099,635. Non-Short-Circuiting Lamp Socket; E. E. Brown, Philadelphia, Pa. App. filed Oct. 20, 1913. Spring member overlies center contact and is engaged with same by lamp inserted in the socket.

1,099,654. Method and Means for Treating Electrodes; C. P. Landreth, Philadelphia, Pa. App. filed Feb. 21, 1913. For preventing coating or oxidation of electrodes used in electrolytic apparatus.

1,099,658. Heating Apparatus; G. Machlet, Jr., Elizabeth, N. J. App. filed Aug. 1, 1906. Supply of gaseous or liquid fuel to furnace regulated by the heat of the furnace itself.

1,099,673. Automatic Ship's Telegraph Alarm; J. A. Sullivan, Victoria, British Columbia, Canada. App. filed Feb. 26, 1913. Audible means indicates to engineer when the position of the way-shaft does not correspond to position indicated by the ship's telegraph.

1,099,683. Meter-Control Panelboard; F. B. Adam, St. Louis, Mo. App. filed April 6, 1912. Any circuit busbar can be connected to any meter busbar on the board.

1,099,704. Manufacture of Metallic Illuminating Bodies for Electric Incandescent Lamps; E. Hurwitz, Berlin, Germany. App. filed Oct. 16, 1906. Eliminates cementing means from the metallic particles by sintering.

1,099,709. Method of Smelting Ores; F. J. Machalske, Plattsburg, N. Y. App. filed June 27, 1913. Forms basic charge of iron ore, artificial graphite and lime and subjects to electric current.

1,099,721. Incandescent Lamp; M. von Pirani, Wilmersdorf, Germany. App. filed Nov. 23, 1912. Halogen compound of silver in the lamp bulb in effective relation to the filament.

1,099,744. Guard for Electric Conductors; H. W. Gonia, Berwind, W. Va. App. filed Oct. 25, 1913. For use in mines; swinging guards prevent person's head coming into contact with the overhead trolley wire.

1,099,777. Portable Burglar Alarm; S. Sundel, New York, N. Y. App. filed Nov. 16, 1912. For travelers; designed for ready attachment to a door or window.

1,099,786. Electric Heater; C. F. Brown and W. T. Lowry, Chattanooga, Tenn. App. filed April 3, 1914. Made of steatite, which is channeled to receive and support heater wires of different circuits.

1,099,795. Railway Block-Signal System. A. S. Gross, Fremont, Neb. App. filed July 17, 1912. Each block has signaling apparatus independent of other blocks.

1,099,799. Method of and Apparatus for Removing or Dissipating Static Electricity from Paper, Cloth, Yarn, etc.; A. C. Heiny, New York, N. Y. App. filed April 14, 1909. Charged dielectric is brought into an alternating electrostatic field, which is gradually suppressed.

1,099,812 Circuit Contact-Closing Device; G. C. Murphy, Louisville, Ky. App. filed July 30, 1913. For signalling between passing cars.

1,099,861. Portable Wireless-Station Tower; J. Raes, Schenectady, N. Y. App. filed Nov. 9, 1912. Auto carrying extensible towers.

1,099,865. Wireless Receiving System; E. G. Stalnaker, Minor, Chicago, Ill. App. filed June 15, 1912. Tuning set which is self-adjusting, being actuated by the incoming wireless impulse.

1,099,892. Electrically Heated Stamping Press; L. Airhart, West Reading, Pa. App. filed Dec. 3, 1913. Self-contained means for regulating the electric heating combined with the die of the press.

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The Illumination of Interiors

At the recent convention of the Michigan Section of the National Electric Light Association a paper was presented by Mr. M. Luckiesh on the fundamental principles of interior illumination. Some valuable experimental data are given in the paper, which deals with the quality, effectiveness and distribution of interior artificial lighting, as well as with the esthetic effects produced. Some of the pleasing effects of good interior illumination can be traced directly to normal physiological influences. On the other hand, there are some effects of an esthetic character which cannot yet be traced to their source. That is to say, they may be due to physiological actions, or to mental habits, or to obscure physical and physiological interactions. While these outstanding unexplained phenomena may serve to interest future investigators for some time, enough is already known to make clear what good interior lighting requires.

Meters for the Small Consumer

The current-limiter and maximum-demand-meter situation in this country needs attention, and that very soon. The manufacturing companies get plenty of blame from the meter men because they have displayed little energy in developing good devices of this type. It is well known that, from the standpoint of modern accurate metering, the old Wright instrument is hardly more than an indicator. Some very fine types of curve-drawing instruments are available, but these are too expensive for small installations. Certain other combinations of clocks, motors, meters, printing devices, etc., have been in a process of development, and even at present are giving good service where the expense of installation and attention is warranted, but they are, strictly speaking, not yet on a commercial basis. One form of instrument which earlier gave much promise is now found to be accurate only on a steady load and reads as much as 25 per cent high or low upon different shaped peaks. In Europe the maximum-demand meter has been developed to a much greater commercial extent than in America, but, as usual, it is not feasible or advisable to imitate, without considerable modification, the practice of the old world. Before railing too much at the manufacturers, however, the meter men and managers should pause. It would seem as if something must be done by them first. As a matter of fact, there is a very serious difference of opinion as to what is wanted, and in view of the enormous expense of development and the simultaneous demand for a low-priced meter when it does come, manufacturers can hardly be blamed for not rushing ahead until they know what will be acceptable. Simultaneously with the demand for a cheap and accurate maximum-demand meter from some quarters comes a demand for a cheaper watt-hour meter or even an ampere-hour meter. Even the cheapest meter that can be hoped for will increase the present cost of installation on the consumer's premises, and this is opposed to logical commercial development. The matter of meters has been referred to in reports of committees of the National Electric Light Association and the Association of Edison Illuminating Companies, notably at the convention of the latter association. The Wisconsin commission postponed its action on the subject for a year pending suggestions from the joint meter committee of the above associations. The matter is, therefore, receiving attention, but before committees or commissions can act intelligently these fundamental questions must be widely discussed and answered as well as they can be. Commissions in particular need much information if well-advised regulations are to be issued. To solve the problems properly involves a consideration of the very fundamentals of the conduct of electricity supply and sale. Such large subjects should be discussed fully by all societies interested in electrical development.

Electric-Vehicle Charging Stations

In his address upon electric vehicles at the recent N. E. L. A. convention Dr. C. P. Steinmetz reflected a fine optimism. It is undeniably true that there is a demand for a type of vehicle of minimum operating cost, suited for ordinary local business or pleasure service rather than for miscellaneous touring and heavy mileage over long distances. That the electric car has many of the qualities to fit it for filling this particular need is thoroughly well understood. As to the ideal car to which Dr. Steinmetz is looking forward, we earnestly hope that the weight and cost will not be more than double the figure he indicated and that the mileage will be at least as great as that to which he looks so hopefully forward. There are rumors of cheap and good electric automobiles about to appear, rumors which we hope will materialize in time to maintain Dr. Steinmetz's reputation as a prophet. Be this as it may, one point of the address we desire to emphasize in a way to leave no doubt about the situation. In the use of the electric vehicle, be it runabout or truck, it is of paramount importance to have a sufficient number of available charging stations to meet with the requirements of those who wish to cover more than trivial distances. The present understanding is that so far as the light and small vehicles are concerned there will probably be available in the very near future portable charging sets capable of being tapped into available lighting circuits. Such a device would meet a long-felt want for home charging purposes, but for the rapid recharging of the more powerful pleasure vehicles, and especially trucks, it is necessary to have available charging stations at a very great number of points, so widely distributed that a charge can be obtained as readily as gasoline. The central-station industry must make the electric car practicable by furnishing ample facilities for charging here, there and everywhere, at a modest rate for energy. Even the most optimistic friends of the electric vehicle realize that its radius of action is short and that the cost of energy in most places is high as compared with analogous accommodations for the gasoline car. Much may be done to popularize the electric vehicle by providing cars of the description to which Dr. Steinmetz made reference, but the main factor in the electric-vehicle situation is not so much the excessive cost and weight of the cars now available as the great difficulty of getting them charged at the time and place of necessity. A foolproof automatic charging system available on one's own premises or operable from roadside taps as common as gasoline stations is the chief desideratum for the immediate future.

Commissioner Erickson on Reasonable Return

Many are in danger of forgetting the connection between regulation and reasonable returns. The public and the companies sometimes make the mistake of thinking that regulation means unreasonable returns. The keystone of regulation, as Mr. Erickson showed in his paper before the Michigan Section of the N. E. L. A., of which an abstract is published in this issue, is fairness to all interests. It cannot permit unreasonably high returns. It cannot enforce unreasonably low returns without arresting development. In discussing the subject most people confine themselves to argument and avoid actual figures. Mr. Erickson, however, has expressed himself on both points. The rates that he quotes apply apparently to securities of established public utility properties.

All doctrines, theories, hopes and fears are controlled by the very practical question of what rate it is necessary to pay to obtain the money. Borrower A does not have to pay the rate that Lender B demands; he does have to pay the rate that supply and demand fix for all the money loanable for his purpose, taking into account risk and convertibility, at a given time. The experiences of Mr. Erickson lead him to say that in public utilities, "even under favorable circumstances, it is not safe to assume that interest and profits will require less than 7.5 per cent on the fair value of the plant and its business." If this is the rate under favorable circumstances, what would it be where the risk of loss was high and the chance of profit low? What would it be for a new utility in an untried community?

As factors bearing upon his conclusions Mr. Erickson considered the tendency and course of prices for commodities and labor as well as for money. That labor and material costs have moved upward is too plain for argument. Unless the return for capital is to be impaired the extra costs have to be included in the cost of service. Some of the extra costs have been overcome by increased economy and efficiency in operation; some have disappeared with the natural growth of business and the accompanying reduction in expenses per unit of output. But the problem as a whole cannot be overcome in all communities by dependence upon these factors. Unfortunately, as Mr. Erickson says, "many rates made a few years ago, not only by commissions, but by the utilities themselves, are now too low." Where rates are too low, is a full revelation of that fact a sound and sufficient reason for an increase? We should like to say that it is. But candor forces the admission that rate-making is so seriously afflicted with considerations of public policy that authority for increases comes slowly and reluctantly from public authorities. Witness the long, weary wait of the railroads for relief from the Interstate Commerce Commission. When there is any other possible remedy the authorities do not act.

Commissioners are public office-holders and they hesitate to act in what they fear may be the face of a certain hostile public sentiment. If they do not have public support, they will lose influence and office and the policy of regulation will die. The course for companies to follow if their rates are inadequate is to try to get the public to see the facts. If they can get the support of public sentiment, they have an argument as strong as the facts themselves. There is much hope for the cause of the utilities when a member of a commission of the standing of Mr. Erickson will admit that there are many cases where rates are too low.

The Electrically Driven Gyroscope

Inertia is one of the great influences or natural laws controlling the universe in which we live. It may be defined as the energy equivalent of change in motion. Energy must be put into matter to change its motion. No change can occur without work to pay for it. On the other hand, as a compensatory principle, work so done must inevitably produce a corresponding change of motion, and such changes of motion, if reversed, release the stored-up energy.

In the gyroscope a relatively large amount of energy is stored up in the rapidly rotating heavy wheel. This energy may be regarded, in a certain sense, as vector energy, since it is associated with angular momentum about an axis. If now moderate twisting forces are allowed to do work on the gyro about some other axis, the amount of vector energy added with reference to the axis of application will be small compared with that contained with reference to the original axis, and will result in a vector summation which will place the final resultant vector energy at a new axis slightly displaced from the original. The process of shifting the axis, in obedience to the vector summation, is called precession. The precession of the ordinary gyro-top is one of the most fascinatingly amusing phenomena for captivating the interest of old or young observers. The spinning top, as a crude form of gyroscope, has charmed many generations of boys, but only to the last generation has the spinning top revealed its wonderful latent powers of holding a vector axis fixed in space indefinitely regardless of surrounding motion-chaos. A gyro-compass on board a ship is started, say, in Boston, with its axis pointing north. The ship crosses the Atlantic, and for a week jumps and curvets in a bewildering dance of motions to the music of the waves; yet the gyro never swerves from its allegiance to the earth's axis by more than a fraction of a degree.

The ordinary spinning top gives but a glimpse of its latent possibilities in holding a direction because its stock of rotary energy is small and short-lived. It was not until an electric motor was harnessed to a heavy and finely balanced top that the real powers of the gyro in this respect became apparent. The larger the stock of vector rotary energy, the smaller the vector deviation due to casual disturbances. The modern gyro-compass gives far more directive torque than the best magnetic compass and ignores magnetic disturbances and declinations. It points to the true geographical north.

The gyro-horizon gives an artificial true horizontal on the deck of a rolling ship. The gyro-stabilizer helps an aeroplane to hold its direction, or a ship's hull to hold its course, in spite of winds or waves. An interesting description of the Sperry gyro-compass is given in the paper by Mr. H. C. Ford, presented at the Detroit convention of the American Institute of Electrical Engineers. One may confidently expect a large future for the commercial gyro in aeroplanes and on seagoing vessels.

Lessons from German Central Stations

An interesting study of the development of central-station work in Germany was outlined recently in our Digest. The statistical information regarding the German electricity works has been very carefully worked out, and the results of a study of the data thus obtained lead to some important conclusions. They are directly in line, too, with the trend of practice in this country, but give perhaps a somewhat fresh viewpoint regarding the economical side of central-station development. The data available show that there were in Germany in 1913 between 3500 and 3600 central stations of one sort or another. Of this total number about 3100 were rated at 500 kw or less; 103 exceeded 5000 kw. This reckoning is probably not absolutely complete, but it is sufficiently so for the purpose of comparison. Within the last ten years nearly 2300 stations of less than 500 kw have been put into operation, while nearly seven-eighths of the big stations mentioned have been built within the same period.

The striking feature of the situation is that the available data show that a little over three-quarters of the total rated capacity in the empire lies in this modest list of stations exceeding 5000-kw rating. What is of even more importance from the economic standpoint is that the unutilized equipment in these stations—that is, the difference between the aggregate rating and the maximum load carried—is greater than that of all the other central stations combined. In other words, if the whole electricity work of supply could be turned over to the hundred or so large stations they would have more than enough equipment to do it all. Meanwhile, in the last ten years nearly 2300 of the little stations have been installed at an aggregate cost which may be reckoned at not less than $25,000,000. In other words, $25,000,000 has been spent in providing station equipment which from the standpoint of aggregate output is unnecessary and represents to a considerable extent lost investment. This is a most striking bit of evidence in favor of that larger central-station work which is characteristic of electrical supply in our own country. Save in rare instances, there is little need now of building small stations carrying an unwarranted cost per kilowatt of equipment and an excess cost of operation, when existing stations working at the highest point of economy are available to do the work.

Of course, in certain instances it happens that a small plant is desired at an inconvenient distance from one of the larger ones, or, if within reach, local conditions may temporarily make it commercially undesirable to depend on the supply of energy from outside. Putting away such somewhat unusual situations, it is perfectly safe to say that in the majority of cases here, or in Germany or anywhere else, it does not pay to run a station of, say, 500 kw or less when energy can be purchased from a large and economical station within striking distance of the field to be supplied. More and more the large hydroelectric systems of the country are becoming wholesalers, delivering energy to the local distribution companies for sale to the ultimate consumers. The German data show clearly the wisdom of this course. Why should 100 stations have surplus equipment enough in the aggregate to supply all the other stations of the country and yet not have the opportunity of doing so? Of course, occasional instances arise where the loads of two adjacent stations may not fit conveniently to secure the best of economy of operation, but for every such case there are a score where the gain in diversity-factor is a very material one, so that instead of requiring considerable spare equipment in the large stations to take care of the little ones, the former might really be able to handle the whole load without utilizing their full reserve equipment. It is an economic waste to burden a community with high investment charges where low ones, as for the building of the distribution network, will suffice. The chief thing to be desired is that the large station managers shall see, as they often do here, the economic possibilities of the situation and make wholesale rates low enough to obviate the unhappy necessity of establishing any more small and uneconomical plants.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

New York's Fourth-of-July Illuminations

New York's city fathers have appropriated $25,000 for publicly celebrating the Fourth of July in a safe and sane manner, and of this amount $11,000 will be spent for electrical decorations in wiring the monuments and parks. The energy for all of the illuminations in Manhattan will be donated, as in previous years, by the New York Edison Company, and in the other boroughs by the local electric-light companies.

Manhattan Island and the greater city will be illuminated with 25,000 multi-colored lamps. Each borough will have its quota of decorative lighting according to the plans drawn up by the illumination committee, of which Mr. Arthur Williams is chairman. The schedule for Manhattan includes the lighting of the Sailors and Soldiers' Monument, the Mall in Central Park, where 3500 lamps will be used; Grant's Tomb, which will be outlined in red, white and blue lamps; a portion of Riverside Drive, the City Hall, and many other places and buildings. In Brooklyn a number of parks will be illuminated and the Brooklyn Edison Company will wire and light the Borough Hall without cost to the city. Other public parks and places will be illuminated in the Bronx, Long Island and Staten Island.

Inauguration of Cabin Creek Junction Plant

The new Cabin Creek Junction (Va.) hydroelectric station of the Virginia Power Company, which is designed to furnish energy to a territory covering about 1500 sq. miles, was recently put in operation. The station is laid out for an ultimate equipment of 166,000 hp, but only two turbine-driven generators, rated at 26,666 hp, are installed at present. By utilizing the water-power it is estimated that about 300,000 tons of coal will be saved per year if the plant is operating at its maximum output. About 125 miles of transmission line have been installed thus far, serving a number of mining plants. The initial operation of the station, which was in charge of Mr. G. O. Lenz, chief engineer, was attended by several capitalists and coal-mine operators. After witnessing the event, the party of visitors proceeded to White Sulphur Springs, where the Virginia Power Company entertained them at a banquet.

Gyroscope Stabilizing Device for Aeroplanes

The recent public tests at Bezons, France, of the aeroplane-stabilizing device invented by Mr. Elmer A. Sperry, of Brooklyn, N. Y., are reported to have been successful. While aloft in a machine, the inventor and his son are said to have left their seats, while the pilot abandoned his position at the steering wheel and climbed out onto one of the planes, the aeroplane meanwhile flying steadily under automatic control. In the stabilizing device use is made of four gyroscopes with their axes at right angles. It is possible to tilt the machine sufficiently to make turns safely, but the aviator cannot tilt the machine to a dangerous angle. The gyroscopes operate delicate valves leading to two servo-motors which control the planes and steering gear of the machine. The entire stabilizing equipment weighs 100 lb. and is operated by alternating current from a generator driven by the aeroplane engine. The device works so quickly and accurately that under emergency conditions the control is declared to be automatic. When the machine travels too slowly or rises at too great an angle the control becomes automatic and the machine volplanes to earth.

A. S. M. E. Discusses Boiler Standardization

At the meeting of the American Society of Mechanical Engineers in Minneapolis, Minn., June 16-19, national standardization of boiler specifications was discussed at length, the formal report occupying approximately fifty typewritten pages. As the outcome of the debate it was resolved that the committee on boiler specifications should hold a meeting on Sept. 15, 1914, in the rooms of the society, New York. Invitations will be issued to representatives of boiler manufacturers and steel-makers, foundrymen and others interested in boiler standardization. It is expected that the set of specifications to be evolved will meet the approval of the various state legislatures and municipalities throughout the entire country. At present there seem to be as many different boiler standards as there are legislative bodies. This condition has made those states and cities where specifications are most lax the dumping ground for boilers which will not pass the more rigid specifications in neighboring states and cities. It is hoped that the specifications will serve as a guide to state legislatures meeting in the fall.

Hewitt and Steinmetz Rectifier Patents

Four patents relating to mercury-vapor rectifiers issued on May 19 are of more than passing interest by reason of the early dates of applications and the developments disclosed therein. Three of the patents, having the titles "directional-current arrester," "single-phase directional-current arrester" and "method of electrical transmission," were granted to Dr. Peter Cooper Hewitt, whose applications were filed Oct. 30, 1902. The fourth was granted to Dr. Charles P. Steinmetz on a "vapor-rectifier system," the application having been filed Sept. 25, 1905. Selected claims from the three Hewitt patents are as follows:

"The combination of an exhausted envelope, multiphase electrodes for said envelope and supplemental means for continuously generating ionized vapor in said envelope."

"The combination of a source of alternating electromotive force, a vapor conductor, including electrodes in an exhausted receptacle, one at least of said electrodes being of vaporized material, and means in circuit with the vapor conductor for consuming current flowing from said source."

"The method of deriving from a source of alternating electromotive forces a flow of current in one direction, which consists in opposing a negative electrode reluctance to the flow of current in the opposite direction and maintaining a condition of low resistance in the desired direction due to a continuous impressed electromotive force in that direction."

One of the claims in Dr. Steinmetz's patents reads as follows: "The combination of a source of alternating current, a vapor electric device traversed by said current, reactances connected in shunt with said rectifier, a circuit connecting said reactances to the source of current and an impedance device in said circuit, proportioned to substantially prevent a discharge of said reactances through said circuit."

A paper by Dr. Peter Cooper Hewitt on "Electric Gas Lamps and Gas Electrical Resistance Phenomena" was published in our issue dated Jan. 11, 1902. An article on "The Mercury Arc," by Dr. C. P. Steinmetz, appeared in our issue of Feb. 21, 1903.

Convention of Electrical Contractors' Association

The National Electrical Contractors' Association will hold its fourteenth annual convention at Detroit, Mich., from July 14 to 18. A meeting of the board of directors and of the executive committee will be held on July 14. The following morning there will be an open session. Mr. E. McCleary, past-president of the association, will open the meeting. There will be addresses by Mr. John C. Gillespie, Mr. John Trix and Mr. W. N. Matthews, Jupiter of the Jovian Order. The Hon. John E. Kinnane, chairman of the Michigan Industrial Accident Board, will speak on "Workmen's Compensation and Employers' Liability." At noon a complimentary luncheon will be tendered by the Detroit Jovian League to the contractors and their guests, at which Mr. Robley S. Stearnes, statesman for Louisiana, will act as toastmaster.

In the afternoon Mr. T. I. Jones, chairman of the Commercial Section of the National Electric Light Association, will address the business session. A rejuvenation of the Jovian Order will be held in the evening at the Detroit Board of Commerce Building. In the afternoon of Thursday Mr. S. E. Doane, chief engineer of the National Lamp Works of the General Electric Company, will address the business session on "Observations of Central Stations and Contractors' Conditions in Foregn Countries." The annual dinner of the association will be held at the Hotel Cadillac on Thursday evening at 7 p. m., when Mr. L. W. Eddy will act as chairman.

Among the entertainment features for Friday will be an automobile ride, in charge of Mr. John H. Busby, scheduled for the morning, and a boat trip and outing arranged for the afternoon in charge of Mr. Thomas M. Templeton. The convention will conclude with various business and executive sessions on Saturday morning.

Water-Power Legislation

Representative Edward T. Taylor, of Colorado, leader of the opposition in the public lands committee of the House of Representatives to the program of government leasing of public resources, has announced that his minority report against the coal leasing bill will stand as his minority report against the "hydroelectric leasing" bill favored by the committee. A synopsis of the majority report filed by Representative James M. Graham, of Illinois, was printed in the *Electrical World* last week.

Representative Taylor said that the whole West is against the general leasing plan. "I am opposed to having the resources of the West withheld from private ownership and put into a general federal leasing system," he declared. "I do not like absentee landlordism. I object to the un-American policy of government by distant bureaus and renters who pay no taxes and are on the 'tenant-at-will' basis, with little or no allegiance to our Western States.

"What honest or fair-minded man can justify putting a federal tax upon the water-power of our non-navigable streams, which cost the government nothing, and putting no tax on the water-power generated by the navigable streams that cost the taxpayers of the entire country hundreds of millions of dollars?

"To me these paternalistic and centralizing tendencies appear little short of national bureaucracy run mad. Conservation has become a mania. I hope I may be mistaken, but this policy looks to me like a bold trampling upon the principle which lies at the foundation of our republican form of government.

"I have an abiding conviction that there are enough brains, honesty and patriotism in the West to regulate and control the public-service corporations; and if there is any question about it in any state at the present time, and until such time as suitable laws shall be enacted, the federal government can and should reserve the right to exercise a supervisory regulation of them whenever the local utility commissions do not perform their duty. In order to retain such control it is utterly unnecessary to impose a federal tax upon our development and at the same time prevent the going into private ownership and onto the tax rolls of hundreds of millions of dollars' worth of property. I look upon it as neither right nor necessary, but humiliating, for Congress to put the Western States upon the same basis as the Territory of Alaska, and thereby force us into a perpetual tenantry class, under the guise of regulating our development. I repeat that this is not a question of individual or of political parties, but one of governmental policy."

Anti-Trust Legislation

Senator Newlands on Tuesday reported his amended trade commission bill to the Senate, with a lengthy report which embodies the substituted bill and which goes into the history of the measure. His amended bill was brought from the Senate committee on interstate commerce as a substitute for the House bill passed June 5.

It is provided that the commission shall be composed of five commissioners with a regular term of seven years, but the terms are so arranged that the whole membership will not be subject to a complete change at any one time. The work of this commission will be of a most exacting and difficult character, demanding persons who have experience in the problems to be met —that is, a proper knowledge of both the public requirements and the practical affairs of industry. The salary proposed for each commissioner is $10,000 per annum.

One of the most important provisions of the bill is that which declares unfair competition in commerce to be unlawful, and empowers the commission to prevent corporations from using unfair methods of competition in commerce by orders issued after hearing restraining and prohibiting unfair methods of competition, which orders are enforcible in the courts.

The committee gave careful consideration to the question as to whether it would attempt to define the many and variable unfair practices which prevail in commerce and to forbid their continuance or whether it would, by a general declaration condemning unfair practices, leave it to the commission to determine what practices were unfair. It concluded that the latter course would be the better, for the reason, as stated by one of the representatives of the Illinois Manufacturers' Association, that there were too many unfair practices to define, and after writing twenty of them into the law it would be quite possible to invent others.

It was stated that representatives of the National Implement and Vehicle Manufacturers' Association, the Ohio Manufacturers' Association and the Illinois Manufacturers' Association approved the passage of a trade commission bill and a provision regarding the inquiry into and condemnation of unfair practices in trade.

The committee said that the term "unfair competition" has a legal significance which can be enforced by the commission and the courts, and that it is no more difficult to determine what is unfair competition than it is to determine what is a reasonable rate or what is an unjust discrimination. The committee was of the opinion that it would be better to put in a general provision condemning unfair competition than to attempt to define the numerous unfair practices, such as local price cutting, interlocking directorates and holding companies intended to restrain competition.

In verifying the returns made by a corporation or in the conduct of such special investigations as the commission may deem necessary, it is indispensable that it should have extensive powers of inquiry, with the right to subpoena witnesses and to require the production of books and papers. The powers which, according to this bill, are granted to the commission are practically the same as those now granted to the Interstate Commerce Commission or the Bureau of Corporations, while the same constitutional protection is given to witnesses who testify as to matters which might incriminate them.

The consideration of Senator Newlands' measure on the floor of the Senate is likely to be delayed by the consideration of the rivers and harbors appropriation bill, which was reported on Thursday and will require a week's time for discussion.

Senators Brandegee, of Connecticut, and Lippitt, of Rhode Island, are opposed to the trade commission bill in its present form and will lead a fight against it.

Attempts to frame trust legislation, in other respects, in Washington during the past week have included a decision by the Senate judiciary committee to modify considerably the section of the Clayton bill which would legalize boycotting, blacklisting and picketing by labor unions. Also, the committee is asking the opinion of the Interstate Commerce Commission on Sections 2, 3 and 4 of the Clayton bill. There may be an attempt to insert these in the Newlands bill.

Section 2 of this bill prohibits discrimination in price between different purchasers of commodities in the same or different sections or communities, when these commodities are sold for use or resale within the United States, with the purpose or intention thereby to destroy or wrongfully injure the business of a competitor.

Section 3 makes it unlawful for the owner, operator or transporter of the product of any mine, oil or gas well, reduction works, refinery or hydroelectric plant producing coal, oil, gas or hydroelectric energy, or for any person controlling the products thereof, to refuse arbitrarily to sell such product to a responsible person, firm or corporation who applies to purchase.

Section 4 provides that it shall be unlawful for any person engaged in interstate commerce to sell, lease, fix a price or rebate upon such price on condition that the purchaser or lessee shall not use or deal in commodities of a competitor.

These ideas will meet with great opposition in the Senate in whatever form presented.

Senate lawyers who are members of the judiciary committee have found so many objections on constitutional grounds to paragraphs in the Clayton bill as it passed the House that they declare they are at a loss to know how to proceed. Headed by Senator Hoke Smith, of Georgia, some of them conferred at the White House Wednesday night with President Wilson, in an effort to gain his consent not to push the administration's proposed anti-trust legislation at this session of Congress, but they met with little success.

After Senator Newlands introduced his amended bill, some Senate lawyers expressed the opinion that paragraphs of that measure also are unconstitutional.

The sundry civil appropriation bill, which is now before the House, contains an item of $300,000 for the enforcement of anti-trust laws. This is an annual appropriation, and the item which caused President Taft to veto the sundry civil budget once because it provides that no part of this sum shall be used in the prosecution of farmers' associations and organized labor bodies. It is said in Washington that, in addition to this $300,000, when the new trust legislation passes it will be necessary to appropriate several times that sum to enforce the new laws, bringing the cost of enforcing the proposed anti-trust legislation up to an enormous total.

A. I. E. E. Convention at Detroit

With a registered attendance of about 350 the annual convention of the American Institute of Electrical Engineers opened at Detroit on Tuesday morning of this week. On Monday evening there was a reception and dance at the Hotel Pontchartrain, the headquarters of the convention.

President C. O. Mailloux, New York, announced as the subject of his address, which opened Tuesday morning's program, "The Evolution of the Institute and Its Members." He first gave a historical résumé of the accomplishments of the society and spoke of the spirit of readiness-to-serve actuating the great body of members. The work is not only done voluntarily, but men actually pay in time for the privilege of doing it. The Institute thus obtains without cost better service than it could hope to obtain for money.

Considering next the evolution of the organization, President Mailloux said that the field of the Institute is enlarging rapidly and in all directions. He spoke of the creation of new specialities in electrical work, some of which have attained the dignity of separate branches of engineering. These branches have even been recognized by the organization of separate societies, such as the American Electrochemical Society and the Illuminating Engineering Society. The creation of these societies was doubtless justified, but of the organization of some others there is a question, said the speaker. The work of the committees of the Institute is done by specialists and is backed by the whole Institute. The organization has a large field and a large audience, and it can perform most classes of electrical-engineering work better than can smaller societies. In a way the Institute is like a central station and its "diversity-factor" should be taken into consideration.

General Culture for Engineers

The concluding part of Dr. Mailloux's address related to the social and civic evolution of the members of the Institute. The necessity of engineers' building up the elements of general culture was emphasized. Mere technical adeptness and dexterity do not constitute the sole end and aim of life. Engineers have not paid enough attention to their relations to the outside world. As a professional class they are entitled to a higher place than has been accorded them by the public. Tasks of social rearrangement are ahead of the body politic, and they provide a field of work where the technical training of the engineer should be almost indispensable. The lawyer, the politician, the agitator and the Utopian dreamer press forward, while the engineers hold back. There are too many "quacks" and not enough real physicians among the preachers on economics, declared the speaker.

The average citizen is untutored and needs the advice of experts. "Where shall he turn for leading?" questioned President Mailloux. "We need to go back to first principles," he continued. "We need to inculcate a taste for deeper thinking and better expression." No one class is competent to deal with all questions before the public. The engineer has learned the value of scientific methods. He should not place too conservative an estimate on himself. The members of the American Institute of Electrical Engineers should develop "class spirit." They should show that engineers are well qualified to discuss and deal with public questions. They must take a social plane parallel to those occupied by the older professional classes. The priest and the lawyer do not possess all of human wisdom.

At the conclusion of the president's address Mr. D. B. Rushmore, of Schenectady, N. Y., indorsed Dr. Mailloux's plea. The situation exists, he said, largely because engineers allow it to exist.

Mr. Farley Osgood, chairman of the convention committee, next told of the arrangements for golf, tennis, automobile rides, boat trips and other entertainment features. He praised the work of the local committee, of which Mr. C. C. Owens is chairman.

Electricity in Marine Service

Mr. H. A. Hornor, Philadelphia, Pa., a member of the committee on electricity in marine work, presided at the rest of the morning session. Mr. D. M. Mahood abstracted the paper prepared by Mr. C. S. McDowell and himself, on the subject of "Electric Heating in Marine Service." He made the interesting statement that the great new vessels, like the *Vaterland*, *Imperator*, *Aquitania*, *Oceanic* and others, have electric heating for the first and second cabins. Mr. W. S. Hadaway, New York, sent in a written discussion which was read by Mr. W. C. Smith. Messrs. A. E. Waller, Bronxville, N. Y.; Charles D. Knight, Schenectady, N. Y.; D. B. Rushmore, Schenectady, N. Y., and F. C. Caldwell, Columbus, Ohio, took part in discussion.

Mr. H. C. Ford then read his paper on "The Electrically Driven Gyroscope in Marine Work," adding that the stabilization of the aeroplane has now been accomplished by means of the gyroscope. In the discussion Mr. Rushmore praised Mr. Elmer E. Sperry, Brooklyn, N. Y., for his original and ingenious work in inventions relating to the gyroscope. Mr. Waller and the author also took part in the discussion.

Gyroscope in Marine Work

The laws of the gyroscope, as Mr. Ford pointed out, had been clearly laid down as far back as 1852 by Foucault. At the present time its most important uses have developed in marine work in steering torpedoes, in its use as a compass and in its applications for stabilizing and controlling the motion of ships. The gyrocompass is now being installed on all the battleships and submarines of the United States Navy where the magnetic compass could not possibly be used. On submarines, where the gyro compass is exceedingly important, a three-phase, 90-volt generator of special design is required to drive the heavy balance wheel at a velocity of about 8600 r.p.m. The characteristics of the generator allow the wheel to be thrown directly upon the line and brought up to full speed automatically in about thirty minutes without attention on the part of the operator and without excessive current. The servo-motor or follow-up system shields the gyro from all external forces and friction, rendering it sensible to a force couple of 0.00022 in.-lb.; operates the transmitter for sending out indications to any number of repeater compasses in distant parts of the ship, and operates the device correcting for speed, course and latitude of ship. So exact is the gyro-compass that the maximum error must not exceed 0.5 deg. in azimuth when swung for six days under conditions of rolling, pitching and yawing of an artificial ship. The stabilizing gyro will require one-tenth the space and weight of the equivalent best designed water pendulum.

Industrial Motor Session

The industrial power committee was in charge of the Tuesday evening session. Chairman R. R. Tschentscher, of Chicago, who presided, spoke of the extensive use of electricity in the iron and steel industry. Statistics from 170 plants show an aggregate of 400,000 kw in generator rating and 1,400,000 hp in motors now in operation in these steel-mill plants. The electrical plants of steel mills are usually very large and average outputs of 10,000,000 kw-hr. yearly.

Mr. R. H. McLain, Schenectady, N. Y., presented his paper on "Direct-Current Motors for Coal and Ore Bridges," which was discussed by Messrs. D. B. Rushmore, H. B. Lindsay, Worcester, Mass., and T. E. Tynes, Buffalo, N. Y.

From the chair President Mailloux announced the news of the death of Mrs. George Westinghouse, which occurred at her home at Lenox, Mass., Tuesday morning, June 23. At his suggestion Mr. C. W. Stone, of Schenectady, N. Y., a relative, was requested to convey to the family the sympathy and condolence of the Institute.

Mr. T. E. Tynes then read his paper on "Methods of Keeping Down Peaks on Power Purchased on a Peak Basis." The subject was discussed by Messrs. P. M. Lincoln, Pittsburgh, Pa.; J. Lester Woodbridge, Philadelphia, Pa.; J. R. Bibbins, Chicago, Ill., and R. H. McLain, Schenectady, N. Y. A written discussion was also presented by Mr. E. D. Dreyfus, Pittsburgh, Pa.

The paper on "Concatenated Induction Motors for Rolling-Mill Drive," by Mr. William Oschmann, was read, and was discussed briefly by Messrs. Tynes and A. E. Averrett, Schenectady, N. Y.

President Mailloux urged support of the International Electrical Congress to be held at San Francisco next year, and Mr. W. A. Phillis, Pittsburgh, Pa., gave a talk, illustrated with motion pictures, on the processes of making steel pipes and tubes.

Electrophysical Discussion Wednesday Morning

Three scientific papers were presented at Wednesday morning's session, over which Dr. J. B. Whitehead, of Baltimore, Md., chairman of the electrophysics committee, presided. Mr. F. W. Peek, Jr., of Schenectady, N. Y., abstracted his paper on "The Sphere Gap for High-Voltage Measurements," and Dr. Whitehead summarized the paper by Mr. W. S. Gorton and himself on "The Electric Strength of Air," and also in the absence of the authors the paper on "Sphere-Gap Discharge Voltages at High Frequencies," by Messrs. J. C. Clark and H. G. Ryan.

The three papers were discussed together. A written contribution by Mr. C. W. Chubb, of Pittsburgh, Pa., was read by Mr. P. M. Lincoln, Pittsburgh, and a written discussion by Mr. D. M. Mahood, New York, was read by Mr. A. E. Waller, Bronxville, N. Y. Others taking part in the discussion were Prof. F. C. Caldwell, of Ohio State University, Columbus, Ohio; Mr. C. L. Fortescue, Pittsburgh, Pa.; Prof. D. D. Ewing, of Purdue University, Lafayette, Ind.; Mr. E. E. F. Creighton, Schenectady, N. Y.; Mr. H. B. Dwight, Hamilton, Ont.; Mr. W. W. Lewis, Pittsfield, Mass.; Mr. E. D. Peck, Atlanta, Ga.; Mr. J. R. Craighead, Schenectady, N. Y., and Dr. M. G. Lloyd, Chicago.

Zero Resistance and Perpetual Current Flow?

At the close of the discussion Professor Whitehead described briefly some recent and apparently remarkable experiments made by Prof. Kamerlingh Onnes, of Leyden. A small short-circuited coil of lead wire was submerged in liquid helium and subjected to the action of a magnetic field. While the coil was thus maintained nearly at absolute zero temperature, resulting in reducing its electrical resistance to zero, a current of electricity was caused to flow in the coil by magnetic induction. The magnetizing influence was then removed, but the flow of electricity persisted, it was declared, and apparently might have gone on indefinitely, although the experiment was concluded at the end of four and one-half hours.

The remaining Thursday and Friday sessions of the Detroit convention will be reported in next week's issue of the *Electrical World*.

Convention Cruise of Michigan Section, N. E. L. A.

Another pleasant shipboard convention was added to the record of the Michigan Section of the National Electric Light Association on June 17-20. At 5 p. m. on the date first named a party of 120 ladies and gentlemen left Detroit on the steamer *City of Cleveland III*. The first session was held that evening on the boat, President H. C. Sterling, of Three Rivers, Mich., presiding.

In the morning (June 18) the party disembarked at Buffalo and proceeded to Niagara Falls on interurban electric cars. Several hours were spent at the Falls, some of the visitors inspecting the famous hydroelectric plants, some crossing to the Canadian side to the scene of the international negotiations. Late in the afternoon the travelers went to Youngstown, N. Y., via the Gorge route, embarking on the steamer *Rochester*. The second session was held during the evening on this boat.

After traversing Lake Ontario, Ogdensburg, N. Y., was reached at 8 a. m. on June 19. A stay of three hours was made in this port, during which time Mr. E. E. Hawkins, of the Ogdensburg Power & Light Company, entertained the party on an interurban-railway inspection tour. Turning westward, the boat made a stop at Alexandria Bay and then set her course for Toronto. The third session was held on board on the night of June 19. It was followed by a successful shipboard rejuvenation of the Jovian Order. Toronto was reached early on the morning of June 20. Here a special Pullman-equipment Canadian Pacific train was taken to Detroit, which was reached at 2.30 p. m. A short executive session was held on the train. The trip was thoroughly enjoyed by all who participated.

Public Utility Regulation

In his annual address President H. C. Sterling praised Secretary Herbert Silvester, of Detroit, for his work in preparing for the convention and boat trip. He remarked the increasing amount and complexity of the work of the N. E. L. A. and said that the geographic sections have an important function. Michigan takes satisfactory rank in the industry, but, unfortunately, is second only to Ohio in number of municipal plants. Mr. Sterling made a plea for good service and reasonable rates and accepted the principle of regulation.

Three good papers relating to important questions of policy were read. Mr. H. A. Fee, of Adrian, Mich., discussed "Reserves for Depreciation." He urged the extreme necessity of establishing an actual cash fund of from 3 to 6 per cent for depreciation. He gave journal and ledger forms, with entries showing the various transactions that occur in setting up and maintaining a reserve-for-depreciation fund.

Mr. Halford Erickson, member of the Railroad Commission of Wisconsin, read a comprehensive, clearly reasoned and valuable paper on "Regulation and Reasonable Returns," an abstract of which is presented on the following page.

Mr. James V. Oxtoby, of the Detroit bar and a vice-president of the Detroit Edison Company, gave the association the benefit of his professional opinion on "Contract and Franchise Rates as Affected by the Public Service Commission Laws." A number of court decisions were cited. Mr. Oxtoby concluded that all contracts entered into between a public utility and its customers are subject to cancellation or revision by a public service commission expressing the police power of the state. However, Mr. Oxtoby said, rates fixed by a franchise are binding as between the municipality and the public utility. Whether such rates are subject to change by legislative authority, where express power is conferred upon the municipality to fix rates, is open to question.

Mr. William J. Norton, of Chicago, gave an address on "Wild Schedules I Have Known." In a good-natured way he pointed out some mistakes of electric service companies in rate-making. Mr. Norton, who is a member and former secretary of the rate-research committee of the N. E. L. A., elucidated the basic considerations entering into the making of rates for the sale of electricity. He declared himself in favor of the demand system of charging and urged not uniform rates but a uniform method of making rates, based on cost.

Mr. H. G. Hall, of Mount Clemens, Mich., gave an illustrated paper descriptive of the electrically operated deep-wells now in service at Richmond, Mich. Mr. Hall said that the local electric-service company considers this class of business very desirable. In the discussion, Professor Bissell described briefly the new Hill-Tripp type of deep-well pump as adapted for electric drive.

Water-Power Transmission and Substation Construction

Prof. G. W. Bissell, M.E., dean of the engineering department of Michigan Agricultural College, East Lansing, presented his paper on "Hydroelectric Power in Michigan." The compilation consisted principally of tables and maps. The data presented showed that there are probably not less than 250,000 hp developed by water-power, while it is probable that a development of 400,000 hp will be witnessed in the State within the next ten years.

Automatic Substation

The Rowena Street substation of the Edison Illuminating Company of Detroit was the subject of an illustrated paper by Mr. James W. Bishop, superintendent of the operating department of the company named. This 500-kw substation, which is operated and started from another plant a mile distant, was described in the *Electrical World* of March 17, 1912, and June 28, 1913.

The paper by Mr. A. A. Meyer, of the Edison Illuminating Company, Detroit, on "Outdoor Substations" brought out some discussion. The author, with the aid of pictures, considered the development of outdoor high-tension switching apparatus which will permit the tapping off of small amounts of energy along high-voltage transmission lines. He listed many applications, some unusual—as a floating 32,000-volt substation used on a river in connection with dredging operations. A table of minimum economical sizes for various voltages, and approximate cost curves of stations with different equipment, were also given.

The discussion related principally to serving farmers and other customers in rural districts. Among those taking part were Messrs. H. C. Sterling, J. A. Cavanaugh of Benton Harbor, R. R. Thomson of Battle Creek, F. R. Mistersky of Detroit, H. A. Fee of Adrian, H. G. Hall of Mount Clemens, James W. Bishop of Detroit and the author of the paper.

Mr. Cavanaugh has 4 miles or 5 miles of single-wire grounded 2300-volt transmission line connected to his Benton Harbor system (see *Electrical World* of Sept. 20, 1913, page 595). Double grounds are employed, both iron pipe and copper cones buried in charcoal being used. The line has been in operation a year and a half and has given no particular trouble, although the telephone people look askance at it. However, such a line could be used only where the demand for power is small. The grounds do not carry more than 10 amp. The Benton Harbor company does not accept money from farmers or other customers for making extensions. The returns to the company are fairly satisfactory. On one farmers' line perhaps half the houses are equipped with some form of electric pumping apparatus. There is also considerable cooking by electricity. Cooking apparatus is sold to customers at cost. The usual rates apply to the farmers, 10 cents per kw-hr. being the maximum.

PRESIDENT-ELECT H. A. FEE

Mr. Charles B. Scott, of Chicago, manager of the bureau of safety of the Middle West Utilities Company, made an effective speech setting forth the importance of the "safety first" movement on both humane and economic grounds. He related some remarkable instances showing the reduction of accidents by systematic effort. The effort should be not so much to guard machinery as to guard the mind of the thoughtless workman. The electric-service industry is not in itself particularly hazardous; nearly all accidents are due to thoughtlessness.

Illumination Topics

Both men and women were interested in the illustrated lecture of Mr. M. Luckiesh, of Cleveland, Ohio, associate physicist of the Nela Research Laboratory, on "Fundamental Principles of Interior Illumination." The speaker showed that light is not only the master painter, but also—since it may be made to reveal varying effects—the master sculptor as well. Mr. Luckiesh gave an intimation of the enormous opportunity for service and beauty opening before the modern lighting specialist.

Mr. J. R. Colville, Cleveland, Ohio, of the engineering department of the National Lamp Works of the General Electric Company, presented in abstract his paper on "The New Mazda Lamp." He pointed out that the new nitrogen-filled tungsten lamps are essentially high-current lamps. The flood lighting of building façades was mentioned; also the promise that photographic work can be done with the new lamp with results about as good as with daylight. In these new lamps the blackening of the bulb is not so bad that the lamp may not be burned upside down on occasion. Mr. Colville said that in most cases it will pay plant managers to throw away inclosed arcs for street lighting and to use the new lighting units.

New Officers

Officers were elected as follows: President, Mr. H. A. Fee, Adrian; vice-president, Mr. Samuel A. Freshney, Grand Rapids; secretary and treasurer, Mr. Herbert Silvester, Detroit; executive committee, Messrs. A. C. Marshall, Detroit; H. C. Sterling, Three Rivers; R. R. Thomson, Battle Creek; A. D. Furlong, Saginaw, and Thomas Chandler, Sault Ste. Marie. Past-president R. W. Hemphill, Jr., of Ann Arbor, was chairman of the nominating committee.

Mr. H. A. Fee, the new president of the Michigan Section of the National Electric Light Association, is president and general manager of the Citizens' Light & Power Company of Adrian, Mich. This company supplies both electric service and steam heating. It was organized in 1903, succeeding the Electric Light & Power Company, which in turn succeeded J. H. Fee & Son. The plant was first established by Mr. W. A. Foote, and was bought in 1885 by Mr. J. H. Fee, father of Mr. H. A. Fee. In 1903 it was entirely rehabilitated. The elder Mr. Fee died in December, 1913, and Mr. H. A. Fee became president, having been general manager for the preceding ten years.

Halford Erickson on Reasonable Return

A valuable and closely reasoned contribution to the literature of public utility regulation was made by Mr. Halford Erickson, member of the Railroad Commission of Wisconsin, before the Michigan Section of the National Electric Light Association on June 17. Mr. Erickson's subject was "Regulation and Reasonable Returns." The speaker pointed out that regulation was first established for the protection of the public. To-day protection is provided for the utility as well as for its customers. Considering the reasonable compensation to be given for the service rendered by the utilities, Mr. Erickson said that this compensation is usually taken to cover interest and profit. In fixing this amount many different views are encountered. Some contend that no more should be allowed than the rate at which the municipality could borrow the necessary capital. On the other hand, it has been urged that no restriction whatever should be placed upon these returns. The reasonable or normal rate of return is undoubtedly found somewhere between these two extremes.

Reasonable Return Made Up of Interest and Profit

Interest and profits are made up of interest on the capital used, insurance against risks and profits for the enterpriser. However, the insurance against risks is seldom treated as a separate factor but rather as a part of the other two. Those who furnish the capital receive interest as a compensation for the service rendered by the capital. The enterprisers, who assume the risk and responsibilities for the management, receive profits as their share for the services they perform. For both of these factors the rate of these returns is higher in proportion to the risk of the undertaking.

Function of the Enterpriser

In the present day business is largely carried on by enterprisers on borrowed capital on which interest is paid. This condition has led to the separation of the functions of the capitalist and the enterpriser or employer and to a more complete analysis of the compensation that each of these factors receives. Profits have their source in the business ability, skill and foresight of the enterprisers, or in their management. The enterpriser is a sort of economic buffer who bears the shock and often much of the loss in case of failure and who also reaps the credit and much of the profits in case of success. Successfully to exercise the functions of an enterpriser requires a high order of ability. Such a man must have organizing capacity of a high order. He must be a good judge of men and have tact in dealing with them. He must have the command of financial resources and the ability to plan and execute broad commercial and industrial policies. He should also have the technical knowledge that is required to adopt the best methods, outline the most economical processes and to pass properly on materials and products.

The wages of management must be high enough to encourage men of the necessary ability and skill to enter the field. Risks are always present and must be assumed by every enterpriser. In the long run the compensation for risks will not fall below the point at which a sufficient number of enterprisers are found who are willing to assume it.

Public Utility Securities Favorably Regarded

In Mr. Erickson's opinion, public utilities should be well regarded by the investor. It is now becoming generally understood that one utility can serve a community better and at lower rates than two or more utilities. Their business goes on in good times and bad and is not often seriously affected by general business depressions. As a rule the utilities earn good returns on a fair valuation. If the securities issued do not exceed this value, then they should be safe. But public utility securities are not wholly free from risks or all other objectionable conditions. Still, giving all factors proper weight, it will mostly be found that public utilities should be well regarded by investors and that the capital needed should be obtained on favorable terms.

The Cost of Securing Capital

Mr. Erickson gave at considerable length the result of an investigation he has made of a large number of bond and stock issues of public utility companies. Ten representative first-mortgage bond issues covering electric service and street-railway plants, brought out in 1913, bearing 5 per cent interest, were placed on the market at prices yielding the investor from 5 to 6 per cent. The average cost to the companies for bond discounts and selling expenses was 6.2 per cent. During the same period ten representative second-mortgage bond issues, covering the same class of properties at the same interest rate, were offered at prices to net investors from 5 to 6.2 per cent. In this case the cost to the companies of this financing was about 6.4 per cent.

Twelve note issues were offered to the public on an average 6.2 per cent income basis. Here the cost of financing was about 9.4 per cent per annum. Five preferred-stock issues were sold on a basis to yield the investor about 7.3 per cent. The cost to the companies was of course much greater than the price to the public. Facts were given by the speaker to show that within the last ten years it has been necessary to market railroad and industrial issues in this country at a rate to produce a greater income return than formerly.

An interesting illustration was presented by Mr. Erickson. He assumed a public utility with plant and business worth about $1,000,000 represented by $800,000 in bonds and $200,000 in stocks. If such an enterprise has net earnings above operating expenses, depreciation and taxes of $75,000 a year, or 7.5 per cent on the value, it would probably be able to sell its bonds on about a 5.5 per cent basis and its stock on something like a 6 per cent basis, provided the conditions are such that these earnings are likely to continue, and provided further that the stock from time to time would receive something in the way of extra dividends or rights. "It appears from these facts," said Mr. Erickson, "that in the public utility field, even under favorable conditions, it is not safe to assume that interest and profits will require less than 7.5 per cent on a fair value of the plant and its business."

This return is considerably higher than the rate at which municipalities can borrow money when the loan is supported by all the taxable property of the city, as well as by its full taxing power. "It would almost seem idle to argue that public utilities should be allowed no greater return for interest and profit than the rate at which the city could borrow the capital under its full borrowing and taxing powers."

Many Rates Are Too Low

Mr. Erickson went on to say that many rates made a few years ago, not only by commissions but by the utilities themselves, are now too low. The situation that has arisen in this way is very embarrassing. Interest rates have increased during the past decade, and the capital itself has been hard to get even when extra inducements were offered. Prices of leading commodities are now about 50 per cent higher than they were eighteen years ago. Just now we seem to be passing through a period of readjustment. While predictions in this respect are futile, many good judges would perhaps not be surprised if the movement now under way had not as yet completed its course.

It is evident that increases in the cost of furnishing the service, unless accompanied by increases in the earnings, mean lower returns for the enterpriser, and perhaps also for the investor. "If this condition is not remedied and the plant is compelled to go on and furnish service for less than paying rates, the result will be that new capital will not enter the field, that needed extensions to the plant will not be made, and that adequate service will not be furnished. The public will, in fact, fail to obtain the service it needs and upon which it depends. A situation like this is neither fair nor in line with public policy. It should be remedied, if necessary, by providing more earnings through higher rates. In fact, it is as much in line with public interest to raise rates that yield less than reasonable returns as to lower rates that yield more."

$100 Bonds Might Be Sold to Small Investors

The speaker concluded his important paper by recommending that the smaller companies issue bonds in denominations of $100 instead of $1,000 and sell them to small investors, especially the customers of the plant. This plan would enable the small investors to get what should be considered a sound investment at better than savings-bank interest. It would also enable the utilities to place their bonds where they would do the most good, and closer relations between the utilities and the public would be established.

As it stands to-day, the doctrine of reasonable return is that the reasonableness of such return is not measured by the bare rate of municipal bond interest but rather by the amounts for which the capital needed and the enterpriser can be had.

Illinois Electrical Contractors' Association Meeting

Liability insurance was the topic of main interest at the semi-annual meeting of the Electrical Contractors' Association of the State of Illinois at Danville, June 19 and 20. Data showing really remarkable savings, presented by Mr. E. J. Burns, assistant secretary, formed the basis of the discussion.

In the absence of Mr. Ernest Freeman, president of the National Electrical Contractors' Association, Mr. George W. Hill, special representative of the national body, spoke at the morning session on the benefits derived from co-operation the past ten years. It is estimated that during that period electrical contractors in general have improved their condition by approximately 100 per cent. Men who now are the influential contractors were at that time mostly new at the business, and many scarcely realize the strides that they have made.

Salesmen Speak at Open Session

Mr. Charles Brown, of the American Electrical Supply Company, urged the contractors to look more closely into the qualifications of prospective members. Business integrity, credit standing and the possession of a well-established place of business should be among the qualifications admitting a man to the association. Rules should be made for the expulsion of members for nonpayment of debt. Among the other salesmen who spoke were Messrs. W. T. Clawsen, Edison Storage Battery Company; H. Larson, Inland Electric Company; H. J. Russell, George C. Richards Company; G. H. Lounsberry, Western Electric Company; C. H. Method, Manhattan Electrical Supply Company; W. C. Reardon, I. A. Bennett Company; P. F. Lyons, India Rubber Company; P. F. Hensel, S. H. Couch Company; E. R. Hunt, General Electric Company; Edward Kerns, Monarch Electric Company; A. T. Ward, Phoenix Glass Company; E. W. Joseph, Electric Appliance Company; Thomas Endsley, Diamond Electric Company; J. W. Gaskins, Holophane Company, and A. W. Hillis, Western Electric Company.

Marron Charges Lack of Co-operation

At the close of Monday morning's program, the only open session, Mr. J. T. Marron, Rock Island, said that his organization had recently figured on $126,000 worth of business, and of this amount $36,400 had been lost on account of prospective customers undertaking the work themselves. This lost business, Mr. Marron said, would have gone to some contractor had manufacturers and jobbers refrained from competitive bidding. Electrical construction carried on by the average factory electrician or other person outside the electrical construction business seldom gives satisfaction and manufacturers who sell their material to be installed by unauthorized persons are inviting trouble, as failures are almost invariably attributed to the particular make of apparatus and not to faulty construction.

The plea is often made, said Mr. Marron, by the prospective customer that he can do electrical construction work cheaper than the electrical contractor. In order to answer this argument the contractor should endeavor to hire this man, who can without experience do successfully what the contractor had been learning to do all his life, and do it cheaper.

New Plan of Liability Insurance Saves

Since the last meeting of the Illinois association Mr. E. J. Burns, assistant secretary, has been investigating the subject of liability insurance, and he has found contractors paying premiums ranging from $1.50 to $2 for each $100 of payroll. In fact, the rates charged by all conference companies are $1.44 for employees' insurance and $0.25 for the public, making a total rate of $1.69 for each $100 of payroll.

Following his investigations, Mr. Burns inaugurated a plan under which he, as an officer of the association, handles the liability insurance of all members, transferring the business as a unit to one of the country's largest risk companies. Under this plan Illinois contractors who are members of the association are enjoying a rate of $1 for each $100 of payroll, this premium covering insurance for both the employees and the public.

PRESIDENT-ELECT W. J. BALL

The average saving of members now carrying insurance through the association is $70.36 a year. With the smaller contractors the saving amounts to about $25, and the largest saving of any one firm is approximately $500. As a conservative estimate Mr. Burns says that with the plan in full operation a saving of $20,000 a year will be effected for contractors in the State.

Routine Business

At the final session of the convention Saturday morning reports of the various committees were heard and it was suggested that the committee on state education, of which Mr. F. L. Decker, Chicago, is chairman, be dismissed. After some discussion the suggestion was voted down, for, although the national body has taken up the question of bookkeeping, there are still other educational features upon which the committee may profitably spend its time.

A discussion regarding the segregation of contracts showed that the general opinion among electrical contractors is in favor of the practice of refusing to combine the estimates with those submitted by the general contractor. Most of the electrical contractors believe that electrical construction work is of sufficient importance to justify separate bids.

Election of Officers

The election of officers for the ensuing year resulted as follows: President, Mr. W. J. Ball, Moline (re-elected); vice-president, Mr. J. T. Marron, Rock Island; secretary and treasurer, Mr. E. J. Burns, Rock Island; board of directors, Messrs. Edward C. Pendergast, Rockford; L. E. Crawley, Peoria, and Guy Carlton, Bloomington. The national directors are Messrs. J. T. Marron, Rock Island, and William McGuineas and F. L. Decker, Chicago.

Mr. Burns, the secretary and treasurer, will act as the association's special representative in all matters. Mr. Burns, who is also secretary of the new Iowa association, will probably present many important and original data at the coming national convention on the saving to be gained by his plan of liability insurance.

Empire State Gas and Electric Association

At the midyear meeting of the Empire State Gas and Electric Association held at the Fort William Henry Hotel, Lake George, N. Y., June 19, about thirty companies were represented. The morning session was devoted almost entirely to the discussion of advertising, with particular reference to the use of space in newspapers. A number of interesting methods were brought out and there was much constructive and valuable criticism.

In a brief paper, Mr. MacSweeney, of the Rochester Railway & Light Company, described the advertising done by his company through newspapers. A number of instances were also cited where members had been able to trace the sale of apparatus directly to their newspaper advertising, and Mr. Robert E. Livingston, of the Consolidated Gas Company, presented some interesting figures in this connection.

After luncheon, which was served in the hotel, the meeting reconvened and a motion was made to appoint a committee of commercial men to devise ways and means of circulating among the members information relating to different methods of advertising.

The afternoon session was devoted to the question of the supply and renewal of incandescent electric lamps or the sale of lamps or other apparatus at less than cost. Considerable difference of opinion developed, and it was decided to postpone further discussion of the subject until some future meeting to be devoted to this topic.

Milwaukee's Street-Lighting Survey

Mr. Francis A. Vaughn, of Milwaukee, was on June 23 appointed to the newly created position of engineer of street-lighting survey for the city of Milwaukee. The local ordinance ordering the survey requires that a study be made of present lighting systems to determine the one best suited for the illumination of Milwaukee's boulevards, streets, parks and public buildings. The report of the survey engineer is to be made to the Commissioner of Public Works and to the Common Council. The engineer in charge is appointed for one year.

Society of Automobile Engineers

At the convention of the Society of Automobile Engineers held at Cape May, N. J., June 23 to 26, several papers on electric-vehicle topics were presented. The report of the electrical equipment division, of which Mr. A. L. Riker is chairman, recommended that all insulating material for lighting fittings be selected to withstand 300 deg. Fahr. continuously for thirty minutes. The single-wire system with grounded return was also recommended for car-lighting practice.

Starting, Lighting and Ignition Devices

The requirements which must be filled by automobile starting, lighting and ignition devices were discussed in Mr. Albion D. Libby's paper on "Starting, Lighting and Ignition Devices." Two-unit, 12-volt starting and lighting systems were recommended, with a gear ratio which would permit of proper carburetion with the least expenditure of energy. Single-wire grounded lighting systems were denounced and fuses were recommended in all lamp and motor circuits. The author advised using an ammeter on the dashboard to show when conditions are abnormal. A starting-motor clutch, a combined generator and regulator, a dashboard ammeter, a new ignition system and several wiring schemes were described.

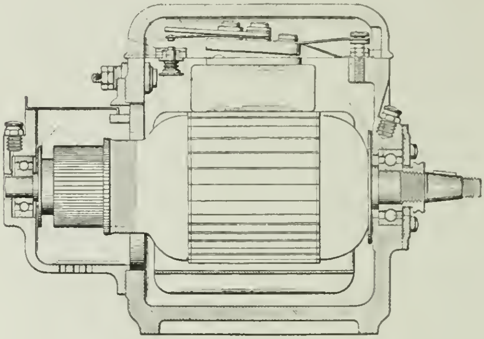

FIG. 1—GENERATOR ARRANGED TO PREVENT LARGE CURRENT FLOW

Six-volt starting equipment is undesirable because it requires circuits of unusually liberal cross-section to prevent losses, and because bad contacts at brush surfaces or switch contacts cut down the potential available at the motor. Eighteen-volt or 24-volt apparatus has the disadvantage of requiring more complicated wiring and control and in addition necessitates parallel charging of batteries, which is objectionable. The 12-volt system, declared the author, is a satisfactory compromise which permits using 6-volt standard lamps in series, simple control and wiring, and series charging of batteries.

Attention was called to the fact that a starting motor should be series-wound and a generator shunt-wound, and that these characteristics can be obtained most economically with a two-unit set. A starting-motor clutch was described consisting of eight pawls engaging with a ratchet wheel, the pawls being thrown out of engagement by centrifugal force when the engine picks up the load. Cranking speeds of 100 r.p.m. to 135 r.p.m. were recommended for four-cylinder engines.

A compound-wound generator was described which depends for its voltage and current-discharge regulation on the automatic insertion of resistance in the shunt-field circuit. This operation is performed by a magnetic keeper being attracted by the polar projections when the field flux rises too high. The differential action of the series winding, together with the reduction in field flux caused by the insertion of resistance, prevents excessive current flow at high speeds.

It was very strongly urged that fuses be inserted in the motor leads. For a 12-volt starting-motor fuse the starting fuse should be capable of carrying 300 amp momentarily and 175 amp for five minutes, but should melt in fifteen seconds with 225 amp flowing.

A new type of dashboard ammeter was described which allows the lines of force to pass through the entire area of the movable element, thereby increasing the torque and damping effect. Two recent productions in high-tension magneto apparatus were also described which permit of 75 deg. or 80 deg. advance in sparking time without affecting the strength of the spark. No auxiliary ignition system is needed with either type described when starting the engine, as a spark can be obtained by short-circuiting the magneto suddenly.

Taxation of Motor Vehicles

The paper entitled "An Engineering Basis for Taxation of Motor Vehicles," by Messrs. C. O. Edgerton and S. I. Fekete, contained a complete and exhaustive analysis of the destruction to roads caused by motor vehicles, with suggestions for a new system of vehicle taxation based on this factor instead of the horse-power of the vehicle. The amount of damage which a vehicle can inflict on a road is dependent on the speed of the car, the unit pressure at the tire contacts, the character of the tires and road, and the diameter of the wheels.

The conclusion drawn was that vehicles should be taxed in proportion to the damage inflicted upon roads and to the number of hours of use per day. Motor-driven omnibuses can be assumed to operate about fifteen hours per day, commercial trucks about 8.25 hours and pleasure cars 4.75 hours. Thus, if the basic rate is set on pleasure vehicles, the rates applying to trucks and omnibuses should be about 1.75 and 3.125 times the basic rate. It was suggested that lower speed limits be prescribed for vehicles exerting excessive unit pressure at the tire contacts. To facilitate assessing a wheel tax on the road-destruction basis, it was suggested that a formula of the general nature shown herewith be employed.

$$\text{Total tax} = \frac{W\alpha}{r} V_m \times K \times \text{tax rate per minute},$$

where W represents total weight of car, α is the coefficient of rolling friction determined by experiment, r is one-half the tire diameter, V_m is the legal speed limit in miles per hour, and K is a factor proportional to the average number of hours' use per day.

Electric Transmission for Automobiles

The operating characteristics of the Entz electric transmission for automobiles were compared with those of mechanical and generator-motor transmissions in Mr. Justus B. Entz's paper entitled "Electric Transmissions for Motor Cars." The Entz system, which was fully described and illustrated on page 281 of the *Electrical World* of Jan. 31, 1914, consists of two dynamos the armatures of which are mounted on a common shaft driving the rear axle. The field frame of one dynamo is attached to and revolves with the gasoline-engine shaft, while the field yoke of the other unit is rigidly attached to the chassis. The first dynamo acts as a drag-clutch, generating energy which drives the second unit as a booster motor at intermediate speeds. At full speed the brushes of the drag-clutch generator are short-circuited and the booster motor operated as a generator for charging batteries, lighting lamps, etc. The accompanying curves show the speed, tractive effort and efficiency characteristics obtained with this system and with mechanical and generator-motor transmissions. With the electric transmission the gasoline engine can be operated continuously at its most economical speed. The efficiency of transmission at intermediate speeds with the Entz system is the product of the efficiencies of the two units composing that set. At full speed the efficiency of transmission is the efficiency of the generator. To increase the torque transmitted by the Entz system it is not necessary to increase the current, as this result is obtained by allowing the generator to slip more and by utilizing the energy produced thereby to operate the booster motor. The amount of current taken by the booster motor is regulated by its field excitation.

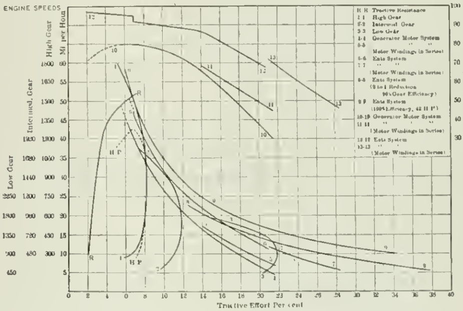

FIG. 2—CURVES SHOWING SPEED, TRACTIVE EFFORT AND EFFICIENCY CHARACTERISTICS

The New York Edison Savings and Loan Association

At the annual convention of the New York State League of Savings and Loan Associations, held at the Hotel Statler, Buffalo, N. Y., June 11 and 12, Mr. E. E. Bondy read a paper telling about the New York Edison Savings and Loan Association. The association was incorporated in May, 1912, principally to provide a means of home owning and a form of saving through instalments. At present there are 1542 members, and loans varying from $200 to $7,400 and totaling $103,010 have been made. The association is conducted on the serial plan, a new series of instalment shares being opened each month. These shares, which have a value of $200 at maturity, are paid for at the rate of 25 cents a week or $1 a month. Thus a payment of $138 yields $200. The payments may be automatic, that is, deducted from the weekly wage. Mortgage loans and note loans are made. The appraisal committee and the company's attorneys are at the service of members free of charge.

Work on Conners Creek Plant, Detroit

Steady progress is being made on the Conners Creek generating plant of the Detroit Edison Company, which has been under construction for several months. This large station is situated on Lake St. Clair on the eastern outskirts of Detroit. The big Delray generating plant of the company is on the western side of the city, so that a good balance for transmission and distribution is effected. The character of the soil at the Conners Creek site is such that it was necessary to drive 9900 piles for the half of the ultimate station for which the foundations are in. These piles support a mat of reinforced concrete, on which the footings for the building and machinery will rest.

Ultimately this station may have a rating of 150,000 kw, the present plan being to install six 25,000-kva turbo-generators. The initial installation, however, will consist of 50,000 kva in two 25,000-kva units. About half of the steel framework for the initial installation is now in position, and it is expected that one of the new units will be in operation early in the winter of the present year and that the other will be turning over before the spring of 1915. Mr. Alexander Dow, the president of the Detroit Edison Company, said recently, in answer to a question from a representative of the *Electrical World*, that electric-service conditions in the City of the Straits are in quite a satisfactory condition. The rate of increase is not quite so large just at present as in previous years, but it is still good. The steadily growing load of the company makes the new plant a necessity.

"White Way" Lighting for Worcester, Mass.

On June 17, the anniversary of the Battle of Bunker Hill, more than 100,000 persons witnessed the inauguration of a new system of "white way" lighting at Worcester, Mass. The installation comprises nearly 500 6.6-amp General Electric ornamental luminous-arc lamps, placed at distances of 80 ft. to 125 ft. and mounted 14.5 ft. above the sidewalk, throughout the business district of the city. A feature of the celebration was a parade of seven divisions, the climax being an electrically illuminated display of service automobiles by the Worcester Electric Light Company, with a float occupied by young women employees grouped about a "Queen of Light," who carried a 750-watt nitrogen-filled lamp on a golden wand. Attached to the float were numerous inscriptions emphasizing the desirability of electric service. The Worcester Rotary Club and other organizations also made excellent use of electric lighting from storage batteries in the displays carried in the procession.

Electrical Construction in Minneapolis and Southern Minnesota

Permanent improvements and extensions for 1914 to the Minnesota properties of the Consumers' Power Company of that State, all of the stock of which is owned by Northern States Power Company, are already in progress under the engineering supervision of H. M. Byllesby & Company. Most of the materials and machinery have been ordered, and the Coon Rapids hydroelectric development on the Mississippi River near Minneapolis is being completed. The first 2100-hp unit of this new water-power, which will add, ultimately, 10,500 hp to meet the rapidly increasing electrical demands of Minneapolis, will, it is expected, be in operation Aug. 1.

Construction work authorized for the Minneapolis division within the city of Minneapolis includes enlargements to substations, additions to the 13,000-volt underground feeder systems and extensions to the distributing lines in various parts of the city. These improvements will enable the company to serve a large amount of new business and to distribute the output from Coon Rapids.

Another important construction feature will be a transmission line 33 miles long from St. Paul south to a point 3 miles east of Northfield, where it will connect with the hydroelectric network of the Faribault and Mankato divisions comprising 100 miles of transmission lines. This line will be of Byllesby standard construction designed to carry 60,000 volts pressure. It will roughly parallel the Chicago, Milwaukee & St. Paul Railway and proceed via Farmington, Westcott, Rosemont and Castle Rock, opening a number of additional rural markets for service. Connection of the distributing systems of the Twin Cities and the Faribault and Mankato divisions will insure further reliability and quality of service and will give to a considerable section of southern Minnesota an interurban electric light and power service matched by few other communities. Five water-power plants, with an aggregate rating of 36,500 hp, and six steam stations, with 29,500 hp, or a total of 66,000 hp, will be connected to the system. During the present year a number of short extensions will probably be made to serve additional cities and towns. Mr. William T. Walker will be resident superintendent of construction at Minneapolis. Mr. Lincoln Nissley will be superintendent of construction on the transmission lines.

Memphis Electrical Show

Under the auspices of the local Jovian League a co-operative electrical exposition was held at Memphis, Tenn., during the week of June 15 to 20. A feature of the show was the plan by which the contractors, dealers and manufacturers taking part pooled their exhibits, permitting the displays to be classified into domestic and industrial departments. Household conveniences, for example, were shown in one booth, heating appliances in another booth, and kitchen devices in a third. Particular attention was attracted by the lighting and decorative effects, popular interest centering upon a huge electric fountain designed by Mr. C. K. Chapin, chairman of the committee on decorations.

EXHIBIT BOOTH IN MEMPHIS CO-OPERATIVE ELECTRICAL EXPOSITION

Mr. W. H. Burroughs was general chairman of the show, and Mr. F. F. Sparks was director. The following acted as chairmen of committees: Mr. H. G. Street, finance; Mr. C. K. Chapin, decorations; Mr. W. C. Tupper, publicity; Mr. C. J. Watson, exhibits; Mr. J. F. Ramier, entertainments; Mr. Burns Stewart, lighting and signs, and Mr. W. R. Herstein, arrangements. The officers of the Jovian League of Memphis are Mr. W. R. Herstein, president; Messrs L. G. Van Ness, H. G. Street and C. K. Steig, vice-presidents, and Mr. W. C. Tupper, secretary and treasurer.

Public Service Commission News

Illinois Commission

The State Public Utilities Commission of Illinois, of which Mr. James E. Quan is chairman and Mr. Charles N. Hebner of Springfield, Ill., is secretary, has issued rules of practice and procedure, with forms, governing matters before the commission. Among other things it is provided that the commission, or any commissioner or officer of the commission designated by the commission, shall have power to hold investigations. It is provided that the technical rules of evidence need not be followed in such hearings and that no informality in any proceeding shall invalidate any order, decision or regulation made, approved or confirmed by the commission. All hearings shall be open to the public.

A dispute over service and cost of street lighting in the city of Jerseyville, Ill., has arisen between the city authorities and the Central Illinois Public Service Company. As a result the Council passed a resolution ordering all street lamps shut off and disclaiming all liability for payment for any lighting after the last day of May, 1914. Mayor A. C. Robb is authorized to employ attorneys to assist City Attorney R. A. Nutt in any legal proceedings against the company in the courts or before the Public Utilities Commission.

Indiana Commission

The city officials of Indianapolis, Ind., claim under an amendment to an act of 1904 the right to contract with public utilities regarding rates for both city and individual service. Under this amendment they question the power of the Public Service Commission to establish rates. The members of the commission, however, believe that the law is invalid, the amendment having been passed after the act itself had been repealed. The commission has practically completed its inventory of the property of the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company. It is thought that the valuation will be very nearly $10,000,000.

Maryland Commission

The Public Service Commission of Maryland refused permission to the United Railways & Electric Company to issue $1,000,000 two-year 5 per cent trust notes convertible into common stock at 33 1/3, or a total of $1,500,000 par value. This decision is expected to affect every corporation in the State, for the commission has placed itself in a position of decided opposition to the watering of stocks. No matter what decisions may have been rendered in the past, this one now has precedence. The company presented a modified plan whereby the notes were to be converted at par, which is $50 a share. The commission approved of this plan.

Ohio Commission

A committee of the Ohio Electric Light Association met last week with representatives of the state public utilities commission, for the purpose of arranging a standard form of appraisement of electric-light companies to be made in accordance with the commission's orders. The committee representing the lighting companies consisted of Messrs. F. B. Lasser, Youngstown; L. K. Funkhouser, Dayton; F. F. Wickham, Cincinnati; F. W. Drager, Canton, and J. H. Scobell, Cleveland.

The electric-lighting companies operating in Ohio have been appraised for purposes of taxation at $40,291,830. About 150 companies are included in the valuation, that of the Allinger Milling Company, of Quincy, being the smallest ($200) and the Cleveland Electric Illuminating Company, with an assessment of $17,792,560, being the largest. The Cleveland company's assessment showed the largest increase, the advance being $1,276,000. The increase is accounted for by extensions and betterments resulting in increased earnings which are believed to justify the increase. Among the increases announced are the following: Youngstown Consolidated Gas & Electric Company, from $3,373,880 to $3,967,890; Sheriff Street Market & Storage Company, Cleveland, from $1,041,650 to $1,049,260; Springfield Light, Heat & Power Company, from $1,205,800 to $1,209,510; Trumbull Public Service Company, Warren, from $888,780 to $908,830; Ohio Light & Power Company, serving twelve central Ohio cities, from $1,455,150 to $1,662,110; Sandusky Gas & Electric Company, from $838,140 to $859,180; People's Light & Power Company, from $16,770 to $20,000; Xenia Gas & Electric Company, from $144,970 to $155,120; Canton Electric Company, from $1,760,080 to $2,116,170; Dayton Power & Light Company, from $3,310,890 to $3,876,790; Massillon Electric & Gas Company, from $275,180 to $318,700; County Electric Company, Coshocton, from $397,550 to $416,650; Wilmington Water & Light Co., from $140,000 to $150,000.

California Commission

The Indian Valley Electric Light & Power Company has filed an application with the Railroad Commission of California, asking the commission to modify an order made in September, 1912, which authorized the issue of $81,535 of 6 per cent bonds. The company has not issued any of the bonds authorized under the order and wishes now to enter into an agreement with the Great Western Power Company to take power at the Big Meadow Dam, which is 13 miles from the main station of the applicant.

The Railroad Commission has rendered a decision in which it grants authority to the Big Four Electric Railway to issue 392,058 shares of its capital stock at the par value of $1 a share. The sale of this stock is restricted so that no commissions are allowed until $100,000 in cash is realized and deposited to the credit of the company, and thereafter no commissions in excess of 20 per cent shall be allowed stock salesmen. The commission also directs the board of directors of the company to recover or reimburse the treasury in the sum of $1,798, owed to the company by Frank Avery, promoter and chief stock salesman of the company and proprietor of the Avery Mill & Lumber Company.

Wisconsin Commission

The commission has authorized an increase in the rates of the Browntown municipal light plant. An investigation disclosed the fact that the cost of operation is considerably in excess of the revenues received, owing very largely to the fact that but a small proportion of the possible number of consumers are taking service from the plant. In this connection the commission was not inclined to prescribe rates which would make the plant self-supporting with its present number of consumers, and attention was called to the fact that the public in going into the venture was fully aware of the conditions involved and could not, therefore, expect the few consumers to stand the entire cost of operation. The present rate schedule consists of a primary rate of 15 cents per kw-hr. for the first 10 kw-hr. used per month, a secondary rate of 10 cents for the next 10 kw-hr. and an excess rate of 8 cents per kw-hr. The commission prescribed a primary rate of 15 cents per kw-hr. for the first 50 kw-hr. used per month and an excess rate of 12 cents for all energy consumed in excess of 50 kw-hr. per month. The minimum bill was increased from 50 cents to 75 cents per month.

Current News Notes

THE AMERICAN PETROLEUM SOCIETY FORMED.—The American Petroleum Society has been formed to consider subjects relating to the science and technology of petroleum and its products for the benefit of the consumer as well as the producer. The secretary is Dr. I. C. Allen, 506 United States Custom House, San Francisco, Cal.

* * *

COMMUTATION.—In the article on commutation by Prof. Alfred Still, the first section of which appeared in the *Electrical World* of June 20, Figs. 4 and 5, which are somewhat similar in general appearance, became transposed on page 1444. The illustration containing references to the neutral zone and the commutating zone is the one designated as Fig. 5 in the text.

* * *

ELECTRIC VEHICLE TOURING.—The New York Electric Vehicle Association has just issued a new booklet, "Electric Touring," which will be found useful not only to present users of electric vehicles but also to manufacturers and dealers in convincing prospective purchasers of the extensive facilities now available for charging electric vehicles and of their consequent adaptability for suburban runs. Copies of the booklet may be obtained from the treasurer of the association, Mr. Harvey Robinson, Irving Place and Fifteenth Street, New York City.

* * *

OVERHANGING SIGNS MUST GO.—At the instance of Mayor Harrison of Chicago, Mr. Joseph O. Kostner, deputy commissioner of public works, has issued an order notifying property owners along Clark Street that they must remove all overhead signs. No objection is made, however, to signs which lie flat against the building. Mr. Victor H. Tousley, chief electrical inspector, states that this order affects 132 signs on Clark Street in the restricted district between Jackson Boulevard and the river. A similar order, which will necessitate the removal of about seventy-five signs, is soon expected for Dearborn Street.

* * *

KILLING INSECTS WITH ELECTRICITY.—Electrical apparatus has been invented by M. Friggori, province of Santa Fé, Argentina, for killing insects which are harmful to the growth of trees and grain. A metallic net supported on a two-wheel vehicle is suspended over the ground where the insects are to be killed, and 6000-volt energy is allowed to discharge from it to the ground. The net and the earth are energized from one terminal of a step-up transformer on the vehicle, the other terminal being grounded. By brushing trees with a metallic broom energized from the same apparatus it is claimed that any insects harboring thereon can be killed.

* * *

SOCIETY MEETINGS

JOVIANS AT SAGINAW, MICH.—A branch of the Jovian Order has been established at Saginaw, Mich., with a membership of thirty. Mr. W. J. Trott, statesman for Grand Rapids, and Mr. Richard L. Kimball, statesman for Saginaw, organized the new section.

* * *

TELEPHONE PIONEERS TO MEET.—The fourth annual meeting of the Telephone Pioneers of America will be held at Richmond, Va., Oct. 29 and 30. The headquarters will be at the Jefferson Hotel. Mr. H. W. Pope, 15 Dey Street, New York, is secretary of the association.

MONTREAL ELECTRICAL SOCIETY.—The following officers have been elected for the current year by the Montreal Electrical Society: President, Mr. J. N. Mochon; vice-president, Mr. L. E. Hamilton; secretary, Mr. J. C. Bray; treasurer, Mr. E. L. Brewer. Board of directors—contracting, Mr. W. H. Tees; commercial Mr. T. R. Campbell; manufacturing, Mr. R. McIllwraith, and traction, Mr. P. T. Davies.

* * *

LOS ANGELES SECTION, E. V. A.—The Los Angeles (Cal.) Section of the Electric Vehicle Association of America has been organized with a membership of thirty-one. Mr. J. H. Pieper is president, Mr. H. W. Harrison vice-president and Mr. J. F. Rogan secretary. The executive committee consists of Messrs. G. B. McLean, A. T. Smith, J. O. Case, H. J. Kister, E. C. Anthony, I. R. Solomon, Charles Carter and V. S. Beardsley.

* * *

WASHINGTON SECTION, E. V. A.—At the June 25 meeting of the Washington (D. C.) Section of the Electric Vehicle Association Mr. Walter Metz, of the Government Printing Office, was scheduled to speak on the subject of "Electric Truck Operation." To Major Richard Sylvester, of the Washington police, was assigned the topic of traffic regulations in the capital. Messrs. J. J. Bartram, C. R. Erkman, A. L. Dickson, Charles M. Marsh and E. S. Marlow composed the committee which arranged the meeting.

* * *

ASSOCIATION OF MUNICIPAL ELECTRICIANS.—The nineteenth annual convention of the International Association of Municipal Electricians will be held at Atlantic City, N. J., Sept. 15 to 18, with headquarters at the Hotel Isleworth. In connection with the convention an exhibit of fire-alarm and police-signal apparatus will be made. Mr. John W. Kelly, Jr., Camden, N. J., is president of the association, and Dr. C. P. Steinmetz, Schenectady, N. Y., is first vice-president. The secretary is Mr. Clarence R. George, Houston, Tex.

* * *

REJUVENATION ON LAKE ONTARIO.—On the night of June 19, during the convention cruise of the Michigan Section, N. E. L. A., there was a rejuvenation of the Jovian Order on board the steamer *Rochester* while the vessel was en route from Alexandria Bay to Toronto on Lake Ontario. Statesman H. C. Sterling, of Three Rivers, Mich., who was also president of the section, presided. A class of thirteen was initiated. The degree team was impersonated as follows: Jupiter, Mr. R. J. Kirchner; Neptune, Mr. J. T. Pearson; Pluto, Mr. E. F. Rhod; Vulcan, Mr. T. J. Tighe; Mercury, Mr. Perry R. Boole; Hercules, Mr. J. F. Lamar; Mars, Mr. T. L. Lowe; Apollo, Mr. S. C. MacNeil; Avrenim, Mr. R. R. Thomson.

* * *

NEW YORK COMPANIES' SECTION, N. E. L. A.—Six hundred members of the New York Companies' Section of the National Electric Light Association held their annual meeting and banquet at the Hotel Astor, New York City, June 17. At the afternoon session résumés of the Philadelphia convention papers were presented and the following officers were elected: Chairman, Mr. J. E. Phillips, Richmond; vice-chairman, Mr. W. J. Clark, Westchester; treasurer, Mr. W. L. Bruce, Westchester; executive secretary, Mr. F. C. Henderschott, New York, and recording secretary, Mr. J. A. Burke, New York. Mr. Clark presided as toastmaster at the evening banquet and addresses were made by Messrs. J. W. Lieb, Jr., H. H. Scott, Frank W. Smith and C. G. M. Thomas.

A Motor-Driven Raw-Water Ice Factory in Brooklyn

The newly completed 150-ton plant of the Bay Ridge Ice Company—Electric operation and control of pumping and compressor equipment—Stationary cans in freezing tank. By E. A. Leslie

ONE of the most interesting developments of central-station service in recent years has been the adaptation of electric motor drive to the making of artificial ice. The practicability of this method of drive has recently been further greatly extended through the introduction of the raw-water and multiple-effect evaporator systems, both of which do away with the necessity of steam-driven units for economical operation, providing in this way an ideal field for the electric motor. From the central-station standpoint such a load is one of most desirable characteristics, and special rates have been introduced by a number of the large electric companies in order to secure this class of business.

While ice plants are generally designed to operate twenty-four hours a day throughout the year, their operating conditions can be so arranged that during the peak loads of the central station in November, December, January and February the ice plants can shut off their power demand from 4 p. m. to 8 p. m. and still make their full quota of ice during these months. During the winter months, again, the ice companies use less power than at other periods of the year as there is a smaller demand for their product. Since the central station's heaviest loads occur during the winter season, the acquisition of this ice-making business obviously enables the central station to equalize its load throughout the year and so raise its load-factor.

Since the off-peak rates have been put in force numerous ice factories operated by electric power have been placed in operation. An example of this method of drive is found in the new factory of the Bay Ridge Ice Company, of Brooklyn, N. Y., which uses energy from the mains of the Edison Electric Illuminating Company of Brooklyn.

Service Supply to Bay Ridge Factory

The Bay Ridge plant is on Sixty-second Street between Sixth and Seventh Avenues, Brooklyn, and is supplied with energy directly from the Bay Ridge station of the Edison company through duplicate feeders, this line being run underground some eleven blocks for the exclusive use of this customer. The present ice-making capacity is 150 tons each twenty-four hours,

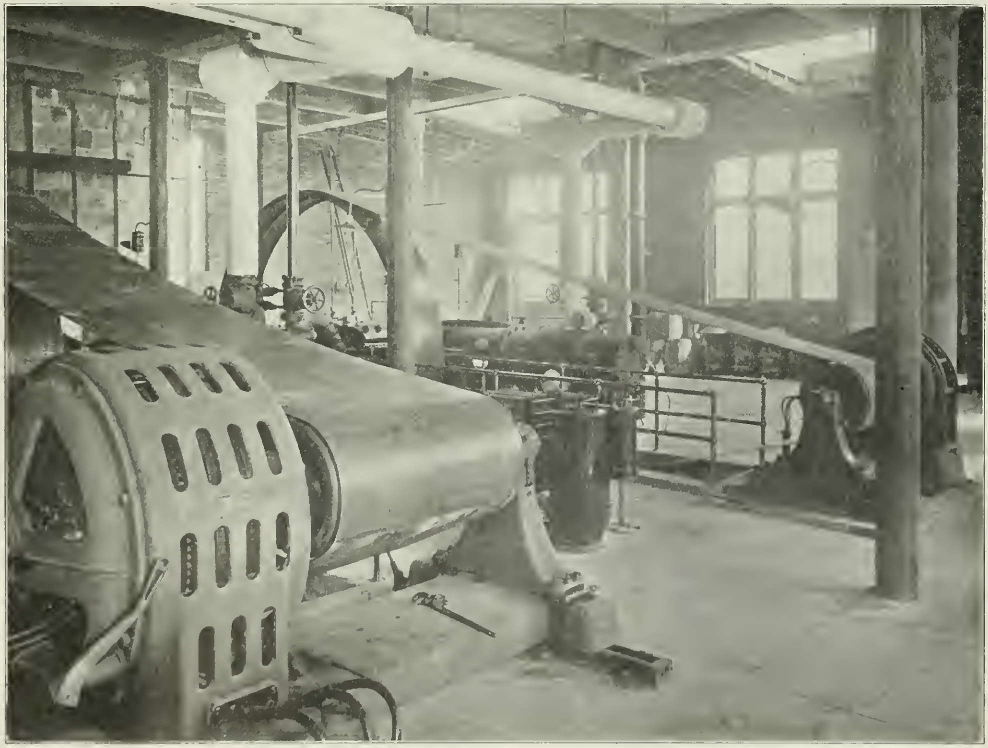

FIG. 1—COMPRESSOR ROOM IN MOTOR-DRIVEN ICE FACTORY, BROOKLYN, N. Y.

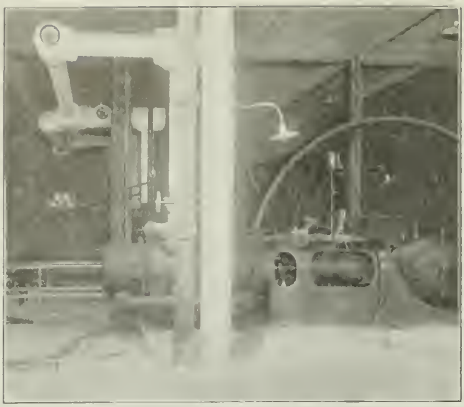

FIG. 2—100-TON ICE MACHINE

although ample provision has been made for doubling this in the near future.

The three-phase, twenty-five-cycle, 6600-volt service enters the plant underground at the front of the building and runs to the high-tension switchboard; from there the lines extend up one story into a fireproof transformer vault.

There are at present installed in this vault, which measures 20 ft. by 5 ft., three General Electric 150-kva, 6600/460-volt air-cooled transformers. Circulation of the air in the vault is effected by drawing the air in through two lattice windows in the front of the building at the floor level and then exhausting this air through two vents in the top of the transformer vault out over the roof of the building. There is also a 10-kva transformer for lighting purposes, which is connected to one leg of the secondary busbars of the main transformers.

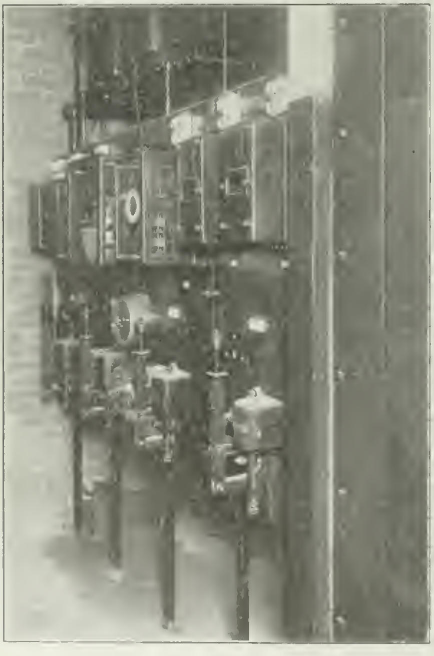

FIG. 3—HIGH-TENSION SWITCHBOARD

The high-tension switchboard is installed on the ground floor directly under the transformer vault and is also provided with a fireproof inclosure. Mounted on the board are four oil switches, two of which are installed on the duplicate feeders, the third on the line to the transformer bank, and the fourth held in reserve for future additions. Both of these feeders are alive, and either one may be pressed into instant use by simply throwing its respective oil switch. In addition to the necessary watt-hour meters for registering the energy consumption, there is also a polyphase Westinghouse curve-drawing wattmeter, one polyphase General Electric demand indicator, and one Minerallac Company's printometer. The desirability of the ice-making load on the central station's lines is admirably proved by the steadiness and length of the curve recorded by the graphic meter throughout the twenty-four hours.

From the secondaries of the transformers, the line runs to the low-tension switchboard installed on the ground floor in the compressor room. On this board are installed the main oil switch with its no-voltage release, two oil switches, one for each of the ice-machine lines, and two auxiliary switches for the small motors throughout the plant. Here are also the necessary indicating voltmeters and ammeters on the lighting and motor circuits, and two recording wattmeters—one on each ice machine—for checking purposes. Each ice machine is protected by an overload relay in addition to the shunt trips on the oil switches.

Main Compressor Equipment

In the compressor room are installed a 50-ton ice machine and a 100-ton ice machine, both of which were manufactured by the Arctic Ice Machine Company, Canton, Ohio, and operate at 65 r.p.m. The 100-ton unit is belt-driven by a 300-hp General Electric induction motor, operating at 500 r.p.m. A 150-hp motor of the same type is belt-connected to the 50-ton unit. Both of these motors are of the constant-speed type and have proved themselves thoroughly adapted to this class of work. This is of special interest in view of the fact that variable-speed motors have been considered by many to be essential for satisfactory compressor drive.

Water for the plant is supplied by a deep-well pump in the compressor room driven by a General Electric 20-hp induction motor. A small auxiliary compressor supplies the necessary refrigeration to the cold-storage rooms when the large compressors are not running. It is also used for charging the system and for pumping out. This machine has a refrigerating capacity of 6 tons and is driven by a 7.5-hp squirrel-cage General Electric induction motor.

The tank room, where the ice is made and harvested, is on the second floor of the main building, with the storage room directly below it on the ground floor. This arrangement obviates the need of any additional power for delivering ice from the tank room to the storage compartment, as the blocks are lowered by gravity directly into the storage room and thence out onto the selling platform.

Tank Room and Method of Freezing

The tank room is divided into three 50-ton units, each unit containing ten 10-ton ice-making tanks and each tank containing sixty-six 300-lb. cans. As forty-eight hours is required for a complete "freeze," it is necessary to have an installation of double the capacity of the twenty-four-hour rating of the plant, each 10-ton tank being harvested once every two days.

The raw-water system of ice making, as its name infers, does away with the necessity for distilled water.

Its operation is based on the principle that the process of freezing consists of the formation of small crystals of pure water in the form of ice and that, in so forming, materials or impurities in the water are eliminated from the crystals.

As the formation of ice begins at the sides of the can and works toward the center, all impurities are gradually pushed toward the center of the cake. Any materials in suspension in the water are eliminated from the cake by the agitation of the water, caused by a current of air entering at the bottom of the can. This prevents the particles from remaining stationary on the surface of the ice that is being formed. Likewise, any gases which come from the water are swept upward by this current of air and escape into the atmosphere. From the foregoing it will be obvious that the last part of the cake to be frozen is the center, which is known as the "core," and that all impurities will collect at this point. When the freezing has proceeded nearly to the center of the block the core water containing the impurities is drawn off and the core refilled with pure water. The block is then frozen solid.

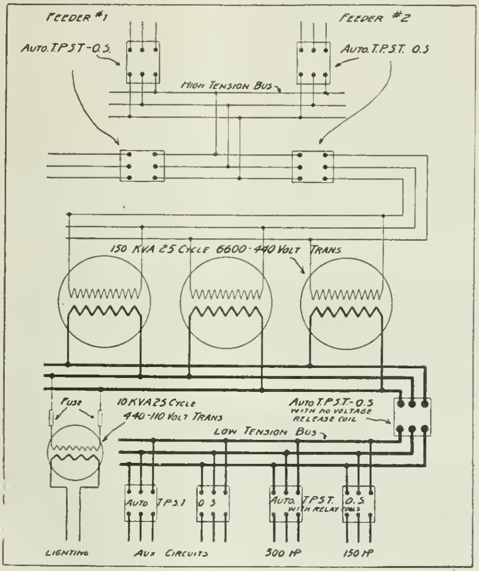
Feeder #1
Feeder #2
Auto. T.P.S.T-O.S.
Auto. T.P.S.T. O.S
High Tension Bus
150 KVA 25 Cycle 6600-440 Volt Trans.
Fuse
10 KVA 25 Cycle 440-110 Volt Trans
Auto T.P.S.T.-O.S with no voltage release coil
Low Tension Bus
Auto T.P.S.T O.S
Auto. T.P.S.T. O.S. with relay coils
Lighting
Aux Circuits
300 HP
150 HP

FIG. 4—DIAGRAM OF CONNECTIONS

In the Arctic-Pownall raw-water system employed at the Bay Ridge plant the bottom of each can is provided with an air inlet, a water inlet and a water outlet. Raw water to be frozen enters through the water-inlet pipe and is agitated by the air passing up through the bottom of the can. During this action the impurities which are drawn off are carried away through the water-outlet header into what is known as the precipitating tank. There is one of these for each 10-ton ice-making tank. The air in entering the cans also produces a siphon or ejector action which causes the water to flow into the cans through the inlet-water header, thus raising the height of water therein to a level slightly above that of the water in the precipitating tank. The water is drawn in at the rate of about one gallon an hour, and the same amount flows back into the precipitating tank, carrying away all impurities from the raw water and depositing them in the precipitating tank. This cyclic action continues until the end of each freeze, when the impurities thus deposited are removed by the core water in the cans, which flushes out the tanks.

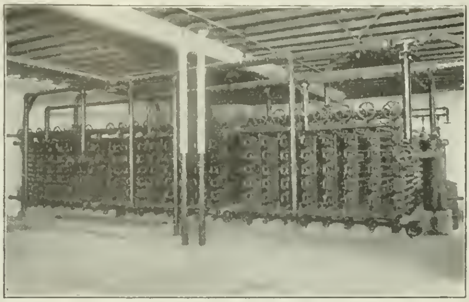

FIG. 5—CONDENSER ROOM

Stationary Freezing Cans

For agitating the water in the cans there are two positive air blowers, each driven by a 7.5-hp motor and furnishing air at about 3 lb. pressure. The air is forced directly into the bottom of each can throughout the entire unit in equal quantities and at the same pressure by opening a single controlling valve. Likewise each of the sixty-six-can 10-ton tanks is filled by opening a single valve which allows the water to flow from the storage tank, of which there are three, one for each 50-ton unit, into the bottom. Filling continues until a predetermined height is reached, which is controlled by an overflow. Just before the cans are filled the air for agitating the water is turned on to the entire unit, each can getting the same quantity of air by special arrangement. After the water has been allowed to run into the cans, cold brine is let into the freezing compartments, thus permitting the circulation of the brine

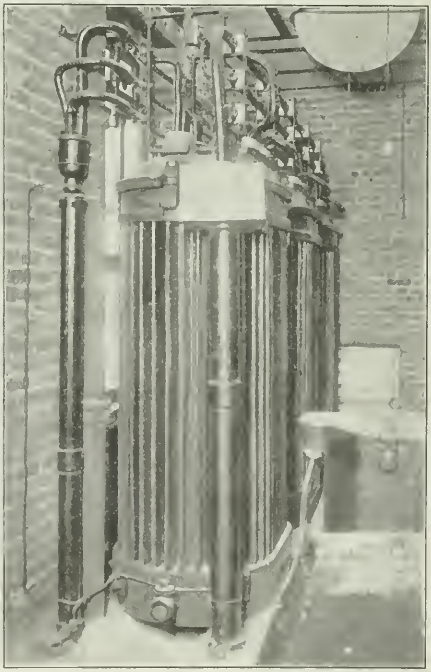

FIG. 6—TRANSFORMER SERVING ICE FACTORY

around the cans. The water is then frozen to a point where there remains a hole about 0.5 in. wide throughout the length of the block. The water therein is next drained off through the precipitating tank by opening the core-water drain valve. The drain valve is then closed and the core filled with fresh raw water and the freezing allowed to continue until the blocks are completely frozen. A small boiler is required for the heating plant during the winter season.

Circulation of Brine

When the freezing process has been completed the cold brine is shut off and the blocks are allowed to stand for about three-quarters of an hour. The brine is then circulated by means of a pump, sometimes termed the "warm brine" pump, from the brine tank through a coil in the storage-water tank and back around the cans, in this way cooling the supply of make-up water and at the same time increasing the brine temperature to about 38 deg. Fahr. This circulation of brine thaws the ice from the sides of the cans and facilitates harvesting. Three centrifugal pumps directly connected to three 5-hp General Electric squirrel-cage motors are utilized to furnish this brine circulation.

It should be noted that in this plant the cans themselves are not pulled, being fastened to the bottom of the tank, but that, in harvesting, the ice is pulled from the cans by means of two small hooks which were at the outset placed over the edges of the can and frozen against the block. This feature minimizes the labor in handling the cakes.

A pneumatic crane is used in hoisting the blocks of ice from the cans, air being supplied for this purpose at 60 lb. pressure by a small compressor in the tank room which is driven by a 5-hp squirrel-cage General Electric motor.

The condenser room is directly over the compressors. At the present time there are installed here three ammonia double-pipe condensers, each bank of which is of sufficient capacity to handle a 50-ton ice-making plant. Sufficient space is provided in this room for taking care of future growth of business necessitating an output twice as great, or 300 tons.

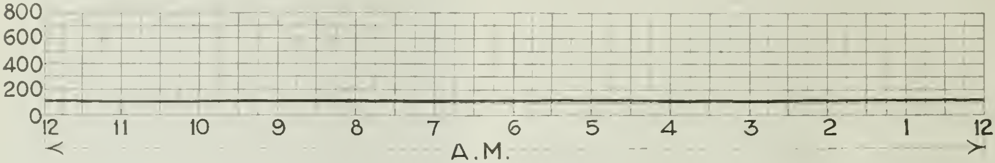

FIG. 7—TYPICAL LOAD CURVE OF MOTOR-DRIVEN ICE PLANT

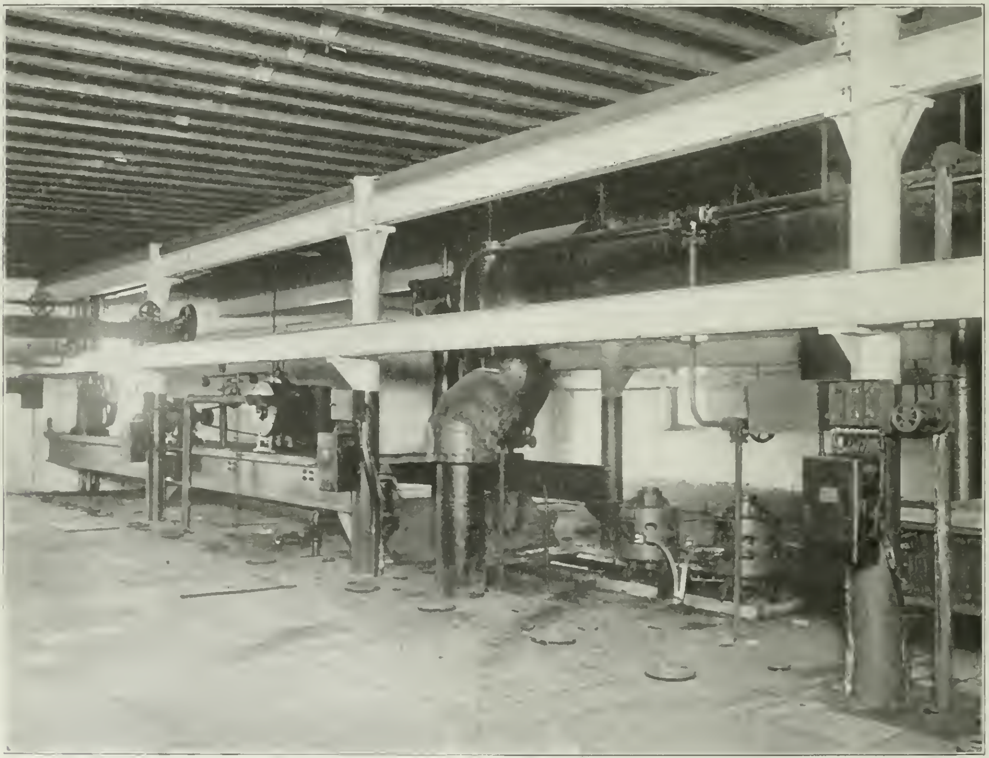

FIG. 8—TANK ROOM, SHOWING PUMP MOTORS, STARTING APPARATUS, ETC.

COMMUTATION—II

By Alfred Still

With a view to calculating within a reasonable degree of accuracy the flux density in the zone *ABC* of Fig. 6, it is necessary to make certain assumptions and to use judgment in applying the calculated results, because it is not possible to determine this value with scientific accuracy even when the exact shape of the armature coils and the configuration of the surrounding masses of iron are known.

In the first place, the angle α of Fig. 6 will be taken as 45 deg., which, although perhaps slightly greater than the average on modern multipolar machines, has the advantage that it permits us to treat the wires *AB* and *BC* as being at right angles to each other. The further assumption will be made that the armature is of large diameter, and the developed view of the end connections, as shown in Fig. 7, can therefore be considered as lying in the plane of the paper. The flux in the zone occupied by the portion *AB* of the coil undergoing commutation is due to the currents in all the neighboring parallel conductors comprised in the parallelogram *ADBC*. The direction of flow of current in these parallel conductors is indicated by the arrows, being outward (i.e., from *A* to *B*) on the left-hand side of the commutating zone, and inward (from *B* to *A*) on the right-hand side. The intensity of the field produced on *AB* by any one of these wires, if the lines of force are assumed to be circles in a path consisting entirely of air (the proximity of masses of iron being for the present ignored), will be inversely proportional to the distance of the wire considered, and the extent to which this wire will be effective in producing a field along *AB* will depend upon its length. Thus, a conductor such as *EF* will produce not only a stronger component of the resulting field in the commutating zone than the wire *GH*, but a field of which the extent is measured by the length *EF*, while the more distant wire will produce a weaker field over a length equal to *GH* only. Thus the effect of the more distant wires in building up the flux over the commutating zone decreases very rapidly with increase of distance. Fig. 8 represents a section at right angles to the conductor *AB* of Fig. 7. It is assumed that the brush covers two bars (a reasonable, but not a necessary, assumption),[1] and the condition shown in Fig. 8 corresponds to the middle of the commutation period, with zero current in the short-circuited coil and full armature currents of $+I_c$ and $-I_c$ respectively in the neighboring conductors.

Considering the full pitch coil of pitch τ centimeters measured over the armature surface, we can write

$$\tau = n\lambda$$

where n = number of slots per pole, and λ = slot pitch in centimeters. Then the length *AB* (Fig. 7), which is approximately one-quarter of the total length of "inactive" copper per coil, is

$$l = \frac{\tau}{\sqrt{2}} = \frac{n\lambda}{\sqrt{2}}$$

and the pitch of the end windings (which are supposed to lie in the same plane as the conductors in the slots) will be,

$$a = \frac{\lambda}{\sqrt{2}} = \frac{l}{n}$$

Let T = number of conductors or turns per coil (which is not necessarily the same as the number of turns between commutator bars, because there may be more commutator bars than there are slots on the armature), and let I_c = the amperes of current per conductor; then, since the field intensity at a distance y cm from a straight conductor is

$$H = \frac{0.2 \times \text{current in amperes}}{y}$$

we may write, for field intensity due to the group of conductors *EF*,

$$H_{ef} = \frac{0.2 \times TI_c}{2a}$$

The flux produced in the zone *AB* by the same group of wires (*EF*) will be proportional to the value of H multiplied by the length *EF*. Thus, in a zone 1 cm wide, of which the center line is *AB*, the flux of induction due to the conductor *EF* is

$$\Phi_{ef} = \frac{0.2\,TI_c}{2a}(l - 2a)$$

The sum of all such elements of the total flux, taken for all the parallel conductors on both sides of *AB* will be

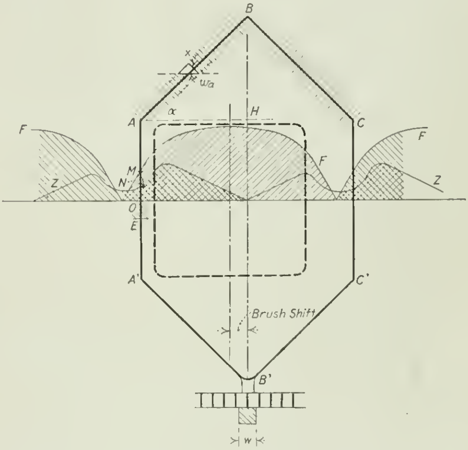

FIG. 6—CORRECTION FOR CUTTING OF END FLUX

$$\Phi_c = \frac{0.4\,TI_c}{a}\left[(l-a) + \frac{l-2a}{2} + \frac{l-3a}{3} + \quad . \quad . \quad + \frac{l-na}{n}\right]$$

which, bearing in mind the relation $l = an$, simplifies into

$$\Phi_c = 0.4\,TI_c n\left(\frac{1}{2} + \frac{1}{3} + \frac{1}{4} \quad . \quad . \quad + \frac{1}{n}\right) \qquad (4)$$

The total flux (maxwells) cut by the end connections *ABC*, being one-half of the length of "inactive" copper in the commutated coil, is given by the expression

$$\begin{aligned}\Phi_t &= 2\,\Phi_c \times w_a \sin\alpha \\ &= \sqrt{2}\,\Phi_c \times w_a \\ &= 0.4\sqrt{2}\,TI_c n\, w_a\left(\frac{1}{2} + \frac{1}{3} + \frac{1}{4} \quad . \quad . \quad + \frac{1}{n}\right) \qquad (5)\end{aligned}$$

in which w_a is, as before, the brush arc expressed in centimeters of armature periphery.

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[1] Within practical limits, the width of the brush does not appreciably affect the average density of the armature flux cut by the commutated coil. A wide brush, by short-circuiting several coils, reduces the number of conductors carrying the full armature current, and to this small extent the total mmf producing the flux in the commutating zone is less with a wide brush than with a narrow brush.

The average flux density over the zone considered is

$$B_e = \frac{\Phi_t}{l} = \frac{0.4\sqrt{2}k\,T\,I_c}{\lambda}\left(\frac{1}{2}+\frac{1}{3}+\frac{1}{4}\quad.\quad.\quad+\frac{1}{n}\right) \quad (6)^{[2]}$$

This assumes air paths for the flux lines, but on account of the proximity of the pole shoes to the points where the end connections leave the slots, and also because the conductors actually remain parallel to the shaft for a short distance beyond the core, the value of B_e would be larger than as given by formula (6). A constant should therefore be included, and if the convergent series is replaced by the logarithmic function, the formula becomes,

$$B_c = \frac{0.4\sqrt{2}\,kTI_c}{\lambda}\,[\,(\log_e 2n) - 1\,] \qquad (7)$$

This value of B_c may be used in formula (3) to calculate the equivalent density, B_a, of the total flux to be cut by the slot conductors in the commutating fringe, in order to counteract the emf generated in the end connections by their movement through the field of density B_c.

If the end coils lie on a cylindrical support of iron or steel, the reluctance of the flux paths is very nearly halved, and the value of k in formula (7) should therefore be doubled. If it is desired to consider the increased flux due to the use of steel binding wires or bands, this can be done by making a suitable correction to the factor k.[3] Should it be desired to calculate separately the average value of the total emf generated in the end connections of the short-circuited coil, we have

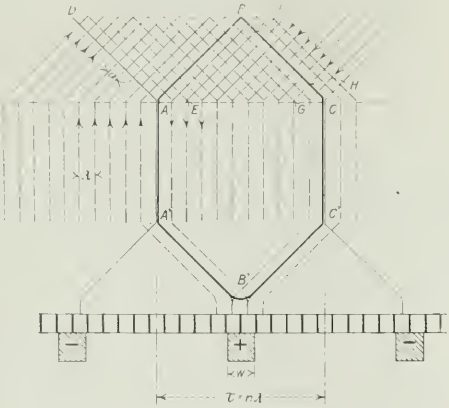

FIG. 7—DEVELOPED VIEW OF END CONNECTIONS

$$E_c = \frac{B_c l_c v\,T}{10^8}$$

where l_c = total length of coil outside armature slots (both ends)

= $2\sqrt{2}\,\lambda\,n$, if we keep to the assumption of angle α = 45 deg.

and v = speed of cutting in centimeters per second,

$= \frac{\pi D R_s}{\sqrt{2}}$, in which D is the armature diameter in centimeters, and R_s is the speed in revolutions per second. The factor $\sqrt{2}$ is the necessary correction to give the component of the velocity at right angles to the conductor. Inserting the value of B_c given by formula (7), and making the required simplifications, the formula for voltage becomes

$$E_e = \frac{k \times 0.8\sqrt{2}\,n\,I_cT^2\,(\pi\,D\,R_s)\;(\log_e 2n - 1)}{10^8} \qquad (8)$$

The numerical value of k in multipolar machines of modern design will usually lie between 1.3 and 3.5, the high value being taken when the end connections lie on a steel or iron supporting cylinder against which they are held by bands of steel wire.

For first approximations the formula may be put into simpler form:

Let A_c stand for the ampere-conductors on armature periphery per pole pitch ($A_c = 2TnI_c$). Let k = 2.4 (being an average value), and for the quantity ($\log_e 2\,n - 1$) put the numerical value 2.2 (the assumption here being that there are twelve to fourteen slots per pole), then

$$E_e\ (\text{approximately}) = \frac{3\,T\,A_cv}{10^8} \qquad (9)$$

where v is, as before, the peripheral velocity of the armature in centimeters per second.

The above calculations and conclusions are based on the assumption of a full pitch winding. With a chorded or short-pitch winding, the average flux density in the commutating zone will be slightly reduced; and there will be a further gain due to the shortening of the end connections (*ABC* and *A'B'C'* in Fig. 6). Thus the voltage generated by the cutting of the end fluxes, with a short pitch winding, will be slightly less than the value calculated by formula (8), or by the approximate formula (9), which applies to a pitch winding.

Calculation of "Slot Flux" Cut by Coil During Commutation

A reference to the diagrams of flux distribution in the commutating zone (Figs. 4 and 5) will make clear the fact that, even when the effect of the end connections is neglected, the center of the neutral commutating zone is not the point on the armature periphery where flux neither enters nor leaves the teeth; because in order that the short-circuited conductors shall not cut the slot leakage flux, this flux must be provided by the main field pole toward which the brushes are shifted to obtain perfect commutation. The point on the armature periphery where flux neither enters nor leaves the teeth may be found by drawing curves representing the magnetomotive forces exerted by field poles and armature windings at every point on the armature periphery, and where the sum of the ordinates of such curves is zero the surface flux density must also be zero. The brushes must, however, be moved forward beyond this point until the reversing flux entering the teeth comprised in the brush arc has the value Φ_t as given by the formula (5), to compensate for the end fluxes plus the total slot flux Φ_s, which is twice the leakage from tooth to tooth in one slot when the conductors are carrying the full armature current.[4] In order to calculate the volts generated in the coil of T turns by this slot leakage flux, it is the *equivalent* slot flux that must be considered, because the total number of lines crossing between the sides of adjacent teeth does not link with all the wires in the coil.

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[2] The value of the series in the brackets is readily computed with the aid of a table of reciprocals, but if preferred this series can be put in the form ($\log_e 2n$) − 1, which is really more accurate, since it assumes a current uniformly distributed through the copper section of the conductors instead of being concentrated at the center of each coil as assumed in deriving formula (4).

[3] This is discussed by Mr. Lamme in his Institution paper previously referred to.

[4] In the case of short-pitch windings, or when there are more commutator bars than there are slots on the armature, the amount of the slot flux must be calculated for the instant when the coil enters or leaves the commutating zone. This flux will depend not only upon the dimensions of the slot but also upon the current carried by each conductor and the position of the latter in the slot.

It will be convenient to assume the same number of slots as there are commutator bars, and the whole of the slot space to be filled with $2T$ conductors, each carrying a current of I_c amp (this follows from the assumption of a full pitch winding). Thus no account will be taken of the fact that a small space occurs between upper and lower coils, where the slot flux will not pass through the material of the conductors. The lines of the slot flux will be supposed to take the shortest path from tooth to tooth; the small amount of flux that may follow a curved path from corner to corner of tooth at the top of the slot will be neglected. Refinements of this nature may be introduced, if desired, when solving the problem for a concrete case.[5] If the usual assumption is made that the reluctance of the iron in the path of the magnetic lines is negligible in comparison with the slot reluctance, the small portion of slot flux in the space dx (Fig. 9) considered 1 cm long axially (i.e., in a direction perpendicular to the plane of this paper) is

$$d\,\Phi = \text{mmf} \times dP$$

where dP is the permeance of the air path. Thus,

$$d\,\Phi = 0.4\,\pi\,(2TI_c)\,\frac{x}{d} \times \frac{dx}{s}$$

but this flux links with only $2T \times \frac{x}{d}$ conductors, and the *equivalent* slot flux, which would generate the same emf if cut by all the conductors in the slot, is therefore

$$d\,\Phi_s = d\,\Phi \times \frac{x}{d}$$

and

$$\Phi_s = \frac{0.8\,\pi\,TI_c}{d^2 s}\int_0^d x^2 dx$$

$$= \frac{0.8\,\pi\,d}{3\quad s}\,TI_c \qquad (10)$$

This is the equivalent flux in maxwells per centimeter of axial length of armature slot. If l_a = axial length of armature core expressed in centimeters[6], the total slot flux cut by each coil side during commutation, being *twice* the flux per slot, as shown in Fig. 4, is

$$\Phi_s = \frac{1.6\,\pi}{3}\,\frac{d}{s}\,TI_c l_a \qquad (11)$$

The voltage component due to the cutting by *both* coil sides[7] of the slot flux considered separately from other fluxes would be

$$E_s = \frac{2\,\Phi_s T}{10^8\,t_c}$$

where the time of commutation

$$t_c = \frac{\text{brush arc in centimeters of armature periphery}}{\text{peripheral velocity in centimeters per second}}$$

$$= \frac{w_a}{v}$$

Thus,

$$E_s = \frac{3.2\,\pi\,T^2 I_c d\,l_a v}{3 \times 10^8\,s\,w_a} \qquad (12)$$

The factor w_a in the denominator of this formula indicates that the slot flux is of less importance with a wide than with a narrow brush. This is generally true, although it must be remembered that the formula (12), in common with other formulas previously developed, is not of general application. Within the limits of this article, it is not possible to consider all special cases; and commutation formulas of general applicability cannot be developed. When there is more than one coil per slot, and when there are "dead coils," inequalities occur which complicate the problem and make it impossible to obtain ideal commutation with every coil on the armature. In such cases the slot flux must be calculated for the coils that are differently situated in regard to the brush position and an average value selected for use in the calculations.

Knowing the slot flux Φ_s and the previously calculated end flux Φ_t cut by the conductors of the short-circuited coil while traveling over the distance w_a, the correct brush position is found when the reversing flux entering the teeth comprised in the commutating zone of width w_a is approximately $\Phi_s + \Phi_t$ maxwells. The flux actually cut by the one coil side is, however, only Φ_t; the component Φ_s of the total flux entering the commutating zone merely supplies the leakage from tooth to tooth across the slot. The presence of the slot flux undoubtedly tends to complicate the problem of commutation. It should be noted that the slot flux Φ_s, if calculated by formula (11), is what has been referred to as the equivalent slot flux; that is to say, a flux of this value, if cut by an imaginary concentrated winding of T turns, would develop the same voltage in the coil as the actual slot flux develops in the actual winding. The condition of importance to be fulfilled is simply that the "equivalent" flux cut by the coil side in the reversing field shall have the value Φ_t. This may be separated into two parts, (1) the flux passing through the teeth into the armature, which links with *all* the conductors in the slot, and (2) the equivalent slot flux. It is important to note that although the total or actual slot flux is the same whether it enters the top or the root of the tooth, the flux linkage and therefore the developed voltage have not the same value in the two cases. The total slot flux, on the basis of the assumptions previously made, is

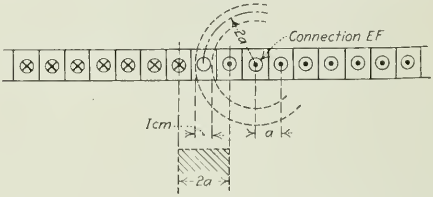

FIG. 8—FLUX DUE TO END CONNECTIONS

$$\Phi_s\ (\text{total}) = \frac{2 \times 0.4\,\pi\,(2TI_c)l_a}{ds}\int_0^d x\,dx$$

$$= \frac{0.8\,\pi\,d\,TI_c l_a}{s} \qquad (13)$$

being one and one-half times the equivalent slot flux given by formula (11). The equivalent flux when the total slot flux enters the tooth top instead of passing through root of tooth is no longer expressed by formula (11); it may be calculated thus:

The magnetic lines represented by the expression $d\,\Phi = 0.4\,\pi\,(2TI_c)\frac{x}{d}\,\frac{dx}{s}$ no longer link with $2T\,\frac{x}{d}$ conductors, but with $2T\,\frac{x\,(d-x)}{d}$ conductors. The equivalent flux, when no part of this flux passes into the armature core below the teeth, is therefore

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[5] With short-pitch windings, or when there are several coils per slot, all the conductors in the slot may not be carrying the full armature current when the coil enters or leaves the commutating zone. In such cases the actual conditions must be studied, and an average value for the slot flux can readily be arrived at. If necessary, the straight-line law of commutation may be assumed in order to estimate the current values in the coils passing through the intermediate stages of commutation.

[6] It is well to let l_a stand for the gross length of armature core, although in slot flux calculations the total width of vent ducts is sometimes deducted.

[7] The $2T$ conductors in the one slot are here considered as equivalent to the two coil sides, each of T wires, in separate slots one pole pitch apart.

$$\Phi_s = 2l_a \int_0^d d\Phi \times \frac{d - x}{d}$$
$$= \frac{1.6\,\pi\, T I_c l_a}{d^2 x} \int_0^d x\,(d - x)$$
$$= \frac{1.6\,\pi\, d}{6s}\, T I_c l_a \qquad (14)$$

or just half the equivalent slot flux as given by formula (11). The question now arises: What is the necessary total flux entering the tops of the teeth comprised in the commutating zone to develop the proper voltage component in the short-circuited coil?

A total slot flux as given by formula (13) has the "equivalent" value as given by formula (14); that is to say, it is—on the basis of the assumptions previously made—three times as great as the equivalent flux. The total flux entering the teeth comprised in the commutating zone should therefore be

$\Phi_c = 3\,\Phi_s' +$ flux passing directly into armature core through the teeth.

$= 3\,\Phi_s' + \Phi_d$

but $\Phi_s' + \Phi_c = \Phi_t$ where Φ_t is, in this particular instance, the equivalent value of the total flux to be cut by the "active" portion of the short-circuited conductors. Thus

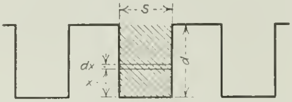


FIG. 9—ILLUSTRATING SLOT FLUX CALCULATIONS

$$\Phi_c = 2\,\Phi_s' + \Phi_t$$
$$= \Phi_s + \Phi_t$$

where Φ_s is the equivalent slot flux as originally calculated and expressed by formula (11).

The flux actually entering the armature teeth in the commutation zone should therefore be equal to the sum of the end flux Φ_t and the equivalent slot flux Φ_s. It is because this conclusion is not obvious that it has been deduced from the foregoing arguments.

Commutating Interpoles

Assuming the same number of interpoles as there are main poles and an axial length of interpole equal to that of the main pole, the flux from each interpole which enters the armature teeth included in the commutating zone of width w_a is, as before, $\Phi_s + \Phi_t$.

If, as is usually the case, the interpole face does not cover the whole length of the armature core, then some flux due to the total mmf of the armature windings will enter or leave the armature core by the teeth included in the commutating zone, and this flux will be cut by that portion of the slot conductors which is not covered by the interpole. With the brushes at the geometric neutral this armature flux is unaffected by the excitation of the main poles; its value depends only upon the armature ampere turns and the reluctance of the air paths between armature surface and the neighboring masses of iron. It can be predetermined within reasonably close limits, but the calculation of flux distribution on armature surface is beyond the scope of this paper. If Φ_a is the total flux leaving the armature in the commutating zone over a space w_a wide and l_a long—where l_a is the gross length of the armature core and w_a is, as before, the brush arc referred to the armature periphery—the portion of this flux which is cut by the short-circuited wires in the space beyond the interpole of length l_p is $\Phi_a \left(\frac{l_a - l_p}{l_a}\right)$, and the flux entering the armature from each interpole should be approximately $\Phi_s + \Phi_t + \Phi_a \left(\frac{l_a - l_p}{l_a}\right)$. Knowing the amount of the flux to be provided by each interpole, its cross-section can be decided upon and the necessary exciting ampere-turns calculated, bearing in mind the following requirements:

(a) The average air-gap density should be low (about 6000 gausses corresponding to full load current), to allow of increase on overloads.

(b) The leakage factor should be as small as possible. This involves keeping the width and axial length of interpole small, thus conflicting with condition (a) and presenting one of the difficulties of commutating-pole design.

(c) The minimum width of pole face is such that the equivalent pole arc (which must include an allowance for fringing) shall cover the commutating zone of width w_a.

(d) The equivalent pole arc should, if possible, be an exact multiple of the slot pitch (either once or twice the slot pitch) as this tends to reduce the magnitude of the flux pulsations in the interpole. The effects of these flux pulsations, caused by variations in the reluctance of the interpole air-gap, are, however, usually of no great practical importance, but the width of brush should not be determined independently of the interpole design.

(e) In order to keep down the I^2R losses in the series turns on the interpole (usually amounting to less than 1 per cent of the total output), the ampere-turns and the length per turn should be as small as possible. The gain resulting from a small air-gap is, however, not great, because the ampere-turns required to overcome the air-gap reluctance rarely exceed 25 per cent of the total, the balance being required to oppose the armature mmf. A reasonably large air-gap has the advantage of reducing the flux pulsations referred to under (d).

(f) The effect of the interpole being to increase the flux in that portion of the yoke which lies between the interpole and the main pole of opposite polarity, it is important to see that the resulting flux density in this part of the magnetic circuit is not excessive. A similar condition exists in the armature core, but this does not usually determine the limits of the allowable average flux density below the teeth.

(g) Series-wound or wave-wound armatures are to be preferred on machines with commutating poles, especially when the air-gap under the main poles is made smaller than it would have to be if interpoles were not used.

(h) The total line current should, if possible, pass through all the interpole windings in series; that is to say, parallel circuits should be avoided because of the possibility that the current may not be equally divided. If the total current is too great, a portion may be shunted through a diverter. The diverter should be partly inductive, the resistance being wound on an iron core in order that the time constants of the main and shunt circuits may be approximately equal. If this is not done, the interpole winding will not take its proper share of the total current when the change of load is sudden, and this may lead to momentary destructive sparking.

Among the advantages of commutating poles may be mentioned the fixed position of the brushes and the fact that fairly heavy overloads can be taken from the machine without destructive sparking, because of the building up of the commutating flux with increase of load. The limiting factor in this connection is the saturation of the iron (mainly of the interpole itself) in the local circuit, and this is aggravated by the large percentage of leakage flux due to the proximity of main and commutating poles. Deeper armature slots may be used than in the case of machines without interpoles, and the specific loading (ampere conductors per unit length of armature periphery) may be increased, thus allowing of greater output notwithstanding the slight reduction in width of main poles necessary to accommodate the interpoles. The maximum output of the machine with commutating poles is usually determined by the heating limits, the ventilation being less effective than in the case of non-interpole machines. The I^2R loss in interpole windings is to some extent compensated for by a reduction of the ampere turns on the main poles when shorter air-gaps are used. With the brushes on the geometric neutral and an air-gap which is small relatively to the space between pole tips, field distortion *per se* has nothing to do with commutation, whether interpoles are used or not; if the fringe from the leading pole tip is not to be used for counteracting the effects of end flux and slot flux on the coil undergoing commutation, the unequal flux distribution under the main poles due to cross-magnetization does not affect the field at a point midway between two main poles. It is not suggested that field distortion is unobjectionable when the brushes are on the geometric neutral or when interpoles are used. The concentration of flux at one side of the main pole may lead to flashing over the commutator surface (an effect often attributed to unsatisfactory commutation, though rarely due to this cause); but the chief objection to a large number of ampere turns per pole is the fact that the flux in the zone of commutation due to this mmf must be compensated for somehow if satisfactory commutation is to be obtained. It is exactly in the zone corresponding to the brush position that the armature mmf has its maximum value. In the case of the interpole machine, the windings necessary to compensate for armature cross-magnetization are an objectionable feature; and, except for the added cost and tendency to interfere with ventilation, there is much to be said in favor of pole-face windings, the function of which is to neutralize the magnetizing effect of the armature winding and maintain an approximately constant flux density over the pole faces. The writer has in mind machines such as those which, for the last twenty years, have been constructed under the Thompson-Ryan patents. One of the attractive features of such designs is the fact that the winding on the commutating poles need be no greater than that required to overcome the reluctance of the air-gap and send the requisite flux into the armature teeth comprised in the commutating zone.

Example of Interpole Design

The numbers and dimensions used to illustrate the method of calculation outlined above will be chosen without reference to an actual design of interpole dynamo, and they must not be considered representative of modern practice. Assume the leading particulars of the machine to be as follows:

Output = 200 kw.
Volts = 440.
R.p.m. = 500.
Number of main poles $p = 6$.
Armature core diameter $D = 30$ in.
Armature core length $l_a = 11$ in. $= 28$ cm.
Total number of slots = 120.
Number of slots per pole $n = 20$.
Slot pitch $\lambda = 0.785$ in.
Slot width $s = 0.39$ in.
Slot depth $d = 1.5$ in.
Style of winding: full pitch, multiple.
Current per armature path $I_c = 76$ amp.
Number of conductors per slot = 8.
Total number of conductors $Z = 120 \times 8 = 960$.
Number of commutator bars = 240. (There are four coil-sides per slot, or two coils, giving two turns between adjacent commutator bars.)
Diameter of commutator = 20 in.
Pitch of commutator bars $= \dfrac{\pi \times 20}{240} = 0.262$ in.
Number of bars covered by brush = 3.5.
Thickness of brush (brush arc) $w = 0.262 \times 3.5 = 0.916$ in.
Brush arc referred to armature periphery $w_a = \dfrac{0.916 \times 30}{20} = 1.375$ in. $= 3.5$ cm.

Assuming the same number of commutating poles as there are main poles, the flux entering the armature teeth in the commutating zone of width w_a should equal the sum of the equivalent slot flux and the end flux, together with the flux which is due to the armature ampere turns and which leaves the armature core in the portion of the commutating zone not covered by the interpole. The end flux cut by the short-circuited coils is given approximately by formula (5) which may be put in the form

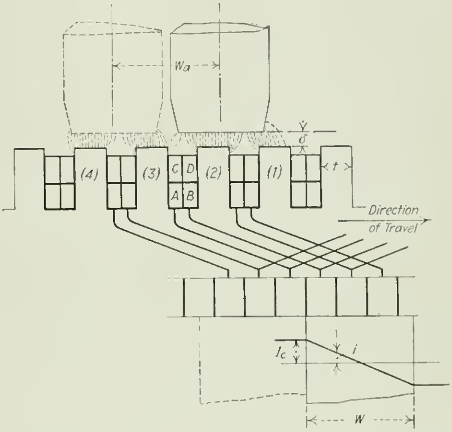


FIG. 10—FLUX FROM INTERPOLE

$$\Phi_t = 0.4\sqrt{2}\,T I_c n w_a\,[(\log_e 2n) - 1]$$
$$= 0.4\sqrt{2} \times 4 \times 76 \times 20 \times 3.5 \times (3.69 - 1)$$
$$= 32{,}400 \text{ maxwells.}$$

In regard to the slot flux, at the beginning or end of commutation (depending upon the position of the coil in the slot) the conductors in the slot affected are not all carrying the full armature current. This will be seen by reference to Fig. 10, where coil *A* (consisting of two turns) is just about to be short-circuited by the brush. At this instant the current in the coil-sides *B* and *D* is $i = 2I_c \times \dfrac{1}{3.5} = 0.572\,I_c$ as indicated by the diagram sketched on the brush of width w covering three and one-half bars, the straight-line law of current variation being assumed. At the end of commutation, when the position of the affected slot relatively to brush and interpole is as indicated by the dotted lines, the current in all four coil-sides is $-I_c$. We may therefore assume the slot flux to be produced by a current of which the average value is not $I_c = 76$ amp, but $I_c \times \dfrac{3 + 0.572}{4} = 68$ amp. The "equivalent" slot flux, as given by formula (11), is therefore

$$\Phi_s = \frac{1.6\,\pi d}{3\,s}\,T I_c l_a$$

$$= \frac{1.6\,\pi \times 1.5 \times 4 \times 68 \times 11 \times 2.54}{3 \times 0.39}$$

$$= 49{,}000 \text{ maxwells.}$$

Turning now to the flux leaving the armature in that part of the commutating belt which is not covered by the interpole, let the curve Fig. 11 represent the full-load flux distribution over armature surface, calculated on the assumption that there are no interpoles. The flux density at a point midway between the two poles has the value B, which for the purpose of this example may be assumed to be 1500 gausses.

If l_p = axial length of interpole (not yet determined), the total flux which must pass from interpole into armature teeth is

$$\Phi_p = \Phi_s + \Phi_t + B\,(l_a - l_p)\,w_a \qquad (15)$$

The axial length l_p of the interpole face can therefore be determined if a suitable value for the average air-gap density under full-load conditions is assumed. Let B_p stand for this value: then

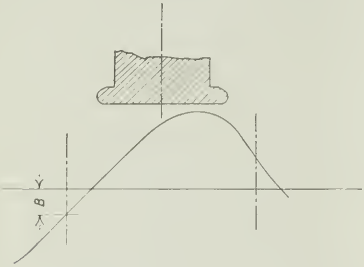


FIG. 11—FLUX DISTRIBUTION OVER POLE PITCH

$$B_p \times l_p \times w_a = \Phi_s + \Phi_t + B\,(l_a - l_p)\,w_a$$

and

$$l_p = \frac{\Phi_s + \Phi_t + B w_a l_a}{w_a\,(B_p + B)} \qquad (16)$$

If the flux densities are expressed in gausses, the dimensions must be in centimeters; and if B_p is taken as 4000 gausses, the length l_p is found to be 12 cm, or, say, 4¾ in.

The total flux in the interpole air-gap at full load is

$$49{,}000 + 32{,}400 + (11 - 4.75)\,1.375 \times 1500 \times 6.45 = 164{,}500 \text{ maxwells.}$$

Assuming a leakage factor of 1.8 and a cross-section under the interpole winding of 4¾ × 1⅜, the full-load density in the core of the interpole would be 7000 gausses.

Calculation of Ampere Turns Required on Interpole

Referring to Fig. 10, it will be seen that when the coil A is about to be short-circuited, the interpole flux enters the armature through the teeth 1 and 2. At the end of commutation this flux enters the teeth 3 and 4. The permanence of the air-gap of length δ may vary slightly with the change in the position of the armature teeth; it may be calculated by any of the approximate methods. Assuming an actual air-gap ¼ in. long, the equivalent air-gap might be 0.3 in. The full-load ampere turns required to overcome air-gap reluctance will therefore be

$$\frac{0.3 \times 2.54 \times 4000}{0.4\,\pi} = 2420$$

To this must be added the ampere turns to oppose the armature mmf. If the reduction of current in the short-circuited coils is neglected, the armature ampere turns per pole are

$$\frac{1}{2}\,\frac{z I_c}{p} = \frac{(120 \times 8) \times 76}{2 \times 6}$$

$$= 6080$$

If we neglect the very small mmf required to overcome the reluctance of the interpole core, the total ampere turns on each interpole should be $2420 + 6080 = 8500$ at full load. The full-load current of the machine is $200{,}000 \div 440 = 455$ amp, and the required number of turns is $8500 \div 455 = 18.7$. In practice about twenty turns would be put on the interpole of this machine, and if necessary a diverter would be provided to adjust the current in accordance with results obtained on test.

Concluding Remarks

It is not suggested that the method of considering commutation phenomena as outlined above covers the subject completely. The designer aims at obtaining "ideal" commutation under certain load conditions, knowing well that, even when series-wound commutating poles are used, the required conditions cannot be exactly fulfilled at other loads. He relies on the resistance of the carbon brush to give sparkless commutation even when the conditions depart appreciably from those of "ideal" commutation. The extent to which the ideal condition can be departed from without producing destructive sparking is not easily determined except by experimental means. This point will not be discussed here, but it may be stated that the best way to approach the problem of sparking limits is to consider the amount of energy, per unit length of brush contact, which has to be dissipated at the moment the mica passes from under the brush.

Apart from all considerations of a mechanical nature, commutation can be improved by increasing the thickness of insulation between commutator bars. This might in many cases be made considerably thicker than the usual 1/32 in. with advantage in the matter of sparking; but it is not always easy to obtain large spacing between bars, and thick mica insulation is otherwise objectionable.

When calculating the equivalent slot flux, the assumption made virtually supposes the slot to contain a large number of small wires all connected in series. With solid conductors of large cross-section, the local currents in the copper would alter the distribution of the slot flux and call for a reversing field differing slightly from the field calculated by the aid of the formulas given in this article. Again, the field due to the armature mmf is usually assumed to be stationary in space. This is practically true when the number of teeth is large and the brush arc is a multiple of the bar pitch. With few teeth and a brush covering a fractional number of bars, the oscillations of the armature field (of small magnitude but high frequency) may have some slight effect on commutation; but with a better understanding of the main principles underlying commutation phenomena these and similar modifying factors of secondary importance tend to assume a less formidable aspect. In the writer's opinion, the fact that machines are now made to commutate satisfactorily without requiring an unreasonable amount of attention on the part of the operator is less the result of the many clever and commendable mathematical papers that have been written on this subject than of experience gained through innumerable failures. The designer who must of necessity be an engineer, desires to see clearly what he is doing. If he uses formulas of which he does not know the derivation or physical significance, he is working in the dark. In general, he asks for more physics and less mathematics. This article, as mentioned at the outset, has been written in the hope that it will help to elucidate some of the physical aspects of commutation phenomena.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

Pittsfield Contest Brings Out 400 Slogans

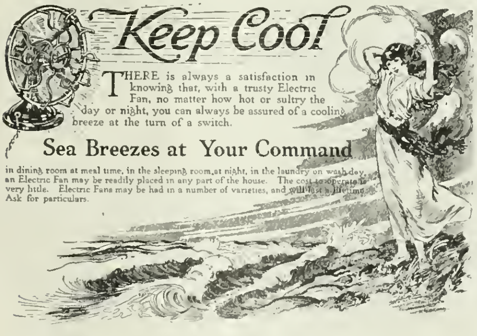
In response to a contest which is being conducted by the Pittsfield (Mass.) Electric Company for a slogan which is to appear on a large electric sign the company purposes to erect, more than 400 suggestions have been sent in to the special committee appointed by the president of the Board of Trade. From the large number received, this committee has selected four slogans as follows: "Pittsfield—Active, Attractive," "Pittsfield—Heart of the Berkshires," "Our Field, Your Field, Pittsfield" and "Pittsfield, Our Town."

Citizens interested in the welfare of Pittsfield have been asked to send postal cards to the Board of Trade stating their own individual choice among the four slogans offered. Two prizes, one of $10 and one of $5, will be awarded to the persons submitting the two slogans to which first and second place are respectively awarded.

The N. E. L. A. Residence-Service Campaign

During the last three years, in answer to a widespread demand for "business-getting" booklets, the Commercial Section of the National Electric Light Association has issued, through its publications committee, eight or ten booklets with an aggregate circulation of upward of 500,000 copies.

A few months ago, however, it was realized that one of the most pressing needs of the hour among the association's member companies was a "hammer-and-tongs" residence-service campaign that would enable commercial managers to keep everlastingly after their unconnected residence "prospects" with a collection of rapid-fire publicity matter covering a period of at least one year. Work was at once started on the preparation of literature for this campaign, and the first edition is now in press.


Keep Cool

THERE is always a satisfaction in knowing that, with a trusty Electric Fan, no matter how hot or sultry the day or night, you can always be assured of a cooling breeze at the turn of a switch.

Sea Breezes at Your Command

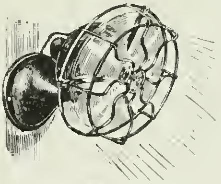
in dining room at meal time, in the sleeping room at night, in the laundry on wash day, an Electric Fan may be readily placed in any part of the house. The cost to operate is very little. Electric Fans may be had in a number of varieties, and will last a lifetime. Ask for particulars.

POST CARD TO BE MAILED JULY 1

The service offered comprises thirteen separate pieces of advertising literature, including snappy, well-printed booklets, mailing folders and fac-simile letters with return cards. It is designed to cover a maximum period of twelve months, or to be mailed twice a month if necessary. Space is provided on each piece of printed matter for the imprint of the local company making use of the service. The scheme is designed to be so flexible that large companies having their own advertising departments will find that this service may be dovetailed into their existing or prospective new-business campaigns with the greatest ease and with most gratifying results. Other companies will find this residence-service campaign an effective and inexpensive solution of one of their most difficult problems.

It may be added that the material of the series has been prepared under the supervision of some of the leading advertising managers of the central-station industry—men who are experts in this particular line of work and whose concentrated craft and experience in the art of rounding up and corralling the prospective customer have been gratuitously contributed in the preparation of this campaign. Member companies of the association are offered this service at actual production cost plus a small percentage for overhead expense. Orders may be addressed to the sales manager of the Commercial Section, Mr. E. A. Edkins, 120 West Adams Street, Chicago.

How Fan Advertising Is Arranged at St. Louis


Makes 90 feel like 60

At St. Louis, Mo., where the appliance department of the Union Electric Light & Power Company is known to have a remarkably efficient selling organization, considerable attractive electric-fan advertising has been used recently in the daily papers. One of these advertisements, which was somewhat of a departure from the usual methods, is reproduced herewith. In the upper left-hand corner of a page of the daily paper appeared the picture of a fan with the single statement "Makes 90 deg. feel like 60 deg," the advertiser's name being withheld from the copy. A reader seeing the advertisement naturally looked for the company's name and found it in the lower right-hand corner of the same page beneath the smiling figure of a big man in his office chair enjoying the cool breezes of the fan. Either advertisement alone gave the reader the idea of the advantages and comforts to be secured by the use of fans, but taken together the two separate pieces of copy told the story concisely and completely. The St. Louis company is offering fans at prices ranging from $8 to $21.40 and allows customers to pay for them in three instalments.

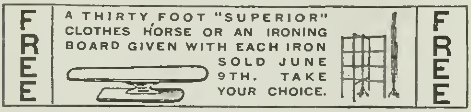
"I should worry"

Fans—All Sizes, all Kinds, $8 to $21.40
On sale at Main Office and All Branches—pay with 3 monthly bills
UNION ELECTRIC LIGHT AND POWER CO.

Selling 2402 Electric Irons in One Day at St. Louis

Beginning early in June, the Union Electric Light & Power Company, St. Louis, Mo., started a flatiron campaign by which it aims to distribute during the summer months more than 6000 electric irons in territory already well saturated with electrical appliances. A special one-day sale was launched June 9, and this was preceded by numerous but small newspaper advertisements known as "teasers," quoting such attractive phrases as "Iron electrically in hot weather," etc. With the opening of the campaign, larger space was used in the newspapers, 44,000 post cards stamped on both sides were mailed to electric-service customers, 45,000 diamond-shaped "fliers" were hung on doorknobs, lamp-posts and other convenient and conspicuous places about the city, and large readable canvas signs were attached to the sides of the company's thirty-five electric trucks.

Advertising literature on the post cards and in the papers offered the company's patrons standard 6-lb. General Electric household irons for $2.85, the payments to be made monthly as follows: first month, $0.85; second month, $1, and third month, $1. As an additional attraction, the company offered with each purchase either a folding clothes-rack having 30 ft. of drying space or a special shirt-waist board.



FREE

A THIRTY FOOT "SUPERIOR" CLOTHES HORSE OR AN IRONING BOARD GIVEN WITH EACH IRON SOLD JUNE 9TH. TAKE YOUR CHOICE.

FREE

CARD DISTRIBUTED IN FLATIRON CAMPAIGN

As the result of its one-day sale on June 9 the company sold altogether 2402 electric irons.

How Motor-Service Business Grows at Muncie, Ind.

All but two factories operating in the city of Muncie, Ind., are now receiving electric service from the mains of the Muncie Electric Light Company. One of these factories is operating low-pressure steam turbines. All the laundries in the city with one exception are also operating on central-station energy, and an estimate of cost is at present being made up for the owner of the laundry not receiving service.

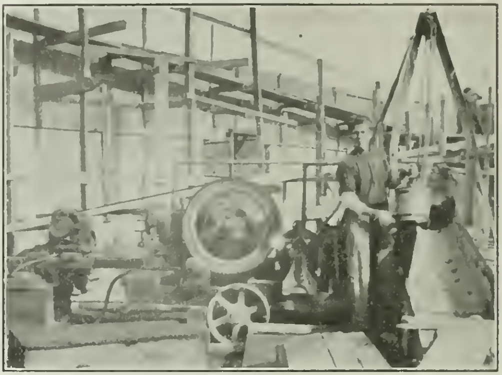
The fact that nearly all of these industrial plants are connected to the central-station company's lines does not mean that motor-service business in Muncie is nearing saturation, for it has been the experience of the new-business department that each industrial concern adds to its motor equipment from year to year, and that each sale of additional service becomes easier than the preceding one. At present the revenue from the sale of motor service in Muncie is greater than that from lighting. During the first part of 1914 the revenue for motor service alone averaged at the rate of about $4.85 per capita.

Apartment-House Owners Provide Free Fan Service

To make one of its apartment houses especially attractive and comfortable during the hot summer months, the Consolidated Realty Company, Louisville, Ky., has installed sixty electric fans. These have been distributed among the apartments according to their size. No additional charge is made for the service which will be furnished through the four summer months. At the end of that time the fans will be leased to the tenants, or will be collected and stored until next season. The fans are of the 8-in. non-oscillating type. Another high-class apartment house now being built by the same realty company will be similarly equipped with fans and also provided with beds which slide into recesses in the wall during the daytime.

An Effective Way to Operate a Gasoline Engine

Recently a motor sales engineer employed by the St. Clair County Gas & Electric Company, of Belleville, Ill., called to see a local manufacturer who had a large warehouse in course of erection. He found the owner in an almost frantic condition induced by the erratic performance of his gasoline engine, which was direct-connected to a concrete mixer. For two days this engine had defied the mechanical talent of the city, barking spasmodically and then subsiding into deep and unbroken repose. Needless to say, the enjoyment which this behavior caused the small army of laborers was not reflected in the looks or diction of their employer. He appealed to the central-station man for aid in starting the engine, with the result as shown in the picture. The engine started forty minutes later with less noise, it is true—but not to stop again without permission until the entire building was completed.



MOTOR-DRIVEN CONCRETE MIXER AT BELLEVILLE, ILL.

The Building Structure for the Home Garage

The construction and architecture of the building to house the electric automobile kept on the owner's premises were discussed before the Washington Section of the Electric Vehicle Association recently by Mr. H. B. Hart, of the Potomac Electric Power Company. The structure selected may vary from that of a size just able to house the car and charging equipment to one of liberal convenience and possibly even spare capacity for a second car. The architecture will be governed, of course, by the amount of money to be spent and the design of the home building and the space available. Such garages may cost as much as $2,000, although, on the other hand, a plain sheet-metal building can be erected for $100 to $200. Similar brick construction would cost perhaps $400

In considering the plans for a garage, stated Mr.

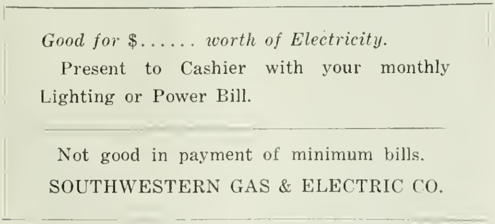
Hart, owners should not overlook the fact that the expenditure of a little extra money for conveniences may add much to the usefulness of the garage. Plenty of light should be provided and several outlets should be arranged for extension lamps to aid in inspection. A floor sloping to a drain is a great convenience where the car is washed in the garage. Provision should also be made for heating the garage in winter, so that the temperature of the battery may be kept close to normal even in extremely cold weather. In small garages this can often be economically and conveniently accomplished by small electric heaters, provided the structure is well built.

Besides the usual minor tool equipment for making incidental repairs and adjustments, the owners should not fail to provide a workbench with a vise and an assortment of wrenches and miscellaneous tools. There should also be jacks to lift the wheels when replacing damaged tires or adjusting and testing brakes. When the car is to be laid up for a month or so the jacks prove useful in relieving the pneumatic tires of their load. With the car on the jacks one can also measure the energy required to see that the mechanism operates freely. Tires should be pumped by gage and the pressure checked at least once a week. By all means, added Mr. Hart, have at least one fire extinguisher and provide a small metal locker in which to keep oil, grease, polish, rags, spare parts or lamps, fuses, tires, hydrometer, thermometer, a pitcher for distilled water, etc.

"Free Electricity" with Each Appliance

At the time of the recent "electrical show" given by the electrical interests of Shreveport, La., the local central-station company presented to the purchaser of each energy-consuming device bought from one of the exhibitors a credit memorandum good for from 50 cents to $3.50 in the payment of the customer's electricity bills. The size of the allowance was based on a schedule of 50 cents for every 50 watts of demand of the appliance purchased, but no memorandum was issued for an amount greater than that above named. Thus, a customer who paid the special price of $2 for a 500-watt electric iron received in addition a credit slip for $3.50, equivalent to the cost of about 40 kw-hr. at the Shreveport rate of 8.5 cents per kw-hr. This credit slip was not good, of course, for the payment of minimum bills.

During the electrical show nearly 600 irons were sold by the contractors and dealers who made exhibits.



Good for $...... worth of Electricity.

Present to Cashier with your monthly Lighting or Power Bill.

Not good in payment of minimum bills.

SOUTHWESTERN GAS & ELECTRIC CO.

CREDIT SLIP USED AT SHREVEPORT, LA.

In Shreveport the average revenue from a 500-watt electric iron is said to be about $1 per month with energy at 8.5 cents per kw-hr., and although the "free electricity" tickets cost the company a good deal the first few months, it is believed that the new business secured through the use of the plan will make the investment a profitable one in the future.

Handling the Customer with a Complaint

"When a customer calls in person to make a complaint, much diplomacy is required," said Mr. F. R. Slater in a discussion of public policy of utility corporations before the recent Southwestern electrical convention at Galveston, Tex.

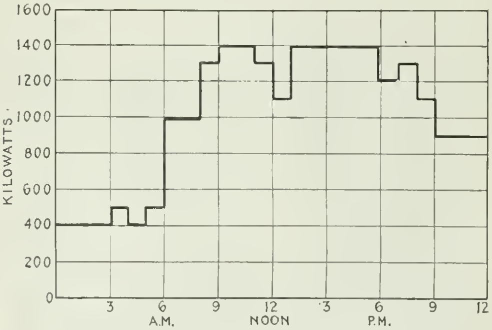
"Such a complaining customer has usually come at some personal inconvenience, and not infrequently has recited to himself so many times his grievance, real or fancied, that he is on the point of exploding when he gets to your office. Listen to his troubles patiently and try to take his viewpoint; you will frequently find that his grievance is trivial and can be readily adjusted without any real trouble on your part. If a complaining patron can be pacified, and at the same time be shown that an endeavor is being made to remedy the situation he has brought to your attention, he is likely to prove a mighty live friend of the company ever after. Much adverse public sentiment with which corporations have to contend could be dissipated if systematic attention were paid to the troubles which individual patrons have on their minds.

"Show appreciation of every service rendered by your patron. If he calls your attention to some fault or weakness in your service—thank him. If he makes a suggestion for the betterment of the service—thank him. If he gives you an order to furnish him your service—thank him. If he pays his bill—thank him. In short, for every service rendered, no matter how trivial, say 'Thank you,' and say it because you mean it."

Daylight Peak Caused by Motor Load at Meridian, Miss.

Unusual load conditions prevail on the system of the Meridian (Miss.) Light & Railway Company, where owing to the large rating in motors connected the demand during daylight hours often exceeds that during the lighting peak. The Meridian company at present has a motor load aggregating 2800 hp, which is divided up among 275 motors. Its total connected load including both lighting service and motor service amounts to 5700 hp.

Below is the load curve of the Meridian steam-turbine station, whose output also includes 5000-volt direct current furnished through rotary converters for the street railway. As revealed by the sketch, the load during the hours of the day is actually greater than the lighting peak which comes between 6 and 9 o'clock p. m. The curve reproduced herewith indicates a load-factor of nearly 70 per cent.



STATION LOAD CURVE, MERIDIAN, MISS.

Illumination and Wiring

Arrangement of Primary and Secondary Lines on Cross-Arms

To afford as much protection as possible to its linemen when they are working on poles, the Public Service Electric Company of New Jersey uses the following construction on its overhead city lines where energy is distributed from the substations over 2400-volt single-phase circuits. The primary conductors are supported on insulators at the outer ends of the top cross-arms well out of reach of men on the pole, while the secondary circuits fed from pole transformers are arranged on a lower cross-arm or else on each side of the pole head on the upper cross-arm. Series street-lighting circuits are also placed as far out on the cross-arms as possible to prevent linemen from coming in accidental contact with them.

An Elaborate Spectacular Sign at Chicago

The large "Do It Electrically" sign which has been in operation for some time on the Harrison Street station of the Commonwealth Edison Company has recently had added to it a spectacular flashing portion. This addition represents the forging of a hot steel bar under a converted steam hammer, the steam power having been superseded by compressed air pumped by an electric motor using central-station energy.

Two machine attendants are represented, one operating the control lever and the other forming the steel bar. The latter is seen to place the white-hot bar beneath the hammer, and at each blow sparks flash out realistically, decreasing in quantity as the iron cools. By outlining the connecting rod with a double circuit of amber and ruby lamps the bar is made gradually to lose its "white-hot" color and to assume a "cherry-red" heat as the hammering continues and the rod cools. The portion of the rod held in and adjacent to the hands of the workman is illuminated with amber-colored lamps to represent a lesser degree of heat.

The movements of the other workman are particularly realistic. With his hand on the throttle he moves it slightly once or twice, to make sure the hammer is operating correctly. Then he throws the valve wide open and allows the hammer to strike with its full blow.

Color effects are secured by using colored-glass tips, which are fastened to the bulbs by means of small springs. Green hoods are employed to outline the machinery, opal hoods for the hammer head and men, and ruby and amber tips for the steel bar and sparks.

Installed in the entire sign are 3617 10-watt tungsten lamps, 1600 of which are in the flashing portion. The total connected load is about 50 hp. Energy is supplied to the sockets of the new addition at 11 volts, being reduced to this pressure by a 10-kw transformer installed near the sign.

The total length of the display is 204 ft. and the height 42 ft., the flashing portion being 55 ft. wide. The magnitude of the sign is indicated by the height of the machine attendants, who are 36 ft. tall.

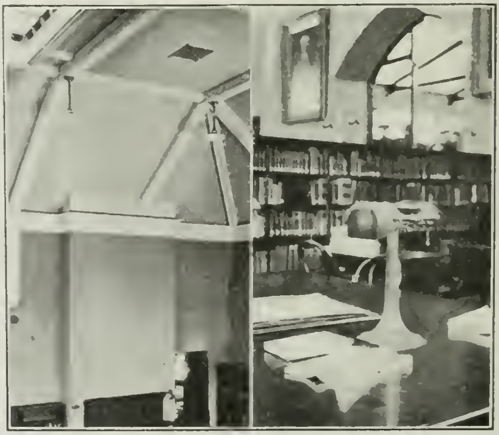
Ten seconds is required for a complete operation of the sign, the bar being on the anvil eight seconds. The sign was manufactured by the Federal Sign System (Electric), Chicago, and the flasher was built by the Reynolds Electric Flasher Company, Chicago.

ELECTRIC SIGN ON HARRISON STREET STATION OF COMMONWEALTH EDISON COMPANY

Modernizing the Lighting of a Public Library

In connection with the recent remodeling of the Newton (Mass.) Free Public Library the interior electric-lighting installation has been thoroughly overhauled and the institution has now become one of the best illuminated buildings of its kind in New England. The principal engineering details of the improved installation are illustrated in the accompanying photographs. Typical equipments are described in relation to the various classes of lighting service required in the building. Energy for the library circuits is furnished by the local lines of the Edison Electric Illuminating Company of Boston.

Fig. 1 shows the general method of lighting the interior of the main reading and reference rooms, the view having been taken from a platform at one end on account of the high studding of the ceiling. This room is sectionalized by low shelves for reading and reference works, with a central aisle running from the vestibule to the delivery room, which is at the rear and between the reading rooms and stackrooms. It is about 58 ft. long by 35 ft. wide, the lamps being approximately 35 ft. above the floor. They are arranged in two rows



FIGS. 1 AND 2—LIGHTING SCHEME, READING AND REFERENCE ROOMS, AND TABLE FIXTURE

spaced 20 ft. apart, the individual lamps being about 8.5 ft. apart in each row. Eight 250-watt tungsten units with prismatic glass reflectors are provided to give an effective general illumination, the individual tables being equipped with two-lamp standards, as shown in Fig. 2.

The typical reading-room table standard is of dull-finished brass, carrying two parabolic porcelain shades, in each of which is mounted a 20-cp lamp on a horizontal axis. The outsides of these shades are tinted green, the inside surfaces being finished in white. The shades are adjustable through an angle of about 330 deg., so that glare can be prevented for readers of every height. The standards are 7 in. square at the bottom and the lamp axes are 16 in. above the table surface, the shades being each 9 in. long and $4\frac{1}{2}$ in. wide. Pull chains are provided at diagonally opposite corners of the fixture, and energy is supplied by a flexible metal conduit carried upward from the floor through the table and up the inside of the standard to the lamps. In the reading room the standard table is 10 ft. long and 4 ft. wide, the lamps being set with the center of the fixture 30 in. in from the edge, making the fixtures 5 ft. apart measured between centers. For the reference room the tables are 8 ft. long by 5 ft. wide, and each is provided with two fixtures holding two lamps each, the fixtures being each 2 ft. from the nearest edge and 4 ft. apart on centers.

Between the main aisle of the library and the reference room is a partition, having on one side shelves carrying books frequently consulted and on the other side photographic displays. The method of lighting these books and the photographic exhibitions is shown in Fig. 3. A typical case is 13 in. wide and about 6 ft. high, its length being 14 ft. Such a section is illuminated by six 20-cp lamps installed in pairs 18 in. apart laterally and 5 ft. apart longitudinally, associated lamps being hung from horizontal brass rods and surrounded by green and white porcelain bell-shaped shades 6 in. in diameter. Three 20-cp lamps, added to the ceiling equipment, suffice for the convenient use of the reference shelves and illuminate the exhibits on the opposite side of the case with entire success. The lamps are carried about 6.5 ft. above the floor, and the supporting rods are 13 in. high above the mahogany case.

Fig. 4 illustrates the local lighting of the delivery desk, which is 14.5 ft. long and 10 ft. wide, with a counter 39 in. high above the floor and 28 in. in width. At the front of the desk are two 20-cp lamps carried in standard reading-room shades at a height of 14 in. above the counter plane and set about 4 ft. apart. Two double 20-cp units set about 7.5 ft. apart are placed at the rear of the delivery counter, and the room is provided with excellent general illumination from twelve 100-watt lamps carried around the central rectangle at the roof-truss level. Adjacent to the delivery desk is a switch and fuse cabinet, illustrated in Fig. 5, controlling the local circuits in the reading and delivery room.

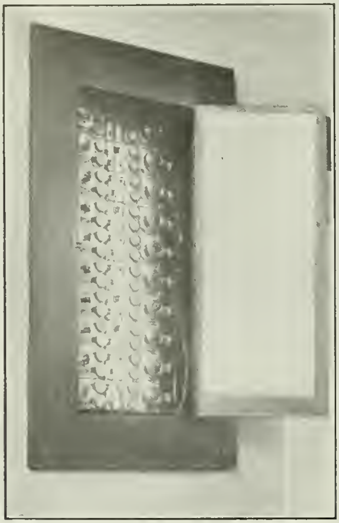
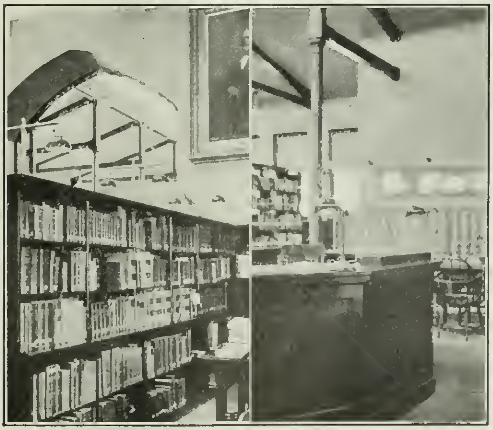
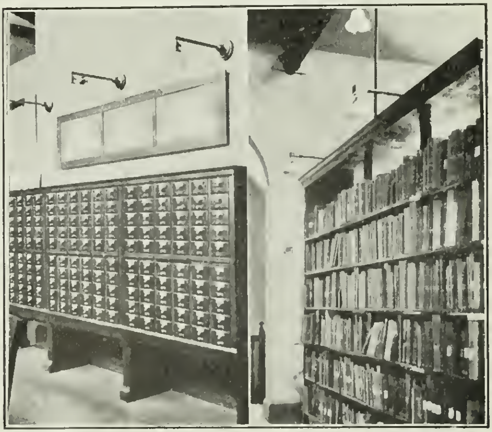


FIG. 5—SWITCH AND FUSE CABINET, DELIVERY ROOM

The card catalog, adjacent to the delivery desk, shares in the general illumination of the room, but is chiefly lighted by 20-cp lamps inclosed in sand-blasted-glass, bell-shaped shades, 7 in. in diameter and 5 in. deep, supported by brass rods 18 in. long and hung 25 in. above the top of the catalog case. The latter is of the "Library Bureau" type, with sixty drawers per sec-



FIGS. 3 AND 4—LIGHTING REFERENCE-BOOK SHELVES AND PHOTOGRAPH EXHIBITS, AND DELIVERY-DESK UNITS



FIGS. 6 AND 7—LIGHTING OF CARD CATALOG AND NEW-BOOK STACK

FIGS. 8 AND 9—LIGHTING OF MUSIC STACK AND MAIN STACKS

tion, a group of three sections being about 4 ft. long, 40 in. high and installed with the bottom 20 in. above the floor. One 20-cp lamp cares for the lighting of sixty card drawers, the lamp tip being installed vertically above the edge of the case, which is 18 in. wide. Fig. 6 illustrates a typical card-catalog-lighting section.

The new-book stack (Fig. 7) is composed of sets of shelves 18 in. wide and about 7.5 ft. high, a section 9.5 ft. long, parallel to the shelves, being illuminated by two 40-watt tungsten lamps carried by condulet outlets attached to pipe conduit run along the tops of the shelves, as shown in Fig. 8. The lamps are spaced 4 ft. 8 in. apart in front of the shelves and are carried about 12 in. out from the shelf in each case. The neighboring sets of shelves are about 5 ft. apart, and it is found unnecessary to light more than alternate lamps between each stack, the amount of light being sufficient from two units beneath each group of shelves.

Fig. 8 represents the lighting of the music stack, the shelf units of which are 35 in. apart horizontally, served by four outlets per intermediate section, the conduit lines being 4 ft. 9 in. apart. In the present location of this stack a single 25-watt lamp between each set of shelves is sufficient on account of the general lighting available from above.

Fig. 9 shows the lighting provided for the main stacks behind the delivery room, each lamp being controlled by a separate key switch in its socket. The usual units are bare 20-cp lamps, these being hung 6 ft. above the floor and from 5.5 to 7.5 ft. apart. Three units handle the service of a 15-ft. stack, whose shelves, five in number per tier, are 18 in. wide and spaced 4 ft. 3 in. apart. These lamps are used mainly in intermittent service and are suspended by lamp cords from ceiling outlets.

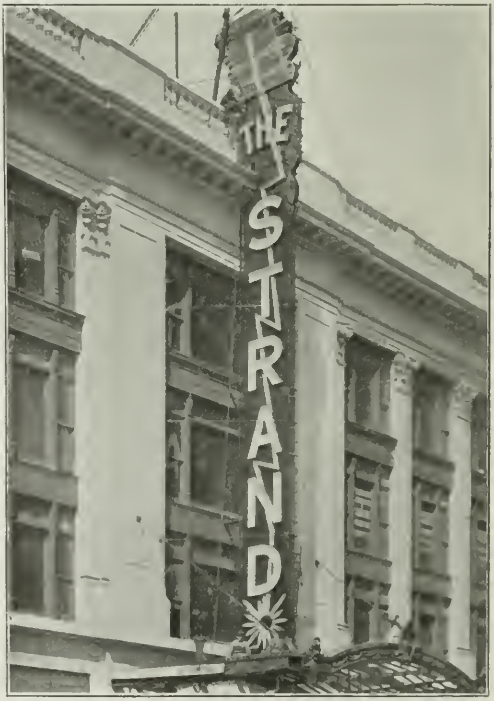
Emergency Cabinet for Line Department

To prevent its linemen from rushing out on dark, stormy nights to re-establish service when they are only partly equipped for the work, the Wichita Falls (Tex.) Electric Company has provided its line department with an emergency cabinet. In this case are kept gloves, spurs, body belts, raincoats, boots, fuse boxes, fuse wires, pliers, hand axes, screwdrivers, hand lines, ropes, lanterns, searchlamps, matches, etc. The searchlamp is particularly useful, being mounted on a tripod so that it can be swung in all directions and flashed on the pole tops for inspection or to facilitate night construction or repair work.

Sign Representing Lightning Stroke and Producing Crash

In front of the new Strand Theater, New York, is an electric sign designed to attract attention to the name of the theater which represents a lightning stroke from some artificial clouds to earth and produces a blue flash and a crash as the lightning strikes. The clouds are very ingeniously constructed so as not to display their source of illumination and to represent sheet lightning prior to the direct stroke. The clouds consists of horizontal metal strips arranged like a louver so that the light from within is diffused over the visible portion of the vanes, which are painted to represent clouds. By causing the light to flicker a semblance of sheet lightning is produced, after which a zigzag stroke darts downward along the sign, terminating with a flash and a crash from the discharge of high-potential energy across a gap. The high-potential discharge is caused by an oscillator similar to that used in wireless-telegraph work. The coil is installed within the building, and the terminals are led out through insulated bushings to the discharge points. While the lightning stroke is spectacular, the noise accompanying the discharge at the gap is decidedly more so and is very effective in attracting the attention of passers-by who are not in the habit of observing illuminating effects.

The sign and flasher were constructed in the factory owned by Mr. Mortimer Norden, New York.



SIGN REPRESENTING LIGHTNING STROKE

Recent Telephone Patents

The transmitter patented by Mr. H. E. Shreeve, of Millburn, N. J., is intended for use with heavy currents as for loud-speaking circuits, and is designed with particular view to the dissipation of heat. The rear part of the instrument is a large circular block of metal carrying deep grooves to increase its radiating surface. The rear electrode is mounted on the front face of this block at its center, and an annular groove in the metal surrounds the electrode. In this groove there rests a ring of catlinite which projects sufficiently to form the side walls of the granule box. A thick plate of metal similarly grooved carries the front electrode and provides a seat for the front end of the catlinite ring. The movable electrode lies midway within the chamber and is mounted upon a stud which fuses through an insulated stuffing box of the front electrode. No casing of the usual sort is provided, but a face plate carrying the mouthpiece and forming a seat for the diaphragm is arranged over the front plate. The patent is assigned to the Western Electric Company.

Antiseptic Device

Antiseptic devices still attract the effort of inventors. Of two patents bearing on this subject recently issued, one, granted to Messrs. E. M. Doeringer and A. C. St. Marie, of San Francisco, Cal., describes a device in the form of a hollow sheet metal cone which fits the base of a mouthpiece, being inserted from the front. It is filled with antiseptic fiber and has lugs which so maintain its position that space is left for passage of sound.

The intercommunication feature of the circuit system patented by Mr. William Aitken, of Liverpool, England, relates to a main line and an extension station upon an exchange line. The main-line station can signal and talk with the extension or can extend the exchange line to the extension. The novelty lies in arranging an electromagnetic trip so that after a conversation involving the extension the keys at the main station are automatically restored to normal.

Testing Circuit

Mr. H. M. Friendly, of Portland, Ore., has patented a method of testing conductors especially designed for wire chiefs' use. Here the idea has been to eliminate calculation as far as possible in the location of faults by the loop test. The special instrument consists of a voltmeter the moving coil of which is tapped at its middle. The high series resistance is in two portions with the coil in the middle, one portion being adjustable by an arm and dial. If the battery be connected from the ground to the middle terminal of the voltmeter, and the two ends of the coil be connected to the two wires of a faulty conductor having the distant ends strapped together, the voltmeter may be adjusted to zero by the variable series resistance. Zero reading will indicate equal current, and therefore equal resistance, in each side of the voltmeter, and the amount of series resistance cut out will equal the resistance of the conductor beyond the fault. There are other similar methods of use for this apparatus.

New Apparatus

Mr. G. H. Nash, Highbury, London, England, has patented a relay cap and assigned his rights therein to the Western Electric Company. The novelty of this device lies in the mode of attaching the cap to the relay. Inwardly projecting radial lugs stamped in the cylindrical case engage with similarly formed spiral grooves in the cap mounting and hold the two pieces firmly together. When attaching the cap to the relay the lugs and groove are registered and the cover twisted slightly about its axis.

Letters to the Editors

Power-Bond Election in Los Angeles

To the Editors of the Electrical World:

Sirs:—In the May 30 issue of the *Electrical World* there is a letter from Mr. E. F. Scattergood, chief electrical engineer for the Bureau of Los Angeles Aqueduct Power, taking exception to my criticism regarding the estimated cost of distribution for the city of Los Angeles. Mr. Scattergood backs his estimate by the statement of the three independent engineers employed by the city to check it.

The differences in the estimates are mainly due to the fact that both Mr. Scattergood and the three engineers mentioned have figured on a hypothetical case, assuming that there is no existing distributing system in the city of Los Angeles and omitting consideration of the fact that the inhabitants thereof have invested hundreds of thousands of dollars in apparatus. For instance, there is a great difference between estimates on the underground system. The existing companies furnish three-wire direct current at 110/220 volts to practically every modern office building, as the baseboards of these offices are equipped with appliances for using direct current at that potential. Furthermore, most of the modern office buildings going up in Los Angeles are being equipped with 220-volt modern traction elevators. These elevators are designed to operate on 220-volt direct-current energy only. Also, every newspaper published in the city of Los Angeles, with the exception of one, uses 110-volt or 220-volt direct-current energy. To supply this service means a very large capital investment in substations, motor-generator sets, heavy copper feeders, and, in the case of the Southern California Edison Company, a large storage-battery auxiliary.

Apparently the policy of the city of Los Angeles as expressed through its engineers, Mr. Scattergood and his assistants, is that the three-wire direct-current system is obsolete; that the people can use alternating-current elevators, if they need elevators; that they can scrap thousands of dollars' worth of small direct-current motors and purchase the alternating-current type, and that, in fact, the people should take what the city gives them and be thankful. This one item of difference in the cost of furnishing alternating and direct current is the cause of a great deal of discrepancy in the estimates.

Under the state law, the public-utility companies are required to use an equivalent of No. 4-0 conductors, or twice the size of the main conductors, for all potentials over 15,000 volts wherever the lines pass over any telephone, telegraph or other wires of lower potential. Mr. Scattergood in his estimate did not figure on this size of conductor; perhaps the city is above the law. The State also compels public-utility companies to use a certain amount of clearance between conductors, the companies being required to use poles at least 45 ft. in height for most of their work. From Mr. Scattergood's estimate of cost of poles, the city cannot possibly purchase poles of this size for the amount given. The estimate made by the three engineers was based on fast-closed lines, according to their instructions, and they were not taken from the service now existing, but given as the solution of a hypothetical case. They also know, as does Mr. Scattergood, that the amount voted on at the recent election cannot possibly duplicate the present distributing systems of the city of Los Angeles and give the people the service they require and have been receiving from private companies.

The aqueduct engineers make no provision for steam-plant reserve. During the severe storms of last winter, when transmission lines, bridges and roadways were washed out throughout southern California, the city service, had it been in existence, would have been out of commission for many weeks. Although the Edison transmission lines were washed out, still service to customers was not interrupted for more than one hour, owing to the presence of the large steam auxiliary plants always in commission.

J. A. Lighthipe,

Electrical Engineer Southern California Edison Company.

Los Angeles, Cal.

Power-Bond Election in Los Angeles

To the Editors of the Electrical World:

Sirs:—Referring to the communication of Mr. E. F. Scattergood in your issue of May 30, in which he takes issue with Mr. J. A. Lighthipe over the latter's contention that "the plant of the city cannot be finished for the amount estimated," the writer has made an independent investigation covering this phase of the Los Angeles problem and has reached conclusions which are at variance with the results to be inferred from the report of Prof. C. L. Cory, Dr. George L. Hoxie and Mr. C. W. Koiner.

It is useless, in a consideration of engineering data, to introduce "suppositions contrary to fact," and it is to be regretted that the political exigencies of this case demanded the presentation to the engineers of certain hypothetical questions which would yield to a reasonable degree the answer desired by the city.

A correct analysis of the possibilities of condemning a portion of the system of the Southern California Edison Company presents more than the mere assumption of control of a system already established, with or without the consent of the party owning the property to be condemned. To the cost of this portion of the Edison company's system must be added the damage sustained by the severance of a considerable portion of an interconnected system, such as that of the Southern California Edison Company. In addition to this, the city will have to obtain the consent of every public-service company in Los Angeles to acquire the Edison company's rights on any jointly owned pole. The legal phases of the problem present difficulties which will lead to the early abandonment of the scheme or to the deferring of the distribution of aqueduct power for many years to come. We must, therefore, consider the city as an incoming competitor, with $5,250,000 available for the construction of a complete distributing system.

The first step taken by the incoming company (rates being equal) should be to render the consumers the same service now given by existing companies. What is the policy as proposed by the city? An examination of the engineers' report displays the rather startling anomaly of ignoring entirely the demands of a large class of consumers operating motors who desire to use 110-volt and 220-volt direct-current energy, now adequately delivered over a system representing an investment of almost $1,000,000. Such policy on the part of the city prohibits its getting any but a small portion of either the alternating-current or direct-current load in the commercial districts. The city will, therefore, find itself under the necessity of taking only the business of the small lighting consumer, the citizen who believes he is to get something for nothing in securing municipal service. The recent bond election furnished ample evidence that these citizens are fairly uniformly distributed throughout the entire city, making a complete distributing system imperative from a competitor's standpoint. All business, however small, that is available must be obtained, even though much of it must be operated at a loss and at a very poor load-factor.

With reference to construction costs on a distributing system in Los Angeles under present conditions, it should be noted that a competing company entering the field is confronted with a comprehensive system of jointly owned poles. Notwithstanding that many streets have been left free and open to a competitor, the item of crossing clearances, as demanded by the regulations of the Railroad Commission, and statute requirements governing overhead construction, render the installation of an additional system impracticable and expensive.

Even from a theoretical standpoint, a distributing system, as proposed by the city, cannot be erected for the amount named in the engineers' estimates, even under the assumption that 40-ft. poles are used throughout. The average pole which the city will be compelled to set will be about 50 ft. in length. The cost of obtaining proper clearance to comply with existing regulations will amount to more than other labor costs on the city's lines. The figures submitted by the engineers represent restricted and ideal conditions which are not found to exist.

However, when the time comes and excuses are required, we may be able to quote reasons similar to that presented in the twelfth annual report of the Bureau of Public Service Commission relating to the dissipation of the former bond issue of $3,500,000. This report offers such interesting reading that I quote it herewith, in part: "The estimates, however, were greatly exceeded, partly because the final designs were changed in order to increase both the amount and the reliability of the power to be developed, but mostly because a great deal of rock, through which tunnels were driven, was found to be very bad, rendering the tunnel work much more expensive than was estimated."

Professor Cory, Dr. Hoxie and Mr. Koiner should certainly know, as Mr. Lighthipe knows, that the city system will not be installed for any figure approximating that represented by the bond issue. No criticism is intended reflecting upon these or the other eminent engineers who were called upon to answer certain hypothetical questions, except in so far as any of them had a part in the framing of these questions. The instructions issued to these engineers limited their examination and report to a consideration of:

(a) The cost of installing a distributing system such as would be appropriate for taking care of all electrical service within the city, exclusive of railways. (This is a theoretical consideration, not capable of even approximate realization and, taken in connection with the omissions previously noted, is without value.)

(b) The annual cost of operation of such a distributing system. (This is immaterial for assumptions given before.)

(c) An estimate of the annual income which the city would derive from the operation of such distributing system.

The absurdity of the conclusions which the engineers were compelled to present as prescribed in (c) is excelled only by the crudity of the idea of seeking practical advice on a purely academic question.

In view of the foregoing considerations, it will probably be well to await developments, when the statement of Mr. Lighthipe will have been proved eminently correct.

Los Angeles, Cal. J. E. Macdonald.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Boiler Brickwork and High CO_2 Ratios

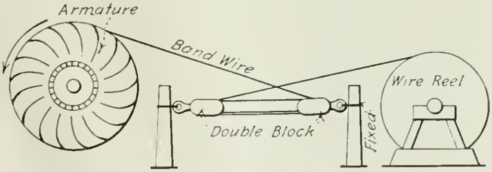
While the limiting theoretical CO_2 content in flue gases is 18 per cent to 20 per cent, it is not advisable to carry the proportion above 12 per cent to 15 per cent in actual boiler operation, on account of the high temperature to which the firebrick will be thereby subjected. At ratios above 15 per cent combustion may be so intense that the brick becomes white-hot and cannot withstand such high temperatures for more than a short time. One Southern plant operator recently made the experiment of running his CO_2 content at 18 per cent one night. For the benefit of engineers who have tried the same experiment it will be hardly necessary to add that he rebuilt his furnaces next day!

The Leaky Roof and the Leaky Steam Pipe

In the smaller electric-light plants of the country many an engineer spends a part or all of his Sunday repacking a leaky joint in some steam main which is "always giving trouble." Some of these chronic leaks may be traced to specific causes, and removal of the cause will prevent their recurrence. Perhaps the most unsuspected and least apparent of these causes is found in a roof leak above the pipe. On a rainy day water drips through the hole in a tiny stream, cooling the top of the pipe as it strikes. The resulting uneven expansion brings about a leaky joint or a blown-out gasket. Repairing the leak in the roof is generally easier than fixing the gasket and is surely more effective.

Banding Armatures with Sheave Blocks

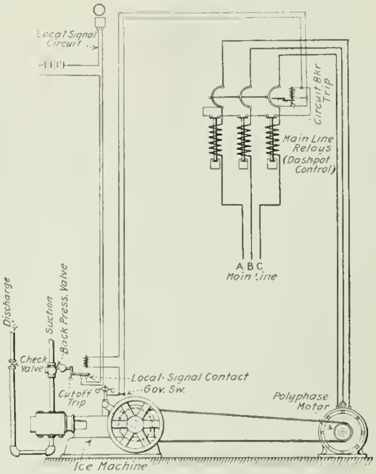
In banding armatures the band wire should be applied with a uniform steady tension under the close control of the operator. The accompanying sketch shows a method of using a four-pulley arrangement of sheave blocks to apply this tension. The scheme illustrated was improvised "on the job" in a plant where the usual equipment for banding was not available, and it at once proved entirely successful, band wire as large as No. 12 gage being handled with ease. By varying the tension of the wire as it is paid off the reel the friction of the pulleys can be adjusted to give the required tension in the wire going onto the armature.



ARRANGEMENT FOR BANDING ARMATURES WITH SHEAVE BLOCKS

An Electrical Remedy for Ice-Plant Troubles

Mr. Nels Joleen, of the Commonwealth Edison Company, Chicago, has recently perfected a wiring scheme for remedying operating troubles in motor-driven ice plants. One of the sources of trouble in the past has been the failure of a fuse in one phase of the three-phase motor circuit, allowing the motor to operate as a single-phase unit until either the motor windings or the control apparatus has burned out. To eliminate this trouble, a main-line relay was inserted in each phase and three pairs of contacts were arranged in series so that the interruption of any phase actuates the main circuit-breaker trip, opening all three phases. At first it was thought that the three-phase circuit-breaker would open with the failure of any one phase, but experience seems to indicate that relays are necessary.



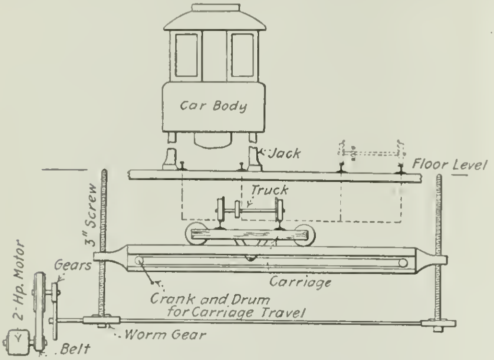
CONNECTIONS FOR REDUCING ICE-PLANT TROUBLES

In multiple with the same circuit-breaker trip coil is another circuit which controls the compressor suction valve and is also connected in series with the contact points of a governor switch. When any phase of the feeder circuit fails the small coil above the cut-off trip is de-energized and drops its armature, accomplishing two results. First, it closes the suction line to the ice machine, taking the majority of the load from the compressor and motor. Second, it closes a local signal circuit, ringing a bell to inform the attendant that the valve in the suction line has been closed. This valve must be opened manually after the plant has resumed operation.

In case the compressor becomes overloaded to such an extent as to cause a serious reduction in speed the governor switch shown above the compressor interrupts the trip-coil circuit. This action takes the load off the compressor by closing the suction-line valve. The alarm bell at the same time notifies the attendant of the trouble. This wiring scheme, with slight variations to suit local conditions, has been in operation in a number of large Chicago ice plants for several months, and it has been instrumental in reducing operating troubles. Reductions in maximum-demand readings have been also effected by the action of the compressor governor switch.

Motor-Driven Transfer Table for Car Shop

With the motor-driven rising and falling transfer table shown in the accompanying sketch one man can remove and replace a car truck in an hour's time, according to Mr. I. H. McArthur, superintendent of the Meridian (Miss.) street-railway system. Mr. McArthur improvised this apparatus out of old rails and spare parts and has found it extremely useful.



ARRANGEMENT OF MOTOR-DRIVEN TRANSFER TABLE

The transfer table is mounted in a concrete-lined repair pit and its movable carriage carries a 5-ft. section of the track. The car truck to be removed is run onto this depressible section and the car body supported by jacks. The 2-hp motor is then set in motion to operate the 3-in. main screws through belt and worm-gear connections, thus lowering the entire carriage with the truck in place on its rails. When the carriage is depressed enough to clear all parts, it is run across on its own transverse rails and is then again raised to floor level at the side of the car, so that the truck can be inspected, repaired or replaced. The use of double worm gears enables the platform to support a 1200-lb. load in any position without drifting. The belt provides a safety member which will slip in the event of improper operation of the transfer table.

The Purchase of Power-Plant Lubricants

In a paper on "Lubrication" presented before the Mississippi Electric Association at Meridian, Miss., Mr. R. L. Ellis, who is superintendent of the Selma (Ala.) Lighting Company and president of the Alabama Electrical Association, gave some pointed advice on the selection and purchase of lubricants. In general, said the speaker, friction is of two kinds, that due to attrition between the bearing surfaces and that within the lubricant itself. To reduce the latter internal friction to its minimum the lubricant selected should be the lightest oil which will hold the surfaces apart. Viscosity is a function of the temperature of the lubricant, $T \times V^n$ being a constant. Plotted on logarithmic paper, this relation becomes a straight line with the exponent n representing the angle of slope.

In the selection of lubricants, Mr. Ellis urged that the purchaser himself take the responsibility of applying common-sense principles to the problem instead of relying on the judgment of so-called "experts" whose own opinions could only be guesses based on the same principles but invariably requiring experimental confirmation also. Mr. Ellis said he recently submitted a detailed report of his oil requirements to four lubricant manufacturers, and that the only point on which they all agreed was that "the conditions described were unusually severe and would require the use of special high-grade oils." After visits from the experts of the four companies Mr. Ellis did not feel reassured by their disagreement among themselves, so he ordered for experimental use samples of all the oils recommended by each and some fifty other oils besides. These were tested in service and analyzed both chemically and physically until a satisfactory inexpensive lubricant was discovered for each purpose. In many cases the only difference found between the oils was in their cost to the purchaser. High prices, declared the speaker, are often attributable chiefly to psychology and salesmanship rather than to inherent differences of quality.

"Burn into the memory of every employee of your company," said Mr. Ellis, "that there is necessarily no relation between price and quality, or, as Henry Ford has put it: 'None but a snob or a fool confuses economy with cheapness.'"

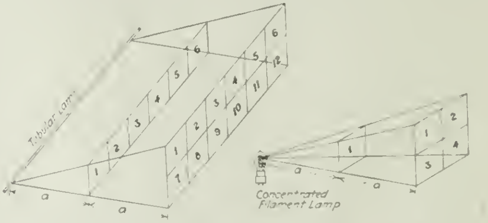
As the result of his investigation into lubrication Mr. Ellis said he has reduced the cost of his cylinder oil to 20 cents a gallon and other oils to 14 cents. His car lubrication cost now averages 19 cents per 1000 car miles. His total oil bill at the plant, which has a monthly output of 200,000 kw-hr., is $15 a month, or 0.0075 cent per kw-hr.

Law of Inverse Squares and Tubular Light Sources

How does the law of inverse squares apply when a surface is illuminated by a source of light having considerable length?

W. E. R.

While the familiar law of inverse squares holds for the intensity of illumination surrounding a point light source, it must be remembered that different conditions exist when the light source has considerable area or length. The light flux from a tubular or straight-filament lamp to the surface illuminated thereby may be considered as forming a solid wedge, therefore the intensity is inversely proportional to the distance from the line source of light. The accompanying drawings illustrate diagrammatically how the intensity varies with point and line sources of light.



GRAPHICAL REPRESENTATION OF LIGHT FLUX FROM POINT AND LINE SOURCES OF LIGHT

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Air-Blast Cooling of Transformers.—F. J. Teago.—A long illustrated abstract of a paper read before the Manchester Section of the (British) Institution of Electrical Engineers on experiments which were made on a 12-kva core-type transformer in order to obtain accurate information concerning the relation between the "heat rating" and the quantity and condition of the cooling air. The chief results are as follows: The temperature rise of the transformer is independent of the temperature of the inlet air within ordinary limits, provided that the surfaces to which the heat is radiated—that is, the walls, etc., of the room—are at the air temperature. Variations in the barometric pressure only affect the temperature rise to a small extent, and the correction is negligible for the small variations in the barometric pressure from day to day. The humidity of the air, up to the point of saturation, has no appreciable effect on the temperature rise. Some experiments were also made with a "fogged" atmosphere produced by atomizing water at the inlet to the transformers. The results justify the serious consideration of a "fogged" atmosphere as a cooling medium for electrical machinery, especially where the electrical pressure is only moderately high.—London *Electrician*, June 5, 1914.

Three-Phase Synchronous Machine.—T. F. Wall.—An article illustrated by diagrams in which the author deals with the development of the circle diagram for a three-phase synchronous machine and compares some experimental results with those obtained theoretically. —London *Electrician*, June 5, 1914.

Lamps and Lighting

Rating of Incandescent Lamps.—H. Lux.—A special committee of the German Illuminating Engineering Society has recently recommended that a lamp should be rated according to mean hemispherical candle-power J_o, or according to the mean lower hemispherical candle-power J_u, or according to the mean horizontal candle-power J_h. In ratings of lamps it must be exactly stated which of these three candle-powers is meant. From a purely physical standpoint the mean spherical candle-power is of most value, but for practical reasons it would often be inconvenient to discontinue the present rating by horizontal or lower hemispherical candle-powers. The committee recommended that there be stated in all such cases the conversion factor by which the mean spherical candle-power may be found. The present author points out that this recommendation is important for the new half-watt lamps. With carbon lamps and the old metallic-filament lamps it was sufficient to give the mean horizontal candle-power, because for these lamps the ratio of the mean spherical candle-power to the mean horizontal candle-power is practically constant, the value being 0.8. If one speaks of such a lamp with a specific consumption of 1.1 watts per hefner candle, one means that 1.1 watts produces 0.5 hefner candle in the horizontal direction, although one mean spherical candle-power requires 1.375 watts. With the new nitrogen-filled lamp with the filament in form of a spiral coil, there is the difficulty that the ratio of horizontal candle-power to mean spherical candle-power varies within rather wide limits. It is therefore necessary in giving the specific consumption to base it on the total light sent out from the lamp. This equals $4\,\pi J_o$. The author urges that incandescent-lamp manufacturers should agree to give in future the specific consumption per mean spherical candle-power. In the period of transition one might say, for instance, that a lamp has the same specific consumption as a standard metallic-filament lamp of 1 watt. For a basis of comparison the following values may be used: A standard metallic-filament lamp with a specific consumption of 0.8 watt per horizontal hefner candle-power has a specific consumption of 1 watt per mean spherical hefner candle-power. In the same way 1 watt per horizontal hefner candle-power corresponds to 1.25 watts per mean spherical hefner candle-power. Further, 1.1 watts per mean horizontal hefner candle-power corresponds to 1.375 watts per mean spherical hefner candle-power. The author urges that such an agreement is very important, for even skilled incandescent-lamp engineers are often in doubt how to "load" correctly the new types of lamps since the simple determination of the horizontal candle-power may lead to great errors. A simple method for determining whether two lamps are equally loaded is the use of a Lummer-Brodhun photometer, especially in the form of the contrast photometer. If the photometer field illuminated by the one lamp on the left is yellow in color while the photometer field illuminated by the other lamp on the right is blue, it must be concluded that the lamp on the right carries the greater load. If the lamp on the right is the standard lamp or the lamp of comparison, it is necessary only to increase the voltage of the lamp on the left until the two photometer fields show exactly the same color. When the new tungsten lamps having their filaments in the form of spiral coils are tested the peculiar result is found that the specific consumption per mean spherical candle-power is higher than for lamps with a straight filament.—*Zeit. f. Beleucht.*, May 30, 1914.

Vapor Arc Lamps.—A note on a recent British patent (No. 15,406, 1913) of the Deutsche Gasglühlicht Aktien-Gesellschaft. The body of the lamp is filled with a gas which, during the operation of the lamp by the vaporized mercury, is driven out of the arc chamber into either a special cooling chamber or the atmosphere. In the latter case the gas used is air; in the former neon or argon can be employed. The outlet from the arc chamber must be long enough to prevent the escape of the mercury vapor. To start the lamp the mercury is caused to boil either by external heating or by tilting the lamp so as to short-circuit the anodes.—London *Elec. Eng'ing*, May 28, 1914.

Generation, Transmission and Distribution

Suppression of the Third Harmonics.—R. Johs. Jensen.—The third harmonics in the voltage curve of an alternator can produce telephone disturbances if the neutral point of the dynamo is earthed. Former proposals made to overcome this disadvantage are briefly discussed and a wiring diagram is given showing a new method by means of which the third harmonics are entirely avoided. This method of wiring shown in Fig. 1 is analogous to the zigzag connections of a three-phase transformer. In the figure, *I*, *II* and *III* are the three phases of the machine. Each phase is subdivided into two equal parts 1 and 2 so that the machine must be built with an even number of slots per pole and per phase. Oscillographic voltage curves are given for a machine built according to this design and for an ordinary alternator.—*Elek. Zeit.*, June 4, 1914.

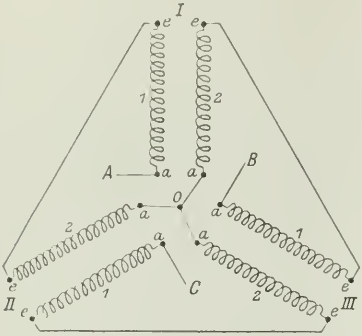


FIG. 1—WIRING DIAGRAM

Electrophysics and Magnetism

Experiments with an Incandescent Lamp.—C. W. S. CRAWLEY AND S. W. J. SMITH.—A note on a (British) Physical Society paper. The first of these experiments was due to Addenbrooke, who, using a 100-volt lamp filled with paraffin oil (the tip being removed) as a convenient high resistance in a 200-volt circuit, noticed that some of the many bubbles forming on the filament behaved in a curious way. Instead of rising at once to the surface from the point at which they formed, they ran down the legs of the filament, against gravity, and then escaped at the leading-in wires. Smith, led to repeat this experiment by Crawley, discovered another even more striking phenomenon. Placing the 100-volt lamp in a 100-volt circuit in series with a variable resistance (conveniently a water trough) it was found possible, by momentarily cutting out most of the resistance, to obtain a single bubble upon the wire. The behavior of such a bubble is very interesting to watch. Instead of escaping at either terminal, as in Addenbrooke's experiment, it travels backward and forward between the two, "looping the loops" of the filament in a fascinating way during every journey. The peculiarities of this phenomenon, which can be obtained with either direct or alternating supply, have been analyzed by examining the size and motion of the bubble under various conditions and also by using filaments of different materials and liquids of different boiling points. It was shown from the experiments that a rapid fall of temperature from the wire through the liquid, in the region through which the bubble moves, is an essential condition of the phenomenon, and also, from theoretical considerations, how this condition can be used to explain why the bubble moves in the manner described. Crawley pointed out, in connection with the first experiment, that the lamp proved most satisfactory, being able not only to absorb more power than with a vacuum, but also to stand momentary overload much better.—London *Electrician*, June 5, 1914.

Electric Brush Discharge in Solutions.—HAROLD SMITH.—An account of an experimental investigation on the spectroscopy of the electric brush discharge in weak acids and solutions. The brush was produced by means of an alternating-current transformer. The secondary terminals were connected to two platinum electrodes immersed in a small cell containing a solution. The author extended his observations into the ultra-violet region of the spectrum and investigated the differences which may occur between the positive and the negative brush. The chief results are as follows: The series and secondary spectrum of hydrogen are a great deal brighter in distilled water than in solutions for the same current value. In distilled water they are stronger in the negative brush than in the positive for the same current. When the potential drop through the brush is the same in each case, the spectra are strongest in the positive brush. In solutions the intensity of the spectra relative to the rest of the brush spectrum (water-vapor bands, platinum and oxygen lines, etc.) is considerably diminished. Neither the nature of the solution or the sign of the brush has any perceptible effect. There is no certain indication that electrolysis plays any part in the appearance of the spectra. The spectrum of the metallic lines of the solute appear in the negative brush in solutions. For constant current the spectrum grows in intensity with the concentration till a certain value of the concentration is reached, when no futher increase occurs. The spectrum appears in the case of the positive brush in the strongest solutions, and then only very faintly. The behavior of the spectrum in all cases can readily be explained from the point of view of electrolysis. The elementary line spectrum of oxygen appears in distilled water in both the positive and negative brush. In dilute acids, solutions of magnesium and zinc sulphates, and in tap-water, it appears in strength in the positive brush, but is generally absent or very weak in the negative. In solutions of salts of lithium, sodium and potassium its appearance in the positive brush is the same as for other solutions; in the negative brush the spectrum appears with the metallic lines of the salt, increases in intensity with them, and reaches its maximum with the same concentration of solution. The negative bands of nitrogen behave in the same manner. In the negative brush both the positive and negative bands appear in general remote from the point, while the oxygen lines are always produced close to the point. The arc spectrum of platinum appears in the negative uncondensed brush. In the condensed brush the spark lines appear. When copper wire is used in the point electrode the copper lines appear in each brush, but are strongest in the negative. The water-vapor bands appear in each brush equally well.—*Philos. Mag.*, May, 1914.

Units, Measurements and Instruments

Measuring Inductances.—W. HAMILTON WILSON.—An illustrated description of a convenient method for measuring inductance. Three different arrangements are shown in Fig. 2. The inductance to be measured is indicated by *L*, while *A* is a movable-coil direct-current ammeter, *B* a battery, *I* an interrupter, *S* a switch, *V* a voltmeter, and r_1 and r_2 non-inductive resistances. The interrupter *I* in the first left-hand diagram is a motor-driven insulating disk carrying a convenient number of contact pieces on its periphery, which make and break the battery circuit *N* times per second. The measurement may be made as follows: On rotating the interrupter with the switch *S* open, a reading A_1 is obtained on the movable-coil ammeter *A*. This reading can be adjusted to a convenient value by means of a non-inductive resistance r_2. The switch *S* is then closed, causing the ammeter reading to fall to a value A_2, due to the discharge of a quantity of electricity from the inductance on interruption of the magnetizing current. This discharge takes place through the circuit

L, S, A, r_{-2}, r_{-1}, and its direction through the ammeter is opposite to that of the battery current. If C is the magnetizing current interrupted and R is the total resistance of the circuit L, S, A, r_{-2}, r_{-1}, then the inductance $L = (A_1 - A_2) R/(NC)$ henries. Much greater sensibility may be obtained by adopting a form of interrupter having a slip-ring and making the connections as shown in the second (central) diagram. By adjusting the brush connected to the ammeter so that it makes contact just before the other brush breaks contact with the battery, the initial resistance A_1 can be greatly cut down without increase of the resistance r_{-2}. Hence the ammeter may be used with a shunt suitable for a smaller current. Any vibration of the brushes may cause variation in the ammeter reading A_1, owing to alteration in the time of contact, rendering it difficult to obtain the difference $(A_1 - A_2)$ accurately. The discharge current from the inductance may be read as a direct quantity by adopting the arrangement in the third (right-hand) diagram, in which 1, 2 and 3 are non-inductive resistance shunts. The readings in this case are less susceptible to vibration.—London *Electrician*, May 29, 1914.

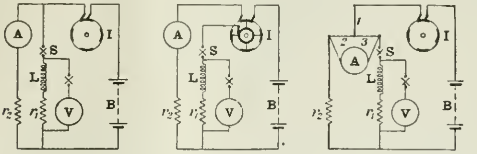


FIG. 2—ARRANGEMENTS FOR MEASURING INDUCTANCES

Insulation Testing Set.—An illustrated article on the "metrohm" insulating testing set of English make. The arrangement of the ohmmeter is shown in Fig. 3. The upper coil carries a current proportional to the voltage and the lower coil one inversely proportional to the resistance under test. The polar extensions are so shaped that the control exerted upon the former coil depends on its angular position, this latter being consequently a measure of the resistance under test, and that independently of the pressure. By appropriately shaping the pole pieces, almost any desired range and form of scale can be obtained. The insulating testing set comprises such an ohmmeter together with a generator combined in one case, the generator in the standard pattern giving 500 volts while the instrument is scaled up to 50 megohms.—London *Electrician*, May 22, 1914.

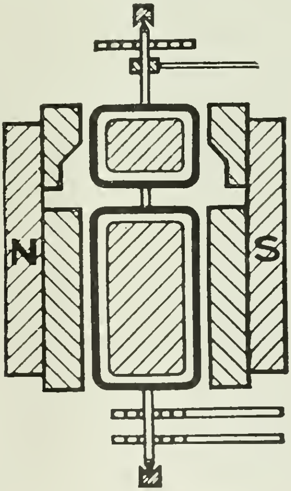


FIG. 3—DIAGRAM OF METROHM INSULATION TESTING APPARATUS

Telegraphy, Telephony and Signals

Electromagnetic Radiation.—LOUIS COHEN.—A mathematical paper giving a new method for deriving Hertz's formulas for the distribution of the electromagnetic forces and the radiation from a cylindrical oscillator. These formulas are being used considerably in wireless telegraphy. The present author's method of derivation employs only elementary mathematics.—*Journal Franklin Inst.*, April, 1914.

Wireless Telegraphic Measurements.—J. ERSKINE-MURRAY.—A paper read before the Wireless Society of London. The author describes the various methods of measurement of the different radio-telegraphic quantities. In this way he deals with power, current, voltage, capacity, inductance, coupling, wave-length decrement and efficiency.—London *Electrician*, June 5, 1914.

Book Reviews

WHERE AND WHY PUBLIC OWNERSHIP HAS FAILED. By Yves Guyot. Translated from the French by H. F. Baker. New York: The Macmillan Company. 460 pages. Price, $1.50.

The attitude of the author is expressed exactly in the following extract from his preface: "I have vainly sought for the benefit arising from public operation by state and municipalities. On the contrary, an unbiased survey of the whole subject forces me to testify to the resulting harm." The book contains an invaluable collection of data in regard to public ownership and operation of utilities, principally in European countries. It presents the thorough conviction of the author that public ownership and operation are costly from a financial standpoint and unsatisfactory from a service point of view. It shows, as many observers have contended, that where public ownership begins the tendency is for it to continue until it embraces not only all kinds of public enterprises but also many kinds of undertakings which are essentially not of a public character.

WIRELESS TELEGRAPHY. A Handbook for the Use of Operators and Students. By W. H. Marchant. 242 pages, 154 illus. New York: Whittaker & Company. Price, $1.60.

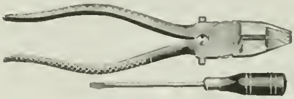
This book has been written from a thoroughly practical viewpoint and contains much information of use to those experimenting with, operating and studying radiotelegraph apparatus. Though written to meet British radio conditions, the data and descriptions of the Poulsen, Telefunken, Lepel, Goldschmidt and Marconi apparatus, as well as the chapters on measurements and localization of faults, make the book of general interest. There is very little to be criticised in the simple presentation of wireless technology, though it is regrettable that in a publication of 1914 so little matter is given concerning advanced radio practice. For example, many readers would doubtless have been gratified by a treatment of the gaseous detectors and heterodyne receiver as clear and specific as that given to the Brown relay and the Poulsen high-speed transmitter. The utility of the chapter on measurements to the average radio man could be made still greater by the addition of a little more introductory instruction. However, as the book now stands it should fill the need of a simply worded and readable handbook of reasonably restricted scope.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

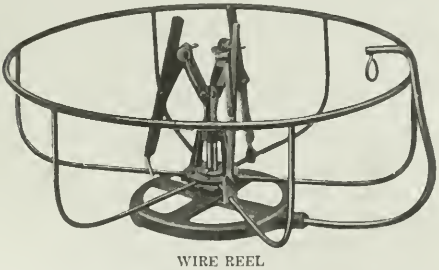
Stripping Plier

A plier for stripping insulated wire is shown herewith. The stripping is accomplished by means of two stripping blades, one of which is in each member of the plier immediately behind the head. The body of the blades is threaded, making possible very minute adjustment. The blades can be used both for cutting and stripping insulation, a narrow cutting edge being utilized for the former and a broad stripping edge for the latter. A screwdriver is used for adjusting the blades, which are renewable. This plier can also be employed as a flat-nose and side-cutting plier. The Smith & Hemenway Company, 150 Chambers Street, New York, is placing this stripping plier on the market, as an addition to its series of linemen's and electricians' tools.


PLIER FOR STRIPPING INSULATED WIRE

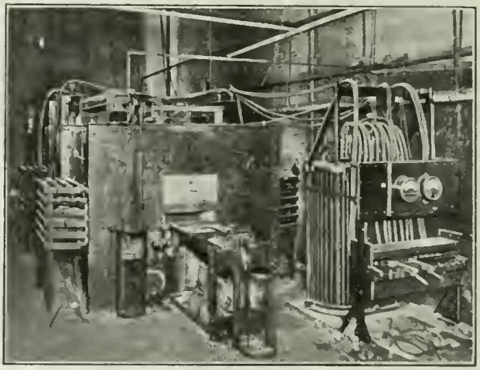
Wire Reel

The reel illustrated herewith is designed for use with any kind of wire manufactured, whether bare or insulated, single-strand or multiple. Wire can be drawn off the reel at any speed without snarling, tangling or kinking, the manufacturers claim. The coil is held in a basket which revolves on a ball bearing and prevents the wire from escaping. The wire is fed out through a loop on a stationary arm, and when the operator stops reeling the wire the reel automatically brakes itself. This "real" reel, as it is called, has no wearing parts and no loose parts, and needs no oiling. For dealers in wire this reel has proved a great convenience in winding off wire for sale. The device is made in two stock sizes, the "standard," weighing 12 lb. and measuring 24 in. in inside diameter, and the "junior," weighing 6 lb. and measuring 12 in. in inside diameter. This reel is being manufactured by the Wiring Equipment Company, 30 Church Street, New York.


WIRE REEL

Electric Furnace

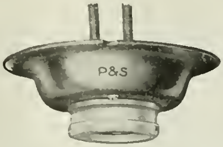
An interesting electric-heating furnace for annealing brass and German-silver flat-ware blanks was recently installed in the plant of a plated-tableware manufacturer at Niagara Falls, N. Y. The furnace framework is made of steel, and the furnace is 15 ft. long, 8 ft. wide and 7 ft. 6 in. high. Doors are placed at both ends of the furnace. A mechanical pusher operated by compressed-air cylinders runs over cast-iron idler sheaves. The mechanism for operating this pusher is at the charging end of the furnace. The material under treatment is packed in steel pans 20 in. square, which are forced through one after another, seven pans being in the furnace at one time. When passing through the furnace the pans are supported by a hearth made of cast-iron grids 24 in. square, so designed that undue warping at ordinary furnace temperatures is prevented. When coming out of the discharge end of the furnace the pan is automatically emptied into a water-sealed discharge hood. The metal under treatment falls into a tank of either clear water or pickling solution, depending upon the cleanliness of the material before it is placed in the furnace. The pan itself is caught by two rails and is held suspended above the trough, and it may be taken out from under the water-sealed hood through a counter-balanced swing door.


ELECTRIC ANNEALING FURNACE

The electrical equipment consists of a 200-kva transformer, built by the Pittsburgh Transformer Company, which is arranged with twelve voltage taps connected to the controller shown in the illustration. The switch is mounted on a switchboard frame in front of the transformer. The instruments on the switchboard panel consist of a Weston wattmeter and a Foxboro pyrometer. The latter is connected to a 48-in. couple placed directly over the pan about to be pushed out of the furnace, making it possible to know at what temperature the material is drawn. This furnace was installed by the Electric Furnace Company of America, Alliance, Ohio.

Outlet-Box Receptacle and Cover

An outlet-box receptacle, formerly equipped with a flat cover and now fitted with a cup cover which gives more room for wiring in the box, is shown in the accompanying illustration. The device is made by Pass & Seymour, Inc., Solvay, N. Y.



OUTLET-BOX RECEPTACLE AND COVER

Automobile-Charging Set

An electric-vehicle-charging set has recently been installed in the garage of the Curtis Publishing Company, Philadelphia, Pa., one of the interesting features of which is the provision for keeping records of the energy used by the various cars.

The switchboard is sectional. On the right is a large panel which controls the motor-generator set. This panel is equipped with a generator circuit-breaker switch, ammeter, voltmeter, field rheostat, and at the bottom a reverse-current relay which opens the circuit-breakers should the direct-current voltage fall below the voltage of the batteries being charged. A line voltmeter and circuit-breaker for the alternating-current circuit are also mounted on this panel. On the left are two series of sections which control the charging circuits to the car batteries. Each section controls two circuits and each circuit is assigned to a single car, a small name-plate designating the circuit.

At the top of each vertical row of sections is an ammeter and a voltmeter which are so connected with the charging line that the operator at the switchboard can tell precisely the condition of charge of the car batteries on any individual circuit at all times and does not have to depend on the automobile instruments. In fact, aside from connecting and removing the charging plugs, which are connected to lines running into the garage, the operator performs all the operations at the switchboard.

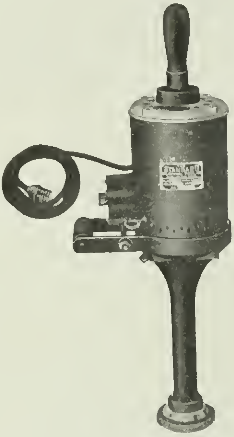
AUTOMOBILE-CHARGING OUTFIT

Watt-hour meters are mounted on the charging sections. Two scales are provided. One, which is set at zero for each charge, shows the amount of each separate charge, and the other shows the total amount of energy used by the car for a given date. Thus, an exact record of the energy consumed by each car can be obtained for any desired period, and one of the important elements of cost of operation for each car can be exactly determined. Fuses to protect the battery from overload and a resistance-adjusting rheostat complete the equipment for each circuit.

The entire equipment for this installation was supplied by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Portable Electric Grinder

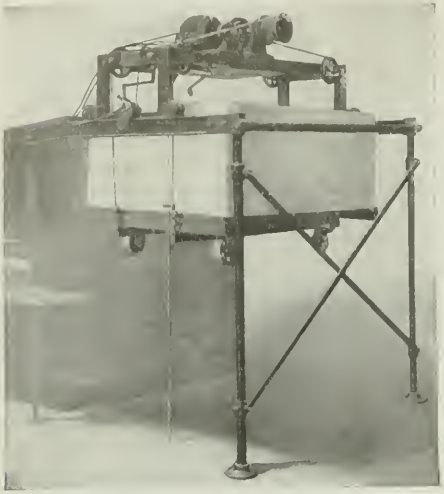
A grinder of the so-called "aerial" type is being placed on the market by the Standard Electric Tool Company, Cincinnati, Ohio. The device is designed for surfacing rough castings and for buffing. This tool is equipped with a motor operating on either direct current or alternating current, and it is especially adapted to twenty-five-cycle, thirty-cycle and forty-cycle circuits. The motor is form-wound and is impregnated with bakelite. This grinder is designed to operate at a speed of 6000 r.p.m., and is fitted with an emery wheel 4 in. in diameter with a 1-in. face. Ball bearings incased in grease in dust-proof chambers are employed throughout. The motor is rated at 0.5 hp. This tool is equipped with a spring for suspending from the ceiling, or it can be operated from a traveler with a counterbalance.



PORTABLE ELECTRIC GRINDING TOOL

Electrically Operated Paper Lift

The paper lift illustrated herewith is practically an electric elevator and is designed to lift a day's run of paper, truck and all, to a point slightly above the level of the feedboard of a printing press. This lift is built in two styles, one with four posts and the other with two posts and two extension arms for bolting to the press frame. The former is for use where plenty of space is available; with the latter about 6 in. of room is saved. The uprights are made of 2-in. pipe and are equipped with flange feet for bolting to the floor. The cross-members are steel I-beams. Either a direct-current or an alternating-current 0.75-hp motor may be used. The direct-current motors are wound so that the speed varies with the weight of load. The empty truck is lowered at a rate of about 3 ft. per minute. The weight of the device complete is 1400 lb.



ELECTRIC PAPER LIFT

The operation of this electric lift is as follows: The truck load of stock is wheeled back of the press. The steel-wire elevator ropes of the lift are hooked to ends of through-bars slipped under the truck. The motor is then started and the truck load of paper is slowly raised until the top of the pile is about 4 in. above the rear of the feed board. A balanced trip-finger then shuts off the motor and the stock is held suspended. The press feeder slides off his "lift" and presses a lever which starts the device in motion again. Each time the feeder slides off a lift he moves the lever, and while he is feathering out his lift the lifting device raises the rest of the stock to the proper level above the feed board.

This lifting device is being manufactured by H. B. Rouse & Company, 2214 Ward Street, Chicago, Ill.

Keyless Socket

An inexpensive keyless socket with porcelain wall base, which is adapted to all kinds of wall and ceiling work, is shown herewith. The supporting screw holes are spaced on 1 3 16-in. centers and will fit outlet boxes with corresponding screw spacings. This socket is being made by Harvey Hubbell, Inc., Bridgeport, Conn.

KEYLESS SOCKET

Illuminating Glassware

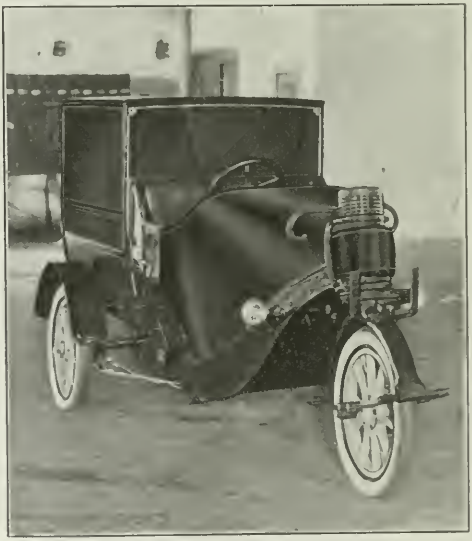
"Parian" is the name chosen for the illuminating glassware being placed on the market by the H. W. Johns-Manville Company, New York. This name was selected because of the close resemblance of the material to Parian marble. Parian ware is said to absorb a small amount of light, and the diffusion it produces is pleasing to the eye. This new ware is suited for stores, offices, churches, theaters, public buildings, auditoriums and residences, where harmony and beauty are important considerations. Various period designs have been produced and are being worked into bowls, hemispheres, spheres, wall lamps, pendants and reflector shades. A wide choice of colors is also available.

Three-Wheeled Electric Vehicles for Hotel Deliveries

Three-wheeled electric vehicles are being employed by Stern Brothers' department store, New York, to make deliveries to hotels. This special type of delivery wagon has been assigned to hotel service, as transient customers seldom buy heavy goods and consequently the weight of the vehicles delivering them does not have to be distributed over so many wheels. More prompt deliveries can be made with these cars, as they are better adapted to maneuvering through crowds and can be turned around easily in restricted quarters.

The delivery wagons are capable of carrying 500 lb. for a distance of 35 miles at a speed of 12 miles per hour. The battery is installed under the seat, and the motor is mounted in a vertical position over the front wheel, which exerts the entire tractive effort. The vehicles were manufactured by the Berliner Electrik Fabrik.

At the present time Stern Brothers are keeping their vehicles in a public garage pending the completion of their own garage, which will be on the New York Edison Company's service.

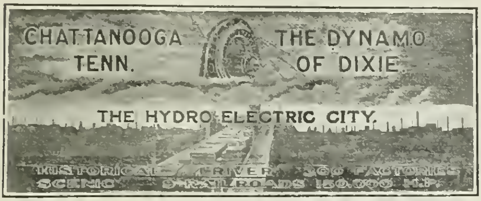


THREE-WHEEL ELECTRIC DELIVERY WAGON

Jobber, Dealer and Contractor

Chattanooga's Co-operative Electric-Lighted Sign

At Chattanooga, Tenn., the Tennessee Power Company is donating the energy to illuminate a large civic sign recently painted under the auspices of the Chamber of Commerce on a conspicuous wall in the business district. The sign measures 35 ft. by 100 ft. in size and is lighted at night by a 2000-cp nitrogen-filled tungsten lamp in a locomotive reflector installed on an adjacent roof.


CHATTANOOGA
TENN.
THE DYNAMO
OF DIXIE
THE HYDRO-ELECTRIC CITY.
HISTORICAL RIVER 300 FACTORIES
SCENIC 9 RAILROADS 150,000 H.P.

CHATTANOOGA'S CO-OPERATIVE SIGN

Labor and material were furnished by several local firms so that the sign was erected without cost to the Chamber of Commerce. The owner of the building donated the wall space, a paint merchant furnished the paint, and the W. C. Teas Company did the electric wiring. Among the local Jovians who took part in the project were Messrs. F. W. Hoover, L. J. Wilhoite, P. J. Kruesi and P. W. Curtis.

Code Requirements Not Binding Unless Specified

Justice Mercier, of Montreal, Canada, has decided that an electrical contractor is not bound to do his work in compliance with the regulations of the insurance companies unless it is so stipulated in his contract. The Routtenberg Company ordered a four-hundred-dollar electric sign from the Macey Sign Company, but when the sign was delivered refused to pay for it, claiming the wiring was not up to the Underwriters' standard. The court held that the sign had been made in accordance with all requirements of the contract, and that therefore payment must be made.

Electrical Concerns to Pay Increased Compensation Premiums in Ohio

That injuries to electrical workers have called for compensation amounting to 104 per cent of the amount resulting from premiums collected from their employers is set forth in a recent report of the Ohio Industrial Commission showing the results of the operation of the compensation law during the past two years. The general average of disbursements to premiums is 82 per cent, indicating that the rate for electrical concerns is too low. Coal mines, paper mills, milling and oil working are other industries where the compensation paid has exceeded the revenue. It has been announced that a readjustment of the rates, on a generally lower level, will be made shortly, based upon the experience of the commission so far, and if this be done it seems certain that the rates applicable to central stations and others employing electricians will be considerably increased.

Louisville Electrical Clearing House to Reorganize

The Louisville (Ky.) Electrical Clearing House Association, which has been conducted under the auspices of the Kentucky Actuarial Bureau during its entire existence, is to be reorganized on an independent basis. The meetings, however, will continue to be held at the offices of the Actuarial Bureau in the Starks building. The executive committee of the clearing house association, consisting of President C. C. Childers, Vice-president F. G. Burdorf and Secretary E. C. Knoop, is working out the reorganization plans.

The last meeting of the association was characterized by the attempt to secure a modification of the requirements for loop-system wiring, but the members adhered to their original stand. At the next meeting a committee representing fixture men will report on the insulation of canopies, while five members of a committee charged with looking into the present regulations on conduit installation will also make a report.

Effective Sign Used by Quebec Electrical Supply House

The electrical supply and fixture house of Goulet & Belanger, Quebec, Canada, makes effective use of electrical advertising, and a recent example of the firm's enterprise is illustrated in the accompanying halftone. On a busy street corner about 200 ft. distant from the store in a diagonal direction the firm erected a huge wooden hand 9 ft. long and 20 ft. high above a vacant lot passed by some of the principal street cars. The emblem was equipped with seven 25-watt tungsten lamps placed inside metal reflectors spaced 18 in. apart and attracted much attention during its "tenure of office." Like many signs in Quebec, the one illustrated appealed to the local population in the prevailing language of the Gallic race, and a keen sense of advertising value was shown in making "Toujours" rather than the firm name the dominating word.

ELECTRICAL SUPPLY DEALERS' SIGN

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments The Electrical Material and Security Markets

New Work at Madison Lake, Minn.—The village of Madison Lake, Minn., which recently granted a franchise to the Consumers' Power Company (Faribault division) for the distribution and sale of electricity, has now contracted with the company for its water pumping and city lighting requirements. Construction of the transmission line and distribution system will be started at once.

Underground Construction "Runs Into Money."—A recent computation puts the total of the conduit owned by the Commonwealth Edison Company of Chicago at 18,961,333 duct-feet. The company's investment in conduit (including tunnels), cable, services, etc., is about $19,000,000, or about 22 per cent of the total assets of the company. The amount of conduit installed by the company in 1913 was about 1,500,000 duct-feet.

Six Years' Experience Under Regulation.—In connection with its campaign against the development of State waterpower in New York, the Empire State Gas & Electric Association has issued a pamphlet containing an address made by Mr. James T. Hutchings, Rochester, N. Y., at the last annual convention of the New York State Waterways Association on "Six Years' Experience of Public Service Corporations Under State Regulation."

Electrical Energy for Cleaning Pullmans.—Among the contracts recently closed by the commercial department of the Louisville Gas & Electric Company was one for supplying electrical energy for an installation of three small motors for operating vacuum cleaners used by the Pullman company in cleaning its sleeping cars. Posts will be installed in the yards with wiring connections so that a car can be connected at any point in the yard.

Brooklyn Tobacco Factory to Use Central-Station Service.—The Edison Electric Illuminating Company of Brooklyn has just completed the extension of its mains for the complete supply of electricity to the Brooklyn manufactory of the American Tobacco Company, one of the largest factories engaged in the cigarette industry, replacing at that point the entire boiler, engine and generator plant by service from the Edison mains. Direct-current service is supplied and a long-term contract has been signed.

Reduction in Rates.—The Hartford Electric Light Company of Hartford, Conn., has announced a reduction in electric-lighting rates both for domestic and commercial use, taking effect July 1, from 9 cents per kw-hr, with 5 per cent discount, to 8 cents per kw-hr, with 5 per cent discount. This reduced rate will be effective throughout the whole territory served by the company. In the last ten years the company has reduced its rates from 17 cents per kw-hr. to the present new rate of 8 cents per kw-hr. The company serves a population of 125,000 and has about 15,500 customers.

Starting and Lighting Equipment for Automobiles.—The Standard Steel Car Company, Butler, Pa., has adopted the Westinghouse electric starting equipment for its 1915-model automobiles. This equipment will consist of a 6-volt starting motor with electrically operated control switch and a 6-volt generator with switches, fuse boxes and ammeter. The Dorris Motor Car Company, St. Louis, Mo., will also use the Westinghouse equipment for starting, lighting and ignition on its 1915-model cars. This equipment consists of a combination ignition and lighting generator, together with a complete set of switches, fuse boxes, junction boxes and a starting motor with switch and ammeter.

Electrical Equipment for Utility Companies.—Among the utility companies which have ordered new electrical apparatus are the following: The Athol Gas & Electric Company, Templeton, Mass., a 300-kw rotary converter; the Cohoes Company, Cohoes, N. Y., three 9000-kva alternating-current waterwheel-driven generators, two 165-kw, two-unit, three-bearing motor-generator sets, four 400-kva transformers, four auto-feeder regulators, a switchboard and accessories; the Newell Water & Power Company, Newell, W. Va., a 300-kw Curtis turbo-alternator; the Southern Power Company, Charlotte, N. C., three 2000-kva oil-cooled transformers; the Keno Power Company, Keno, Ore., a 450-kva alternating-current generator with a 20-kw exciter, two 300-kva transformers and switchboard. The above equipment will be furnished by the General Electric Company.

Extension of Waterside Generating Station at Louisville.—Work is in progress for the enlargement of the Waterside generating station of the Louisville Gas & Electric Company. This company is controlled by H. M. Byllesby & Company through the Standard Gas & Electric Company. Excavation is being made and piles are being driven for a steel-concrete addition with ground dimensions 27 ft. by 110 ft. Four Babcock & Wilcox water-tube boilers will be added, as well as superheaters, coal and ash conveyors and overhead coal bunkers having a storage rating of 85 tons for each boiler. Preliminary arrangements have been made for the installation of an additional General Electric 5000-kw horizontal turbo-generator complete with surface condenser, a separate exciter and other auxiliaries. This station, which was described in the *Electrical World* of Oct. 25 and Nov. 1, 1913, is the principal generating station of the Louisville company named.

New Steam Power Station for Public Service Company.—The Public Service Electric Company of New Jersey has preliminary work under way for the construction of a large power station at Point-No-Point on the Passaic River. The plant property covers an area of 16 acres, and the plant will be known as the Essex station. When fully completed it will be one of the largest steam plants in the country, having an ultimate rating of 150,000 kw. Although it is not intended to build the plant with the full rating at once, something like $2,000,000 will be spent within the next year, and the station will be so designed that it can be enlarged to meet the demands of future growth. Much has already been done in the way of preparing the ground and securing data to pave the way for awarding contracts. As the land was practically inaccessible for business purposes, the company has built a road about 2000 ft. long to the nearest street. Proposals have been invited for the building of a dock which will have a total length of 682 ft. and which will extend from the pierhead line back to the present high-water mark, a distance of about 65 ft. Intakes for condensing water will be built through the dock and the latter will be arranged to accommodate the coal-handling machinery. The company will have the water route as well as two railroads to carry its coal supplies. In its finished state the building will measure 366 ft. by 285 ft. Two turbines rated at 25,000 kw each will be installed, leaving room for a third unit. Space will be provided for eight boilers, although only four will be set up. It is expected that bids will be asked for the foundation early in August, and that the plant will be in operation in the late summer or early fall of next year.

Electric Truck Sales in Massachusetts.—The General Vehicle Company's Boston office reports the sale of three 5-ton electric trucks for service on the new South Boston fish pier, the machines being of the electrically operated dumping-body type and designed for carrying cracked ice from a refrigerating plant at the head of the pier to fishing smacks moored alongside the wharf. The new pier supersedes T-wharf, a famous old-time receiving and distributing market in the Boston fish trade, and will shortly be operated by an elaborate electrical and mechanical plant for motor, lighting and cold-storage service. These trucks are the first of a fleet and are to be operated with gravity delivery into the holds of the vessel, the backs overhanging the wharf during discharge, which can be made in one minute from the arrival of the truck at the vessel's side. The complete installation will consist of six 5-ton trucks, which will take the place of about twenty ordinary ice carts. The batteries will be charged on the pier. Pending the completion of the refrigerating plant, the trucks are utilized in the haulage of coal. The American Sugar Refining Company, Boston, has just installed a 7-ton electric truck for the haulage of sugar, the machine having the largest body of any truck in Boston. At New Bedford, Mass., special activity is apparent in the electric-vehicle field. Ten electric business wagons have been placed in service by the New Bedford Gas & Edison Light Company, and a fleet of delivery wagons has lately been adopted by the Pairpoint Corporation and the J. V. Spare Dry Goods Company.

Electrical Equipment for Textile Manufacturers.—A number of orders have recently been received by the Westinghouse Electric & Manufacturing Company for installations in the textile industry. Among the companies which have ordered this equipment are the following: Waltham Bleachery & Dye Works, Waltham, Mass., thirteen motors totaling 400 hp; River Spinning Company, Woonsocket, R. I., seven motors totaling 230 hp, and two 37.5-kva transformers with one three-panel switchboard; American Woolen Company, Fulton, N. Y., three 1160-kva waterwheel alternators with three 30-kw exciters and one 75-kw motor-generator set with one fourteen-panel switchboard; John H. Meyer & Company, Bloomsbury, N. J., one 75-kva turbo-generator unit and an exciter with a three-panel switchboard and four motors totaling 35 hp; J. & J. Dobson, Inc., Philadelphia, Pa., one 470-kva low-pressure turbo-generator unit, one Westinghouse-LeBlanc barometric condenser, two motors totaling 500 hp, one 25-kw turbine-driven exciter, one 16-kw motor-generator exciter set and one six-panel switchboard; Pennsylvania Textile Company, York, Pa., one 562-kva belted alternating-current generator, one 22.5-kw belted exciter and twenty-three motors totaling 600 hp; Orr Cotton Mills, Anderson, N. C., one 1000-kva turbo-generator, one 10-kw turbo-exciter set, one Westinghouse-LeBlanc condenser, one 12.5-kw motor-generator set and one four-panel switchboard; Cliffside Mills, Cliffside, N. C., one 375-kva turbo-generator with exciter, one 125-kva turbo-generator, one 18-kw generator, two motors totaling 480 hp and one four-panel switchboard; Flint Manufacturing Company, Gastonia, N. C., two 200-kva self-cooled transformers with one two-panel switchboard, fourteen motors totaling 300 hp and thirteen oil circuit-breakers; Brown Manufacturing Company, Concord, N. C., ten motors totaling 290 hp, six oil circuit-breakers and four auto-starters; Aurora Cotton Mills, Burlington, N. C., three 100-kva, 22,000-volt outdoor transformers, one outdoor substation complete, eleven motors totaling 240 hp; Pelzer Manufacturing Company, Pelzer, S. C., two 100-hp motors, two 300-kva self-cooled transformers and one four-panel switchboard; Lang Manufacturing Company, West Point, Ga., thirteen motors totaling 275 hp, three 100-kva, 11,000-volt transformers and one 15-kva, 11,000-volt transformer with one three-panel switchboard and one electrolytic lightning arrester.

TABLE I—EARNINGS AND OUTPUT FOR APRIL, 1914 AND 1913, FOR SIXTEEN CENTRAL-STATION COMPANIES IN FOUR EAST NORTH CENTRAL STATES

	Gross Earnings from the Sale of Energy			Total Energy Output in Kw-hr.		
	April, 1914	April, 1913	Per Cent Increase	April, 1914	April, 1913	Per Cent Increase
Ohio . .	$1,289,133	$1,078,408	19.7	49,308,386	41,090,470	20
Michigan. . . .	773,903	687,134	12.8	38,954,629	35,099,231	11
Wisconsin and Indiana.	334,130	295,817	13.0	18,991,829	17,247,704	10.2
Total. . .	$2,397,166	$2,061,359	16.4	107,254,844	93,437,405	14.8

TABLE II—COMPARISON OF EARNINGS AND OUTPUT FOR MARCH AND APRIL, 1914 AND 1913, OF ABOVE SIXTEEN COMPANIES IN FOUR EAST NORTH CENTRAL STATES

	Gross Earnings from the Sale of Energy			Total Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
March. .	$2,339,496	$2,068,666	13.2	119,175,200	104,470,876	14.1
April.	2,397,166	2,061,359	16.4	107,254,844	93,437,405	14.8

TABLE III—COMPARISON OF EARNINGS AND OUTPUT FOR MARCH AND APRIL, 1914 AND 1913, OF FIVE COMPANIES IN THE WEST NORTH CENTRAL STATES

	Gross Earnings from the Sale of Energy			Total Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
March. .	$235,542	$215,457	9.3	6,516,087	5,880,666	10.9
April	250,881	222,646	13.0	7,598,351	6,749,188	12.7

Central-Station Business in the Central States.—The accompanying data regarding the April earnings and output of lighting and motor-service companies in the Central States may be compared advantageously with the returns of March published in the *Electrical World* of May 30. In Table I are given the April returns for sixteen companies in Ohio, Michigan, Wisconsin and Indiana, while Table II contains a comparison of these returns with those of the same companies for March. On the basis of output, these companies between them represent somewhat over 70 per cent of the entire lighting and motor-service industry in the four states. The March percentage of 13.2, which was found to represent the rate at which 1914 earnings were increasing over 1913, was satisfactory enough; and it is somewhat striking to notice that for April the demonstrated rate of increase works out as high as 16.4. This is probably a little better than the true average for the year, but it would at least seem that in these states the year 1914 is securing a steady increase in revenue from the sale of energy of some 14 or 15 per cent over the year 1913. From Table II it will be noted that the companies reporting to the *Electrical World* show increased earnings for April over March, while reporting a considerable decrease in energy output. This same condition, it may be remembered, was reflected by the data from the Atlantic States published in last week's issue of the *Electrical World*. April contains one day less than March in addition to possessing more daylight hours, and the energy demand naturally falls off. Revenue would also fall off (though possibly not to the same extent) if the figures of dollars related strictly to the calendar month; but the earnings data for March did not cover the thirty-one calendar days of that month, and those for April probably indicate a truer monthly average. Five other companies in Wisconsin, Indiana and Illinois not included in the March returns have reported for April, and four of these show increases generally confirming the percentages given above. The fact that the fifth company—the largest—reports a falling off in both gross sales and station output shows that the central-station growth is broken here and there by exceptional cases, where, either through reduced rates, adverse municipal action, depression of the local industries or any other of a number of causes, the present year shows some recession upon 1913. Between them these five additional companies report gross earnings of $119,942 for April, 1914, against $116,647 for April, 1913, and an output of 4,775,385 kw-hr. against 5,263,103 kw-hr. The West North Central States include Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska and Kansas; and returns from some nine companies in this area indicate that gross earnings from the sale of energy increased from $607,427 in April, 1913, to $755,960 in April, 1914, or about 24.5 per cent; while output increased from 45,743,132 kw-hr. to 64,062,758 kw-hr., or at a rate of 40 per cent. On the basis of energy output these companies are handling over 60 per cent of the entire central-station business in the West North Central territory. It should be mentioned that the returns for one city represent a large percentage of the aggregate for this area. The returns at least betoken a very healthy condition in the city of St. Louis and its surrounding territory, which is more than sufficient to offset certain decreases which have been reported to the *Electrical World* from other Missouri properties. Table III presents comparative data for March and April for five companies in the West North Central belt which seem to be typical; and since for March the *Electrical World* reported 9 and 12 per cent as the probable rates of increase for earnings and output, respectively, for the whole of these seven states, it is likely that for April the values are somewhat higher and may be placed at more than 13 per cent on both the earnings and the output. The East South Central States include Kentucky, Alabama, Tennessee and Mississippi, and returns from four companies in this area show that gross earnings increased from $116,301 in April, 1913, to $132,379 in April, 1914, or at a rate of 13.8 per cent, while output increased from 5,623,127 kw-hr. to 6,151,581 kw-hr., or at a rate of 9.3 per cent. On the basis of output these companies represent only one-fourth of the central-station industry in the East South Central territory, but the returns for April check rather closely with those for March, which covered a larger portion of the total. For that month the estimated rates of increase were 14 on earnings and 10.1 on output. April returns from the West South Central group (Louisiana, Arkansas, Texas and Oklahoma) are more satisfactory than the March returns from the same group. For that month the *Electrical World* estimated an increase of 4.8 per cent on earnings and 6.2 on output in 1914 over 1913. The rates for April are certainly higher. Four Stone & Webster subsidiaries which showed less than 4 per cent increase for March on more than $500,000 of gross now show 7.3 per cent for April. Seven other Texas utilities not reporting for March show extremely flattering figures for April, for which month combined earnings were $170,310 for 1914 against $130,419 for 1913, and combined output 5,277,000 kw-hr. against 2,936,000 kw-hr. No decreases are reported by any of the Texas properties making returns to the *Electrical World*, and, since the estimates given for March for the West South Central States were 4.8 and 6.2 on earnings and output, it is probable that for April the ratios are more nearly 8 and 10 per cent, respectively. Summarizing all the foregoing results, it may be said that the condition of the electrical business in the Central States for April of this year, as compared with April of last year, is shown fairly accurately by the following rates of increase: East North Central, gross earnings 16.4, output 14.8; West North Central, 13 and 13; East South Central, 13.8 and 9.3; West South Central, 8 and 10. With the single exception of the East South Central States, from which the returns have not yet been truly representative, all of the values are higher for April than for March.

NEW YORK METAL MARKET PRICES

	June 16		June 23	
Copper	Bid	Asked	Bid	Asked
Standard spot*	13.25	13.75	13.30	13.70
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	61 10 0		61 0 0	
Prime Lake	14.12½	to 14.25	14.00	to 14.25
Electrolytic	13.80	to 13.90	13.70	to 13.80
Casting	13.65	to 13.75	13.50	to 13.60
Copper wire base	15.00	to	14.62½	to 14.75
Lead	3.90		3.90	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.10	to 5.20	5.05	to 5.15
Tin, spot*	30.00	to 30.25	30.75	to 31.25
Aluminum:				
Prompt delivery	17.75	to 18.00	17.75	to 18.00
Future	17.75	to 18.00	17.75	to 18.00

*OLD METALS

	June 16	June 23
Heavy copper and wire	12.62½	12.87½
Brass, heavy	8.50	8.62½
Brass, light	7.37½	7.50
Lead, heavy	3.70	3.75
Zinc, scrap	4.00	4.15

*COPPER EXPORTS

Total tons to June 23	27,747

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Easton Consolidated Electric Company Dividends.—The Easton Consolidated Electric Company has announced that hereafter dividends will be paid on $1,500,000 par value instead of the paid-up value of $750,000. In the past the company has paid $30,000 a year in dividends while now it will pay $60,000. With the exception of the directors' shares, the stock is owned by the Lehigh Valley Transit Company.

Havana Electric Railway, Light & Power Company's Annual Report.—The company in its annual report shows gross earnings of $5,417,054, operating expenses of $2,489,832, and therefore net earnings of $2,927,222. After deducting interest and fixed charges, the surplus for the year was $1,848,103. The total surplus to Jan. 1, 1913, was $2,999,662. The electric-light department showed the following: Gross earnings, $1,497,527; operating expenses (not including first charges), $426,253, or 28.46 per cent of gross earnings. The net earnings were therefore $1,071,274, or 71.54 per cent of the gross earnings. Mr. F. Steinhart, president and general manager, gave a detailed report of the improvements. The company served an estimated population of about 325,000. For new construction $1,649,286 was expended. A contract was made with the Westinghouse Electric & Manufacturing Company for three 12,500-kw turbo-generators with the necessary equipment, and later boilers and superheaters were purchased from the Babcock & Wilcox Company. The building contract for the new power plant was made with the Snare & Triest Company, of New York and Havana. The work is to be completed about Aug. 1, 1914.

San Joaquin Light & Power Corporation.—The special meeting of stockholders of the San Joaquin Light & Power Corporation to approve the issue of $3,500,000 6 per cent prior preference stock has been postponed to June 29. If the issue of this new stock is approved and it can be sold on a satisfactory basis, the company will be in a position to liquidate its floating debt and to complete its program of expansion in the San Joaquin Valley. At the same time the stockholders will be asked to authorize $2,000,000 of either first and refunding bonds or debentures. These, however, will not be issued provided there is a satisfactory market for the prior preference stock. The proceeds will be used to pay that portion of the floating debt which cannot be paid from the present bills and accounts receivable and other funds, and to provide adequate working capital for the future. The company had to contend with a dry season in 1913 because it could not use its reservoir in the Crane Valley. As a result it had to buy energy, operate an expensive steam plant, and at a high cost rapidly push the work at Tule River. This made unduly high expenses, which, now that the Tule River project is completed, in the future will be considerably less. The *Electrical World* of Jan. 10, 1914, gave an account of some of the new developments of the company. The financial conditions of 1913 made it impossible for the company to market its first and refunding bonds, and it authorized a two-year note issue secured by the deposit of $4,000 bonds for each $3,000 of notes issued. Of these notes, $1,054,000 were sold. It is to care for these notes, for other floating debts and for other corporate requirements that it is proposed to issue the prior preference stock.

Annual Statement of the Western Canada Power Company, Ltd.—In the annual report to stockholders President C. H. Cahan gives the following information as to present condition and future developments of the Western Canada Power Company, Ltd. At Stave Falls the company has a power house designed for four 9000-kw units, two of which are in commission and the other two contracted for, one to be installed this summer and the other in 1914. During 1913 considerable work was done on the dams and the foundations for the power-house extension were excavated. During 1914 and 1915 this work will be rushed to its completion. To utilize the 130-ft. fall from the tailrace of the Stave Falls power house to tidewater the company had proposed to build one power house. It has since abandoned that plan in favor of two power houses, each for 65-ft. head. In so doing the initial expenditure will be far less for the installation of the first unit. The preliminary designs and estimates show that this can be done at a cost of from $55 to $60 per hp of maximum demand. For transmission the company owns 33 miles of 60,000-volt steel-tower transmission line, about 22 miles of 60,000-volt modern pole transmission line, a system of 12,000-volt and 2000-volt distributing lines covering a district 50 miles long by 10 miles wide, and a receiving station at Ardley providing for 18,000 kw of transformer capacity. During 1913 55,000,000 kw-hr. was generated, of which 20,000,000 kw-hr. was supplied to the Puget Sound Traction, Light & Power Company, 18,000,000 to the British Columbia Electric Railway Company, and 12,000,000 to the company's own distributing system. During the winter of 1914-15 it is estimated that the demand will be from 16,500 kw to 21,000 kw; 48,196,000 kw-hr. was sold in 1913, realizing a revenue of $293,697. The annual income from lighting and motor service now averages approximately $50 per kw of maximum demand.

Duquesne Light Company of Pittsburgh.—The annual report issued to stockholders by the Philadelphia Company, of Pittsburgh, contains a report of the subsidiary Duquesne Light Company. President James D. Callery of the latter company says that during the year the power plants have been so successfully operated as to furnish better service than ever before, although none of the new 18,000-kva turbo-generators being installed at Brunot Island was in use. One of these units was run under preliminary tests during March, 1914. The new installation at the Brunot Island power plant is going on rapidly and the second turbo-generator is expected to be in operation within a short time. The other two turbo-generators, together with boilers, condensers, piping, coal dock, etc., are expected to be completed during the coming year. At the close of the year the company had in force 43,097 contracts, an increase during the year of 6299, representing an increased power load of 17,758 hp, and also an increased load of 6025 kw for lighting, 381 100-watt lamps and 347 250-watt lamps for municipal lighting, and 135 new signs, using 25,026 4-cp lamps. During the ensuing year it is expected that a number of the company's smaller plants that have been operated during the past year will be shut down and service furnished from the new plant at Brunot Island. For the past fifteen months the company has supplied electric current to the Pittsburgh Railways for the operation of its entire system, and through a most severe winter there were but few outages and the service was considered satisfactory. A comprehensive study has been made of the total power requirements in the Pittsburgh district and a census taken of the individual users of steam power. The severe winter, with an unusually large amount of snow, did not affect the transmission lines to any great extent. A contract was made by the Duquesne Light Company with the Philadelphia Company for the purchase of Brunot Island and the power plant and property thereon for $3,500,000, coincident with which the Philadelphia Company subscribed to an equal amount of Duquesne stock at par. Pending the delivery of the deed for this property the Duquesne Light Company has entered into possession of and is operating that plant, paying a substantial rental therefor to the Philadelphia Company. In the meantime the stock is held for the benefit of, but is not paying dividends to, the Philadelphia Company. Except as to this amount, regular dividends have been paid upon the stock as issued, at the rate of 7 per cent per annum. During the year there were sold $2,500,000 one-year 6 per cent gold notes, dated Feb. 2, 1914, the proceeds of which are to be used for the increase in the power plant at Brunot Island and for betterments, improvements and extensions to the company's other property and plants. The cash on hand March 31, 1914, amounted to $2,543,796, which is estimated to be sufficient to meet all the demands for payments to be made during the year on account of such improvements and provide working capital, and to leave available for dividends that portion thereof derived from earnings. The Pennsylvania Light & Power Company has been operated entirely separate from the Duquesne Light Company. Gross earnings of the Duquesne Light Company in the year were $4,844,223. Total operating expenses were $2,778,043. Taxes amounted to $176,741. Net earnings were $1,889,439. Other income aggregated $283,786, making total income of $2,173,225. Total deductions from income were $608,947, leaving a net income for the year of $1,564,278.

Business Notes

The Traylor Engineering & Manufacturing Company, Allentown, Pa., has made arrangements with Mr. Charles A. Jacobson by which the company will manufacture and sell the Jacobson gas engines. Mr. Jacobson will be associated with the Traylor company.

The Lord Electric Company has delegated its vice-president and chief engineer, Mr. Frederic W. Erickson, to supervise the installation of the mechanical and electrical equipments of the New York State Barge Canal, for which contracts aggregating $2,000,000 were let to this company associated with the MacArthur Brothers Company. The work will involve the construction of sixty-five reinforced-concrete buildings and the installation of twenty-two hydroelectric plants and ten gasoline-electric plants for supplying energy to the motors for the lock gates, valves and capstans and to the arc and incandescent lamps at forty-two canal locks. The work of installation will be completed in May, 1915.

New Industrial Companies

The American Electric Starter Company, of Detroit, Mich., has been organized to take over the Disco Self-Starter Company. The company is capitalized at $250,000. Mansell Hackett is president and general manager.

Becker Brothers, of Chicago, Ill., has been incorporated by Oliver E. Becker, Charles J. Becker and William F. Becker. The company is capitalized at $25,000 and proposes to manufacture and deal in motors, dynamos, electrical apparatus, etc.

The K. H. Sign Manufacturing Company, of Pittsburgh, Pa., has been incorporated with a capital stock of $5,000 to manufacture electric signs and signs of all descriptions. The incorporators are Leon S. Klein, Morton H. Herzog and Eugene B. Strassburger, all of Pittsburgh, Pa.

Trade Publications

Lamp Guards.—Keystone lamp guards are the subject of a folder being sent out by the Electric Service Supplies Company. The details of construction are shown.

Transformer Bells.—The P. R. Manufacturing Company, Detroit, Mich., is mailing a folder referring to its PR transformer bells. This company makes bells for almost every purpose.

Ozone Apparatus.—The Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York, illustrate and describe briefly their ozone apparatus in Leaflet No. 853.

Electric Incubators.—Reed's system of electric poultry production is the subject of a sixteen-page pamphlet recently issued by the Electric Manufacturing Company, New Orleans, La. A self-regulating electric incubator is fully described.

Inter-Phones.—The Western Electric Company, 463 West Street, New York, has issued a forty-eight-page catalog referring to its intercommunicating telephone apparatus. Condensed data concerning the various "inter-phone" systems and some wiring diagrams are given.

Exhaust Fans.—Bulletin No. 65 of the Diehl Manufacturing Company, Elizabeth, N. J., relates to motor-driven exhaust fans. Several illustrations of Diehl motors directly connected to exhaust fans show the adaptability of these motors to fans of any style, size or type.

Sight Flow Indicator.—The Richardson-Phenix Company, Milwaukee, Wis., has issued Bulletin No. 57, relating to its standard and minimum flow types of sight flow indicators. Recent improvements include an arrangement that permits the adjustment of the indicator so that it will give an alarm before the liquid stops flowing entirely when the flow drops to some predetermined minimum. This improvement has made the indicator suitable for use on water-cooled transformers.

Personal Mention

Mr. John J. Barlum is the new president of the Detroit (Mich.) public-lighting commission.

Mr. O. A. C. Clarke was recently appointed superintendent of the Geneva (Neb.) Electric Company.

Mr. W. D. Jones has been appointed superintendent of the Phoenix Water Power Company, of Phoenixville, Pa.

Mr. C. L. Howse, assistant to Mr. E. I. Sifton, manager of the Hamilton (Ont.) Hydroelectric Department, has been appointed chief of the electrical and waterworks system in Peterboro, Ont.

Mr. F. F. Funk, of Columbus, Ohio, has been appointed by the Youngstown (Ohio) Consolidated Gas & Electric Company to succeed Mr. W. H. Acker, electrical engineer, who recently resigned.

Mr. Edward Hendley has been appointed manager at Litchfield, Ill., of the Southern Illinois Light & Power Company, to fill the position made vacant by the resignation of Mr. W. E. Peach.

Mr. Henry E. Longwell, formerly consulting engineer for the Westinghouse Machine Company, Pittsburgh, Pa., is now general manager of the Westinghouse Air Spring Company, New Haven, Conn.

Mr. Gerard Swope, vice-president and general sales manager of the Western Electric Company, sailed from New York for Europe on board the steamship *Imperator*. Mr. Swope will be absent two months.

Mr. Walter C. Fish, general manager of the Lynn (Mass.) plant of the General Electric Company, was tendered a dinner by his associates, June 13, to mark the twentieth anniversary of his service with the company.

Mr. N. P. Zech has resigned as assistant to the general auditor of H. M. Byllesby & Company, Chicago, to become treasurer and general auditor of the Atlantic Gas & Electric Company, with headquarters in New York City.

Mr. W. H. Acker, who recently resigned as electrical engineer for the Youngstown (Ohio) Consolidated Gas & Electric Company, has gone to Pittsburgh as transmission engineer of the West Penn Traction Company.

Miss Louise B. Krause, librarian for H. M. Byllesby & Company, has been elected president of the Chicago Library Club, an organization with 275 members. Miss Krause attended the recent annual meeting of the American Library Association at Washington, D. C.

Mr. H. Scholey, of the firm of Scholey & Company, Ltd., London, who represent a number of American electric-railway and lighting specialties in England, is paying a visit to the United States. For a time Mr. Scholey's address will be the Engineers' Club, New York City.

Mr. E. M. Scofield, president of the Scofield Engineering Company, Philadelphia, has been appointed vice-president of the Texas Southern Electric Company, which is being financed by Warner, Tucker & Company, of Boston, for owning and operating public utilities in southern Texas.

Mr. M. R. Hutchinson, who has been associated with Mr. Thomas A. Edison for the past five years, received the degree of doctor of philosophy from the Society of Jesus at Spring Hill College, Spring Hill, Mobile, Ala., on June 17. He attended Spring Hill College in the early nineties and this year delivered the baccalaureate sermon.

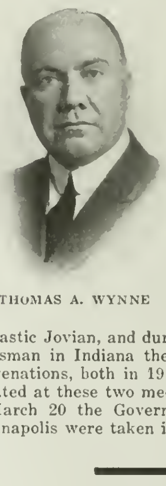
Mr. Arthur Williams, of the New York Edison Company, has been appointed vice-chairman of the committee in charge of the display of commercial exhibits to be held at the Grand Central Palace, New York City, Aug. 8 to 29, in connection with the celebration of the tercentenary anniversary of the beginning of the chartered commerce of New York.

Mr. Charles E. Scribner, chief engineer of the Western Electric Company, recently returned to New York on board the new Cunard liner *Aquitania*. While abroad Mr. Scribner appeared in London before a Parliamentary commission to present data regarding the new long-distance, high-speed printing telegraph developed under his supervision. A trial installation has been ordered, and the equipment is now being built.

Mr. H. M. Byllesby, president of H. M. Byllesby & Company, Chicago, in company with Mr. John J. O'Brien, vice-president and general auditor of the same corporation, left Chicago on June 14 for an inspection of the Pacific Coast public utility properties managed by this company. Among the cities to be visited are San Diego, Stockton, Richmond and Eureka, Cal., and Tacoma, Olympia and Everett, Wash. Mr. Otto E. Osthoff, vice-president and chief engineer, and Mr. Elmer Dover, vice-president in charge of the Pacific Coast properties, are now in the West and will accompany Mr. Byllesby on his tour of inspection.

Mr. Frederic W. Erickson, who has been placed in charge of the installation of the mechanical and electrical equipments for the New York State Barge Canal as general manager representing MacArthur Brothers Company and the Lord Electric Company, is vice-president and chief engineer of the latter company. In 1900 Mr. Erickson was associated with the Edison Electric Illuminating Company of Boston and later he was with the wiring department of the New York Edison Company. In 1896 he associated himself with the Lord Electric Company, just then organized. Among his inventions are the Erickson conduit outlet bushing patented in 1896 and the Shawmut bushings for conduits. He is a member of the Engineers' Club, New York, and the Illuminating Engineering Society.

Mr. Thomas A. Wynne, statesman for Indiana of the Jovian Order, is vice-president and engineer of the Indianapolis Light & Heat Company and one of the best known central-station men in the State. He is associated with Mr. C. C. Perry, the president of the Indianapolis Light & Heat Company, one of the pioneers of the electric-service industry in the Middle West. Mr. Wynne has done much high-class engineering work for his company, including the planning of extensions to the main generating station of the company, the use of storage-battery auxiliaries, a well-built distribution system, and one of the best subaqueous coal-storage pits in the United States. He also possesses executive abilty of a high order. Mr. Wynne is an enthusiastic Jovian, and during his incumbency of the office of statesman in Indiana there have been two very successful rejuvenations, both in 1914, the total number of candidates initiated at these two meetings being 274. At the initiation of March 20 the Governor of Indiana and the Mayor of Indianapolis were taken into the order.



THOMAS A. WYNNE

Obituary

Thomas Dolan, for many years president and later chairman of the board of directors of the United Gas Improvement Company, Philadelphia, died of general debility at his home near Torresdale, Pa., June 12, at the age of eighty years. Mr. Dolan organized the Brush Electric Company of New York and Philadelphia and carried out the early electric-arc lighting of Philadelphia and later aided in the organization of the Philadelphia Electric Company in 1899. He was also a director of the Philadelphia Electric Company and of the United Lighting & Heating Company.

James Campbell, chairman of the board of directors of the North American Company, died of pneumonia, June 12, at his summer home, "Indian Field," near Greenwich, Conn. Interment was at St. Louis, where he had lived for a number of years. Mr. Campbell was in his sixty-sixth year. Among the operating companies controlled by the North American Company are the Union Electric Light & Power Company, St. Louis; the United Railways Company, St. Louis; the Milwaukee Electric Railway & Light Company, the Detroit Edison Company, and other associated interests.

Construction

New England

PORTSMOUTH, N. H.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 11, for furnishing and installing an after cooler complete, with piping and all accessories, at the central power plant in Portsmouth, N. H. Plans and specifications can be obtained upon application to the bureau or to the commandant of the navy yard named. H. R. Stanford is chief of bureau.

BENNINGTON, VT.—Surveys are now being made for the erection of a high-tension transmission line from North Adams to Bennington for the purpose of connecting this village with the lines of the New England Pwr. Co., which has large generating plants at Brattleboro, Va., and Shelburne Falls, Mass. Distribution in Bennington, it is understood, will be through the local system of the Twin State Gas & El. Co.

FALL RIVER, MASS.—The Fall River El. Lt. Co. has submitted a proposal to the aldermanic committee on lighting offering to install the proposed 4-amp ornamental lamps on South Main, North Main, Pleasant and Morgan Streets, and maintain them until Jan. 1, 1915, free of cost to the city. This would mean an addition of 36 arc lamps.

PITTSFIELD, MASS. — The Common Council has entered into a new contract with the Pittsfield El. Co., whereby new street lamps will be installed from the new union station in West Street to Maplewood Hotel on North Main Street. The committee on street lights has recommended the installation of 51 luminous arc lamps and 110 incandescent lamps.

SOUTHBORO, MASS.—Plans are being considered by the Metropolitan Water and Sewerage Board to establish a hydroelectric plant at the Fayville Dam, a short distance from the Southboro-Framingham town line, similar to the plant erected at Clinton several years ago, at a cost of $125,000.

WORCESTER, MASS.—Plans are being considered, it is reported, by the White & Bagley Co., manufacturer of soaps and oils, for the construction of a new power house. H. P. Bagley is president and treasurer.

Middle Atlantic

AMSTERDAM, N. Y.—The contract for the construction of a power plant for McCleary, Wallin & Crouse, of Amsterdam, manufacturers of rugs, has been awarded to J. W. Bishop, 109 Foster Street, Worcester, Mass. The cost of the plant is estimated at about $85,000.

FLUSHING, N. Y.—Under the new contract with the New York Edison Co. for lighting the streets and public places, the present electric street lamps will be changed to the new nitrogen lamps.

HINSDALE, N. Y.—The Town Board has entered into a contract with the Cattaraugus County Ltg. Co., of Olean, for lighting the streets of the village. The company is planning to erect a transmission line from Olean to Franklinville.

HUDSON, N. Y.—Bids will be received by Miss Mary Hinckley, president of the board of managers of the New York State Training School for Girls, Hudson, N. Y., until July 10, for construction, heating, plumbing and electrical work for Contagious Hospital, also for two horizontal tubular boilers for the New York State Training School for Girls. Drawings and specifications may be consulted and blank forms of proposal obtained at the New State Training School for Girls, Hudson, and at the office of Lewis F. Pilcher, state architect, Capitol, Albany.

LE ROY, N. Y.—The Village Board is considering the question of installing a new street-lighting system. It is proposed to replace the present arc lamps with cluster lamps.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner Park Avenue and Fifty-ninth Street, New York, N. Y., until June 29, for additions and repairs to electric equipment in Public Schools 51, 69, 84, 106, 151 and 166, borough of Manhattan. A separate proposal must be submitted for each school.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, headquarters of the Fire Department, eleventh floor, Municipal Building, New York, until June 29, for furnishing and installing electric-lighting systems and altering gas-lighting systems in quarters of engine companies Nos. 9, 27, 29 and hook and ladder company 6. Blank forms and further information may be obtained at the above office.

ORWELL, N. Y.—Plans and specifications for the construction of a dam on the Salmon River in the town of Orwell by the Salmon River Pwr. Co. have been approved by the Conservation Commission.

ROCKVILLE CENTER, N. Y. — The Board of Village Trustees has purchased for delivery this summer one 500-hp cross-compound 18-in. by 24-in. by 24-in. Ball engine and one Fort Wayne 375-kva, two-phase, 60-cycle, 2300-volt generator. H. C. Mayor is chief engineer.

SOUTHAMPTON, N. Y.—The Suffolk Lt., Ht. & Pwr. Co., of Southampton, has applied to the Public Service Commission for permission to issue $22,500 in bonds.

WATKINS, N. Y.—Within the next six months the managers of the municipal electric-light plant expect to purchase a generator and engine (directly connected) and a generator switchboard panel; also within the next 30 days 60 lamp standards and globes. Charles E. Dennis is superintendent.

WAYLAND, N. Y.—Within the next three months the Wayland El. Lt. & Pwr. Co. expects to erect 3 miles of transmission lines and to purchase one 100-kw, three-phase generator directly connected to engine and switchboard panel. John Kimmel is manager.

DERRY, PA.—The Council is considering replacing the present street lamps with tungsten lamps. The West Penn El. Co., of Pittsburgh, furnishes electrical service in Derry.

HERSHEY, PA.—The contract for the power house of the Hershey Transit Co., to be located near Gingrich's Meeting House, about 2½ miles from Lebanon, has been awarded to Stohler Brothers, of Lebanon. The building will be 38 ft. by 28 ft., and will supply electricity to operate the cars between Lebanon and Mount Pleasant.

PHILADELPHIA, PA.—Applications have been filed with the Secretary of State for charters for the Equitable El. Pwr. Co. and the Pennsylvania El. Pwr. Co., both to operate in Philadelphia. Each company is capitalized at $10,000, and the incorporators are M. P. Quinn, John Rapp and Charles Doebler, of Philadelphia. The Equitable El. Pwr. Co. has submitted a bid for lighting the Second District, covering Germantown and the Northeast, contingent on being granted a franchise. The Philadelphia El. Pwr. Co. proposes to furnish water and water-power for commercial and manufacturing purposes in Philadelphia.

BAYONNE, N. J.—The Council has passed a resolution calling for a referendum on the installation of a municipal electric-light plant, to be submitted to the voters at the next election.

BOONTON, N. J.—The Board of Utility Commissioners has granted the Boonton El. Co. permission to issue $15,000 in bonds.

HACKENSACK, N. J.—Bids will be received by a committee of the Board of Chosen Freeholders of Bergen County, at the office of clerk of board, Court House, Hackensack, until July 1, for installing a new lighting system on the Anderson and Court Street bridges over the Hackensack River, Hackensack. Plans and specifications can be examined and necessary information obtained at the office of the county engineer, Court House, Hackensack.

NEWARK, N. J.—Preliminary work has been started by the Public Ser. El. Co. on the construction of a large electric generating station at Point-No-Point on the Passaic River. Plans for the initial installation provide for 50,000 kw, with provision for an ultimate output of 150,000 kw. The station will be known as the Essex station, and about $2,000,000 will be expended on it within a year.

NEW HOPE, N. J.—Plans are being considered by the Bucks County El. Co., of Newtown, Pa., for the installation of an electric-lighting system in New Hope. An ordinance passed by the Council provides that construction must begin within a year.

PARK RIDGE, N. J.—Within the next six months the Electric Light Commission expects to erect 100 chestnut poles (with arms and equipment) to replace old poles. E. Vernon Smith is superintendent.

PENNINGTON, N. J.—The Hopewell Township committee is negotiating with the Public Ser. El. Co. for the installation of an electric-lighting system on the Pennington Road.

PERTH AMBOY, N. J.—The Board of Water Commissioners has appropriated $100,000 for new pumping equipment and extensions to the water-works system and Runyon pumping station.

RED BANK, N. J.—Municipal ownership of the electric-light system is under consideration by the Borough Council. The present contract for street lighting with the Public Ser. El. Co. expires next January.

WOODSTOWN, N. J.—The El. Co. of New Jersey, which furnishes electricity in Salem, Glassboro, Grenloch and several other towns, is negotiating for the purchase of the electric system of the Woodstown Ice & Cold Storage Co., of Woodstown.

CUMBERLAND, MD.—The installation of an ornamental street-lighting system on Baltimore Street is under consideration.

CAMBRIDGE, MD.—The City Council is reported to have granted Martin W. Smith, John Burgess, Jr., and Robert B. Porter a franchise to furnish electricity in Cambridge.

COVINGTON, VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 14 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Covington. Drawings and specifications may be obtained from the custodian of site at Covington, or from the above office. O. Wenderoth is supervising architect.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Room 509, District Building, Washington, D. C., until July 14 for furnishing electrically operated centrifugal sewage pumps for use in the sewer department of the city. Specifications and forms of proposal may be obtained from the purchasing officer, Room 320, District Building, Washington.

WASHINGTON, D. C.—A bill authorizing an expenditure of $15,021,600 for a hydroelectric development on the Potomac River, a short distance above the city of Washington, as an amendment to the river and harbor bill has recently been introduced in the Senate by Senator Norris, of Nebraska. The proposed project includes the construction of a 115-ft. dam and a hydroelectric power plant at Chain Bridge. The dam, it is said, would create a dam 9 miles long, reaching back to Great Falls. It is estimated that about 99,000 hp could be developed.

North Central

COLDWATER, MICH.—Bids will be received by J. B. Montgomery, superintendent of Board of Control of the Michigan State Public School, Coldwater, until July 7 for electrical work in connection with the new buildings to be erected. Edwyn A. Boyd, of Lansing, is architect.

CRYSTAL FALLS, MICH.—The Council it is reported, has accepted the offer of the Electrical Engineering Co., of Minneapolis, Minn., to take charge of the installation of a new generator and water-wheel at the municipal power plant. The cost of the improvements is estimated at about $6,000.

AKRON, OHIO.—Bids will be received at the office of the director of public service, Akron, until July 14, for construction of buildings for garbage reduction works, as follows: (A) excavation, embankment and concrete work; (B) brick work, cut stone work, steel work, carpenter work, electrical work, and mill work, metal windows, etc.; (C) rolling steel doors, metal lockers, castings, industrial equipment and loading conveyor; (D) boilers and steam piping; (E) brick stack and appurtenances; (F) feed-water heater and regulator, boiler-feed pumps, drain pump and draft regulator; (G) railroad track and appurtenances. Bids will be received collectively or separately. Copies of plans and specifications, proposal forms, etc., may be seen at the office of the director of public service, City Hall, Akron, or at the office of W. Winthrop Pratt, Hippodrome Building, Cleveland, or may be obtained upon deposit of $20, to be refunded upon return of same.

ATHENS, OHIO.—The Ohio El. Pwr. Co., which is erecting a power plant in Floodwood, has submitted a proposal to the City Council offering to purchase the municipal electric-light plant. The Council is contemplating calling an election to vote on the proposal to issue bonds for improvements to the municipal plant.

CANTON, OHIO.—The Canton El. Co., has asked the City Council for an extension of its street-lighting contract with the city, which expires in two years, in return for which the company agrees to place its wires underground.

CHICAGO JUNCTION, OHIO.—Within the next 30 days the Board of Trustees of Public Affairs expects to purchase second-hand equipment as follows: One 120-kw. single-phase, 125-cycle or 133-cycle, 1100-volt alternator, and one 150-hp engine to drive same; one new or second-hand heater having a capacity of 300 hp.

CINCINNATI, OHIO.—Steps have been taken by the Main Street Merchants' Association to obtain a uniform lighting system on Main Street.

COLUMBUS, OHIO.—Plans are being considered by the merchants and property holders on the four blocks facing the Statehouse for lighting the State Capitol dome, at a cost of about $5,000. The State will maintain the service after it is installed.

EATON, OHIO.—The Eaton Ltg. Co. has applied to the City Council for a franchise for lighting the streets of the city for a period of ten years. The company proposes to replace the present 40-cp lamps in the business section of the city with 100-cp lamps.

LOGAN, OHIO.—The Ohio Lt. & Pwr. Co. has begun work on the reconstruction of its wires in this city, taking them from the streets wherever possible and placing them in alleys. The right-of-way for a transmission line to Shawnee has been secured. The old electric-light station will be used as a substation to transform energy transmitted from Thornsport for local distribution; a complete circuit of the high-tension line will be erected from Thornsport via Lancaster to Logan, thence to New Straitsville, Shawnee, New Lexington, Somerset and back to Thornsport, where this wire intersects with the lead wires from Newark.

MANSFIELD, OHIO.—The date for receiving bids for furnishing electric street lamps for the city of Mansfield has been changed from July 1 to Aug. 1. For details see proposal columns.

OAK HARBOR, OHIO.—Arrangements have been made by the village of Oak Harbor to purchase energy to operate the municipal electric system. The generating station will be closed down about Aug. 1 and the entire equipment of the plant, including boiler, engine, arc and alternating-current generators, and all accessories, will be sold to the highest bidder. For details see proposal columns. Louis L. Carsten is clerk.

SANDUSKY, OHIO.—The City Council is considering the installation of an ornamental street-lighting system. John J. Molter is director of public service.

SPRINGFIELD, OHIO.—Plans have been prepared by Schenck & Williams, of Dayton, architects, for the construction of a large building in Springfield for E. L. Shuey, of Dayton. The building will be equipped with electric freight and passenger elevators and power equipment for the joint use of manufacturers occupying the building. The cost of building and equipment is estimated at $150,000.

WARREN, OHIO.—The Western Reserve Steel Co., which is erecting a large steel plant in Warren, has contracted with the Trumbull Pub. Ser. Co. for 6000 kw per year to operate its plant, which will be equipped with electrically operated machinery throughout. The Trumbull company, it is reported, will remodel its generating station and install new boilers, turbines, etc.

WYOMING, OHIO.—Plans are being prepared for the installation of a municipal electric-light plant in Wyoming.

BURLINGTON, KY.—The Walton El. Lt. Co. is installing an electric-light plant in Burlington. H. W. Mayfield is interested in the project.

LOUISVILLE, KY.—The contract for the construction of the new Boys' High School Building in Louisville has been awarded to Bailey & Koerner, Walker Building, Louisville. Bids, it is understood, will soon be asked for electrical work, which will include vacuum-cleaner service, clock service, telephone and lighting systems, to cost from $8,000 to $10,000.

LOUISVILLE, KY.—The Lee Cook Mfg. Co., of Louisville, is in the market for the following second-hand equipment (to be in first class condition): One 300-hp or two 200-hp water-tube boilers, capable of 150 lb. pressure; two standard two-stage high-duty air compressors with 700 ft. free air capacity; one 10-kw to 15-kw direct-current generator directly connected to engine, either 110 volts or 220 volts, the latter preferred; one standard gage saddle-tank locomotive capable of 140 lb. steam pressure with about 12-in. cylinders; one 600-hp wet vacuum pump, duplex and flywheel type preferred: one standard gage locomotive crane with approximately 30-ft. boom and 10-ton capacity. C. Lee Cook is president.

BROWNSTOWN, IND.—The plant and holdings of the Brownstown Wtr. & Lt. Co. have been purchased by E. Darrow, former general manager of the Merchants' Ht. & Lt. Co. of Indianapolis, and Robert M. Cass, former assistant general manager of the Indianapolis Lt. & Ht. Co., of Indianapolis. The new owners contemplate revamping plant, establishing a day power service and the installation of an ice plant in connection with the water and light plant.

GOSHEN, IND.—The Hawks El. Co., of Goshen, has been granted permission by the Indiana Public Service Commission to extend its transmission lines to Waterford and New Paris.

INDIANAPOLIS, IND.—The City Council has ratified the contract between the city of Indianapolis and the Merchants' Ht. & Lt. Co., of Indianapolis, for lighting the city.

TELL CITY, IND.—The City Council has voted to issue bonds to the amount of $17,000 for remodeling and improving the municipal electric-light plant.

GLASFORD, ILL.—The Town Board has entered into a contract with the Canton Gas & El. Lt. Co., of Canton, to light the streets of the town for a period of five years. The contract calls for 25 tungsten lamps.

LINCOLN, ILL.—Funds have been provided by the Commercial Association and the City Council for changing the street-lighting circuit, so as to provide for the installation of cluster lamps. About $1,600 will be expended.

STERLING, ILL.—The contract for the installation of the ornamental-lighting system has been awarded to the Electric Construction Co., of Rock Island, at $7,997. The contract provides for 82 lamp standards and also for equipping transforming room in the city hall building.

DEER PARK, WIS.—The Village Council has decided to erect lamps at all corners of the platted part of the village. On Main Street 80-cp lamps will be used.

DELAVAN, WIS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 16 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Delavan. Drawings and specifications may be obtained from the above office or from the custodian of site at Delavan. O. Wenderoth is supervising architect.

WASHBURN, WIS.—Plans are being considered, it is reported, to equip the coal docks of the Northwestern Fuel Co. in Washburn with electrically operated apparatus.

CLARA CITY, MINN.—The Village Council has entered into a contract with the Montevideo Lt. & Pwr. Co., of Montevideo, to establish an electric-lighting system in Clara City.

DES MOINES, IA.—The City Council, it is reported, is contemplating replacing the present Welsbach gas lamps with a municipal electric-lighting system.

ESTHERVILLE, IA.—At an election held recently bonds to the amount of $60,000 were voted for improvements to the municipal electric-light plant and waterworks system.

HUME, MO.—The proposal to grant a franchise for the installation of an electric-lighting system will soon be submitted to the voters.

NEVADA, MO.—The installation of a municipal electric-light plant in Nevada is under consideration. At a special election held June 18 the proposal to renew the street-lighting contract with H. R. Gunn for one year was defeated. As a result of the election the city will be without street-lighting service after Oct. 1, when the present contract expires.

PALMYRA, MO.—The City Council has voted to call an election to submit the proposal to issue $26,000 in bonds for improvements to the municipal electric-light and water plants. Of the proceeds about $8,000 will be used for the electric-light plant.

SHELDON, MO.—A special election will be held June 30 to vote on the proposal to enter into a contract with G. B. Beeny, owner of the local electric-light plant, to furnish the city with electricity for a period of three years. The proposal to install 28 new electric street lamps will also be submitted to the voters.

BOWBELLS, N. D.—The Kenmare Lt. & Pwr. Co., controlled by the National Briquetting Co., of Kenmare, has submitted a proposal to the town of Bowbells, offering to furnish electricity for lighting the town.

SHERWOOD, N. D.—Work will soon begin on the construction of an electric-light plant in Sherwood. C. H. Butke, of Sherwood, is reported interested in the project.

ALEXANDRIA, S. D.—Plans are being considered for the installation of a municipal electric-light plant in Alexandria, bids for construction of which will be received about Aug. 1. The plant will probably be driven by an oil engine. As yet an engineer has not been engaged. H. M. Schumacher is city auditor.

DECATUR, NEB.—The contract for building an addition to the municipal power house has been awarded to Robert Burns.

ST PAUL, NEB.—The City Council is considering the question of establishing a municipal electric-light plant in St. Paul.

LA CROSSE, KAN.—An election will be held in July to submit to the voters the proposition to issue $12,000 in bonds, the proceeds to be used for extensions to the street-lighting system and improvements to the municipal electric-light plant.

LARNED, KAN.—Estimates submitted by Worley & Black, Reliance Building, Kansas City, Mo., consulting engineers, place the cost of installing a municipal electric-light plant in Larned at $64,100. The plans provide for a steam generating plant and an ornamental street-lighting system, consisting of 70 lamp standards. Bonds to the amount of $90,000 were recently voted to establish a municipal plant.

LEAVENWORTH, KAN.—Application has been made to the City Council by W. J. Squires for a franchise to construct and operate an electric-light plant in Leavenworth. A special election will be held in July to submit the proposal to the voters.

MANHATTAN, KAN.—Negotiations are under way between the City Commissiuners and the Manhattan Ice, Lt. & Pwr. Co., with a view of purchasing the plant of the latter to be owned and operated by the municipality.

PITTSBURG, KAN.—Plans have been completed for the installation of an ornamental street-lighting system in the business district.

ROBINSON, KAN.—The City Council has passed an ordinance granting C. T. Stocking, of Hiawatha, a franchise to construct and operate an electric-lighting system in Robinson. Charles Pirkey is clerk.

Southern States

BETHEL, N. C.—Contracts have been awarded for equipment and construction of the proposed municipal electric-light plant in Bethel, to cost about $6,000.

GASTONIA, N. C.—Within the next four months the Board of Public Works expects to purchase lamp-posts for the business district. H. Rutter is superintendent.

WADESBORO, N. C.—Within the next two months the Yadkin River Pwr. Co., of Wadesboro, expects to erect about 2 miles of 2300-volt feeder and series arc-lamp line. P. N. Pittenger is local manager.

WAKE FOREST, N. C.—Within the next 30 days the town of Wake Forest expects to purchase the following equipment for the municipal electric-light plant: One 75-kw, three-phase, 60-cycle, 2300-volt generator, a 150-horizontal-return tubular boiler, 75-ft. smokestack and a 125-hp engine for direct connection to generator. J. L. Bullard is superintendent.

COLUMBUS, GA.—The Columbus Pwr. Co., it is reported, is planning to install an additional 5000-kw generating unit at its Goat Rock station.

MOULTRIE, GA.—Bids will be received by the city of Moultrie until July 1 for the installation of an ornamental street lighting system. The plans provide for 100 lamp standards. R. J. Corbett is chairman of purchasing committee.

COOKEVILLE, TENN.—Preparations are being made by the Gainesboro Tel. Co. (main office at Cookeville) for improvements to its system, involving an expenditure of about $40,000. Copper circuits will be erected in Tennessee from Cookeville to Sparta, Cookeville via Monterey and Crossville to Rockwood; in Kentucky: Monticello via Burnside and Somerset to Danville, Glasgow to Burkesville, at a cost of $20,000.

PULASKI, TENN.—The Board of Aldermen has decided to remove the new municipal electric-light plant from the City Hall to a site near the depot. The old electric plant (which is not in use) will be moved to the same building, and will be used during the removal of the other plant.

SPRINGFIELD, TENN.—The City Commissioners, it is reported, are contemplating improvements to the municipal electric-light plant.

MORRILLTON, ARK.—The Seven Cities Co., of St. Louis, it is reported, is negotiating for the electric-light and water plants in Morrillton and Atkins. The Seven Cities Co. has increased its capital stock from $250,000 to $500,000.

ABITA SPRINGS, LA.—The contract for lighting the streets of the city, it is reported, will be awarded to James Rauch and Emile Aubert.

NEW ORLEANS, LA.—Bids will be received by George G. Earl, general superindentent sewerage and water board, until July 30 for wire and valves for the drainage system.

GUTHRIE, OKLA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 18, for the installation of an electric passenger elevator and a hydraulic lift, etc., in the United States post office and court house in Guthrie. For details see proposal columns.

POND CREEK, OKLA.—Arrangements are being made for reconstruction of municipal electric-light plant and water-works system, including the installation of a 50-hp oil engine, one 40-kw generator, two centrifugal pumps, two 15-hp, single-phase motors, four transformers, 1½ miles three-wire transmission line, switchboard and instruments. C. C. Shepard is superintendent.

BEEVILLE, TEX.—The plant and holdings of the Beeville Pwr. & Lt. Co. are reported to have been taken over by the Texas Southern Electrical Co., of Boston, Mass. It is understood that the new owner contemplates improvements to the system.

DALLAS, TEX.—Application has been made to the Commissioners' Court of Dallas County by the Rev. O. S. Thomas, commissioner for the Southern Methodist University, on behalf of the institution, for a franchise to construct a street railway on Atkins Avenue to the university addition.

DALLAS, TEX.—Plans are being prepared by Smith & Whitney, of Dallas, for the installation of a municipal lighting plant in the basement of the new city building at Main and Harwood Streets, to furnish electricity to light the municipal building, central fire station and the ornamental lighting system on Main, Elm and other streets.

DE LEON, TEX.—The De Leon-Gorman Lt. & Pwr. Co. has decided to install an electric-light plant in Gorman.

KIRVIN, TEX.—The Young Men's Christian Association is considering plans for the installation of an electric-lighting system on Main Street. An electric plant has recently been installed in Kirvin by A. V. Kelley.

TAFT, TEX.—The electric plant of the Taft Gin & Oil Co., recently destroyed by fire, it is reported, will be rebuilt.

Pacific States

RIDGEFIELD, WASH.—The City Council has granted J. H. Cunningham, of Portland, Ore., franchises to install and operate an electric-light plant and water-works system in Ridgefield.

SEATTLE, WASH.—The City Council has passed the ordinance authorizing the installation of cluster lamps on Madison, Marion and Columbia Streets, west of First Avenue. Bids for material and installation of same will soon be asked by the Board of Public Works. A. L. Valentine is chairman.

SPOKANE, WASH.—Harry Flood, president of the Trustee Co., has filed with the city clerk the acceptance of the franchise granted to the company by the City Council on April 6 to construct and operate an underground system to furnish steam or hot-water heating and electricity for lamps and motors.

EUGENE, ORE.—Bids will soon be received by the city clerk for the installation of cluster lamps on Olive Street (electrical equipment only), between Fifth and Ninth Avenues, and on Eighth Avenue, between Willamette and Lincoln Streets. Iron posts will be furnished by the Eugene Iron Works. The cost of the system is estimated at about $7,500.

MAPLETON, ORE.—The County Court has granted Richard H. Clow, of Mapleton, a franchise to erect and maintain electric transmission lines on the streets in Mapleton and county roads adjacent.

NEHALEM, ORE.—At an election to be held July 15 the proposal to issue $12,500 in bonds for the purchase of the water system and construction of reservoir and installation of an electric-light plant will be submitted to the voters.

RIDDLE, ORE.—The Sugar Pine Box Co., of Riddle, is planning to install an electric-light plant to furnish electricity to light the town. The equipment will include a Fairbanks-Morse gas engine and a direct-current generator; about 4 miles of wire and fir poles will be used for the distributing system; 45 meters and about 600 incandescent lamps will be required. W. W. Vaughn, of Riddle, is engineer in charge.

PLACERVILLE, CAL.—Plans are under way for enlarging and improving the local system of the Western States Gas & El. Co., at a cost of about $50,000. An additional generator will be installed and the flume enlarged.

SACRAMENTO, CAL.—The installation of an electric generating plant in the basement of the Capitol will be recommended by George G. Radcliff, superintendent of buildings and grounds, to furnish electricity for lamps and motors for the Capitol, state printing office and the Governor's mansion.

SAN BERNADINO, CAL.—The Board of County Supervisors has granted the Southern California Ed. Co., of Los Angeles, permission to erect transmission lines along certain highways in San Bernardino County.

SAN FRANCISCO, CAL.—The Board of Public Works has awarded the contract for furnishing and installing overhead electrical conductors for the Municipal Railway to H. S. Tuttle, at $36,245.

SAN FRANCISCO, CAL.—The lighting committee of the Board of Supervisors has recommended that the contract for supplying electricity for lighting the City Hall, Hall of Justice, pumping station at Drumm and Commercial Streets, the corporation yard at 313 Francisco Street, and corporation yard at Sixteenth and Harrison Streets, to be awarded to the City El. Co., at 2¼ cents per kw-hr.

PROVO, UTAH.—The Southern Utah Pwr. Co., recently incorporated under the laws of the State of Delaware, has filed a certificate of incorporation with the county clerk. The company is capitalized at $600,000 and proposes to generate and transmit electricity for lamps, heaters and motors. It is understood that the company will take over the holdings of L. L. Nunn in Sevier County and operate and extend the same.

SALINA, UTAH.—Application has been filed in the office of the State Engineer by William Johnson, of Richfield, for permission to construct a concrete weir in the Sevier River, north of Salina, to divert 400 second-ft. of water into a power canal, which will be 19,000 ft. long.

FORT BENTON, MONT. — The City Council has passed an ordinance providing for an issue of $17,000 in bonds for the purchase of an electric-light plant.

FORT BENTON, MONT.—The Benton El. Lt. Co., of Fort Benton, has recently installed one 30-hp electrically driven pump. George L. Overfield is superintendent.

GREAT FALLS, MONT.—The Great Falls Pwr. Co. has applied for permission to erect transmission and telephone lines across Helena National forests.

CASPER, WYO.—The Netrona County El. Co., of Casper, is contemplating a bond issue, the proceeds to be used for improvements. Correspondence is invited with bond houses that may be interested. J. A. Ward is general manager.

RIVERTON, WYO.—The Town Council has granted P. B. Dykeman, of Riverton, a franchise to construct and operate an electric-light plant here.

GLENWOOD SPRINGS, COL.—At an election held recently the proposal to issue $110,000 in bonds, the proceeds to be used to purchase the plant of the Glenwood, to be owned and operated by the municipality, was carried.

LAS ANIMAS, COL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 11, for furnishing and installing four 100-hp water-tube boilers, a fan, and motor, valves, piping and all other accessories in the central power plant, at the United States Naval Hospital, Las Animas. Plans and specifications can be obtained on application to the bureau. H. R. Stanford is chief of bureau.

Canada

EDMONTON, ALTA.—Plans are being prepared by the Wahanun Pwr. Co., of Edmonton, for the construction of a power plant at its mines about 40 miles from here. The plant will have an output of 10,000 kw and will furnish electricity in Edmonton and surrounding territory, within a radius of 100 miles.

LETHBRIDGE, ALTA.—By-laws providing funds amounting to $59,923 for construction of electric plant and machinery and $1,642 for construction of power buildings are being advertised in Lethbridge; also a by-law providing $22,666 for extensions to electric light and power system.

SHOAL LAKE, MAN.—All tenders received May 28 for the installation of a direct-current lighting system with storage batteries were considered too high. New bids will be asked for alternating-current apparatus about July 12. The John Galt Engineering Co., 317 Portage Avenue, Winnipeg, is consulting engineer.

STONY MOUNTAIN, MAN.—A substation to provide electricity for lighting purposes, it is reported, will be erected in Stony Mountain.

WINNIPEG, MAN.—Bids will be received by the city of Winnipeg until June 30 for switchboard and other apparatus for fire-alarm system.

EUGENIA, ONT.—Contracts have been awarded for the construction of a new electric generating station to be built for the Hydro-Electric Power Commission at Eugenia Falls, near Owen Sound, as follows: For dam No. 1, 2000 ft. long and from 40 ft. to 50 ft. high, to the Ambursen Hydraulic Construction Co., of Montreal; dam No. 2 to Hyland, Scribbin & White, of Toronto. Tenders are being received for the necessary hydraulic and electrical equipment, which will be used to develop 4000 hp.

NIAGARA FALLS, ONT.—The Ontario Hydro-Electric Power Commission of Ontario is planning to utilize the waste waters of the new Welland ship canal on the Niagara River, conveying the waters to the Whirlpool, where a generating station will be built. The cost of the undertaking is estimated at $2,000,000. Surveys are now being made under the direction of F. A. Gaby, chief engineer.

STRATFORD, ONT.—Plans have been prepared for the installation of an ornamental street-lighting system in Stratford, for which $22,000 has been appropriated. The plans provide for the erection of 180 steel trolley posts carrying 500-watt nitrogen-filled lamps, maintained by overhead wires. R. H. Myers is secretary of the Stratford light and heat commission.

TAVISTOCK, ONT.—The ratepayers have recently voted in favor of a bylaw providing for the installation of hydroelectric power to be obtained from the Hydro-Electric Power Commission of Ontario.

MONTREAL, QUE.—The Montreal Electrical Commission has applied to the Quebec Public Utilities Commission for approval of plans for further underground conduits.

BELCARRES, SASK.—A small power plant, it is understood, will be installed in connection with the new hotel being erected in Belcarres by J. Dawsey, of Melville, to furnish electricity to light the hotel and the main part of the town; also for street lighting.

REGINA, SASK.—At an election held June 3 the by-law to appropriate $200,000 for extensions to the city electrical department was carried.

WOLSELEY, SASK.—Preparations are being made for improvements to the municipal electric-light plant, consisting of a 30-kw, 60-cycle Westinghouse generator, Westinghouse switchboard, two 4-kva, two-phase transformers and one 5-kva, three-phase transformer, 45 35-ft. poles, No. 6 double-braided weather-proof wire, eight Westinghouse indoor-type lightning arresters. Charles Stengel is manager.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing office, the Panama Canal, Washington, D. C., until July 6, for furnishing switches, switch stands, steel billets, steel cable, brass rod, copper bar, sheet copper, motor-driven woodworking shaper, motor-driven sail-maker's sewing machine, etc. Blanks and general information relating to this circular (No. 858) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Maj. F. C. Boggs is general purchasing officer.

New Incorporations

WASHINGTON, D. C.—The New Arcade Co. has been chartered with a capital stock of $150,000 to acquire and operate electric-light plants.

WESTBROOK, MINN.—The El. Lt. & Pwr. Co. has been chartered with a capital stock of $10,000. The incorporators are K. Kreuger, John E. Villa, P. G. Hiebert

MEDIANA, OHIO.—The Phoenix El. Co. has been incorporated with a capital stock of $25,000 by F. W. Woods, L. F. Carver, R. G. Strong and others.

NOWATA, OKLA.—The Nowata El. Lt. Co. has been incorporated with a capital stock of $30,000 by E. B. Lawson, Frank Hancock and D. B. Howell, of Nowata.

DENMARK, S. C.—The Denmark Lt. & Pwr. Co. has been chartered with a capital stock of $10,000 by C. D. Campbell, T. M. Phifer and Frank G. Tompkins, all of Columbia, S. C. The company proposes to supply electricity in Denmark. T. M. Phifer is president.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 16, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,099,909. Apparatus for Testing Storage-Battery Circuits. C. E. Beach, Binghamton, N. Y. App. filed Sept. 24, 1910. For switching in the testing instruments and protecting them from undue current.

1,099,915. Key-Plunger Unit; E. B. Craft, Hackensack, N. J. App. filed Sept. 2, 1911. Contact springs mounted in a frame so as to be all removable as a unit.

1,099,934. Coating of Flexible Objects of Organic Origin with Metals; R. Rafn and G. E. Schmidmer, Nuremberg, Germany. App. filed Oct. 16, 1912. Articles passed in vacuum in proximity to suitable metal electrodes.

1,099,960. Electric Converter; C. I. Zimmerman (deceased), Niagara Falls, N. Y. App. filed Oct. 17, 1906. One or more asymmetric conductors, together with means for accumulating a very appreciable electrostatic charge.

1,099,968. Protective Device; E. E. F. Creighton, Schenectady, N. Y. App. filed Feb. 10, 1914. Electrolytic lightning arrester of the aluminum-cell type.

1,099,986. Outlet or Junction Box; G A. Lutz, New York, N. Y., and C. C. Sibley, Perth Amboy, N. Y. App. filed July 19, 1906. Detachable covers to the outlet openings in the box.

1,099,987. Outlet or Junction Box; G. A. Lutz, Plainfield, N. J. App. filed Dec. 17, 1910. Special closures to the outlet openings.

1,099,988. Electric Flatiron; C. P. Madsen, Chicago, Ill. App. filed Sept. 26, 1912. Has relatively small conductors with two or more coils in multiple.

1,099,998. Submarine Signaling Apparatus; F. J. Schiessler, Vienna, Austria-Hungary. App. filed May 12, 1909. Includes a clock and wireless receiving mechanism for starting the clock.

1,099,999. Electrical Heater; W. S. Sheppard, Colorado Springs, Col. App. filed July 25, 1913. For use in motor vehicles.

1,100,014. Overhead Contact Shoe for Electric Railways; G. Gibbs, New York, N. Y., and E. R. Hill, East Orange, N. J. App. filed March 26, 1914. Length of the contact shoe is reduced automatically upon a lowering of the pantograph.

1,100,018. Case for Loading Coils; F. B. Jewett, Wyoming, and T. Shaw, Hackensack, N. J. App. filed Nov. 10, 1910. Hermetically sealed and arranged for convenient application to submarine cable.

1,100,037. X-Ray Tube; S. Tousey, New York, N. Y. App. filed Feb. 23, 1911. Utilizes only the direct rays coming from the anticathode.

1,100,116. Testing System for Telephone Party Lines; C. C. Bradbury, Rochester, N. Y. App. filed March 25, 1912. Gives operator a positive indication of the condition of a line being tested.

1,100,117 Electromagnetic Musical Instrument; C. Breed, Philadelphia, Pa. App. filed March 30, 1912. Effects pulsations of the current in the desired phase relation to the vibrations of the piano strings.

1,100,134. Controller; C. A. Jackson, Chicago, Ill. App. filed Nov. 26, 1909. Stopping, starting and reversing control for motors as used in elevator service.

1,100,139. Electric Locomotive with Automatic Cable Reel; W. S. Mayers, Fairmont, W. Va. App. filed Nov. 18, 1906. Has separate reel-driving motor, independent of the propelling motor.

1,100,168. Telegraph Key; A. H. Adams and J. N. Wallace, Sparkill, N. Y. App. filed May 31, 1912. Special construction for printing telegraph systems.

1,100,178. Spool-Head; O. F. Forsberg, New York, N. Y. App. filed Dec. 18, 1909. Carries a terminal screw.

1,100,188. Electromagnetic Device; B. Liebowitz, New York, N. Y. App. filed Sept. 5, 1912. Constructed to maintain the air-gaps substantially constant during movement of armature.

1,100,191. Electric Furnace; W. F. McNabb, Pittsburgh, Pa. App. filed Sept. 15, 1913. Crucible with arched chamber forming an arc chamber thereheneath.

1,100,207. Semaphorical Direction Indicator. G. F. Watts, Brooklyn, N. Y. App. filed April 25, 1913. Semaphore rear-end auto signal.

1,100,225. Electric Testing Apparatus. J. H. Conlon, Union, Ore. App. filed May 14, 1913. For testing fuses, lamps, wiring, etc.

1,100,243. Railway Signal Apparatus, G. Jackson, Jr., Hohokus, N. J. App. filed July 11, 1913. Signifies approach of a car to a crossing.

1,100,247. Sash of Frame Construction; L. S. Lachman, New York, N. Y. App. filed Sept. 26, 1913. Button applied to and welded to the joint formed by intersecting frame members.

1,100,253. Electric Switch; A. N. Petit, West Orange, N. J. App. filed Jan. 2, 1913. Pull socket construction.

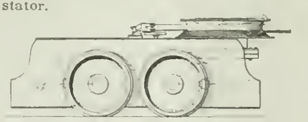
1,100,262. Means for Handling and Distributing Parcels, Bales, Loads and Other Articles; A. G. Seaman, Bowden, England. App. filed July 9, 1912. Self-propelled vehicles traveling at predetermined intervals upon a main track and from sidings onto the main track.

1,100,268. Interlocking Overhead Trolleys; S. B. Stewart, Jr., Schenectady, N. Y. App. filed July 2, 1908. For roads operating on different current at different sections; trolley in service locks the other trolley out of commission.

1,100,290. Method of and Apparatus for Electrolyzing Liquids; H. H. Dow, Midland, Mich. App. filed Dec. 30, 1912. Electrically treating natural brines in the production of chlorine and alkali.

1,100,293. Electrical Vaporizer Attachment for Gas Engines; L. L. Forde, Laurinburg, N. C. App. filed Jan. 6, 1914. Plug carrying heater coil inserted in engine intake.

1,100,294. System for Preventing Shaft Voltages or Bearing Currents in Electric Machines; W. Frick, Frankfort-on-the-Main, Germany. App. filed April 9, 1910. Counteracting winding on the stator.



1,100,139—Electric Locomotive with Automatic Cable Reel

1,100,336. Miner's and Like Electric Safety Lamp; P. Wolf, Zwickau, Germany. App. filed Jan. 30, 1913. Lamp removable without removing the glass cylinder of the lamp.

1,100,340. Potential Regulator for Dynamo-Electric Machines; V. G. Apple, Dayton, Ohio. App filed May 31, 1911. For maintaining substantially constant the difference of potential at the dynamo terminals.

1,100,341. Indicator; V. G. Apple and G. B. Sayre, Dayton, Ohio. App. filed Oct. 6, 1913. "On" and "off" indicator for autos to show whether storage battery and dynamo are connected.

1,100,358. Combined Jack and Signal; A. F. Dixon, Newark, N. J App. filed March 16, 1909. When plug is inserted in the jack it forces the target to its normal restored position.

1,100,382. Signaling System. M. Levison, Chicago, Ill. App. filed May 27, 1912. Call system for hospitals.

1,100,383. Thermostat; G. W Lorimer, Piqua, Ohio. App. filed Aug. 26, 1912. For fire-alarm purposes; adjustable and has manually operable circuit-closing attachment.

1,100,385. Control System for Automatic Telephone Switches; F. R. McBerty, Antwerp, Belgium. App. filed Dec. 7, 1912. Avoids unnecessary running of the switch-driving motor.

1,100,407. Electric Control System; H. A. Steen, Milwaukee, Wis. App. filed Nov. 2, 1910. For preventing a too rapid accelerating movement of the motor controller.

1,100,408. Interbraced Pantograph Trolley; J. A. Townsend, Pasadena, Cal. App. filed June 17, 1913. Has obliquely disposed pivoted pantograph arms.

1,100,413. Selective Impulse Transmitter; J. A. Wotton, Montclair, N. J. App. filed Feb. 8, 1912. Combination of impulse transmitter and controlling mechanism with key plungers.

1,100,428. Circuit-Controlling Device; C. C. Graves, Newark, N. J. App. filed March 27, 1913. Improved electromagnetic relay construction and mounting.

1,100,480. Telephone Equipment; W. M. Haralson and J. F. Pilkington, Dallas, Tex. App. filed June 6, 1913. Has an electric light illuminating the dial of the automatic telephone.

1,100,485. Shield for Circuit Closer; J. F. Kelly, Pittsfield, Mass. App. filed May 31, 1912. Automatic closure for mercury-containing trough during the threading of the note-sheet in an automatic piano player.

1,100,501. Electromagnetically Controlled Keyboard for Perforating Apparatus; B. Soldatencow, Paris, France. App. filed Jan. 8, 1913. For perforating telegraphic tape.

1,100,505. Electric Outlet Fitting; G. B. Thomas, Bridgeport, Conn. App. filed Feb. 5, 1913. Combination fitting with switch and pilot light, as for use with electric irons, etc.

1,100,515. Electric Switch; J. M. S. Anderson, Bridgeport, Conn. App. filed Aug. 29, 1913. Rotary snap switch with lock preventing reverse rotation.

1,100,539. Cyclical Process of Fixing Atmospheric Nitrogen; K. F. Cooper, Buffalo, N. Y. App. filed Feb. 10, 1914. Employs calcium carbide.

1,100,542. Trolley Guard; R. Dac, Passaic, N. J. App. filed Dec. 24, 1913. Pivoted spring-pressed guards projected up at opposite sides of trolley wheel.

1,100,567. Dynamo-Electric Machine; W. Holt, Erdington, Birmingham, England. App. filed Nov. 3, 1911. Axle-driven train-lighting system.

1,100,584. Means for Regulating Electric-Lamp Circuits; H. Leitner, London, Eng. App. filed April 11, 1912. For preventing "over-volting" of lamps in train-lighting systems.

1,100,585. Electric Heating Coil; C. C. Lilibridge, Hutchinson, Kan. App. filed July 21, 1913. Insulating plates bound to a combustible spacing material by the current-conducting coil.

1,100,614. Wire Tapper; S. J. Pukropp, Sturgeon Lake, Minn. App. filed Aug. 30, 1913. Has a rod provided with folding contact grapples at its upper end for engagement with the live wires.

1,100,633. Alarm Lock; C. C. Tuch, Honolulu, Territory Hawaii. App. filed Oct. 3, 1913. Springs which hold the locking bolt in place also perform the function of contacts for an alarm circuit.

1,100,639. Process and Apparatus for Making Phosphoric Acid and Compounds of the Same; F. S. Washburn, Nashville, Tenn. App. filed Feb. 17, 1914. Preheats compound of phosphate rock, silicious material and carbonaceous material in furnace and discharges said mass into electric furnace.

1,100,651. Alternating-Current Magneto for Ignition and Combustion Engines; G. A. Briggs, Elkhart, Ind. App. filed Jan. 22, 1912. Includes a hammer actuated by a cam to operate the movable contact member.

1,100,680. Socket or Base of Trolley Poles for Electric-Traction Systems; E. M. Munro, London, England. App. filed Feb. 17, 1913. For trackless trolley systems.

1,100,681. Electric Lock and Alarm Apparatus; O. Nitsch, Harburg-on-the-Elbe, Germany. App. filed Jan. 29, 1914. Door-lock alarm.

13,748 (reissue). Insulator; J. Ellis, St. James, Mo. App. filed April 28, 1913 (Original patent No. 1,029,980, June 18, 1912.) Has notches which receive and lock the wire in place.

13,750 (reissue). Circuit-Controlling Device; W. B. Hughes, Newark, N. J. App. filed July 12, 1913. (Original patent No. 1,016,268, Feb. 6, 1912.) Automatic thermally controlled fire-alarm device.

13,753 (reissue). System of Control for Dynamo-Electric Machines; J. N. Mahoney, Wilkinsburg, Pa. App. filed Feb. 25, 1914. (Original patent No. 1,056,921, March 25, 1913.) Includes liquid rheostats; for controlling plurality of electric locomotives from single master controller.

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